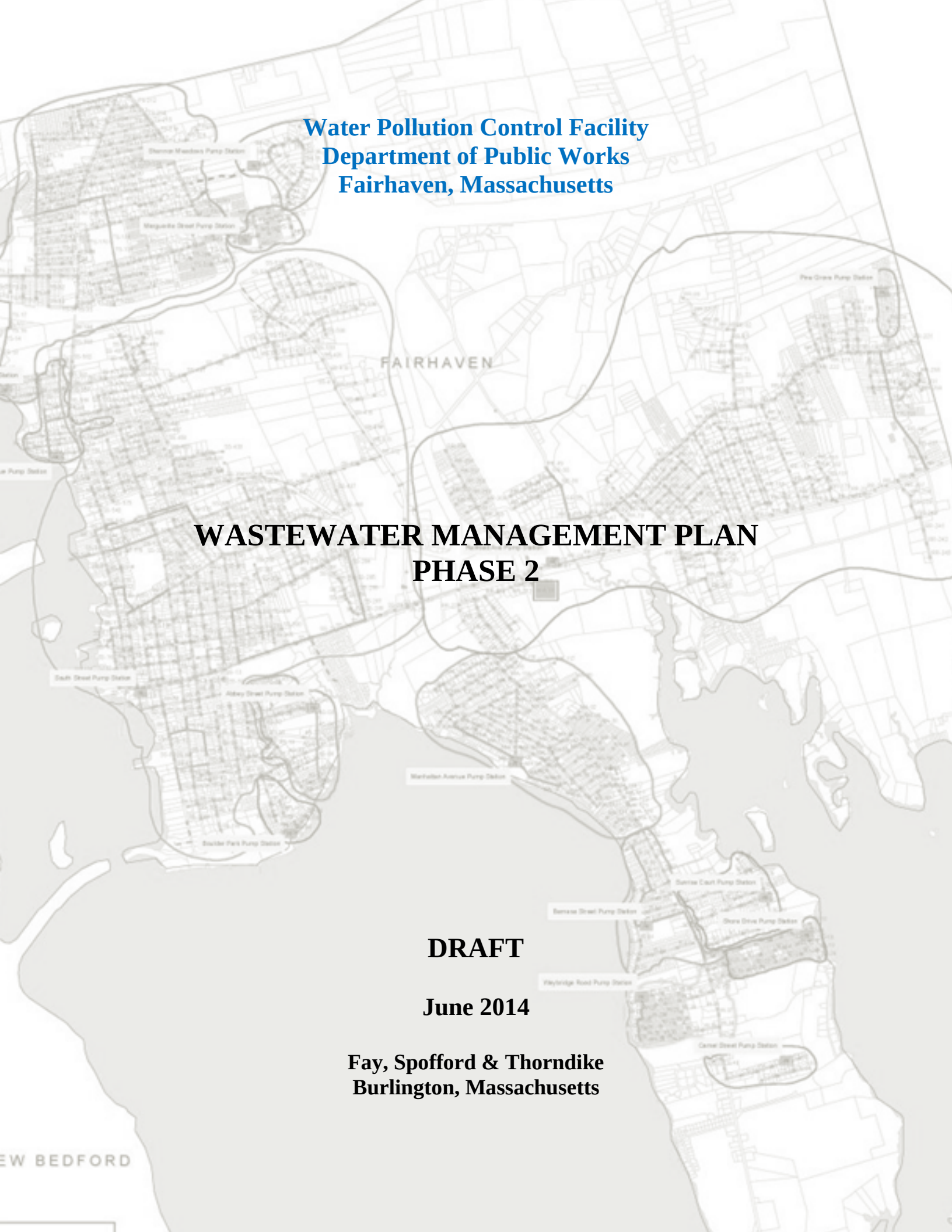

Water Pollution Control Facility
Department of Public Works
Fairhaven, Massachusetts

WASTEWATER MANAGEMENT PLAN
PHASE 2

DRAFT

June 2014

Fay, Spofford & Thorndike
Burlington, Massachusetts

June 30, 2014

Ms. Linda L. Schick, Supt. Sewer/Wastewater
Fairhaven Water Pollution Control Facility
5 Arsene Street
Fairhaven, Massachusetts 02719

Subject: Fairhaven, Massachusetts
Wastewater Management
Plan – Draft – June 2014

Dear Ms. Schick:

FST is please to submit the Wastewater Management Plan – Draft – June 2014 for the Town of Fairhaven, Massachusetts. Enclosed please find three (3) copies of the draft report for your review. The document includes the main report and appendices A through E.

Should you have any questions or comments, please do not hesitate to contact me at 781-221-1220 or Meredith Zona at 781-221-1254.

Very truly yours,

FAY, SPOFFORD & THORNDIKE, LLC
By

Robert H. Letourneau, P.E.

JF-066
Enclosures
Cc: Vincent D. Furtado, Superintendent – BPW
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Water Pollution Control Facility
Department of Public Works
Fairhaven, Massachusetts

WASTEWATER MANAGEMENT PLAN
PHASE 2

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June 2014

Fay, Spofford & Thorndike
Burlington, Massachusetts

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1.0 INTRODUCTION

This Wastewater Management Plan – Phase 2 report for the Town of Fairhaven, MA is a follow-up to the Wastewater Management Plan report submitted in February 2013, noted herein as the "Phase 1 report". This Phase 2 report also represents the completion of the Town's wastewater planning efforts to achieve the following goals:

- Improved database management of its wastewater collection system.
- Compliance with current and anticipated National Pollutant Discharge Elimination System (NPDES) Permit conditions.
- Determining capacity needs in the wastewater collection and treatment system to handle future growth or sewer system extensions over the next 20 years.
- Optimizing wastewater treatment processes and operations.
- Prioritizing rehabilitation and/or upgrades and improvements, and managing the associated financing.

To accomplish these goals, the Phase 1 report conducted several tasks, including:

- Develop wastewater flow projections (through the year 2025) for the Main Water Pollution Control Facility (Main WPCF) on Arsene Street.
- Update town-wide sewer plan in Geographic Information Systems (GIS) format.
- Engaged the database management firm "PeopleGIS" to provide the Town with online mapping capabilities.
- Evaluate wastewater treatment capacity and processes for the Main WPCF.
- Complete Main WPCF conditions survey update.
- Update and assess infiltration/inflow (I/I) impacts.
- Evaluate collection system/pump station conditions.

This Phase 2 report expands upon the above tasks, as follows:

- Develops wastewater flow projections through the year 2035 for the Main WPCF and West Island WPCF, located in the southern part of Fairhaven.
- Provides additional attributes to the sewer plan in GIS format, and continue with PeopleGIS to assist with mapping updates, database management, and related training.

- Using Biowin modeling software, evaluates wastewater treatment capacity and processes for the Main and West Island WPCFs, under current and proposed NPDES permit conditions.

- Performs a conditions survey for the West Island WPCF, and provide updates to the conditions survey at the Main WPCF contained in the Phase 1 report.

- Provides an update of current collection system and pumping station rehabilitation/upgrade work, and specific recommendations and estimated costs for pumping station upgrades described in the Phase 1 report.

- Contains a recommended action plan identifying the need for further detailed evaluations, design, permitting, applications for financial assistance, construction and implementation. This plan shall also contain a schedule for implementing these various items.

2.0 BACKGROUND

2.1 West Island WPCF and Collection System

The Phase 1 report provided background information about the Main WPCF and the tributary sewer system. To complete the description of background data for the town's wastewater facilities, this report includes the following summary for the West Island WPCF and sewer system.

The wastewater collection system serves about 380 homes and consists of approximately 26,400 linear feet of gravity sewers and two pumping stations – Rocky Point Road and Causeway Road Pump Stations.

The WPCF is designed for an average daily flow of 80,000 gallons per day (GPD), and a maximum daily flow of 100,000 gpd. The advanced wastewater treatment facility is a rotating biological contactor (RBC) process consisting of the following components:

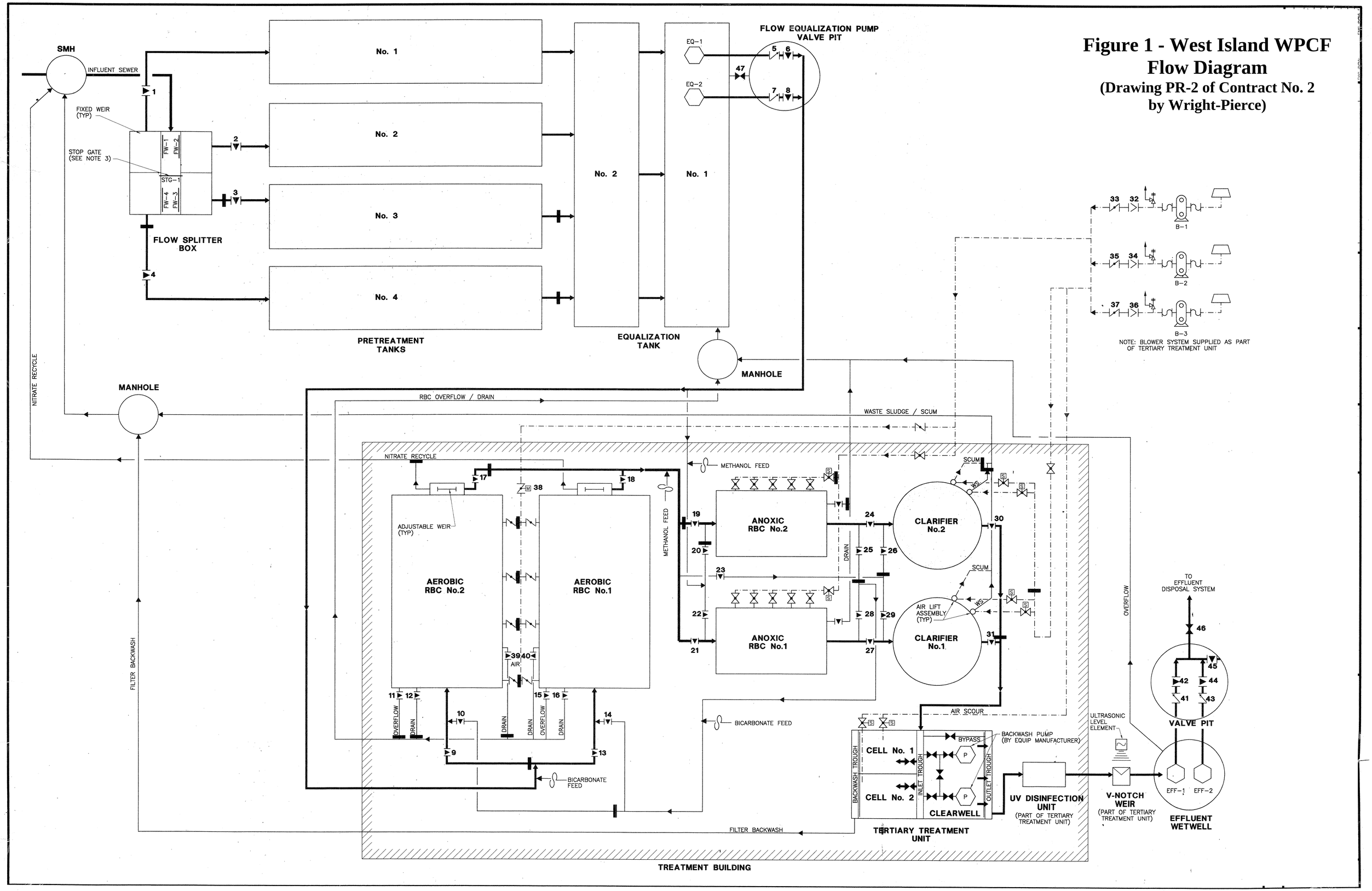
- Splitter box
- Four pretreatment tanks
- Two equalization tanks
- Two aerobic RBCs
- Two anoxic RBCs
- Two clarifiers
- Two-cell sand filter
- Ultraviolet disinfection
- Effluent pump station

The tertiary-treated effluent is pumped to groundwater disposal facilities containing one 18-inch diameter wick and three 12-inch diameter wells. Figure 1 is a flow diagram of the West Island facility's unit processes.

The WPCF's average daily flow in 2013 was 15,331 GPD, with average monthly flows varying from 10,445 GPD in October, to 23,769 GPD in March.

Figure 1 - West Island WPCF Flow Diagram

(Drawing PR-2 of Contract No. 2 by Wright-Pierce)



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3.0 DEVELOPMENT OF WASTEWATER FLOW PROJECTIONS

3.1 Main WPCF

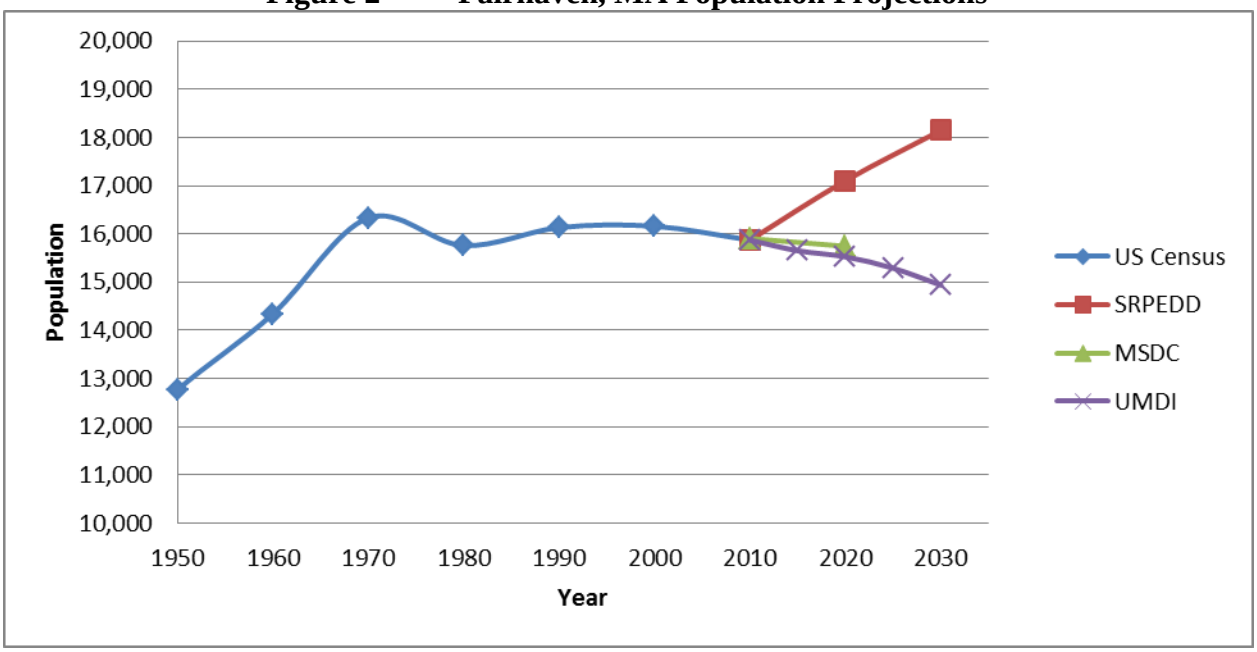
3.1.1 Update from Phase 1 Report

The Phase 1 report developed wastewater flow projections for the Main WPCF for the year 2025 based on population projections, water usage, WPCF flow data and Mattapoisett wastewater flow. This report provides flow projections through 2035, giving the Town a more reasonable time frame on which to base plant upgrades, and a time frame approximately coinciding with the 20-year period of the Intermunicipal Agreement (IMA) between Fairhaven and Mattapoisett, which is due to be finalized later this year.

3.1.2 Population

To project the population contributing wastewater to the Main WPCF in 2035, we first looked at town-wide population projections developed by various sources. The graph below presents historical data for the Town along with population projections determined by the Southeastern Regional Planning and Economic Development District (SRPEDD), "middle growth" projections by the former Massachusetts Institute for Social and Economic Research (MISER), now known as the Massachusetts State Data Center (MSDC), and the UMass Donahue Institute (UMDI). SRPEDD and UMDI have projections up to the year 2030, while MSDC only projects to the year 2020. To estimate the population in 2035, we looked at the yearly growth percentages for SRPEDD from 2020 to 2030, and for UMDI from 2025 to 2030, projected these same annual percentages out another five years to determine the 2035 population for each source, and then took the average of these two values as our town-wide projected population for 2035. This value is 16,644 - about a 6.5% increase above the Town's total estimated population of 15,622 in 2012.

Figure 2 Fairhaven, MA Population Projections



Based on conversations with the Town and our review of water and sewer accounts for the year 2013, we determined that the current sewered population tributary to the Main WPCF is about 14,104. An increase of 6.5% results in a future sewered population of 15,021 in 2035.

3.1.3 Current Wastewater Flow Based on Water Usage

One way to project future wastewater flow is to look at current water usage data. If that compares favorably with current wastewater flows, we can apply the usage rates to future growth estimates to develop future wastewater flows. We reviewed the 2012 Public Water Supply Annual Statistical Reports for the Town of Fairhaven, which provide a breakdown of metered water consumption by user categories. If we apply the report's per capita water usage of 52 GPD to the residential population connected to the Main WPCF of 14,104 people, this results in a water usage of 733,400 GPD. Adding this flow to the water usage determined for the other categories (commercial, industrial, municipal, institutional, etc. – 189,400 GPD) in the above 2012 report, the total water use amounts to about 922,800 GPD. Sewage flow is often 85 – 90% of water use, so the sewage flow would be about 784,000 – 830,000 GPD. Since this range is significantly less than the estimated sewage flow based on the WPCF flow data discussed in the next section, we decided not to use water use and future population estimates to project future wastewater flows.

3.1.4 Current Wastewater Flow Based on WPCF Flow Data

We reviewed the Discharge Monitoring Reports (DMRs) for the year 2013 for the Main WPCF and selected a low-flow period in October 2013, from October 13 through October 19, to estimate the sewage flow component. The minimum nighttime flows during this period averaged only 0.56 MGD. During this same period the total daily flow averaged 2.14 MGD, of which 0.27 MGD originated from the Town of Mattapoisett. Subtracting the Mattapoisett flow from the total daily flow leaves 1.87 MGD as the total daily flow for Fairhaven. If we assume that the average minimum nighttime flow rate of 0.56 MGD is the baseline minimum I/I flow rate, we can subtract this from the Fairhaven total daily flow of 1.87 MGD to get the Fairhaven sewage flow component of 1.31 MGD. This value is much higher than the estimate based on water usage.

3.1.5 Town of Mattapoisett Future Wastewater Flow

Following the Phase 1 report, Town of Mattapoisett representatives requested increasing Mattapoisett's allotted capacity at the Main WPCF from 0.50 to 0.80 MGD (average daily flow) for the 20-year IMA period. Therefore, for the wastewater flow projections in this study, we will carry the figure of 0.80 MGD for the Town of Mattapoisett for 2035.

3.1.6 Wastewater Flow Projections

A review of 2013 monthly reports for the Main WPCF indicates the current annual average daily flow to this facility is approximately 3.09 MGD, including domestic/commercial/ industrial wastewater and I/I. Mattapoisett pumping station flow records for 2013 show an annual average daily flow of 0.37 MGD for that community, leaving 2.72 MGD for Fairhaven.

We estimate the present average annual I/I flow rate at the Main WPCF to be 1.55 MGD, which results in a 1.17 MGD domestic/commercial/industrial wastewater flow to that facility. This value is about 11% less than the October flow rate of 1.31 MGD calculated above, but may be more accurate because it is determined over a year's timeframe.

To calculate domestic/commercial/industrial wastewater flows for 2035, we assume that the change will be similar to the projected population change, or about a 6.5% increase above 1.17 MGD, plus the equivalent of another 8 new sewer connections annually as a result of infill and sewer abutters converting from discharge to septic systems to sewer discharge (The Town has no plans for major sewer extensions in the foreseeable future, and has been experiencing about 5 – 10 new connections per year over the past several years.). The 6.5% increase translates to a wastewater flow of about 0.076 MGD, and the 8 connections per year will add about 202 gpd/connection, based on the current flow of 1.17 MGD for 5,802 sewer connections, or a total of 35,552 gpd over 22 years (2013 – 2035). Given the current regulatory environment and the public's awareness of water conservation issues, we do not anticipate an increase in the per capita water usage/sewage flow rate. In accordance with these assumptions, through the year 2035 the projected population increase plus the new sewer connections will contribute an additional domestic/commercial/industrial wastewater flow of 0.11 MGD, bringing the total to 1.28 MGD.

Concerning the flow contribution from I/I, the Town has been rehabilitating sewers to reduce I/I for many years, so we expect the I/I component of the wastewater flow will at worst remain constant through the year 2035. As stated above, we determined the present average annual I/I flow rate to be about 1.55 MGD, and we estimate the maximum daily I/I flow rate to be 6.20 MGD, for the wastewater collection system tributary to the Main WPCF.

Table 1 summarizes the projected average and maximum daily flow rates in 2035 for the Main WPCF. For other than I/I, we determined the maximum daily flow rates based on Figure 2-1, "Ratio of Extreme Flow to Average Daily Flow" in TR-16 – *Guides for the Design of Wastewater Treatment Works*. The basis for maximum I/I rates is flow metering data in the wastewater collection system.

Table 1 Wastewater Flow Projections for Year 2035 (MGD)

	Average Daily Flow	Maximum Daily Flow
Fairhaven – domestic/commercial/industrial	1.28	2.76
I/I	1.55	6.20
Mattapoisett	0.80	1.84
Total	3.63	10.80

3.2 West Island WPCF

The average daily flow at the West Island WPCF for any one month in 2013 was well below the design value of 80,000 gpd, and maximum daily flows were also significantly less than the 100,000-gpd design limit. The basis for the design flows is the existing population of West Island, a portion of which is not yet connected to the sewer system. The design flows are also limited by the capacity of the effluent disposal wells, which cannot be enlarged. Therefore, the

WPCF will continue to see more flow in the future, up to design limits, as new connections are made, but will never be expanded to handle more than current design flows.

4.0 TOWN-WIDE SEWER PLAN UPDATE IN GIS FORMAT

4.1 Database Update

For the Phase 1 report, FST updated the town's wastewater collection system GIS database by identifying pump station tributary areas, and re-labeling manholes according to these tributary areas. For Phase 2, we added the following information to the wastewater collection system database:

- Televised sewer inspection areas for work completed in 2011.
- Location and type of sewer or manhole rehabilitation for work completed in the late 1980s through 1990, and for pipe lining work done in 2011.
- Parcels contributing inflow, including estimated quantity and type – sump pump, roof drain, foundation drain, etc., for Sewer System Evaluation Survey (SSES) work completed in the early 1980s.
- Location of excessive pipeline infiltration, and infiltration quantity for SSES work completed in the early 1980s.
- Areas of flow isolation, and flow quantity for flow metering work completed in February 2014.
- Service connection locations/sketches.
- Sewer system record plans.

With the addition of this and other information to the GIS database, the Town will have ready access to data that will facilitate analysis for sewer system expansion or rehabilitation, assist with daily system operation and maintenance, and generally provide a solid foundation for an effective asset management program. The transfer of information to perform routine, daily functions, emergency investigations and non-routine analyses will be much quicker, and there will no longer be a need to rely on hard-copy plans and data, and to spend the time and money associated with filing, retrieving and maintaining this information.

Appendix A contains maps illustrating many of the characteristics noted above (Figures A-1 through A-5). These maps are in the vicinity of Sycamore Avenue in the Taber Street Pumping Station tributary area, and are representative of how the characteristics would be displayed throughout the community. The Town will be able to continue to update its wastewater collection system database using the hardware and software systems described in Section 4.2.

The Town also has areas with onsite subsurface disposal systems that have performance issues. These are located on Wilbur's Point and portions of Mill Street, Bridge Street and New Boston Road. We were unable to identify specific parcels experiencing problems, but if the Town is able to obtain this information in the future, it may be wise to add it to the database for use in considering future sewer extensions or alternative treatment for these parcels.

4.2 PeopleGIS Assistance with Online Mapping and Database Management

During the Phase 1 planning process, the Town used PeopleGIS, a database management subcontractor to FST, to begin online GIS mapping using its mapping/GIS program called MapsOnline. The MapsOnline setup in Phase 1 included uploading of the Town's Assessor's data to this program. In Phase 2, PeopleGIS provided the Town with two mapping websites, one for the public and one for Town DPW Sewer Department staff. Additional websites can be established in the future for other Town departments depending on their needs and wishes.

Also during Phase 2, PeopleGIS provided the Town with its online forms builder and database management tool called PeopleForms, for updating and managing the Town's GIS database. PeopleGIS will maintain the GIS files previously created for the Town's sewer system, and will keep the files up-to-date as FST adds or modifies data layers, or Town staff adds information by means of data entry forms the Town can create from scratch, or by adapting forms in the PeopleForms' library of over 1,300 forms built by other communities. These forms will serve as the platform for adding new information to the database such as:

- Location of new sewer construction and system characteristics
- Service connection addition, investigation or repair
- Sewer line cleaning/televising/repair
- I/I sources and quantities
- Planned roadway paving
- Pump station visits, maintenance and repair
- Sewer system work orders

Through the Town's contract with FST, the Town purchased three Nexus 10 tablet-style computers for Town personnel to create data entry forms, and then to use these or other forms in the Town's PeopleForms account to efficiently record field information and add it to the Town's database either at the time of data gathering or following in-house review. These tablets save time and resources by allowing one-time entry of data that can be easily uploaded to the database and website, and then made available for future retrieval and use/evaluation. The tablet computers also allow access to the Town's mapping website to view system characteristics in the office or the field.

4.3 PeopleGIS Training

In addition to online mapping and database management, PeopleGIS conducted three days of training with Fairhaven DPW Sewer Department staff. The purpose of the training was to teach staff about the database of information currently available to access and evaluate the Town's sewer system, and how to use data entry forms to update and enlarge the database.

Training on the first day consisted of an introduction to PeopleForms and database tables: primary tables, secondary tables, and lookup tables. The instructor explained how the database works with the mapping. He presented several examples of previously developed forms by other

municipal clients and demonstrated how to create and edit a form, enter data, and submit the completed form to PeopleGIS, where the data is entered automatically into the map as soon as it is received. At the end of the training session, those who attended received user names and passwords for access to and use of the Town's GIS database.

On the second day of PeopleGIS training, the instructor went through the forms that were built for Sewer Department personnel during their first day of training. The staff gave comments and suggestions on those forms and built additional forms. The staff also used their tablets to access the PeopleGIS website and create a few entries on the forms for practice. When the session ended, the instructor took additional forms to build at his office.

On the third and final day of training, the instructor presented additional forms that he had created and explained how he had built the forms. Having had time to work with the tablet computers prior to the last day of training, Town staff also posed questions concerning data entry into the initial forms. The instructor also worked with Fairhaven staff in creating custom forms that would be used in the field.

5.0 WASTEWATER TREATMENT CAPACITY AND PROCESS ASSESSMENT – MAIN WPCF

5.1 Capacity

The Phase 1 report discussed the current NPDES Permit (Permit No. MA0100765) for the Main WPCF that was issued in March 2003, and is still in effect. Also mentioned in the Phase 1 report is the Draft NPDES Permit that the United States Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MassDEP) issued in 2010. Since the Phase 1 report there has been no finalization of the 2010 Draft NPDES Permit, the limits for which are summarized below:

Table 2 Draft NPDES Permit

Parameter	Average Monthly	Maximum Daily
Flow	5.0 MGD	Report
BOD_5	30 mg/L	45 mg/L
TSS	30 mg/L	45 mg/L
pH	6.5 – 8.5	
Fecal Coliform	88 cfu/100 mL	260 cfu/100 mL
Enterococci	35 cfu/100 mL	276 cfu/100 mL
Total Nitrogen	125 lbs/day	Report

The Phase 1 report contains a complete copy of the draft and current NPDES Permits. Recent discussions with EPA indicate that MassDEP and EPA will finalize the NPDES Permit by September 1, 2014.

As noted in Phase 1, the permit changes include:

- Nitrogen limit of 125 lbs/day (equivalent to 3 mg/L @ 5.0 MGD design average daily flow) instead of only reporting concentration/loading.
- Addition of Enterococci with an average monthly limit of 35 colony-forming units (cfu)/100 milliliters (mL) and maximum daily limit of 276 cfu/mL.

Table 3 presents the wastewater influent and effluent characteristics at the Main WPCF in 2013 in comparison to average monthly criteria in the 2010 Draft NPDES Permit. Review of the Main WPCF's monthly reports through 2013 shows the plant is meeting all of its current NPDES Permit requirements, and the UV disinfection system should ensure compliance with future Enterococci limits. To meet the effluent total nitrogen loading of 125 lbs/day would require significant plant modifications, a number of which were reviewed in the Phase 1 report.

The basis for the draft permit's proposed nitrogen limit is the Massachusetts Estuaries Project (MEP) June 2013 final report "Linked Watershed-Embayment Model to Determine Critical and

Table 3 2013 Wastewater Characteristics and Draft NPDES Permit Limits

	2013 Influent		2013 Effluent		Effluent
Parameter	**Average**	**Range**	**Average**	**Range**	**Draft NPDES**
Flow (MGD)	3.06	1.84 – 9.43	--	--	5
TSS (mg/L)	125.9	18 – 760	10.74	1 - 112	30
BOD5 (mg/L)	152.74	30 – 360	7.71	1.7 – 27	30
Nitrogen (mg/L)	30.01	6.9 – 60	15.11	4.9 – 33	--
Nitrogen (lbs/day)	698	142 – 1180	370	97 - 866	125
Fecal Coliform (cfu/100 mL)	--	--	37.09	0.8 - 138	88

Nitrogen Loading Thresholds for the New Bedford Inner Harbor Embayment System, New Bedford, MA". The University of Massachusetts School of Marine Science Technology (SMAST) and MassDEP were the main authors of this report. The Town has been communicating with SMAST about various assumptions and criteria used in the MEP report, and has requested nitrogen model runs for a WPCF effluent discharge of 10 mg/L total nitrogen, and for isolating just the total nitrogen discharge from the WPCF to understand the facility's impact on the nitrogen concentration at a designated measurement point in the embayment.

While the nitrogen limit in the NPDES Permit is not yet final, this report adds to the work completed in Phase 1 for an effluent limit of 3 mg/L, assuming this is a worst-case scenario. The additional tasks include modeling the plant's processes to determine the achievable effluent nitrogen concentration with process optimization, and then modeling the combination of the optimized process with significant plant upgrades to achieve 3 mg/L total nitrogen in the effluent. We performed the modeling with Biowin software, and developed costs for the optimized and significant upgrade options.

Modeling the Main WPCF treatment processes needs to account for the impact of the recently installed anaerobic digestion system, and especially the effect of the digester supernatant. Currently this supernatant is combined with thickened waste activated and primary sludge and disposed offsite. However, the relatively low solids content of this supernatant (< 2%) makes this disposal infeasible over the long term, so the modeling assumes this supernatant returns to the head of the plant with other recycle flows. With the possible future acceptance of fats, oil and grease as a supplemental feed to the digesters to boost methane production; the supernatant may incur even greater biological, solids and nutrient loadings.

Before delving into process modeling, a brief discussion on plant hydraulics is in order. The Phase I report noted that the Main WPCF has no hydraulic limitations for handling peak flows, and contains a hydraulic profile that confirms this. Wastewater flow projections through 2035, determined in Section 3 of this report, also do not indicate a need for a hydraulic capacity increase during this timeframe. Significant plant upgrades to achieve low effluent total nitrogen concentrations may, however, change hydraulic needs in the future, as discussed later in this chapter.

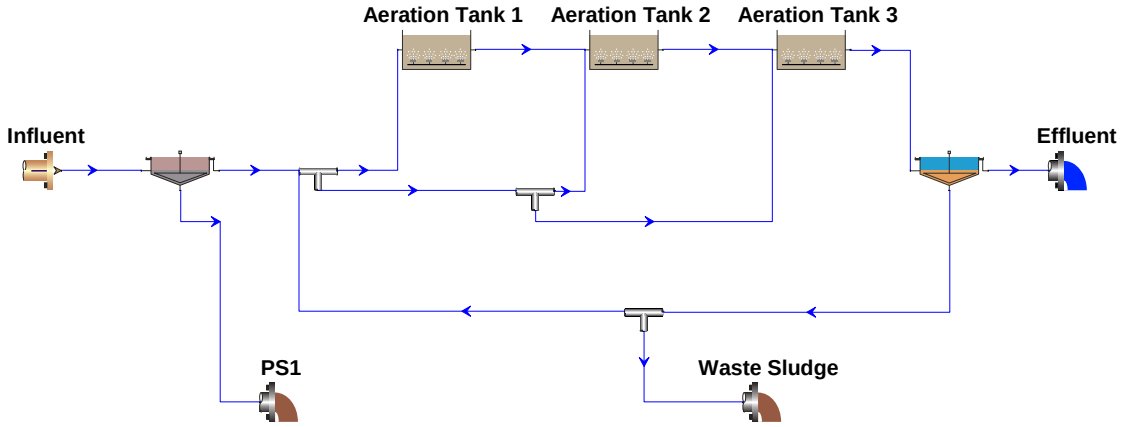
5.2 Biowin Modeling – Existing Process Operation

Biowin is a computerized wastewater process simulator that can combine various biological, chemical and physical treatment processes to aid in the design of all types of wastewater treatment processes. Biowin modeling can be used to: simulate the performance of a wastewater treatment plant, predict potential effects of operational changes such as placing unit processes in and out of service or changing sludge recycle rates, or evaluate the relative effectiveness of different facility upgrades. Modeling can also help identify process bottlenecks because it looks at the treatment plant as a whole rather than examining each unit process separately. It is a therefore a low-cost way to make virtual changes in a treatment system without the risk of causing a process upset or violating permit limits.

For the Main WPCF, FST utilized Biowin to first input the plant's reported influent flow data and wastewater characteristics, along with the existing tank sizes and configurations, to analyze the performance of those existing wastewater treatment processes. We then adjusted various model parameters as necessary to customize the model so the model results replicated, as closely as possible, the plant's average annual level of treatment.

As shown in the Figure 3 schematic diagram, the existing wastewater treatment process at the Main WPCF utilizes primary clarifiers for the removal of settleable solids; diffused aeration activated sludge in a step-feed configuration for the removal of carbonaceous biochemical oxygen demand (BOD); and secondary clarifiers to settle out activated sludge material and return it to the aeration basins.

Figure 3 Existing Schematic Flow Diagram for Main WPCF



This process is preceded by preliminary treatment in the form of screening and grit removal, and the process is followed by disinfection facilities prior to effluent discharge to the Acushnet River. The plant was designed to treat an average daily flow of 5.0 MGD and a maximum hourly wet weather flow of 16.0 MGD. Based on the plant's records, the plant presently handles an average daily flow of about 3.1 MGD. The excess wet weather wastewater flows, which include I/I, are diverted to on-site sidestream flow equalization facilities and later returned to the normal treatment process. Waste solids from the primary and secondary clarifiers are thickened and sent to anaerobic digesters where they are reduced and stabilized. Presently, the Town has a

contract with Synagro that allows the Town to have the stabilized liquid sludge from the digesters hauled off-site for incineration at a waste-to-energy facility.

To initially setup and test the computer model, information on the influent flow rate and load characteristics to the treatment facility was taken from the plant's monthly operation reports for the year 2013. Table 4 presents a summary of the present average annual influent flows and loads to the plant.

Table 4 2013 Present Influent Wastewater Flow Characteristics

Element name	Influent
Flow	3.06
Total Carbonaceous BOD mg BOD/L	153.00
Volatile suspended solids mg VSS/L	90.00
Total suspended solids mg TSS/L	126.00
Total Nitrogen mg N/L	30.00
Total P mg P/L	5.00
Nitrate N mg N/L	0
pH	6.90
Alkalinity mmol/L	6.00
Calcium mg/L	80.00
Magnesium mg/L	15.00
Dissolved oxygen mg/L	2.15
Wastewater Temperature, ^{0}C	15

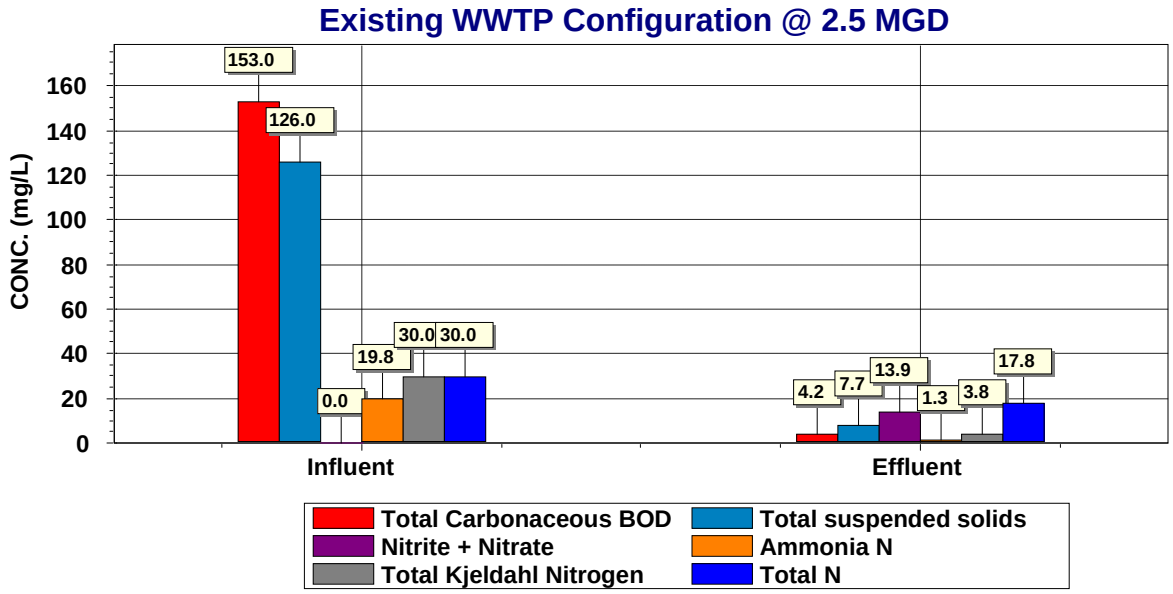
Mixed liquor solids concentration (MLSS) in the aeration tanks, MLSS recycle rates and sludge wasting rates were set based on the average annual data listed in the plant's monthly operations reports. Using the plant's 2013 data, we ran the Biowin model in an attempt to replicate the actual results achieved at the treatment plant. Figure 4 presents the predicted results of the concentrations for BOD, TSS and nitrogen loadings in the plant effluent.

As reported by the plant, in 2013 the actual average annual effluent total nitrogen concentration was 15.1 mg/L, which approximates the predicted value of 17.8 mg/L. Meanwhile, the reported annual average values for BOD and TSS of 7.7 and 10.7 mg/L, respectively, were also approximated by the model's predicted results of 4.2 and 7.7 mg/L, respectively.

A complete list of input data and results for the Biowin modeling for the existing plant configuration when operating under the existing WWTP flow configuration can be found in Appendix B of this report.

Once we established the accuracy of the customized model of the existing Main WPCF, we used the Biowin model to aid in re-designing the existing facility to determine the changes needed to

Figure 4 Influent Concentrations and Effluent Results



allow it to meet the more stringent nitrogen effluent limits in the Town's draft NPDES discharge permit.

5.3 Biowin Modeling - Process Modifications for Nitrogen Reduction

To model nitrogen reduction, we undertook a multi-step approach to first evaluate the changes that can be made to optimize the existing tankage and equipment, thereby avoiding the need for adding new process tanks, added chemicals, or expensive add-on treatment equipment. The available process modifications that can be modeled using Biowin to optimize the existing wastewater treatment facilities to achieve additional nitrogen reduction include the following:

- Pre-anoxic Zone (Modified Ludzack-Ettinger, MLE)
- Secondary Anoxic Zone (Bardenpho)
- Carbon Addition
- Mechanical Mixing

Other add-on type treatment systems for nitrogen reduction were also modeled using Biowin, and those alternatives are discussed later in Section 5.3 of this report.

Since temperature has a significant impact on the nitrification/denitrification process, we developed separate models to determine the impact of plant optimization during the cold weather and warm weather portions of the year. Subsequent modeling was then undertaken to evaluate the impact of plant optimization coupled with specific added treatment systems to achieve the required nitrogen removal. The added treatment processes that are capable of being modeled with Biowin include Membrane Bioreactors (MBR), the Biomag process and denitrification filters.

The MLE and Bardenpho processes are both types of suspended growth treatment processes that achieve nitrogen removal by allowing the wastewater to pass between anoxic and aerobic conditions. The MLE process includes an initial anoxic zone followed by an aerobic zone. The anoxic zone would be created by adding walls and shutting off the air in the influent ends of the first aeration tanks. Mixers would be added to keep the mixed liquor in suspension. In the aerobic zone, aerobic bacteria convert ammonia nitrogen to nitrate. To maximize the aerobic detention time, we converted the smaller set of secondary clarifiers to additional aerobic zones. An internal recycle from the aerobic zone to the anoxic zone is provided to allow anoxic bacteria to convert the nitrate-nitrogen produced in the aerobic zone to nitrogen gas. An additional carbon source, such as methanol, may be needed in the anoxic zone to optimize denitrification.

In the Bardenpho process, the first two stages would be the same as for the MLE process, an anoxic zone followed by an aerobic zone. A second anoxic zone is added to provide denitrification of the portion of the main flow that is not recycled to the first anoxic zone. A second aerobic zone is also added to provide re-aeration to strip off more nitrogen gas and increase the dissolved oxygen of the wastewater prior to secondary clarification. Here again, we anticipated the need to convert the smaller set of secondary clarifiers to additional aerobic zones. The addition of methanol, or some other carbon source, may be necessary in the second anoxic zone to enhance denitrification.

As previously stated, the effluent from the anaerobic digesters is presently disposed of offsite. However, the relatively low solids content of the stabilized biosolids (~ 2%) may make this disposal alternative infeasible over the long term. The modeling conducted therefore assumes the stabilized biosolids from the digester will need to be dewatered to increase the solids concentration prior to off-site disposal, and that the filtrate from dewatering equipment will be returned to the head of the plant along with other recycle flows.

5.3.1 Case Study No. 1 - Optimization of Existing WWTP Using MLE During Warm Weather (May – December)

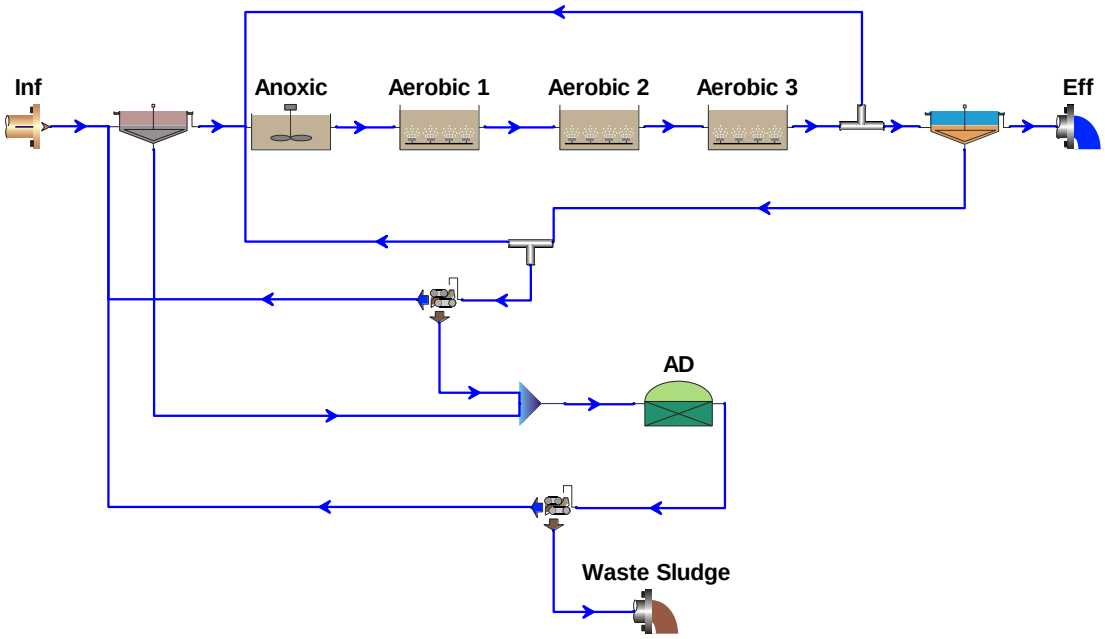
Table 5 presents the influent wastewater flow and characteristics that we used for Case Study No. 1. It should be noted that the concentrations of the influent characteristics are typically higher during the warm weather months of May through December because the dilution impact caused by groundwater infiltration into the wastewater collection system is typically lowest during this period. The values used represent the average for this warm weather time period for the year 2013, except that the design flow was set at the plant's original design value of 5.0 MGD.

Figure 5 shows the MLE process flow schematic for Case Study No. 1. In this arrangement, the first aeration tank in each train would be set up as an anoxic zone with the rest of the aeration basin capacity and the smaller secondary clarifiers used for aerobic zones. Recycle in the amount of 200-400% of the influent flow rate is returned to the start of the anoxic zone. Return activated sludge from the secondary clarifiers, also in the vicinity of 200-400% of the influent flow rate, also returns to the anoxic zone.

Table 5 Warm Weather Influent Wastewater Flow Characteristics for May through December

Element name	Influent
Flow, MGD	5.0
Total Carbonaceous BOD, mg BOD/L	180.00
Volatile suspended solids, mg VSS/L	110.00
Total suspended solids, mg TSS/L	145.00
Total Nitrogen, mg N/L	36.00
Total P, mg P/L	5.00
Nitrate N, mg N/L	0
pH	7.00
Alkalinity, mmol/L	6.00
Calcium, mg/L	80.00
Magnesium, mg/L	15.00
Dissolved oxygen, mg/L	1.10
Wastewater Temperature, ^{0}C	18

Figure 5 MLE Schematic Flow Diagram

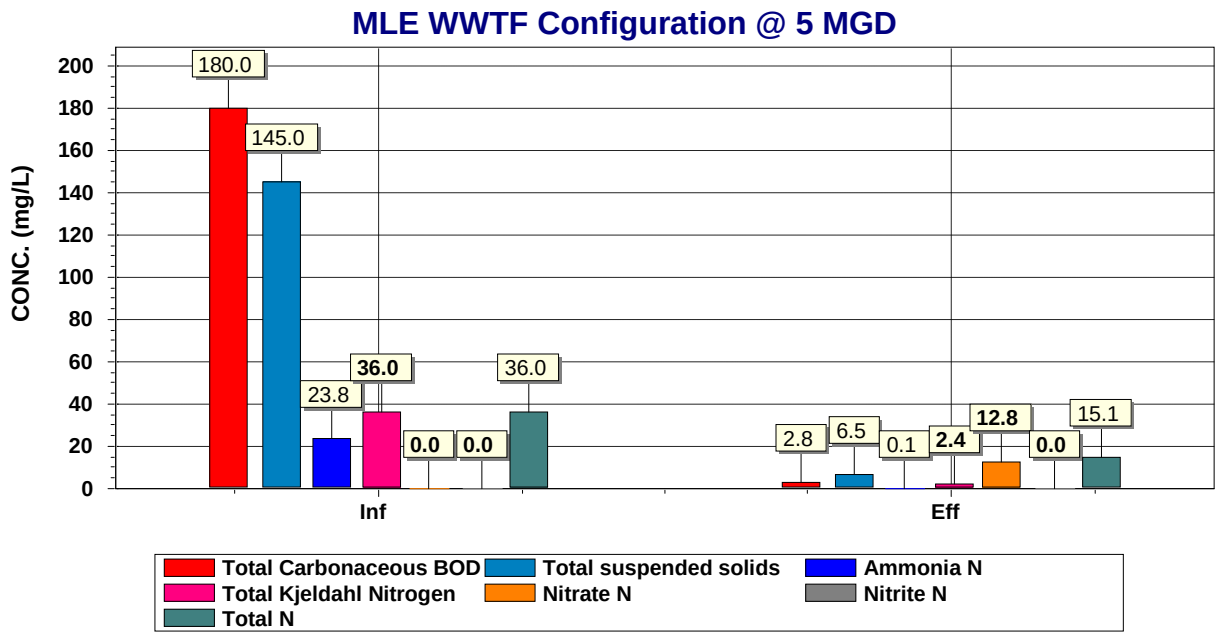


Waste sludge would be thickened and sent along with sludge from the primary clarifiers to the anaerobic digester. Filtrate from the thickener would be returned to the start of the process. Stabilized sludge would be withdrawn from the digesters and dewatered prior to being

transported off-site for disposal. Filtrate from the dewatering equipment would be returned to the head of the plant. The results of the Biowin modeling both with and without methanol addition were determined.

Figure 6 presents the predicted concentrations for BOD, TSS, phosphorus and nitrogen in the plant effluent for Case Study No. 1. These results are for the condition where no extra carbon source such as methanol is added to the treatment system, and indicate that modifications of the Main WPCF to provide the MLE process would have limited success at reducing total nitrogen levels in the plant effluent.

Figure 6 Case Study No. 1
Influent Concentrations and Effluent Results for MLE Process
During Warm Weather Conditions



When methanol is added, the results from Biowin modeling indicate that total nitrogen levels in the plant effluent could be reduced to less than 10 mg/L, but the process would still not be capable of achieving the proposed effluent limit of 3 mg/L. The amount of methanol addition to achieve 10 mg/L of total nitrogen in the effluent is about 110 gpd.

5.3.2 Case Study No. 2 - Optimization of Existing WWTP Using MLE During Cold Weather (January – April)

Typically, during the months of January through April groundwater elevations are at the highest levels for the year. This usually results in more groundwater infiltration into the wastewater collection system, higher influent flow rates and more dilute influent waste concentrations at the treatment facility, including the nitrogen concentration. The wastewater temperatures are also relatively low during the cold weather months. Water temperature plays a significant role in biological wastewater treatment. When the water temperature drops below about 15^0C,

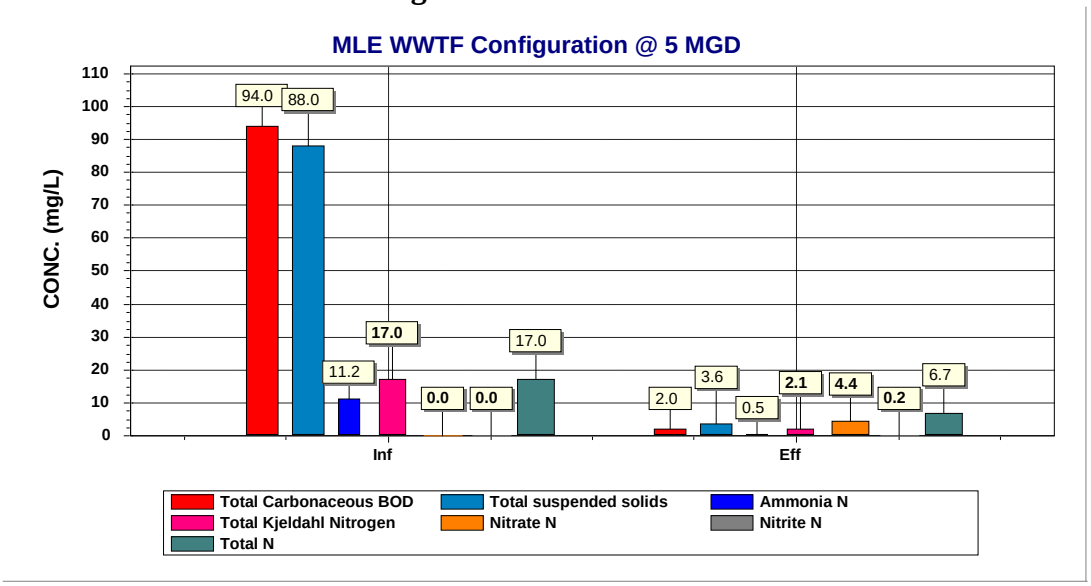
nitrifying and denitrifying bacteria become less active. Under these conditions, the nitrification and denitrification rates drop, and the detention times and tank volumes required to nitrify and denitrify increase. Table 6 presents the cold weather influent wastewater flow and characteristics for the year 2013 that were used in Case Study No. 2.

Table 6 Cold Weather Influent Wastewater Flow Characteristics for January through April

Element name	Influent
Flow	5.0
Total Carbonaceous BOD mg BOD/L	94.00
Volatile suspended solids mg VSS/L	66.00
Total suspended solids mg TSS/L	88.00
Total Kjeldahl Nitrogen mg N/L	17.00
Total P mg P/L	5.00
Nitrate N mg N/L	0
pH	7.00
Alkalinity mmol/L	6.00
Calcium mg/L	80.00
Magnesium mg/L	15.00
Dissolved oxygen mg/L	4.20
Wastewater Temperature, ^{0}C	11

The MLE process flow schematic for this case study is the same as in Case Study No. 1. Figure 7 presents the predicted results for Case Study No. 2 for BOD, TSS, phosphorus and nitrogen concentrations in the plant effluent.

Figure 7 Case Study No. 2
Influent Concentrations and Effluent Results for MLE Process During Cold Weather Conditions



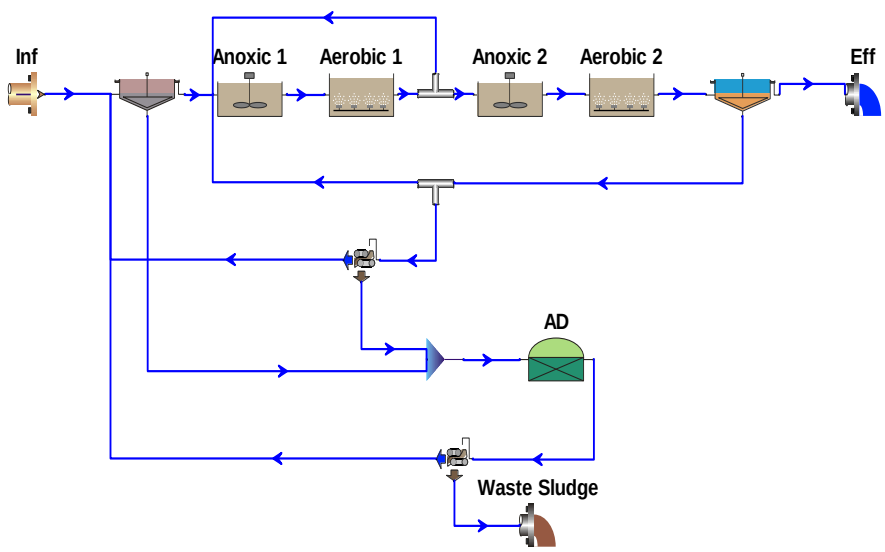
The Biowin modeling for this case study indicates that the effluent concentrations for almost all contaminants are lower than those determined in Case Study No. 1, but this is primarily the result of lower influent concentrations. Effluent concentrations for total nitrogen are improved but are still higher than the proposed effluent discharge limit. When methanol is added at a rate of 100 gpd, the effluent concentration for total nitrogen is reduced to less than 10 mg/L, but still exceeds the proposed discharge limit of 3 mg/L.

A complete list of input data and results for the Biowin modeling for Case Studies No. 1 and 2 can be found in Appendix B of this report.

5.3.3 Case Study No. 3 - Optimization of Existing WWTP Using the Bardenpho Process (May through December)

The following case studies involve the optimization of the existing treatment facilities using the Bardenpho process. Each of these case studies utilized the same warm weather and cold weather influent wastewater flows and loads that were used in Case Studies No. 1 and 2. Figure 8 shows the schematic layout for the 4-stage Bardenpho modifications to the Main WPCF.

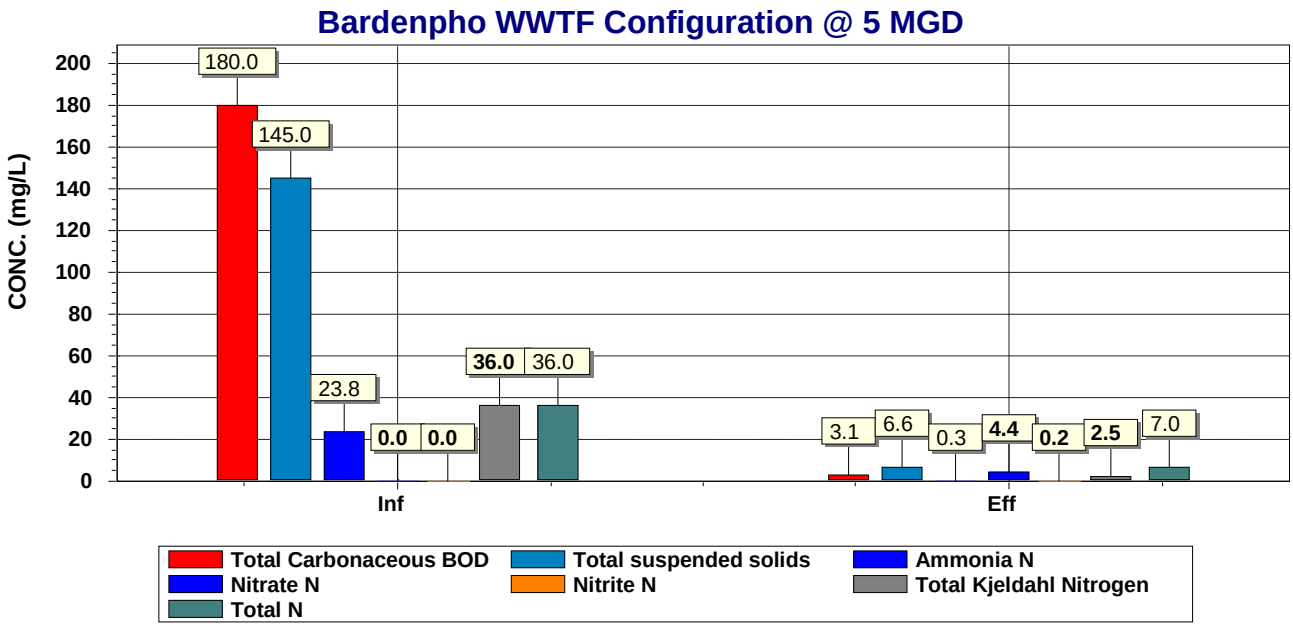
Figure 8 Bardenpho Schematic Flow Diagram



In this arrangement, the first and third aeration tanks in each train would be set up as anoxic zones, with the second aeration basin and the smaller secondary clarifiers used for aerobic zones. Recycle in the amount of 200-400% of the influent flow rate is returned from the first aerobic zone to the start of the first anoxic zone. Return activated sludge from the secondary clarifiers, also in the amount of 200-400% of the influent flow rate, is returned to the first anoxic zone as well. Waste sludge would be thickened and sent along with primary sludge to the anaerobic digesters. Filtrate from the thickener would be returned to the start of the process. Stabilized sludge would be withdrawn from the digesters and dewatered prior to being transported off-site for disposal. Filtrate from the dewatering equipment would be returned to the head of the plant.

As indicated in Figure 9, the results of Biowin modeling for this configuration show that, during the warm weather months with higher waste load concentrations, the modifications to the Main

Figure 9 Case Study No. 3
Influent Concentrations and Effluent Results for Bardenpho Process
During Warm Weather Conditions



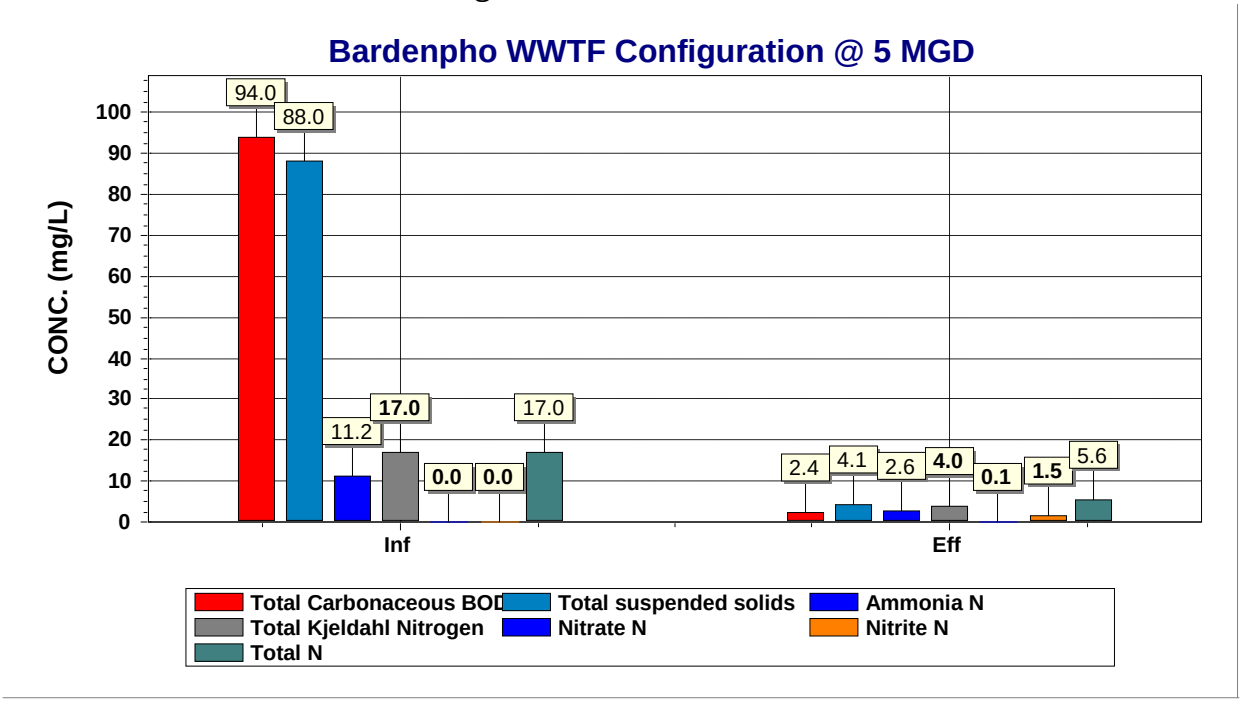
WPCF to provide the 4-stage Bardenpho process, without methanol addition, would have improved success at reducing total nitrogen levels in the plant effluent to about 7 mg/L. When methanol is added at a rate of about 100 gpd, the modeling results indicated that total nitrogen levels in the plant effluent could be slightly further reduced by 2 or 3 mg/L, but the process would still not be capable of achieving the proposed effluent limit of 3 mg/L.

5.3.4 Case Study No. 4 - Optimization of Existing WPCF Using the Bardenpho Process (January through April)

During the cold weather months of January through April when wastewater flows are high and pollutant concentrations are reduced, Biowin modeling indicated that optimizing the existing treatment process to incorporate the 4-stage Bardenpho treatment process resulted in lowering the effluent nitrogen level to about 6 mg/L.

With methanol addition up to 100 gpd, the modeling results showed the total nitrogen levels in the plant effluent could be further reduced, but the process would still not be capable of achieving the proposed effluent limit of 3 mg/L. The modeling results for Case Study No. 4 are shown in Figure 10. The results of Case Studies No. 1 through 4 indicate, however, that the 4-stage Bardenpho process is more effective in reducing nitrogen than the MLE process.

Figure 10 Case Study No. 4
Influent Concentrations and Effluent Results for Bardenpho Process
During Cold Weather Conditions



5.4 Biowin Modeling - Alternatives for Add-On Treatment Facilities at the Main WPCF

The add-on treatment systems that can be modeled using Biowin to optimize the existing wastewater treatment facilities and provide for additional nitrogen reduction have previously been listed in this report as including the following:

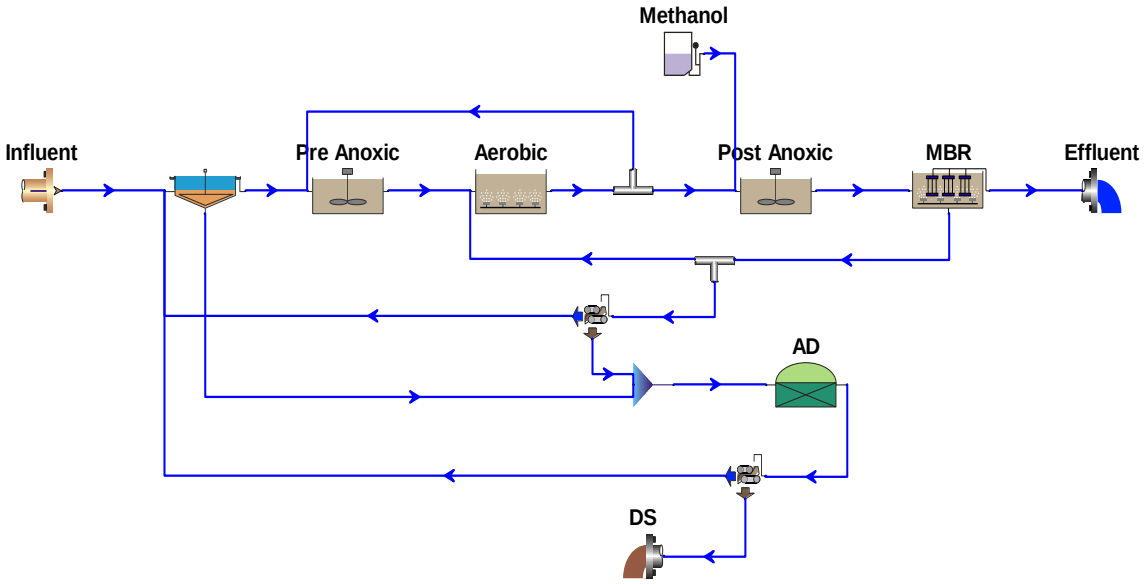
- Membrane Bio-Reactor (MBR)
- Denitrification Filter
- Biomag

5.4.1 Case Studies No. 5 and 6 - Optimization of Existing WWTP Using the Bardenpho/MBR Process (May through December and January through April)

The Membrane Bio-Reactor (MBR) process is a process that replaces the need for secondary clarification with a membrane reactor that provides ultrafiltration of the effluent and recycles some of the waste to the influent of the aeration system. This treatment alternative is able to significantly increase the amount of solids present in the reactor and produce an effluent with low solids and reduced nitrogen. To achieve a higher degree of nitrogen removal, the MBR would be coupled with the 4-stage Bardenpho process modifications previously discussed. In Fairhaven, the MBRs would be installed in one of the larger secondary clarifiers while the other large secondary clarifier is converted to a post-anoxic zone. The first aeration tank in each train would be set up as pre-anoxic zones, with the remaining four aeration tanks and the two smaller secondary clarifiers used as aerobic zones. Recycle in the amount of 200-400% of the influent

flow rate is returned from the aerobic zone to the start of the pre-anoxic zone. Return activated sludge from the MBR basin, also in the vicinity of 200-400% of the influent flow rate, is returned to the aerobic zone. Waste sludge would be thickened and sent along with sludge from the primary clarifiers to the anaerobic digester. Filtrate from the thickener would be returned to the start of the process. Stabilized sludge would be withdrawn from the digesters and dewatered prior to being transported off-site for disposal. Filtrate from the dewatering equipment would be returned to the head of the plant. Methanol would need to be added in the post-anoxic zone to assist in completing the denitrification process. Figure 11 shows the schematic layout for a 4-stage Bardenpho system with MBR addition to the Main WPCF.

Figure 11 Bardenpho/MBR Schematic Flow Diagram



The Biowin modeling results shown in Figures 12 and 13 utilized the same warm weather and cold weather influent wastewater flows and loads that were used in Case Studies No. 1 and 2. The results of the Biowin modeling indicated that the combination of plant optimization to include the Bardenpho process with the add-on MBR equipment would be capable of reducing the effluent total nitrogen level to less than 3 mg/L. To achieve this level of treatment, approximately 250 gpd of methanol would need to be added to the treatment process during the warm weather months of the year. During the cold weather months of January through April, the Biowin modeling also indicated that lowering the effluent total nitrogen to less than 3 mg/L would be possible by using about 125 gpd of methanol.

5.4.2 Case Studies No. 7 and 8 - Optimization of Existing WWTP Using the Bardenpho/Denitrification Filter Process (May through December and January through April)

Biological denitrification filters have been frequently added onto secondary treatment nitrification processes to reduce the amount of total nitrogen in the plant effluent. The process simultaneously removes suspended solids from the effluent. There are two main denitrification filter configurations that are available: downflow filters and upflow continuous backwash filters.

Figure 12 Case Study No. 5
Influent Concentrations and Effluent Results for Bardenpho/MBR Process During Warm Weather Conditions

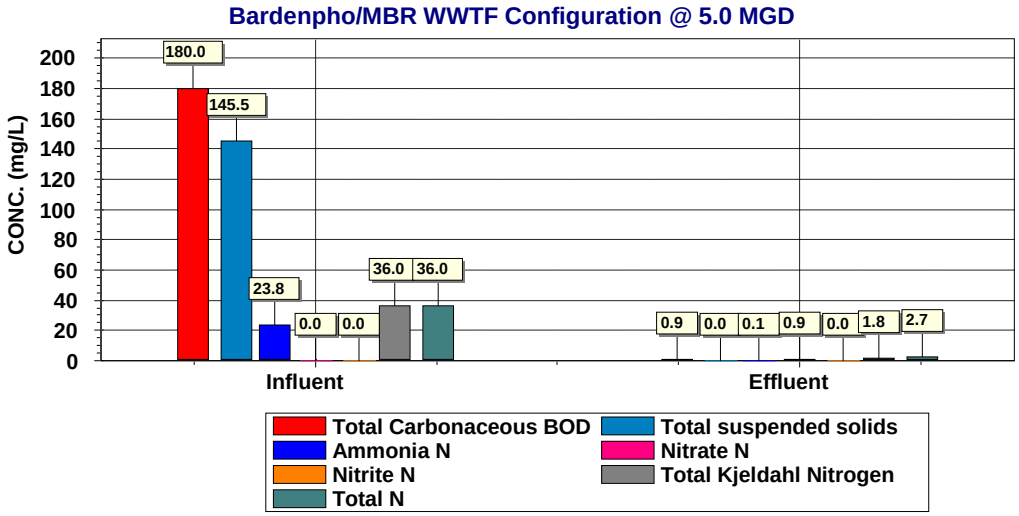
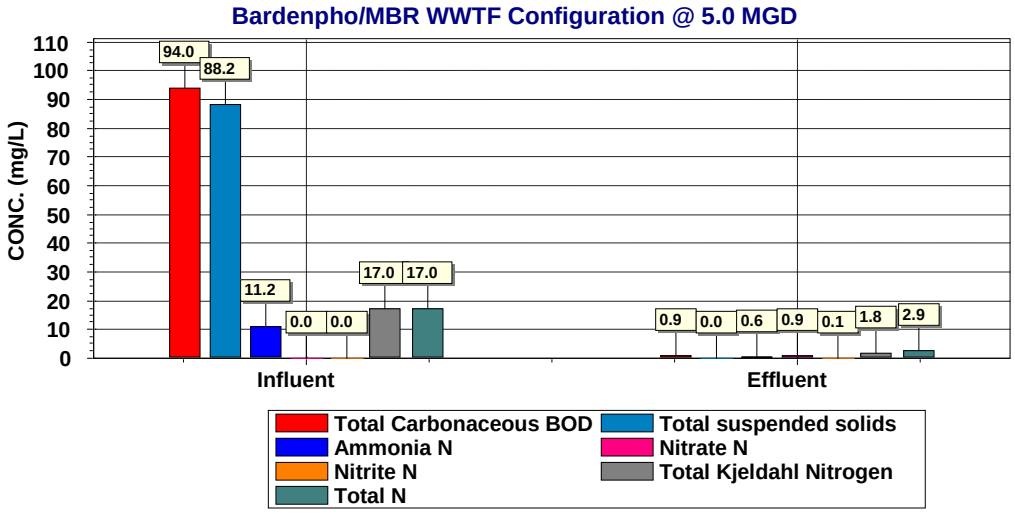


Figure 13 Case Study No. 6
Influent Concentrations and Effluent Results for Bardenpho/MBR Process During Cold Weather Conditions



With both configurations, methanol (or another readily biodegradable carbon source) is added to wastewater ahead of the filter to enable denitrifying bacteria to grow.

Downflow denitrification filters operate in a conventional filtration mode and consist of gravel and sand supported by an underdrain. Filters must be taken out of service at regular intervals for a short backwashing cycle consisting of air scouring and backwashing with air and water. Nitrogen-release cycles are needed to remove nitrogen gas bubbles that are produced during

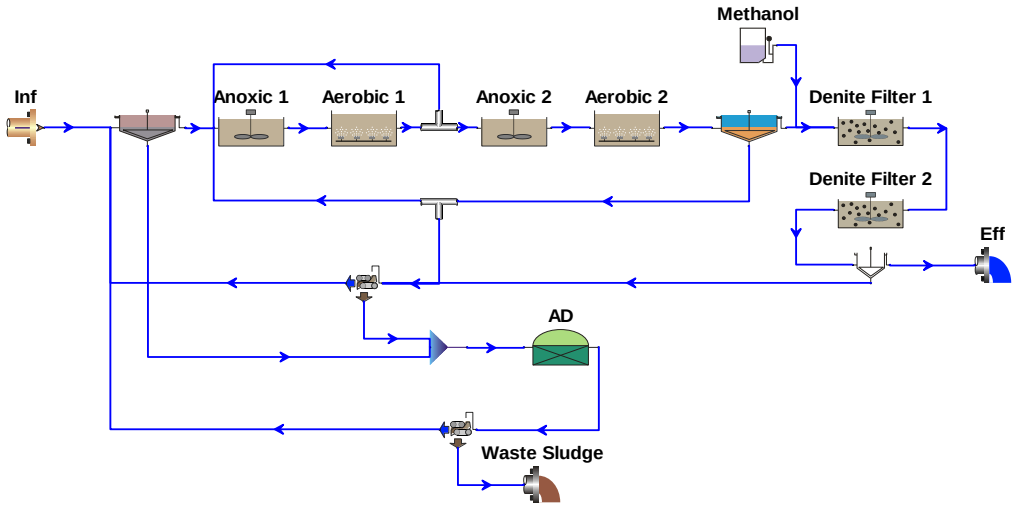
denitrification and accumulate in the media. A mudwell normally is provided for equalization to avoid sending slugs of spent backwash water to the plant's headworks.

Upflow continuous-backwash filters differ in that influent wastewater flows upward through the filter countercurrent to the movement of the sand bed. The filters are supplied as modular units installed in steel tanks or in multiple cells in concrete basins. With proper control of the methanol dose, these types of filters are capable of producing total effluent nitrogen levels below 3 mg/L. To achieve this higher degree of nitrogen removal in Fairhaven, the 4-stage Bardenpho process modifications previously discussed would be utilized to convert the influent ammonia and organic nitrogen loadings to nitrate nitrogen, and the denitrification filters would then convert the nitrate nitrogen to nitrogen gas.

In terms of the effect of denitrification filters on plant hydraulics, both types of filters would add significant headloss through the system. In Fairhaven's case, gravity flow through the treatment process would no longer be possible since the new filters would necessitate the construction and operation of an intermediate pumping station to offset the added headloss.

Figure 14 shows the Biowin schematic layout for a 4-stage Bardenpho system with add-on denitrification filters for the Main WPCF.

Figure 14 Bardenpho/Denitrification Filter Schematic Flow Diagram



The results of the Biowin modeling shown in Figures 15 and 16 indicate that the combination of plant optimization to include the Bardenpho process with the add-on denitrification filter equipment would be capable of reducing the effluent total nitrogen level to less than 3 mg/L. Approximately 150 gpd of methanol would need to be added to the treatment process during the warm weather months of the year to achieve this level of treatment. During the cold weather months, methanol addition could be reduced to about 30 gpd.

Figure 15 Case Study No. 7
Influent Concentrations and Effluent Results
for Bardenpho/Denitrification Filter Process
During Warm Weather Conditions

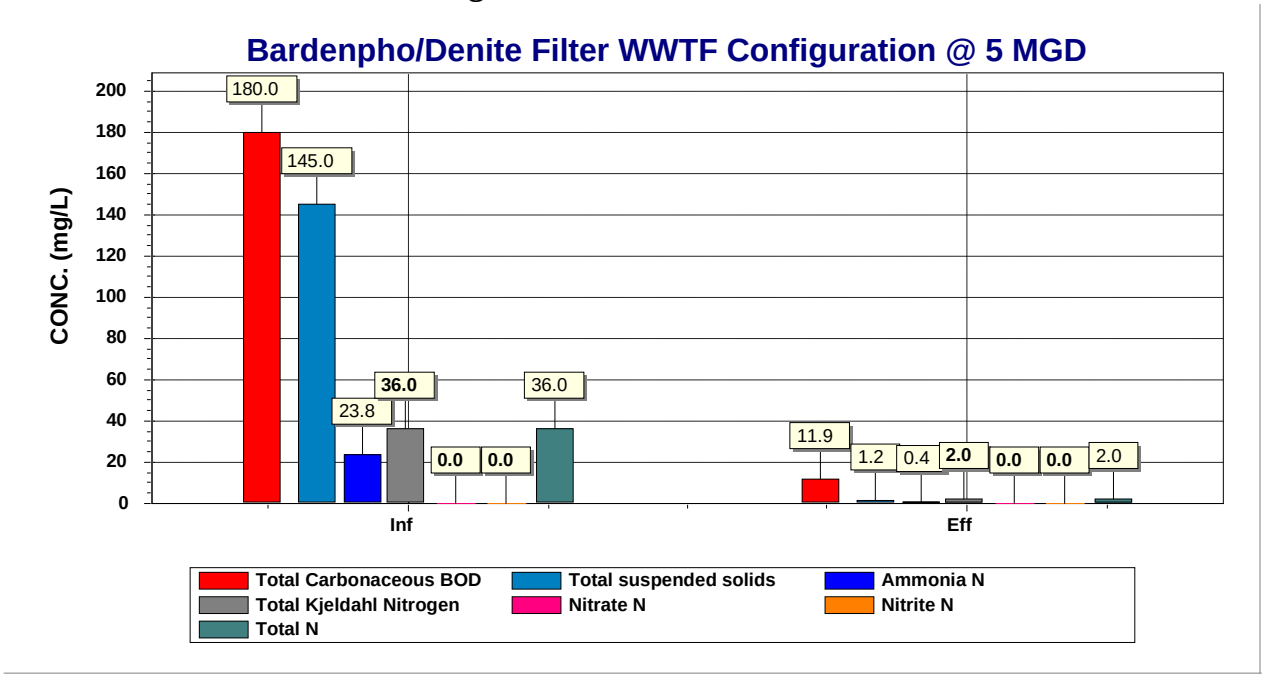
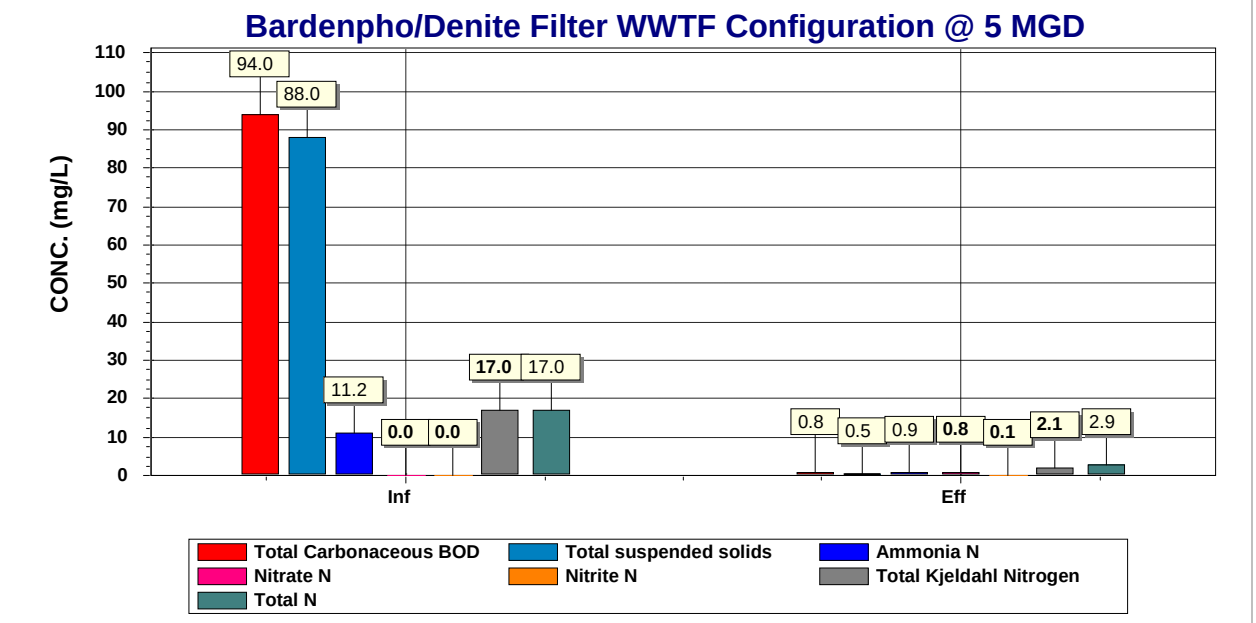


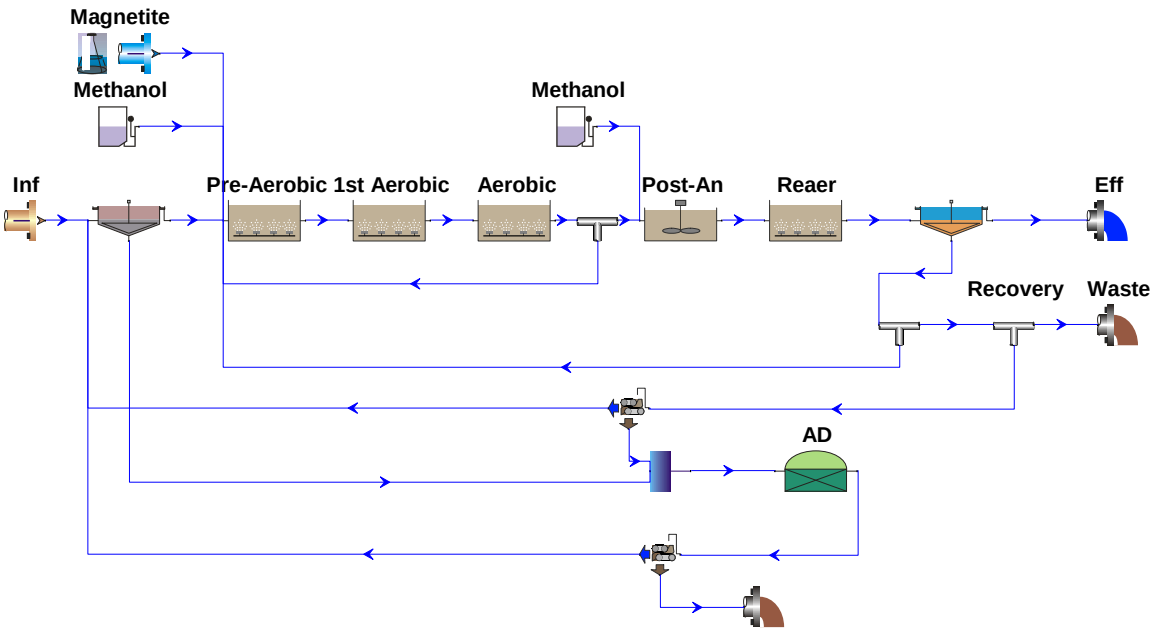
Figure 16 Case Study No. 8
Influent Concentrations and Effluent Results
for Bardenpho/Denitrification Filter Process
During Cold Weather Conditions



5.4.3 Case Studies No. 9 and 10 - Optimization of Existing WWTP Using the Biomag Process (May through December and January through April)

The Biomag process is an enhanced biological wastewater treatment process that utilizes magnetite (Fe_3O_4) as a ballast material to combine with the biological floc in the aeration basins. This combination of materials has a high specific gravity that rapidly settles out in the secondary clarifiers. This in turn enables the biological treatment system in the aeration tanks to operate at elevated mixed liquor solids concentrations, which can enable the processing of higher flows while also achieving enhanced suspended solids, nitrogen and phosphorus removal rates. As shown in Figure 17, magnetite is added at the beginning of the first pre-aerobic tank where it is blended with return activated sludge from the secondary clarifiers that is also combined with magnetite. Additional magnetite is recovered from the waste activated sludge by means of a magnetic drum separator and returned to the head of the process. Internal recycle in the amount of 200-400% of the influent flow rate is returned from the end of the aerobic zone to the start of the pre-aerobic zone. Methanol is also added as a carbon food source to facilitate the denitrification process. The post anoxic and re-aeration zones would be created by the conversion of the existing two small secondary clarifiers. Waste sludge from the process would be thickened, digested and dewatered as previously described in the other treatment alternatives.

Figure 17 Biomag Schematic Flow Diagram



The Biowin modeling results shown in Figures 18 and 19 utilized the same warm weather and cold weather influent wastewater flows and loads that were used in Case Studies No. 1 and 2. The results of the Biowin modeling indicated that with incorporation of the four stage Bardenpho and Biomag processes, the Main WPCF would be capable of reducing the effluent total nitrogen level to less than 3 mg/L. To achieve this level of treatment, approximately 240 gpd of methanol would need to be added to the treatment process during the warm weather months of the year

Figure 18 Case Study No. 9
Influent Concentrations and Effluent Results for Biomag Process
During Warm Weather Conditions

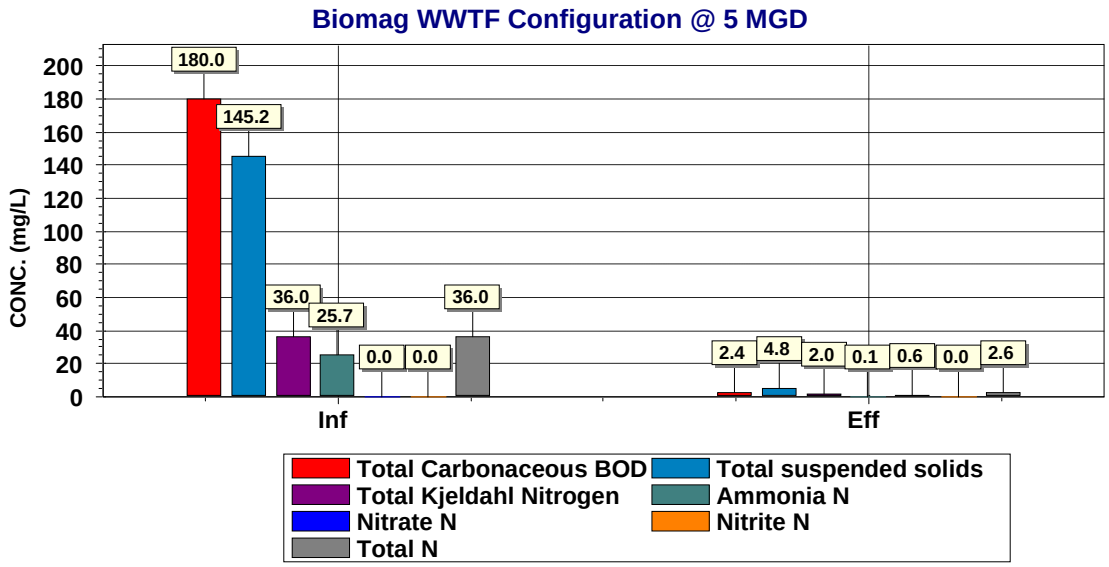
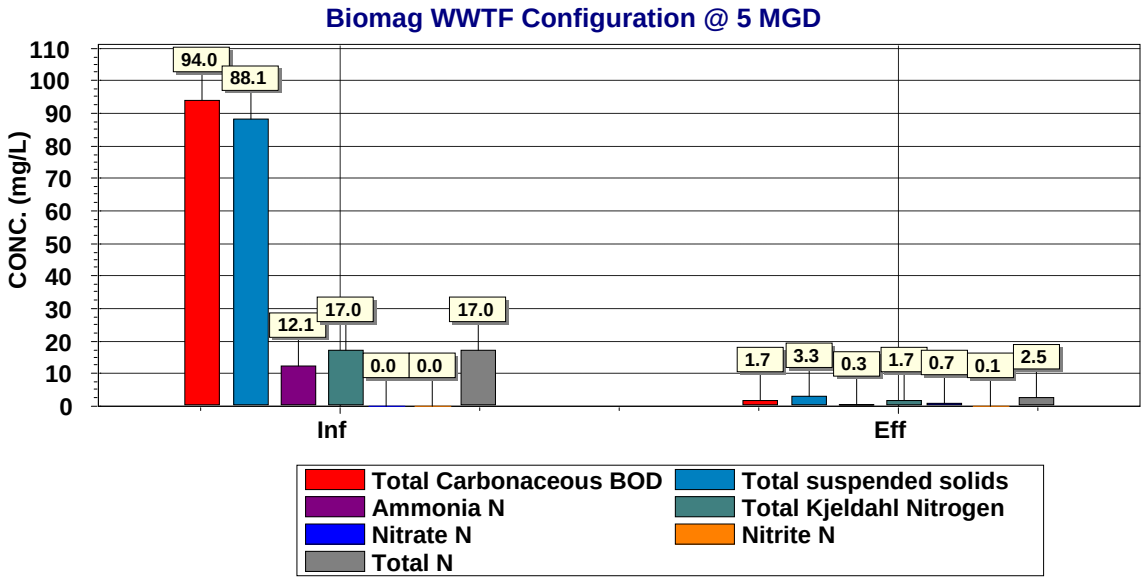


Figure 19 Case Study No. 10
Influent Concentrations and Effluent Results for Biomag Process
During Cold Weather Conditions



(May through December), and about 200 gpd of methanol would need to be added during the cold weather months of January through April.

5.5 Cost Estimates

We prepared cost estimates as a means of evaluating the various alternatives for optimizing and adding onto the existing facilities at the Main WPCF. These alternatives included:

Option 1 – Optimization to the four-stage Bardenpho process.

Option 2 – Optimization to the four-stage Bardenpho process followed by the addition of an MBR system.

Option 3 - Optimization to the four-stage Bardenpho process followed by the addition of denitrification filters.

Option 4 - Optimization to the four-stage Bardenpho process followed by the addition of a Biomag system.

Option 1, the optimization of the existing tanks and equipment to the four-stage Bardenpho process, was included in the event that the new NPDES permit is issued with a higher limit of 10 mg/L for total nitrogen. The Bardenpho process was selected over the MLE process because the results of the Biowin modeling indicate that it is more effective in reducing the nitrogen levels in the plant effluent.

We determined capital costs based on estimated construction costs including equipment, installation, piping, building, site preparation, electrical, instrumentation, HVAC, plumbing, and controls. Equipment costs were obtained from the manufacturers, and construction costs from our current cost data files. Copies of the detailed cost estimates are included in Appendix C of this report.

Mark-ups to the base construction cost are shown on the detailed cost estimates and include the following:

- General Requirements 15%
- Contractor Overhead and Profit 15%
- General Contractor Profit on Subs 5%
- Bonds and Insurance 3%
- Construction Contingencies 30%
- Engineering 15%

Operation and maintenance (O&M) costs were also estimated for each treatment option listed above. O&M costs include the additional costs for labor, power, chemical, materials, and sludge disposal associated with each treatment option. The present worth cost was calculated using a 4.5 percent discount rate applied to the annual O&M costs.

Table 7 presents a summary of the estimated construction, O&M and present worth costs for the various alternatives.

Table 7 Main WPCF Nitrogen Reduction Cost Summary

Treatment Option	Construction Cost	Annual O&M Cost	Total Present Worth Cost
Four-stage Bardenpho	$2,828,000	$696,800	$12,298,000
Bardenpho with MBR	$11,341,000	$1,123,000	$26,603,000
Bardenpho with Denitrification Filters	$10,570,000	$828,800	$21,833,000
Bardenpho with Biomag	$9,786,000	$825,500	$21,005,000

The above table indicates the Four-stage Bardenpho process alone is the least expensive alternative, but cannot achieve the proposed total nitrogen effluent limit of 3 mg/L. Of the remaining three processes, Bardenpho with MBR is the most expensive, and Bardenpho with Biomag is the least expensive, followed closely by Bardenpho with denitrification filters. Because the costs for the latter two processes are very similar, we recommend further study of these alternatives prior to making a decision about final design, should the new NPDES permit require the 3 mg/L total nitrogen limit. Additional study could involve investigations into and/or site visits to other facilities employing these processes, and/or pilot studies at the Main WPCF as a next step to confirm process operation and effluent results prior to committing to a very significant upgrade.

6.0 WASTEWATER TREATMENT CAPACITY AND PROCESS ASSESSMENT – WEST ISLAND WPCF

6.1 Capacity

Table 8 presents the wastewater influent and effluent characteristics at the West Island WPCF in 2013.

Table 8 West Island WPCF Flow Characteristics

	Influent		Effluent	
Parameter	**Average**	**Range**	**Average**	**Range**
Flow (gpd)	--	--	15,331	10,445 – 23,769
TSS (mg/L)	97.0	50.5 - 178	4.95	2.3 – 6.8
BOD5 (mg/L)	136.83	89 – 174	3.76	1.9 – 6.8
NH4-N (mg/L)	28.75	16.6 – 39	0.98	0.2 – 2.2

The West Island WPCF is currently meeting all NPDES permit requirements, and the permit is not expected to change in the foreseeable future. However, there are some hydraulic limitations for handling peak flows occurring in the sand filter or secondary clarifiers. Discussions with the WPCF personnel indicate that there is a bottleneck effect in the sand filters during the peak summer operating season. Because the sand filters have been rebuilt several times within the past few years, it is believed that the secondary clarifiers may not be operating correctly, which leads to solids carryover into the sand filter. There is additional discussion of this problem in Section 8.0 of this report.

6.2 BIOWIN Modeling – Existing Process Operation

To develop and calibrate a model for the West Island WPCF, we followed the same process described previously for the Main WPCF. The treatment process at the West Island WPCF differs from the Main WPCF in that it utilizes conventional and anoxic RBCs to accomplish secondary treatment before filtration and disinfection. The Biowin software does not have a module for the RBC processes, so we created a model to simulate the RBC processes using media bioreactors, both aerated and unaerated. We ran the simulation multiple times using the influent characteristics listed in Table 8 above and modified treatment process parameters; however, the results obtained were not comparable to actual measurements from the monthly operation reports.

At this time, there are no process improvements planned for the West Island WPCF. If there are upgrades or improvements to be implemented in the future, Biowin modeling should be revisited since forthcoming versions of the software may include the required treatment processes. Additional modeling at this point in time for the West Island WPCF does not seem to be necessary.

7.0 COLLECTION SYSTEM AND PUMPING STATION CURRENT WORK AND RECOMMENDED UPGRADES

7.1 Collection System Current Work and Recommended Upgrades

The Town recently purchased a sewer television inspection vehicle to televise pipelines ahead of street pavement projects and in areas identified in the 2010 report that may not be part of an upcoming pavement program. The current televised inspection project for 2014 includes several pipelines tributary to the Taber St. Pumping Station that exhibited high infiltration rates during a flow isolation program conducted in February 2014. Design and construction of rehabilitation measures will follow later in 2014 and 2015.

The Town completed an extensive evaluation of the older wastewater collection system in Fairhaven in the May 2010 *Sewer Hydraulic Model Analysis Report* by Tighe & Bond. This portion of the collection system contributes the majority of the I/I to the Main WPCF, and the report contains costs and recommendations for future upgrades of this system.

7.2 Pumping Station Current Work and Recommended Upgrades

7.2.1 Current Work - Taber Street and South Street Pumping Stations

The work of Contract 26 at the Taber Street and South Street Pumping Stations, as described in the Phase 1 Report, is scheduled for completion in June of 2014. Additional modifications to the two stations are presently under design, and bidding and construction is scheduled for later in 2014. The modifications will be completed in a single project, Contract 28.

At the Taber Street Pumping Station, Contract 28 work will include installing a new natural gas service; replacing the existing diesel generator with a natural gas generator; installing bypass pumping facilities; replacing the three wastewater pump units; installing variable frequency drives; replacing piping, fittings, and valves; replacing the magnetic flow meter; replacing the roofing material and exterior doors; replacing the motor control center and pump control system; and replacing the dry-side ventilation system.

Contract 28 work at the South Street Pumping Station will include replacing the roofing material and exterior doors and installing bypass facilities.

7.2.2 Recommended Upgrades - Pine Grove Pumping Station

The Pine Grove wastewater pumping station, built in 1989, is located towards the northern end of Pine Grove Street, which is near the Mattapoisett town line off Route 6. The station serves approximately a dozen residential homes on Pine Grove Street. The station is a duplex, submersible grinder pumping station with a five-foot inside diameter wet well with a three-sided, roofed generator shelter (Figure 20). The generator, electrical switchgear and pump control panel are located in the shelter. The underground pumping station has two access covers, flush with the driveway pavement, including a circular, two-foot diameter cover for access to the wet well and a rectangular, one and one-half foot by three foot cover for access to the pumps. Both of the pumping station access covers are cast iron.

Figure 20 Pine Grove Pumping Station Exterior

The following conditions were observed during the field visit or were noted by the Town staff:

1. Pump rail system is loose and corroded.
2. Pump base elbows are corroded.
3. One pump must be pushed back into position manually in order for the pump discharge to seal with the discharge elbow.
4. Check valves clog with rags. There is no bar rack or screening basket on the influent pipeline.
5. The concrete on the front edge of the generator shelter base slab has spalled, which may be in part due to snow plows striking the concrete edge.
6. Both cast iron wet well access covers are heavy and difficult to handle, and are not hinged. Town staff would prefer aluminum access hatch covers with hinged spring-assist hardware.

Based on this list, FST has prepared an estimated construction cost for the repairs of this station with some options. The cost breakdown is presented in Table 9 below with discussion following.

Table 9 Construction Cost – Repairs to Pine Grove Pumping Station

Description of Repair	Opinion of Probable Cost
Remove and replace pump rails, base elbows, anchor bolts and repair concrete	$32,900
Replace grinder pumps	$11,500
Repair concrete on generator shelter	$2,300
Replace wet well access cover with 24” by 30” aluminum access hatch	$3,000
Replace pump access cover with 24” by 30” aluminum access cover	$3,700
Total	***$53,400***

Correction of Items 1 through 3 in the list above require working within the wet well itself; therefore the opinion of probable cost for these items has been grouped together. This hazardous confined space work would require providing pumps, piping and appurtenances to temporarily bypass the wastewater flow during the work, cleaning the interior of the wet well, and pumping out any wastewater remaining in the wet well both prior to and following cleaning. Additionally, Item 3 suggests that the anchor bolts securing the pump elbows to the stations floor are loose, which may require removal and replacement of the existing anchor bolts and repair of the surrounding concrete. Replacing the anchor bolts was included in the construction cost estimate, and the total estimated cost for the repairs needed for Items 1 through 3 is approximately $33,000.

Check valves clogging with rags (Item 4 above) are most likely a result of the impeller wear on the ABS grinder pumps. Due to the age of this station, 25 years, the pumps probably need to be replaced and not just refurbished, since the pumps, if original, have exceeded their useful life. The estimated cost for replacing the grinder pumps is $11,500. Since the pumps are on a rail system, this work simply requires raising the existing pumps and sliding the new pumps down the rails. However, the repairs described above in Items 1 through 3 should be performed prior to conducting the work of Item 4.

The estimated cost for repairing the concrete slab for the generator shelter is $2,300. If the Town wishes to add some sort of protective cover to the concrete to prevent future damage from snow plowing, then this amount would increase. A metal plate could not simply be bolted onto the concrete, as the mounting bolts would protrude from the metal plate. Snow plows could then strike the protruding bolts, which would cause more harm to the concrete. The Town may want to pursue additional measures in the future to protect the concrete slab.

FST has contacted manufacturers of aluminum hatches regarding retrofit hatches for both pumping stations. From these conversations, FST developed an estimated cost for removal of the existing cast iron access covers, saw-cutting circular openings and making new rectangular openings in the pumping station roof slab and installing new rectangular aluminum hatches. However, there are two concerns that must be addressed during design. First, at the Pine Grove Station, the existing hatches are in close proximity to each other, which would require moving the new hatches from the current locations. Second, the aluminum retrofit hatches are not rated for vehicle loading. Service vehicles would not be able to park on the new hatches. The estimated cost for replacing the two hatches is $6,700.

An alternative to replacing the existing cast iron hatches with aluminum hatches would be to replace the access hatches with composite or fiberglass hatches. These hatches come in both rectangular and circular shapes (eliminating the need to saw-cut the roof slab), are lockable, are much lighter than cast iron covers and can be H-20 loading rated. This alternative could be developed further during final design. The estimated cost for replacing the existing cast iron covers with composite covers is $2,600, or approximately $4,000 less than the two aluminum hatches.

7.2.3 Recommended Upgrades - Shannon Meadows Pumping Station

The Shannon Meadows Pumping Station was built in 2005 as a privately-owned station to serve approximately 50 homes in the newly constructed Shannon Meadows subdivision on Oliver Street. The Town took over the station in 2011, and it is located at the intersection of Rivard Street and Rivard Lane. The station is a duplex 6x6 Gorman Rupp suction lift station with a trailer-mounted standby Katolight generator (dedicated to the station and permanently wired to the station). The wet well is a 6' diameter precast concrete structure with a 38" diameter cast iron access cover. The influent gravity sewer line is 8" in diameter and enters the wet well approximately 9' below grade. There is no bar rack or basket screen on the influent gravity sewer. The 6'x 6' enclosure is mounted on a concrete slab that also serves as the wet well top slab. The station has a standard Gorman Rupp pump control panel mounted inside the 6' x 6' enclosure and utilizes a bubbler tube system for wet well level control. The electric meter, main disconnect switch, automatic transfer switch, and exterior alarm horn and light are mounted on a 4' x 8' sheet of plywood located behind the 6' x 6' enclosure. The station is secured by a 6' high chain link fence, and there is a pole-mounted floodlight for illuminating the site for night work.

Figure 21 Shannon Meadows Pumping Station Exterior

Figure 22 Shannon Meadows Pumping Station Interior

The wet well actually has two top slabs. According to Town staff, the first top slab is the original top slab of the precast concrete wet well structure. It has a 30" diameter opening. The original structure was installed too low for the site grading, and the developer had to add a second 8" concrete slab on top of the wet well's roof slab to raise the finished elevation for site drainage to work properly. The second top slab has a 36" diameter opening positioned over the 30" diameter opening in the original top slab, and there is no cover for the 30" opening. The site has a short paved driveway.

According to Town staff, the 6' x 6' Gorman Rupp enclosure setup is difficult to service due to the compact pump and piping arrangement. The sides of the enclosure must be removed to access pumps and valves, and staff is exposed to the weather while maintaining the station.

Staff noted several problems at this station in 2012:

1. Rags clogging the pumps.
2. Belt problems with belt-driven pumps.
3. Air release valve problems.
4. Pumps do not always self-prime.
5. Town needed to replace generator power control panel.
6. Piping in wet well is rusting; both steel suction pipelines and cast iron force main.
7. Cast iron access cover to the wet well is heavy and difficult to handle. Town staff would prefer an aluminum access hatch with hinged spring-assist hardware.

Based on this list, FST has prepared an estimated cost for the repairs of this station with some options. The estimated cost is presented in Table 10 below with discussion following.

Table 10 Construction Cost – Repairs to Shannon Meadows Pumping Station

Description of Repair	Opinion of Probable Cost
Service Pump Station by Gorman Rupp Representative	$13,700
Remove and replace suction and discharge piping	$29,800
Replace 30” wet well access cover with 30” by 30” aluminum access cover	$3,700
Total	***$47,200***

For Items 1 through 4 above, FST contacted Hayes Pump, a local firm that both furnishes and services Gorman Rupp pumping stations. Hayes Pump gave a rough opinion of cost for servicing the station based on the descriptions of the problems and their typical costs for servicing a station of this size.

For Item 5 above, it appears that this work has already been performed and was not included in the estimated cost.

Correction of Item 6 in the list above requires working within the wet well itself. As discussed earlier, this hazardous confined space work would require providing pumps, piping and appurtenances to temporarily bypass the wastewater flow during the work, cleaning the interior of the wet well, and pumping out any wastewater remaining in the wet well both prior to and following cleaning. The total estimated cost for the repairs needed for Item 6 is approximately $29,800. It may be possible to clean and repaint the existing piping instead of replacing it. However, most of the cost associated with Item 6 is related to working in the wet well and not replacing the piping. Thus, the estimated cost would not change significantly.

Replacing the existing cast iron hatch with an aluminum hatch would require saw-cutting the concrete slab as discussed earlier. The cost for this work and new aluminum hatch would be about $3,700. Again, as an alternative, a composite or fiberglass access cover could be used. The estimated cost for a composite access hatch is $1,300.

7.2.4 Recommended Work - Storm Flooding Mitigation at Remote Pumping Stations

As discussed in the Phase 1 Report, the Town has several pumping stations that are located close to the coastline on the unprotected side of the hurricane dike. During significant coastal storm events the Town implements a hurricane preparedness plan that includes manually shutting down all wastewater pumping stations in flood-prone unprotected areas so that sea water will not be pumped into the sewer system. According to the hurricane preparedness plan, the wastewater pumping stations are only to be shut down after the municipal water supply system in the same area has been shut down. During Hurricane Sandy, flood waters were already encroaching on the Boulder Park and Shore Drive Pumping Station sites, which are both situated at an elevation of about 6.0 feet (NGVD 1929), before the WPCF staff arrived at the stations to manually shut off the incoming power. There are no provisions at these stations to enable a remote shutdown.

Figure 23 Boulder Park Pumping Station Exterior

The Boulder Park Pumping Station was built in 1998 and is located at the southern end of James Street on the south-facing coast of Fairhaven. It is a submersible pumping station with access openings to the wet well at street level and a pedestal-type electrical enclosure elevated approximately two feet above grade.

The Shore Drive Pumping Station is located adjacent to the beach parking lot near the intersection of Seaview Avenue and Shore Drive. It is a submersible pumping station with wet well access at ground level, and is situated adjacent to an east-facing beach. The electrical enclosure is located on an elevated concrete platform approximately ten feet above grade accessed by a concrete stairway.

We have investigated a couple of alternatives for modifications to the stations whereby WPCF staff would be provided with the capability to shut down the stations remotely. The Sewer Department currently uses a Mission Communications Panel Model 110 RTU at their pumping stations for transmission of alarms and data. The Model 110 unit sends and receives data by cellular technology on an hourly basis and has a single contact closure that could be used to receive an input to activate a shutdown of the station or pumps. The individual charged with the responsibility for making the shutdown would initiate the action by making a cellular telephone call to the RTU. However, the one-hour period will not provide an immediate response; it could take as long as 59 minutes from the time of the call for the RTU to send/receive the data before activating the station shutdown. Mission also manufactures a Model 800 RTU that provides an immediate response and has three contact closures that could be used for shutting down the station or each pump individually. The purchase price of the Model 800 unit is approximately $800 per unit, and the annual maintenance contract would increase by about $216 per unit. The

WPCF staff is capable of performing this installation. The Mission RTUs have four levels of security built into the units that would allow various levels of access for monitoring and controlling the stations. Each user has a unique user ID and password that allows them to access at one of the four levels. This security feature would allow the Town to restrict access for the emergency shutdown to only certain individuals.

A second alternative method for shutting down the stations can be accomplished using a MultiSmart Pump Controller manufactured by MultiTrode, Inc. The Town presently has one MultiSmart Pump Controller installed at the South Street Pumping Station, and a second unit is scheduled to be installed at the Taber Street Pumping Station in a future contract. The MultiSmart Pump Controller is capable of providing full SCADA functionality including the ability to activate and deactivate equipment remotely. Presently, the Boulder Park and Shore Drive Pumping Stations do not have any SCADA capability. By installing MultiSmart Pump Controllers at both stations and purchasing annual contracts with MultiTrode, the Town then will have full SCADA functionality at the two stations and would be capable of remotely controlling the operation. However, the cost of the pump controllers and the annual contracts for this alternative would be more expensive than the first alternative. The MultiSmart unit is a pump controller, and if the existing control system at a station is in need of upgrading, the MultiSmart unit becomes more economically justifiable. The MultiSmart unit also provides multiple security levels, similar to the Mission unit, whereby the Town can establish restrictive access for emergency shutdowns.

Either option would provide the Town with the ability to remotely shut down the Boulder Park and Shore Drive Pumping Stations, as well as other coastal municipal stations located on the unprotected side of the hurricane dike.

8.0 WPCF CONDITIONS SURVEYS

8.1 Main WPCF Conditions Survey

The conditions survey for the Main WPCF updated under Phase 1 of this study has been edited herein to reflect modifications to the Main WPCF under Contract 26, which is presently under construction, and under Contract 29, which is currently in design. The scopes of work for these two contracts are described in the following paragraphs. Appendix D contains the updated conditions survey database for the Main WPCF.

Figure 24 New Membrane Diffusers at Aeration Tanks

In 2013 under Contract 26, the Town began construction of modifications to the Aeration Tanks at the Main WPCF on Arsene Street. Contract 26 work included rehabilitation of the concrete walls, removal of the deteriorated elevated concrete walkways in Side B, Replacement of the PVC air distribution laterals and headers in Side B, replacement of the ceramic diffusers with membrane diffusers on both sides, replacement of slide gates installed in 1970, rehabilitation of slide gates installed in 1990, replacement of stop gates in the influent channels and center channel, and replacement of two stop gates with handwheel-operated slide gates to control flow from the aeration tanks to the final clarifiers. This work will be completed in July 2014.

Figure 25 Existing Grit Removal Equipment

Also in 2013, design began on Improvements to Preliminary Treatment Facilities, Contract 29. This project includes replacing the grit removal equipment; rehabilitating concrete surfaces in the grit removal channels; replacing two Parshall flumes; replacing two handwheel-operated slide gates with motor-actuated slide gates; replacing doors and windows throughout the Preliminary Treatment Building; replacing concrete slabs on grade at the Loading Area; replacing unit heaters, dampers, and exhaust fans; and replacing corroded electrical components in the Grit and Screenings Room. Contract 29 is scheduled to be funded and constructed in 2015.

8.2 West Island WPCF Conditions Survey

On October 22, 2013, FST sent a multi-disciplined team of engineers to the West Island WPCF located on Fir Street. During the facility inspection and staff interviews performed on that day, and as a result of subsequent discussions with WPCF staff, various architectural/structural features, process mechanical equipment and piping systems, HVAC/plumbing systems, and electrical systems at the West Island WPCF were evaluated and rated as being in Satisfactory,

Marginal, or Unsatisfactory condition based on the information gathered. The following discussion of the findings is presented by discipline, and the conditions survey database is found in Appendix E. Conducting conditions surveys is a critical component of an effective asset management program because these surveys prioritize needs and identify costs.

8.2.1 Architectural/Structural

In general, the architectural elements at the West Island WPCF are in good to very good condition, with a few exceptions.

The primary exterior architectural concerns relate to the building envelope materials: cedar shingles, wood trim, CMU, and roof shingles. Present conditions exhibit deterioration that allows water to infiltrate the building envelope; therefore, a high priority is placed on repairing such deficiencies.

Figure 26 West Island Water Pollution Control Facility

1. Cedar Shingle Siding and Wood Trim – Wood components have been neglected over the years and have dried out or rotted to the point of requiring replacement. Wood shingle and trim replacement may be accomplished on a location-by-location manner, while the entire building exterior requires painting.

2. Split-Face Concrete Masonry Units – The CMU is in very good condition, with only minor mortar joint repair required where joints are cracked. The primary concern is that the sealant in control joints has failed and water can enter the building envelope through these joints. The sealant must be removed, building-wide, and replaced with new sealant.

3. Some exterior doors exhibit varying degrees of rusting and corrosion, some of which has negatively affected the door operation. We recommend replacing rusting doors and then determining if frames can be salvaged and re-used. Similarly, hardware is in varying stages of deterioration and replacement for some hardware; i.e., closers, may be required within the next five years. It may also be worthwhile to replace frames.

4. No examples of roof leaks were observed inside the building; however, discoloration observed at shingles may be the result of extractive bleeding, or bleed-through of the black pigment in the asphalt beneath the mineral granules. This phenomenon is typically attributable to defective material. It cannot be determined if the staining is the result of mineral granule loss without performing an on-the-roof inspection. Determining the reason for the observed conditions is important to assess how to correct the problem. Granule loss may be the result of several factors, including: normal aging; shingle blistering; shingles were walked-on; severe storm damage; and/or defective product. It is not possible to examine the shingles under the solar PV array, so the condition of these shingles is unknown. The Town should keep a close watch on the roof shingles. Replacement may be on the table in the next 5 years if the condition continues to worsen.

Interior architectural elements are also in good to very good condition with few exceptions.

1. Due to the extremely damp conditions in the treatment room, corrosion pitting is evident on aluminum surfaces, while painted ferrous surfaces exhibit spot rusting. Additional dehumidification and/or ventilation may help moist air conditions, but the rusting metal must be re-painted to stop the corrosion from spreading further.

2. We recommend repairing cracked CMU mortar joints and replacing sealant in CMU control joints.

3. We recommend replacing rusting safety chains at stair and ladder openings on elevated platforms and catwalks.

4. We place a high priority on repairing interior doors, especially those labeled as fire doors, so that they operate properly and do not compromise occupant life safety. Consider replacing all questionable door hardware, especially door closers.

5. Better storage facilities are needed for the staff's personal belongings. The electric room next to the control room may have space available for lockers.

8.2.2 Process Mechanical

In general, the overall plant-wide treatment units, equipment, pumping and piping systems are in good condition and operating satisfactorily, with a few exceptions. The West Island WPCF is consistently meeting its NPDES groundwater discharge permit and the facility has been able to handle peak influent wastewater flows during extremely heavy rainstorm events in the past several years. The WPCF O&M staff has performed a commendable job in operating and maintaining the existing treatment equipment and systems and making required repairs and improvements as necessary to insure that the facility functions as designed.

We have categorized our observations and recommendations into two groups: physical condition and operational/performances issues, both of which are listed below:

Physical Condition:

1. Compressed Air Piping

   The staff has observed internal corrosion of the steel air piping when replacing solenoid valves at various locations in the piping system. To date, they have not experienced any leaks. The piping may need to be replaced in 5 to 10 years.

2. Sodium Bicarbonate Feed Pump

   The staff typically rebuilds the LMI pumps on an as-needed basis. However, the manufacturer no longer makes refurbishing kits for this particular model, and a new pump will need to be purchased in the future.

3. Instrumentation Panel P2

The panel itself appears to be operating satisfactorily. However, when power is transferred due to a power failure or generator testing, the effluent pumps and flow equalization pumps will sometimes trip out and need to be reset manually. The same pumps will sometimes trip out when starting or stopping the sodium bicarbonate equipment. Surge protection may be required to control this issue.

4. Painting and Preservation

Especially in the Process Area due to the extremely damp conditions, there is corrosion pitting on aluminum surfaces and spot rusting on painted ferrous surfaces. The rusting metal surfaces on tanks, supports, piping and equipment must be re-painted to stop corrosion from spreading.

Figure 27 Rusting Metal Surface

During the staff interview, many of the problems noted were performance and operational type issues, which are listed as follows:

Operational/Performance Issues:

1. Sludge Removal in Pretreatment Tanks.
There is limited access to the buried pretreatment tanks for removal of the sludge. Each of the four tanks is 45 feet in length and has four manhole access openings centrally located along the length of the tank. For this reason, it is difficult to remove accumulated sludge along the sides and in between the access openings.

Additional access openings should be provided or a better sludge removal method should be implemented.

Figure 28 Pretreatment Tanks

2. Pacing of Influent Flow to RBCs.
There is no influent flow metering at the WPCF or at the Causeway Road Pumping Station. Currently, the flow equalization pumps, which feed the RBC process, are controlled only by a high level switch in the Flow Equalization Tank and a manually set timer. Operators must anticipate how the influent flow will vary from day-to-day and adjust the timers accordingly. There is no level control or pacing capability at this plant. Chemical feed systems must be adjusted manually to match the varying influent flow rate.

3. Clarifier Performance.
The plant has experienced settling, solids carryover and solids removal problems at

the clarifiers. The problems are compounded by the ineffective air lift pumping system for removal of sludge. The staff typically drains off the sludge from the bottom of the tanks on a daily basis because of the ineffectiveness of the air lift pumps.

4. Solids Removal at the Sand Filters.
   Blinding of the sand filters has occurred during high flow and high influent solids loading periods that typically occur during the summer, especially around July 4th when most property owners are on the island with guests. The filter blinding problem may be influenced by solids carryover from the clarifiers during these high flow and solids loading periods. The solids removal performance of both the clarifiers and the sand filters should be evaluated to determine if modifications can be made to the equipment to improve performance, or if additional solids removal capacity is warranted.

5. Effluent Pumping and Disposal.
   Due to hydraulic limitations at the disposal wells, the Town has had to reduce the pumping rate of the effluent pumps by replacing the impeller on one pump with a smaller impeller.

8.2.3 HVAC and Plumbing Systems

Overall, HVAC and plumbing systems were found to be in satisfactory condition showing good housekeeping and maintenance. In general, the WPCF personnel have done a very good job of maintaining the facility's HVAC and plumbing systems. The deficiencies observed are mostly code-related issues or preservation measures that should be routinely implemented. The following improvements are provided with field observations and recommendations and estimated repair/replacement construction costs.

1. Louver/Damper in Chemical Room.

   The louver/damper in the exterior wall of the Chemical Room is covered with metal shields on the interior and exterior such that air can only enter or discharge from the bottom opening. The shields are in place for vandalism reasons.

   However, the shields may be restricting air flow and may not meet code. Besides impacting ventilation of the room, the restricted air flow may be "starving" the exhaust fan and reducing its service life. The airflow through the shielded louver should be measured to determine if the required airflow is being achieved. If it is determined that the airflow is restricted, and if vandalism is still a concern, then a different shielding configuration may be required.

Figure 29 Covered Air Intake Louver at Chemical Room

2. Emergency Shower/Eye Wash Stations.

   The emergency shower and eye wash stations in the Process Area and Chemical Room may not meet code because there are no provisions for tempered water.

3. Roof Exhaust Fan/Damper.

   Due to the location of EF-1 and EF-2 on the roof and the intake registers located on the ceiling in the Process Area, inspection was not possible on October 22, 2103 – the date of our site visit. According to WPCF staff, drive belts fail on an annual basis. There is excessive moisture in the Process Area especially above the Aerobic RBC units causing this area to be extremely humid, which exacerbates rusting and corrosion of metal surfaces and components. The need for additional ventilation, dehumidification, and/or air conditioning should be investigated.

4. Boiler.

   The boiler is 15 years old and showing significant signs of rust. The typical service life for such equipment is approximately 20 years. Although the staff noted that the boiler is performing satisfactorily, the Town should anticipate replacing the boiler in about 5 years.

Figure 30 Boiler and Flue Pipe

5. Boiler Flue Pipe.

   The boiler flue piping is showing some signs of rust. The flue piping is typically replaced when the boiler is replaced partly due to age and partly because the flue material is dependent on the boiler type.

6. Fire Extinguisher.

   Fire extinguishers require recharging and/or inspection on an annual basis. The date of last recharge noted on the tags is July 2013.

All operating equipment, valves, and piping systems have typical service lives. For equipment and valves the typically accepted service life can range from 15 to 25 years. For piping systems, the service life can range from 25 to 40 years. Under actual use, however, the service life can vary significantly depending on the severity of the application. It should be noted that the West Island WPCF has been in operation since 1998 and the original equipment and piping systems have been in use for 16 years. Although many components have been categorized presently as being “Satisfactory”, it should be recognized that a substantial portion of the useful life has elapsed and the Town should plan for systematic replacement in the coming years.

9.0 RECOMMENDED ACTION PLAN

On the basis of the information discussed in the Phase 1 Report and in previous sections of this report concerning the Town of Fairhaven's needs for its wastewater collection and treatment facilities, we recommend the following actions:

- Continue use of tablet computers and PeopleGIS forms and maps for wastewater collection system applications such as data entry of field work, creation of new work forms, looking up data, analyzing issues, updating system characteristics, etc. The use of these database and mapping tools may also be expanded to other DPW tasks such as work order management, stormwater management, roadway paving, etc. These tools are also critical components of an effective wastewater facility asset management program.

- Update the GIS database to include future sewer system investigation and rehabilitation work, using either Town personnel or consultants participating in the study or design.

- Update the GIS database to include data from the conditions surveys for the Main and West Island WPCFs. The spreadsheet format developed for these surveys should allow for a relatively easy transition of information into the database.

- Renew annual contract with PeopleGIS to maintain and upgrade the GIS database. In 2013, the annual costs were as follows:

    - MapsOnline Service - $3,500

    - PeopleForms Service - $3,500

    - Document Manager - $2,000 (Required for photos and drawing files)

- Appropriate local funds and/or seek other government funding sources to continue with wastewater collection system investigations and follow-up rehabilitation. Use the Town's new CCTV truck to identify pipeline defects in areas exhibiting high I/I rates, or where street paving is scheduled. In addition to sewer rehabilitation, the Town should also pursue rehabilitation/upgrade of the Pine Grove, Shannon Meadows, Boulder Park and Shore Drive Street Pumping Stations described in this report, and other pumping station modifications noted in previous reports.

- Appropriate local funds and/or seek other government funding sources to continue with the Main WPCF improvements identified in the Conditions Survey in Appendix D of this report and Appendix E of the Phase 1 report. This may include submitting a Project Evaluation Form (PEF) in August 2014 to seek eligibility for State Revolving Fund (SRF) loans. If eligible for funding, design and permitting would need to be complete by October 2015. Other maintenance issues identified as a result of the Conditions Survey may necessitate an increase in the annual O&M budget for this facility to prevent expensive replacement options in the future.

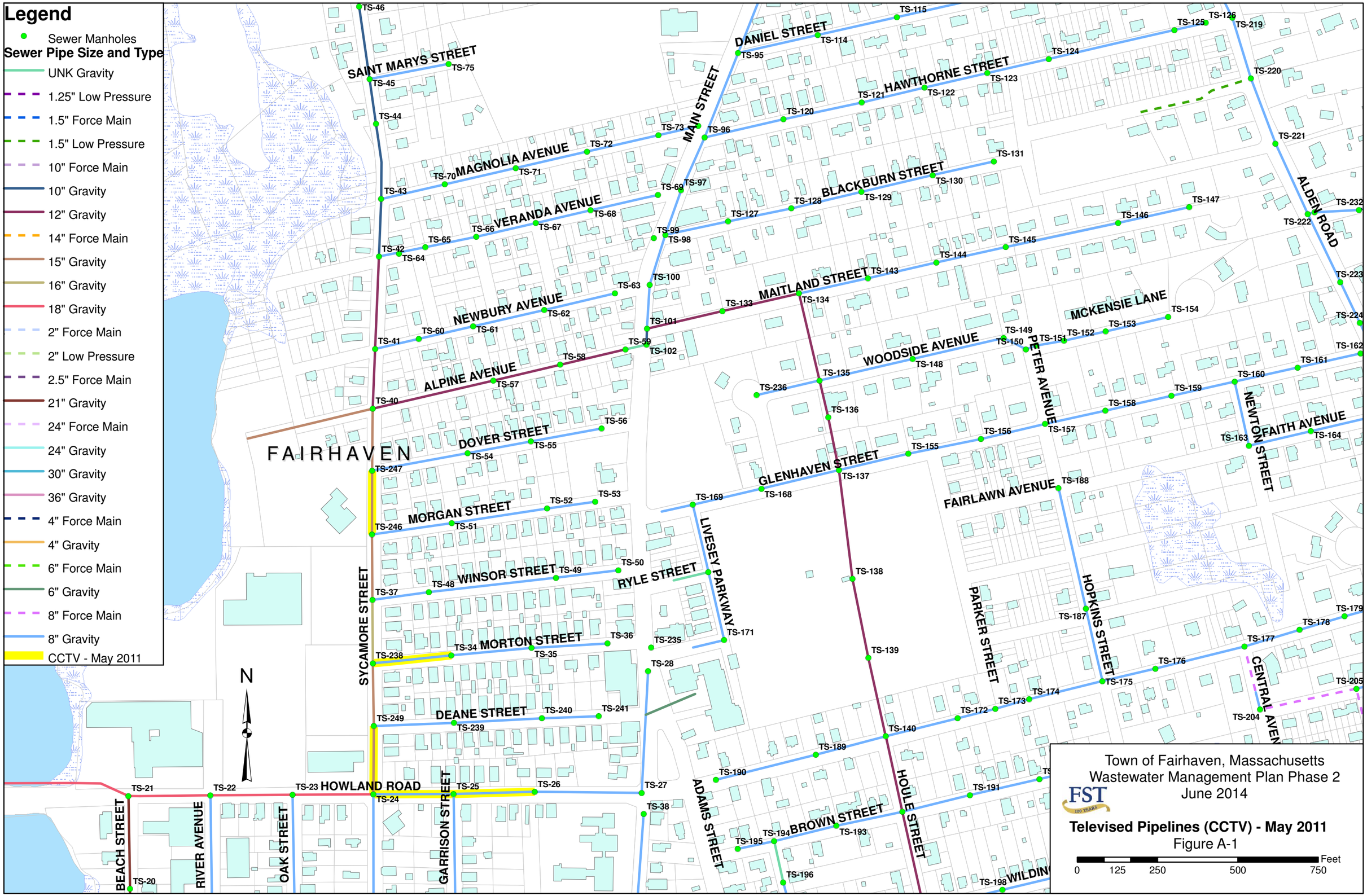
- Investigate options for flow pacing at the West Island WPCF, and for resolving solids carryover from the final clarifiers and blinding of the sand filters. Resolution of these problems may require local fund appropriation or investigating other government funding sources, as described for the Main WPCF. Other maintenance issues identified as a result of the Conditions Survey in Section 8.0 and Appendix E of this report may necessitate an increase in the annual O&M budget for this facility to prevent expensive replacement options in the future.

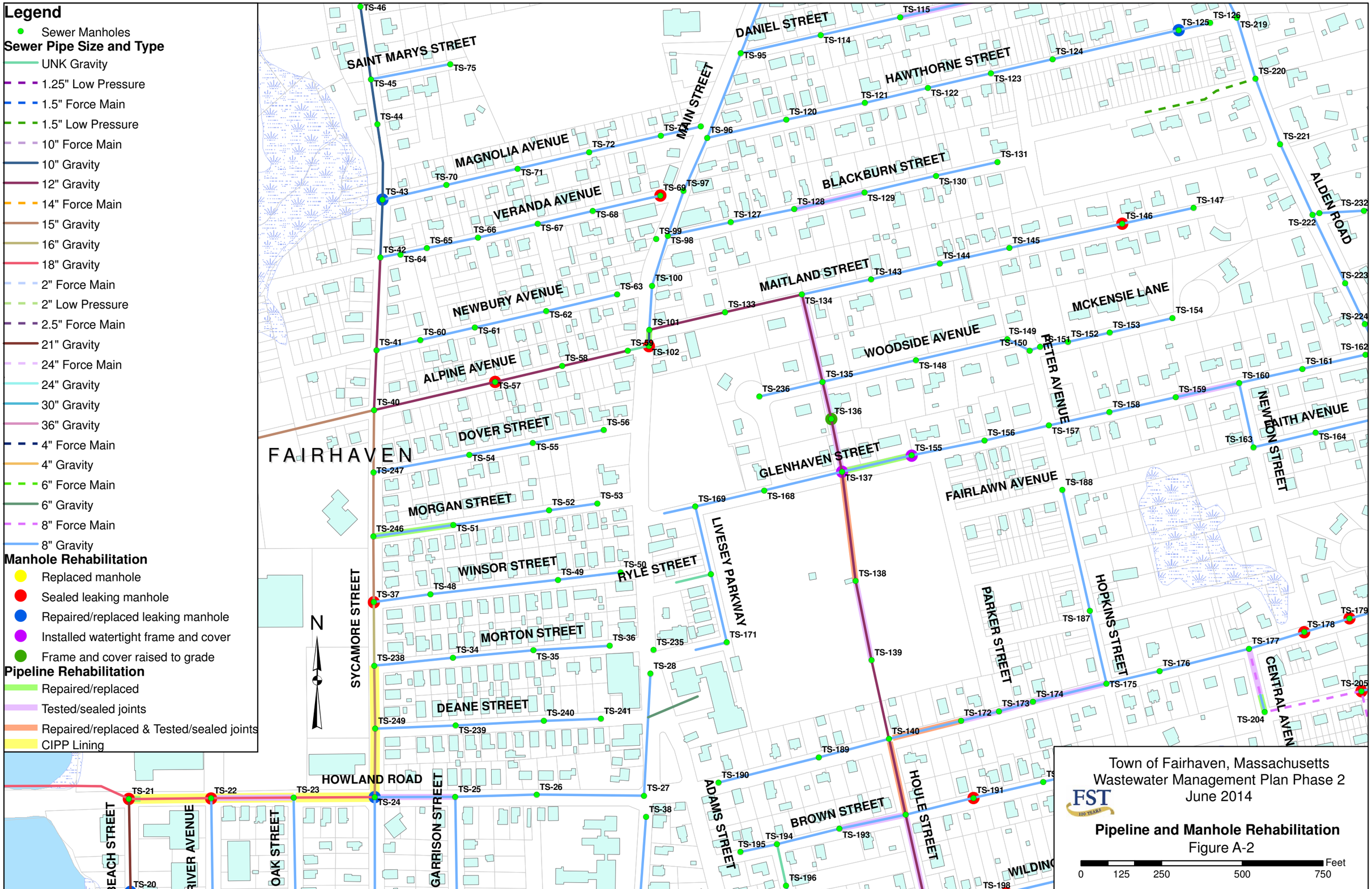
- Seek a Nutrient Management Grant from the Southern New England Coastal Watershed Restoration Program for funding a nitrogen reduction pilot study at the Main WPCF (final grant application due July 21, 2014). This pilot study will further define the feasibility of one or more nitrogen reduction alternatives that may be required by the proposed NPDES permit, to be issued in September 2014. If the Town does not receive the grant, they should visit and/or communicate with other plants employing the technologies investigated in this report to further evaluate their applicability for the Main WPCF.

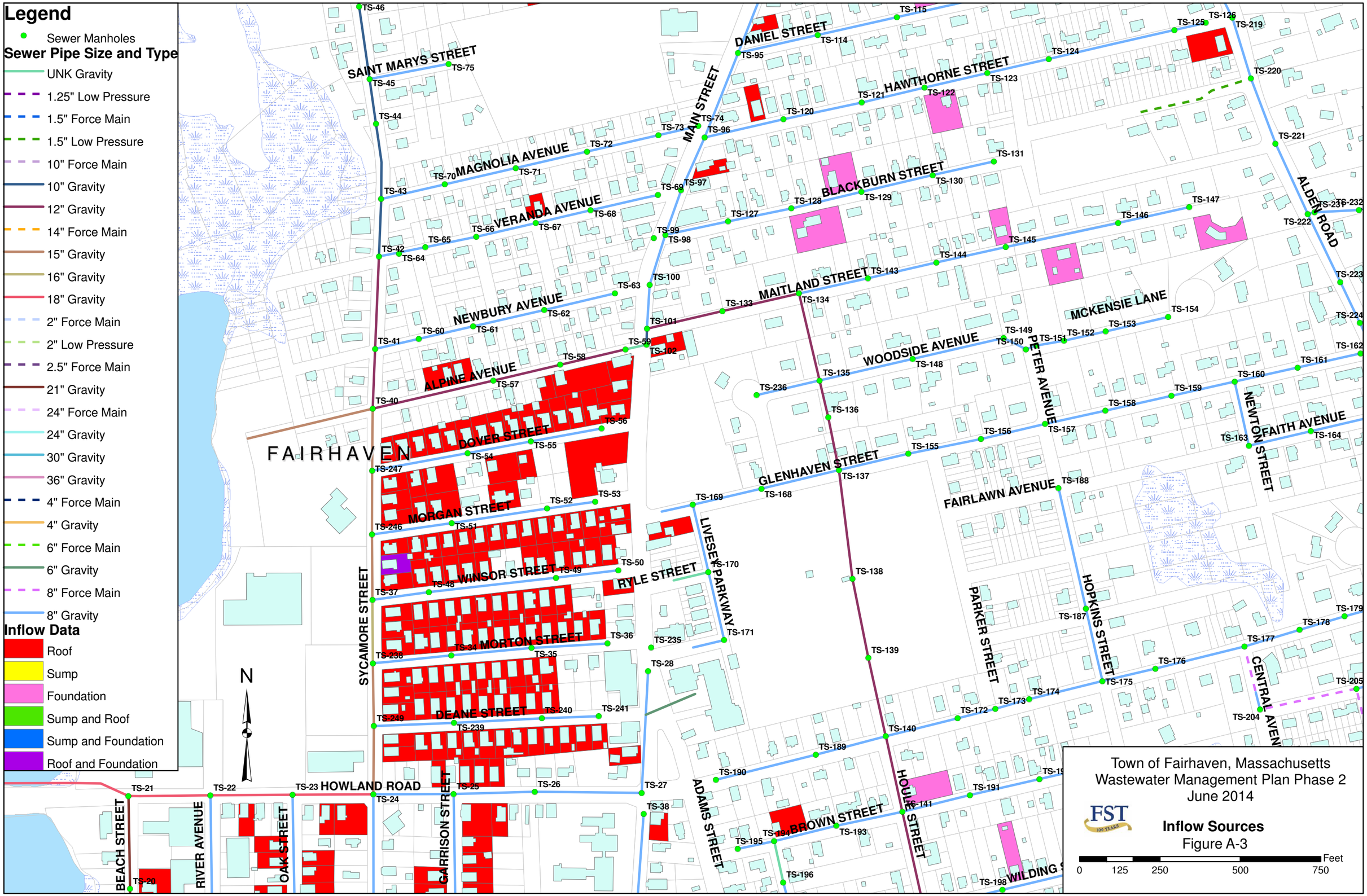
- Based on pilot study results and/or visits and communications with other plants employing nitrogen reduction technologies, appropriate local funds and seek government funding sources for design and construction of nitrogen reduction facilities at the Main WPCF. The schedule for this and degree of nitrogen reduction will be in accordance with the upcoming NPDES permit requirements.

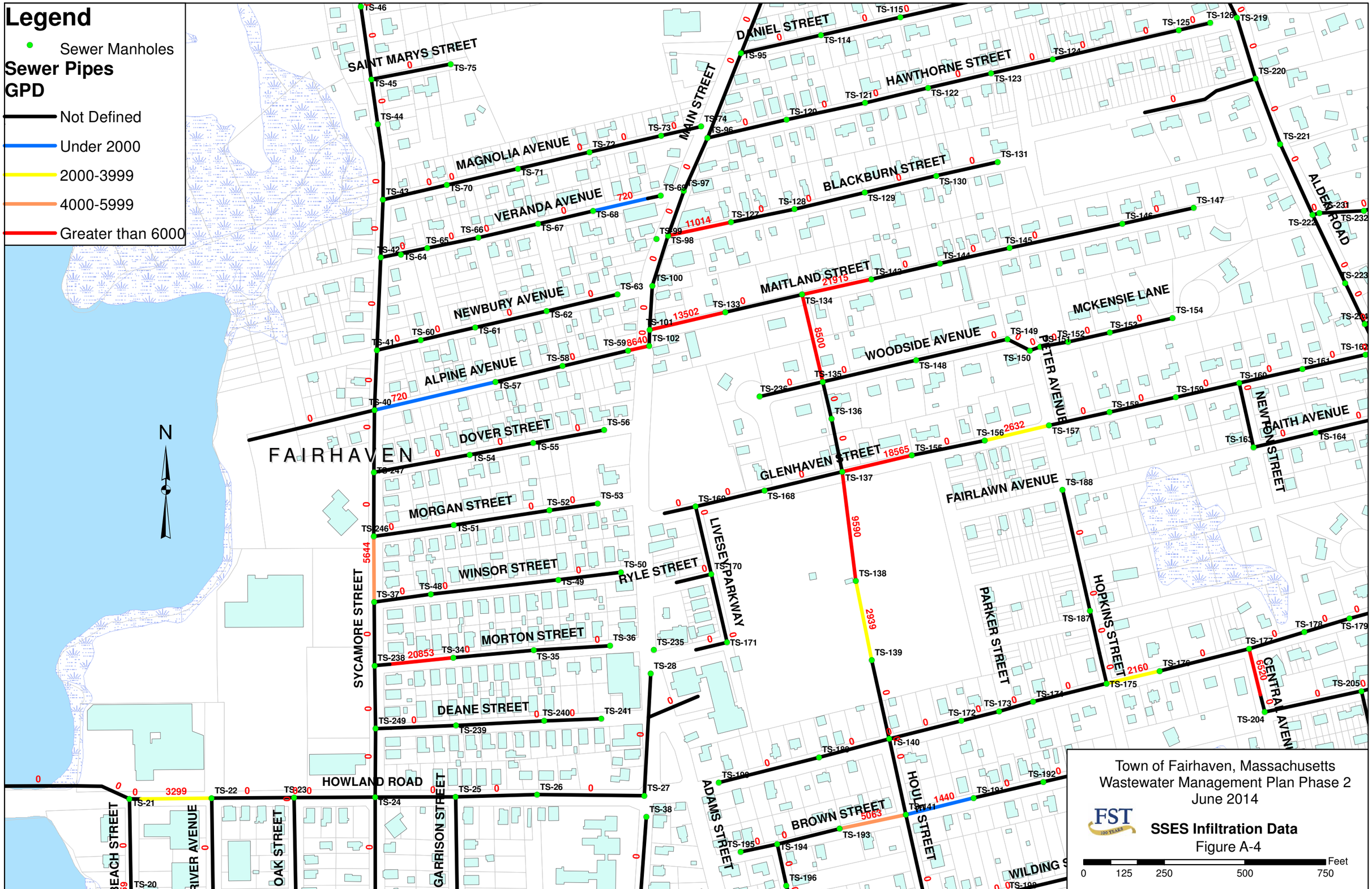
APPENDIX A

WASTEWATER COLLECTION SYSTEM PLANS


Legend
Sewer Manholes
Sewer Pipe Size and Type
UNK Gravity
1.25" Low Pressure
1.5" Force Main
1.5" Low Pressure
10" Force Main
10" Gravity
12" Gravity
14" Force Main
15" Gravity
16" Gravity
18" Gravity
2" Force Main
2" Low Pressure
2.5" Force Main
21" Gravity
24" Force Main
24" Gravity
30" Gravity
36" Gravity
4" Force Main
4" Gravity
6" Force Main
6" Gravity
8" Force Main
8" Gravity
CCTV - May 2011
FAIRHAVEN
SAINT MARYS STREET
MAGNOLIA AVENUE
VERANDA AVENUE
NEWBURY AVENUE
ALPINE AVENUE
DOVER STREET
MORGAN STREET
WINSOR STREET
MORTON STREET
DEANE STREET
HOWLAND ROAD
SYCAMORE STREET
BEACH STREET
RIVER AVENUE
OAK STREET
GARRISON STREET
MAIN STREET
DANIEL STREET
HAWTHORNE STREET
BLACKBURN STREET
MAITLAND STREET
WOODSIDE AVENUE
MCKENSIE LANE
PETER AVENUE
GLENHAVEN STREET
FAIRLAWN AVENUE
LIVESEY PARKWAY
RYLE STREET
ADAMS STREET
BROWN STREET
HOULE STREET
PARKER STREET
HOPKINS STREET
NEWTON STREET
FAITH AVENUE
CENTRAL AVEN
ALDEN ROAD
N
Town of Fairhaven, Massachusetts
Wastewater Management Plan Phase 2
June 2014
FST
Televised Pipelines (CCTV) - May 2011
Figure A-1
Feet
0
125
250
500
750


Legend
Sewer Manholes
Sewer Pipe Size and Type
UNK Gravity
1.25" Low Pressure
1.5" Force Main
1.5" Low Pressure
10" Force Main
10" Gravity
12" Gravity
14" Force Main
15" Gravity
16" Gravity
18" Gravity
2" Force Main
2" Low Pressure
2.5" Force Main
21" Gravity
24" Force Main
24" Gravity
30" Gravity
36" Gravity
4" Force Main
4" Gravity
6" Force Main
6" Gravity
8" Force Main
8" Gravity
Manhole Rehabilitation
Replaced manhole
Sealed leaking manhole
Repaired/replaced leaking manhole
Installed watertight frame and cover
Frame and cover raised to grade
Pipeline Rehabilitation
Repaired/replaced
Tested/sealed joints
Repaired/replaced & Tested/sealed joints
CIPP Lining
FAIRHAVEN
N
SAINT MARYS STREET
MAGNOLIA AVENUE
VERANDA AVENUE
NEWBURY AVENUE
ALPINE AVENUE
DOVER STREET
MORGAN STREET
WINSOR STREET
MORTON STREET
DEANE STREET
HOWLAND ROAD
SYCAMORE STREET
MAIN STREET
DANIEL STREET
HAWTHORNE STREET
BLACKBURN STREET
MAITLAND STREET
WOODSIDE AVENUE
MCKENSIE LANE
PETER AVENUE
GLENHAVEN STREET
FAIRLAWN AVENUE
RYLE STREET
LIVESEY PARKWAY
PARKER STREET
HOPKINS STREET
NEWTON STREET
FAITH AVENUE
ALDEN ROAD
CENTRAL AVEN
BEACH STREET
RIVER AVENUE
OAK STREET
GARRISON STREET
ADAMS STREET
BROWN STREET
HOULE STREET
WILDING
Town of Fairhaven, Massachusetts
Wastewater Management Plan Phase 2
June 2014
FST
Pipeline and Manhole Rehabilitation
Figure A-2
Feet
0
125
250
500
750


Legend
Sewer Manholes
Sewer Pipe Size and Type
UNK Gravity
1.25" Low Pressure
1.5" Force Main
1.5" Low Pressure
10" Force Main
10" Gravity
12" Gravity
14" Force Main
15" Gravity
16" Gravity
18" Gravity
2" Force Main
2" Low Pressure
2.5" Force Main
21" Gravity
24" Force Main
24" Gravity
30" Gravity
36" Gravity
4" Force Main
4" Gravity
6" Force Main
6" Gravity
8" Force Main
8" Gravity
Inflow Data
Roof
Sump
Foundation
Sump and Roof
Sump and Foundation
Roof and Foundation
FAIRHAVEN
SAINT MARYS STREET
MAGNOLIA AVENUE
VERANDA AVENUE
NEWBURY AVENUE
ALPINE AVENUE
DOVER STREET
MORGAN STREET
WINSOR STREET
MORTON STREET
DEANE STREET
HOWLAND ROAD
SYCAMORE STREET
BEACH STREET
RIVER AVENUE
OAK STREET
GARRISON STREET
MAIN STREET
DANIEL STREET
HAWTHORNE STREET
BLACKBURN STREET
MAITLAND STREET
WOODSIDE AVENUE
MCKENSIE LANE
PETER AVENUE
GLENHAVEN STREET
FAIRLAWN AVENUE
FAITH AVENUE
NEWTON STREET
ALDEN ROAD
LIVESEY PARKWAY
RYLE STREET
PARKER STREET
HOPKINS STREET
CENTRAL AVENUE
ADAMS STREET
HOULE STREET
BROWN STREET
WILDING
N
Town of Fairhaven, Massachusetts
Wastewater Management Plan Phase 2
June 2014
FST
Inflow Sources
Figure A-3
Feet
0
125
250
500
750


Legend
Sewer Manholes
Sewer Pipes
GPD
Not Defined
Under 2000
2000-3999
4000-5999
Greater than 6000
N
FAIRHAVEN
SAINT MARYS STREET
MAGNOLIA AVENUE
VERANDA AVENUE
NEWBURY AVENUE
ALPINE AVENUE
DOVER STREET
MORGAN STREET
WINSOR STREET
MORTON STREET
DEANE STREET
HOWLAND ROAD
SYCAMORE STREET
BEACH STREET
RIVER AVENUE
OAK STREET
GARRISON STREET
MAIN STREET
DANIEL STREET
HAWTHORNE STREET
BLACKBURN STREET
MAITLAND STREET
WOODSIDE AVENUE
MCKENSIE LANE
PETER AVENUE
GLENHAVEN STREET
FAIRLAWN AVENUE
RYLE STREET
LIVESEY PARKWAY
PARKER STREET
HOPKINS STREET
NEWTON STREET
FAITH AVENUE
CENTRAL AVENUE
ALDEN ROAD
ADAMS STREET
BROWN STREET
HOULTON STREET
WILDING S
Town of Fairhaven, Massachusetts
Wastewater Management Plan Phase 2
June 2014
FST
SSES Infiltration Data
Figure A-4
Feet
0 125 250 500 750

Town of Fairhaven, Massachusetts
Wastewater Management Plan Phase 2
June 2014

FST

Flow Isolation Data
Figure A-5

0 125 250 500 750 Feet

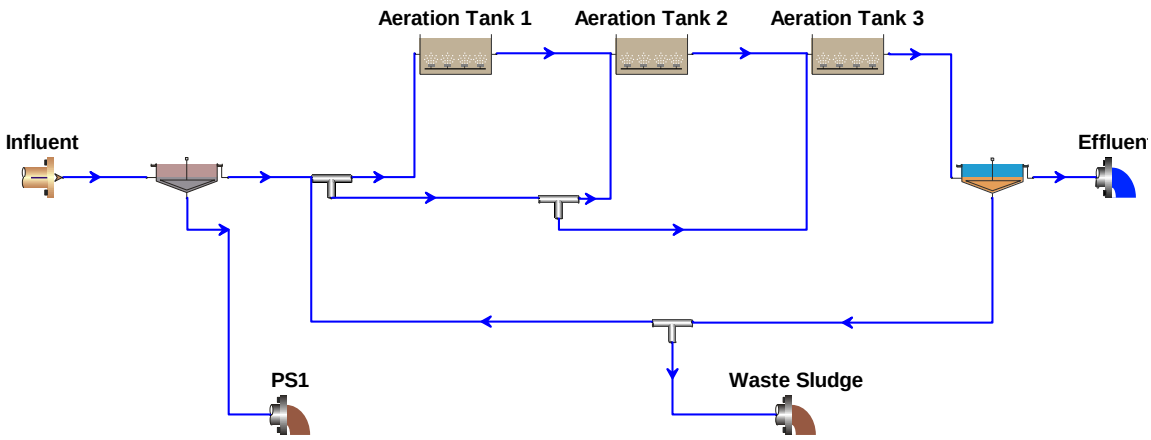
APPENDIX B

BIOWIN MODELING DATA AND RESULTS

FAIRHAVEN, MA

Existing WWTP Configuration

Flow = 2.5 MGD @ 15^{0}C



Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Primary Clarifier 1,2	0.2782	3318.0000	11.210

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Primary Clarifier 1,2	Flow paced	0.39 %

Element name	Percent removal	Blanket fraction
Primary Clarifier 1,2	35.00	0.85

Configuration information for all Bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Aeration Tank 1	0.1556	1600.0000	13.000	228
Aeration Tank 2	0.1556	1600.0000	13.000	228

Aeration Tank 3	0.1556	1600.0000	13.000	228

Operating data Average (flow/time weighted as required)

Element name	Average Air flow rate [ft3/min (20C, 1 atm)]
Aeration Tank 1	750.0
Aeration Tank 2	750.0
Aeration Tank 3	750.0

Element name	Average Temperature [deg. C]
Aeration Tank 1	15.0
Aeration Tank 2	15.0
Aeration Tank 3	15.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^0.25 + k2	k2 in C = k1(PC)^0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	% of tank area covered by diffusers [%]
Aeration Tank 1	2.5656	0.0432	0.8200	0.4413	6.2900
Aeration Tank 2	2.5656	0.0432	0.8200	0.4413	6.2900
Aeration Tank 3	2.5656	0.0432	0.8200	0.4413	6.2900

Element name	Alpha (surf) OR Alpha F (diff) [-]	Beta [-]	Surface pressure [kPa]	Fractional effective saturation depth (Fed) [-]
Aeration Tank 1	0.5000	0.9500	101.3250	0.3250
Aeration Tank 2	0.5000	0.9500	101.3250	0.3250
Aeration Tank 3	0.5000	0.9500	101.3250	0.3250

Element name	Supply gas CO2 content [vol. %]	Supply gas O2 [vol. %]	Off-gas CO2 [vol. %]	Off-gas O2 [vol. %]	Off-gas H2 [vol. %]	Off-gas NH3 [vol. %]	Off-gas CH4 [vol. %]	Surface turbulence factor [-]
Aeration Tank 1	0.0350	20.9500	2.0000	18.8000	0	0	0	2.0000
Aeration Tank 2	0.0350	20.9500	2.0000	18.8000	0	0	0	2.0000

Aeration Tank 3	0.0350	20.9500	2.0000	18.8000	0	0	0	2.0000

Configuration information for all BOD Influent units

Operating data Average (flow/time weighted as required)

Element name	Influent
Flow	3.05911219175086
Total Carbonaceous BOD mgBOD/L	153.00
Volatile suspended solids mgVSS/L	90.00
Total suspended solids mgTSS/L	126.00
Total Kjeldahl Nitrogen mgN/L	30.00
Total P mgP/L	5.00
Nitrate N mgN/L	0
pH	6.90
Alkalinity mmol/L	6.00
Calcium mg/L	80.00
Magnesium mg/L	15.00
Dissolved oxygen mg/L	2.15

Element name	Influent
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.1600
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1500
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.5389
Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0500
Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.1300
Fna - Ammonia [gNH3-N/gTKN]	0.6600
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.5000
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0350
Fpo4 - Phosphate [gPO4-P/gTP]	0.5000
FupP - P:COD ratio for unbiodegradable part. COD [gP/gCOD]	0.0110

FZbh - OHO COD fraction [gCOD/g of total COD]	1.000E-4
FZbm - Methylotroph COD fraction [gCOD/g of total COD]	1.000E-4
FZaob - AOB COD fraction [gCOD/g of total COD]	1.000E-4
FZnob - NOB COD fraction [gCOD/g of total COD]	1.000E-4
FZamob - ANAMMOX COD fraction [gCOD/g of total COD]	1.000E-4
FZbp - PAO COD fraction [gCOD/g of total COD]	1.000E-4
FZbpa - Propionic acetogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbam - Acetoclastic methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbhm - H2-utilizing methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZe - Endogenous products COD fraction [gCOD/g of total COD]	0

Configuration information for all Effluent units

Configuration information for all Ideal clarifier units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Sec. Clarifier 1,2	0.5483	6008.0000	12.200

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Sec. Clarifier 1,2	Flow paced	46.00 %

Element name	Average Temperature	Reactive	Percent removal	Blanket fraction
Sec. Clarifier 1,2	Uses global setting	Yes	99.80	0.05

Configuration information for all Sludge units

Configuration information for all Splitter units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
	Flow paced	1.23 %
	Ratio	0.50
	Ratio	0.50

BioWin Album

Album page - Page 1

Influent

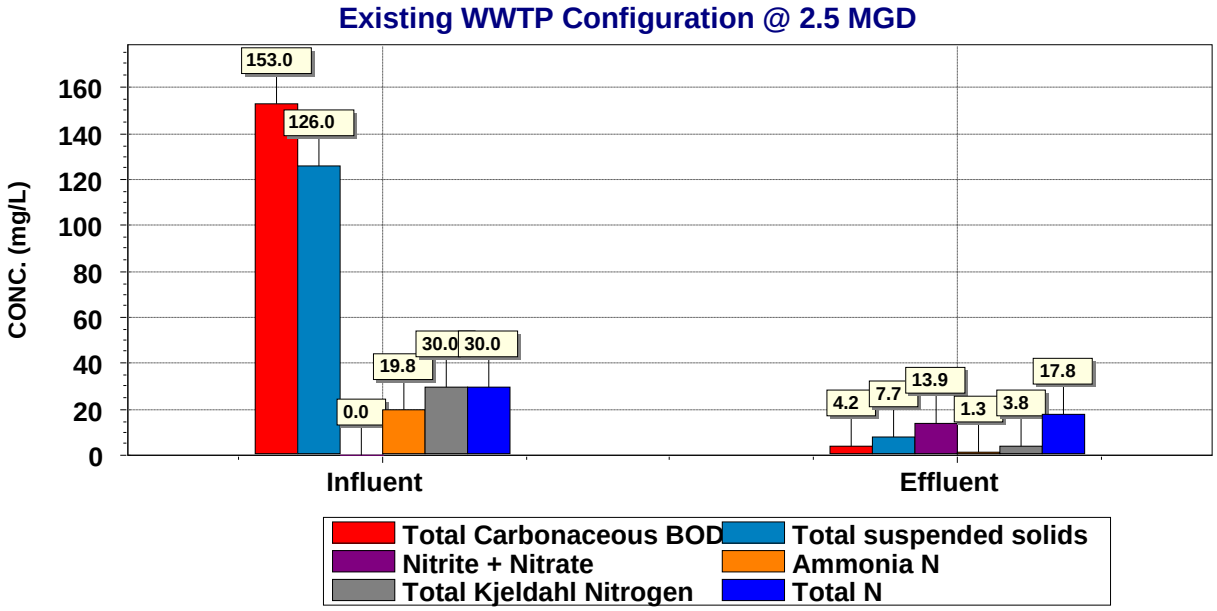
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	90.00	2297.66	
Total suspended solids	126.03	3217.37	
Particulate COD	143.97	3675.39	
Filtered COD	152.19	3885.46	
Total COD	296.16	7560.85	
Soluble PO4-P	2.50	63.82	
Total P	5.00	127.65	
Filtered TKN	24.52	625.91	
Particulate TKN	5.48	139.98	
Total Kjeldahl Nitrogen	30.00	765.89	
Filtered Carbonaceous BOD	97.25	2482.65	
Total Carbonaceous BOD	153.00	3906.02	
Nitrite + Nitrate	0	0	
Total N	30.00	765.89	
Total inorganic N	19.80	505.48	
Alkalinity	6.00	69.48	mmol/L and kmol/d
pH	6.90		
Volatile fatty acids	7.11	181.46	
ISS precipitate	0	0	
ISS cellular	0.03	0.65	
ISS Total	36.03	919.71	
Ammonia N	19.80	505.48	
Nitrate N	0	0	

Parameters	Value	Units

Album page - Page 2

Elements	Total Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Nitrite + Nitrate [mgN/L]	Ammonia N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]
Influent	153.00	126.03	0	19.80	30.00	30.00
Primary Clarifier 1,2	133.63	82.24	0.00	19.80	28.09	28.09
Aeration Tank 1	1080.41	2626.12	8.40	6.99	181.13	189.52
Aeration Tank 2	1071.20	2618.79	11.53	3.74	177.92	189.46
Aeration Tank 3	1062.64	2611.13	13.89	1.38	175.52	189.42
Sec. Clarifier 1,2	4.25	7.67	13.94	1.33	3.83	17.77
Effluent	4.25	7.67	13.94	1.33	3.83	17.77

Album page - Page 3



Album page - Page 4

Primary Clarifier 1,2

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	58.73	1493.49	
Total suspended solids	82.24	2091.27	
Particulate COD	93.94	2389.02	

Filtered COD	152.19	3870.29	
Total COD	246.14	6259.31	
Soluble PO4-P	2.50	63.58	
Total P	4.13	105.06	
Filtered TKN	24.52	623.44	
Particulate TKN	3.58	90.99	
Total Kjeldahl Nitrogen	28.09	714.43	
Filtered Carbonaceous BOD	97.25	2472.95	
Total Carbonaceous BOD	133.63	3398.15	
Nitrite + Nitrate	0.00	0.02	
Total N	28.09	714.45	
Total inorganic N	19.80	503.51	
Alkalinity	6.00	69.20	mmol/L and kmol/d
pH	6.89		
Volatile fatty acids	7.11	180.73	
ISS precipitate	0	0.00	
ISS cellular	0.02	0.40	
ISS Total	23.51	597.79	
Ammonia N	19.80	503.49	
Nitrate N	0.00	0.00	
Parameters	Value	Units	
Hydraulic residence time	2.18	hours	
Percent removal	35.00	%	
Height of specified concentration	9.53	ft	
Total solids mass	22184.09	lb	
Surface overflow rate	918.38	gal/(ft2 d)	
Solids loading rate	0.97	lb/(ft2 d)	

Album page - Page 5

Aeration Tank 1			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	1934.87	47545.69	
Total suspended solids	2626.12	64531.80	
Particulate COD	2834.76	69658.50	
Filtered COD	18.70	459.54	
Total COD	2853.46	70118.05	
Soluble PO4-P	1.82	44.77	
Total P	56.22	1381.37	
Filtered TKN	9.25	227.29	
Particulate TKN	171.88	4223.50	
Total Kjeldahl Nitrogen	181.13	4450.79	
Filtered Carbonaceous BOD	2.74	67.45	
Total Carbonaceous BOD	1080.41	26548.94	

Nitrite + Nitrate	8.40	206.30	
Total N	189.52	4657.09	
Total inorganic N	15.39	378.07	
Alkalinity	4.54	50.57	mmol/L and kmol/d
pH	6.91		
Volatile fatty acids	0.09	2.25	
ISS precipitate	0	0.00	
ISS cellular	126.26	3102.49	
ISS Total	691.25	16986.11	
Ammonia N	6.99	171.78	
Nitrate N	0.81	19.86	

Parameters	Value	Units
Hydraulic residence time	1.3	hours
Velocity gradient	170.07	1/s
VSS destruction	0	%
Total solids mass	3410.03	lb
Total readily biodegradable COD	2.72	mg/L
OUR - Total	51.49	mgO/L/hr
OUR - Carbonaceous	33.90	mgO/L/hr
OUR - Nitrification	17.58	mgO/L/hr
Nit - Ammonia removal rate	5.15	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	5.09	mgN/L/hr
Nit - Nitrate production rate	0.85	mgN/L/hr
Denit - Nitrate removal rate	0.22	mgN/L/hr
Denit - Nitrite removal rate	0.22	mgN/L/hr
Denit - N2 production rate	0.42	mgN/L/hr
Off gas flow rate (dry)	740.56	ft3/min
Off gas Oxygen	19.08	%
Off gas Carbon dioxide	2.21	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.01	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	9.73	mg/L
OTR	66.54	lb/hr
SOTR	182.04	lb/hr
OTE	8.50	%
SOTE	23.79	%
Air flow rate	750.00	ft3/min (20C, 1 atm)
Air flow rate / diffuser	3.29	ft3/min (20C, 1 atm)
# of diffusers	228.00	

Album page - Page 6

Aeration Tank 2			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	1926.94	63134.47	
Total suspended solids	2618.79	85802.01	
Particulate COD	2820.84	92422.25	
Filtered COD	17.21	563.83	
Total COD	2838.05	92986.08	
Soluble PO4-P	1.82	59.77	
Total P	56.22	1841.83	
Filtered TKN	5.82	190.66	
Particulate TKN	172.11	5638.86	
Total Kjeldahl Nitrogen	177.92	5829.52	
Filtered Carbonaceous BOD	1.69	55.47	
Total Carbonaceous BOD	1071.20	35096.92	
Nitrite + Nitrate	11.53	377.87	
Total N	189.46	6207.40	
Total inorganic N	15.27	500.40	
Alkalinity	4.08	60.65	mmol/L and kmol/d
pH	6.88		
Volatile fatty acids	0.03	0.94	
ISS precipitate	0	0.00	
ISS cellular	126.85	4156.05	
ISS Total	691.84	22667.54	
Ammonia N	3.74	122.53	
Nitrate N	1.43	47.00	

Parameters	Value	Units
Hydraulic residence time	1.0	hours
Velocity gradient	170.13	1/s
VSS destruction	0	%
Total solids mass	3400.50	lb
Total readily biodegradable COD	2.00	mg/L
OUR - Total	45.52	mgO/L/hr
OUR - Carbonaceous	27.90	mgO/L/hr
OUR - Nitrification	17.62	mgO/L/hr
Nit - Ammonia removal rate	5.12	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	5.06	mgN/L/hr
Nit - Nitrate production rate	0.98	mgN/L/hr
Denit - Nitrate removal rate	0.11	mgN/L/hr
Denit - Nitrite removal rate	0.10	mgN/L/hr

Denit - N2 production rate	0.20	mgN/L/hr
Off gas flow rate (dry)	739.40	ft3/min
Off gas Oxygen	19.28	%
Off gas Carbon dioxide	1.91	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.00	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	9.73	mg/L
OTR	60.13	lb/hr
SOTR	182.04	lb/hr
OTE	7.68	%
SOTE	23.79	%
Air flow rate	750.00	ft3/min (20C, 1 atm)
Air flow rate / diffuser	3.29	ft3/min (20C, 1 atm)
# of diffusers	228.00	

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Aeration Tank 3			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	1918.84	70727.69	
Total suspended solids	2611.13	96244.88	
Particulate COD	2806.97	103463.78	
Filtered COD	16.71	616.05	
Total COD	2823.69	104079.82	
Soluble PO4-P	1.87	69.00	
Total P	56.22	2072.06	
Filtered TKN	3.38	124.43	
Particulate TKN	172.15	6345.29	
Total Kjeldahl Nitrogen	175.52	6469.72	
Filtered Carbonaceous BOD	1.34	49.54	
Total Carbonaceous BOD	1062.64	39168.35	
Nitrite + Nitrate	13.89	512.09	
Total N	189.42	6981.80	
Total inorganic N	15.27	562.92	
Alkalinity	3.74	62.57	mmol/L and kmol/d
pH	6.86		
Volatile fatty acids	0.01	0.50	
ISS precipitate	0	0.00	
ISS cellular	127.29	4691.76	
ISS Total	692.28	25517.19	
Ammonia N	1.38	50.84	
Nitrate N	2.11	77.77	

Parameters	Value	Units
Hydraulic residence time	0.8	hours
Velocity gradient	170.16	1/s
VSS destruction	0.27	%
Total solids mass	3390.55	lb
Total readily biodegradable COD	1.71	mg/L
OUR - Total	39.67	mgO/L/hr
OUR - Carbonaceous	25.10	mgO/L/hr
OUR - Nitrification	14.58	mgO/L/hr
Nit - Ammonia removal rate	4.15	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	4.11	mgN/L/hr
Nit - Nitrate production rate	1.06	mgN/L/hr
Denit - Nitrate removal rate	0.07	mgN/L/hr
Denit - Nitrite removal rate	0.06	mgN/L/hr
Denit - N2 production rate	0.13	mgN/L/hr
Off gas flow rate (dry)	738.68	ft3/min
Off gas Oxygen	19.49	%
Off gas Carbon dioxide	1.64	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.00	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	9.73	mg/L
OTR	53.01	lb/hr
SOTR	182.04	lb/hr
OTE	6.77	%
SOTE	23.79	%
Air flow rate	750.00	ft3/min (20C, 1 atm)
Air flow rate / diffuser	3.29	ft3/min (20C, 1 atm)
# of diffusers	228.00	

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Sec. Clarifier 1,2			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	5.63	141.48	
Total suspended solids	7.67	192.72	
Particulate COD	8.22	206.53	
Filtered COD	16.45	413.17	
Total COD	24.67	619.70	
Soluble PO4-P	1.87	46.99	

Total P	2.03	51.02	
Filtered TKN	3.32	83.40	
Particulate TKN	0.51	12.81	
Total Kjeldahl Nitrogen	3.83	96.21	
Filtered Carbonaceous BOD	1.16	29.09	
Total Carbonaceous BOD	4.25	106.68	
Nitrite + Nitrate	13.94	350.16	
Total N	17.77	446.37	
Total inorganic N	15.27	383.60	
Alkalinity	3.74	42.56	mmol/L and kmol/d
pH	6.86		
Volatile fatty acids	0.01	0.21	
ISS precipitate	0	0.00	
ISS cellular	0.38	9.59	
ISS Total	2.04	51.25	
Ammonia N	1.33	33.44	
Nitrate N	2.12	53.30	

Parameters	Value	Units
Hydraulic residence time	2.98	hours
Percent removal	99.80	%
Height of specified concentration	0.61	ft
Total solids mass	1902.48	lb
Surface overflow rate	500.92	gal/(ft2 d)
Solids loading rate	16.02	lb/(ft2 d)

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Effluent			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	5.63	141.48	
Total suspended solids	7.67	192.72	
Particulate COD	8.22	206.53	
Filtered COD	16.45	413.17	
Total COD	24.67	619.70	
Soluble PO4-P	1.87	46.99	
Total P	2.03	51.02	
Filtered TKN	3.32	83.40	
Particulate TKN	0.51	12.81	
Total Kjeldahl Nitrogen	3.83	96.21	
Filtered Carbonaceous BOD	1.16	29.09	
Total Carbonaceous BOD	4.25	106.68	
Nitrite + Nitrate	13.94	350.16	

Total N	17.77	446.37	
Total inorganic N	15.27	383.60	
Alkalinity	3.74	42.56	mmol/L and kmol/d
pH	6.86		
Volatile fatty acids	0.01	0.21	
ISS precipitate	0	0.00	
ISS cellular	0.38	9.59	
ISS Total	2.04	51.25	
Ammonia N	1.33	33.44	
Nitrate N	2.12	53.30	

Parameters	Value	Units

Global Parameters
AOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9000	0.9000	1.0720
Substrate (NH4) half sat. [mgN/L]	0.7000	0.7000	1.0000
Byproduct NH4 logistic slope [-]	50.0000	50.0000	1.0000
Byproduct NH4 inflection point [mgN/L]	1.4000	1.4000	1.0000
AOB denite DO half sat. [mg/L]	0.1000	0.1000	1.0000
AOB denite HNO2 half sat. [mgN/L]	5.000E-6	5.000E-6	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiHNO2 [mmol/L]	0.0050	0.0050	1.0000

NOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.7000	0.7000	1.0600
Substrate (NO2) half sat. [mgN/L]	0.1000	0.1000	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiNH3 [mmol/L]	0.0750	0.0750	1.0000

ANAMMOX

Name	Default	Value	
Max. spec. growth rate [1/d]	0.1000	0.1000	1.1000
Substrate (NH4) half sat. [mgN/L]	2.0000	2.0000	1.0000
Substrate (NO2) half sat. [mgN/L]	1.0000	1.0000	1.0000
Aerobic decay rate [1/d]	0.0190	0.0190	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0095	0.0095	1.0290
Ki Nitrite [mgN/L]	1000.0000	1000.0000	1.0000
Nitrite sensitivity constant [L / (d mgN)]	0.0160	0.0160	1.0000

OHO

Name	Default	Value	
Max. spec. growth rate [1/d]	3.2000	3.2000	1.0290
Substrate half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Anoxic growth factor [-]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.6200	0.6200	1.0290
Anoxic decay rate [1/d]	0.2330	0.2330	1.0290
Anaerobic decay rate [1/d]	0.1310	0.1310	1.0290
Hydrolysis rate [1/d]	2.1000	2.1000	1.0290
Hydrolysis half sat. [-]	0.0600	0.0600	1.0000
Anoxic hydrolysis factor [-]	0.2800	0.2800	1.0000
Anaerobic hydrolysis factor (AS) [-]	0.0400	0.0400	1.0000
Anaerobic hydrolysis factor (AD) [-]	0.2000	0.5000	1.0000
Adsorption rate of colloids [L/(mgCOD d)]	0.1500	0.8000	1.0290
Ammonification rate [L/(mgN d)]	0.0400	0.0400	1.0290
Assimilative nitrate/nitrite reduction rate [1/d]	0.5000	0.5000	1.0000
Fermentation rate [1/d]	1.6000	3.2000	1.0290
Fermentation half sat. [mgCOD/L]	5.0000	5.0000	1.0000

Fermentation growth factor (AS) [-]	0.2500	0.1250	1.0000
Endogenous products decay rate[1/d]	0	0	1.0000
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

Methylotrophs

Name	Default	Value	
Max. spec. growth rate [1/d]	1.3000	1.3000	1.0720
Methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.0400	0.0400	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0300	0.0300	1.0290
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

PAO

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9500	0.9500	1.0000
Max. spec. growth rate, P-limited [1/d]	0.4200	0.4200	1.0000
Substrate half sat. [mgCOD(PHB)/mgCOD(Zbp)]	0.1000	0.1000	1.0000
Substrate half sat., P-limited [mgCOD(PHB)/mgCOD(Zbp)]	0.0500	0.0500	1.0000
Magnesium half sat. [mgMg/L]	0.1000	0.1000	1.0000
Cation half sat. [mmol/L]	0.1000	0.1000	1.0000
Calcium half sat. [mgCa/L]	0.1000	0.1000	1.0000
Aerobic/anoxic decay rate [1/d]	0.1000	0.1000	1.0000
Aerobic/anoxic maintenance rate [1/d]	0	0	1.0000
Anaerobic decay rate [1/d]	0.0400	0.0400	1.0000
Anaerobic maintenance rate [1/d]	0	0	1.0000
Sequestration rate [1/d]	4.5000	6.0000	1.0000
Anoxic growth factor [-]	0.3300	0.3300	1.0000

Acetogens

Name	Default	Value	
Max. spec. growth rate [1/d]	0.2500	0.2500	1.0290
Substrate half sat. [mgCOD/L]	10.0000	10.0000	1.0000
Acetate inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Anaerobic decay rate [1/d]	0.0500	0.0500	1.0290
Aerobic/anoxic decay rate [1/d]	0.5200	0.5200	1.0290

Methanogens

Name	Default	Value	
Acetoclastic max. spec. growth rate [1/d]	0.3000	0.3000	1.0290
H2-utilizing max. spec. growth rate [1/d]	1.4000	1.4000	1.0290
Acetoclastic substrate half sat. [mgCOD/L]	100.0000	100.0000	1.0000
Acetoclastic methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
H2-utilizing CO2 half sat. [mmol/L]	0.1000	0.1000	1.0000
H2-utilizing substrate half sat. [mgCOD/L]	0.1000	0.1000	1.0000
H2-utilizing methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Acetoclastic propionic inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Acetoclastic anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
Acetoclastic aerobic/anoxic decay rate [1/d]	0.6000	0.6000	1.0290
H2-utilizing anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
H2-utilizing aerobic/anoxic decay rate [1/d]	2.8000	0.6000	1.0290

pH

Name	Default	Value
OHO low pH limit [-]	4.0000	4.0000
OHO high pH limit [-]	10.0000	10.0000
Methylotrophs low pH limit [-]	4.0000	4.0000
Methylotrophs high pH limit [-]	10.0000	10.0000
Autotrophs low pH limit [-]	5.5000	5.5000

Autotrophs high pH limit [-]	9.5000	9.5000
PAO low pH limit [-]	4.0000	4.0000
PAO high pH limit [-]	10.0000	10.0000
OHO low pH limit (anaerobic) [-]	5.5000	5.5000
OHO high pH limit (anaerobic) [-]	8.5000	8.5000
Propionic acetogens low pH limit [-]	4.0000	4.0000
Propionic acetogens high pH limit [-]	10.0000	10.0000
Acetoclastic methanogens low pH limit [-]	5.0000	5.0000
Acetoclastic methanogens high pH limit [-]	9.0000	9.0000
H2-utilizing methanogens low pH limit [-]	5.0000	5.0000
H2-utilizing methanogens high pH limit [-]	9.0000	9.0000

Switches

Name	Default	Value
Aerobic/anoxic DO half sat. [mgO2/L]	0.0500	0.0500
Anoxic/anaerobic NOx half sat. [mgN/L]	0.1500	0.1500
AOB DO half sat. [mgO2/L]	0.2500	0.2500
NOB DO half sat. [mgO2/L]	0.5000	0.5000
ANAMMOX DO half sat. [mgO2/L]	0.0100	0.0100
Anoxic NO3(->NO2) half sat. [mgN/L]	0.1000	0.1000
Anoxic NO3(->N2) half sat. [mgN/L]	0.0500	0.0500
Anoxic NO2(->N2) half sat. (mgN/L)	0.0100	0.0100
NH3 nutrient half sat. [mgN/L]	0.0050	1.000E-4
PolyP half sat. [mgP/mgCOD]	0.0100	0.0100
VFA sequestration half sat. [mgCOD/L]	5.0000	5.0000
P uptake half sat. [mgP/L]	0.1500	0.1500
P nutrient half sat. [mgP/L]	0.0010	0.0010
Autotroph CO2 half sat. [mmol/L]	0.1000	0.1000
H2 low/high half sat. [mgCOD/L]	1.0000	1.0000
Propionic acetogens H2 inhibition [mgCOD/L]	5.0000	5.0000

Synthesis anion/cation half sat. [meq/L]	0.0100	0.0100

Common

Name	Default	Value
Biomass volatile fraction (VSS/TSS)	0.9200	0.9200
Endogenous residue volatile fraction (VSS/TSS)	0.9200	0.9200
N in endogenous residue [mgN/mgCOD]	0.0700	0.0700
P in endogenous residue [mgP/mgCOD]	0.0220	0.0220
Endogenous residue COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Particulate substrate COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000
Particulate inert COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000

AOB

Name	Default	Value
Yield [mgCOD/mgN]	0.1500	0.1500
AOB denite NO2 fraction as TEA [-]	0.5000	0.5000
Byproduct NH4 fraction to N2O [-]	0.0025	0.0025
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

NOB

Name	Default	Value
Yield [mgCOD/mgN]	0.0900	0.0900
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

ANAMMOX

Name	Default	Value
Yield [mgCOD/mgN]	0.1140	0.1140
Nitrate production [mgN/mgBiomassCOD]	2.2800	2.2800
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

OHO

Name	Default	Value
Yield (aerobic) [-]	0.6660	0.6660
Yield (fermentation, low H2) [-]	0.1000	0.1000
Yield (fermentation, high H2) [-]	0.1000	0.1000
H2 yield (fermentation low H2) [-]	0.3500	0.3500
H2 yield (fermentation high H2) [-]	0	0
Propionate yield (fermentation, low H2) [-]	0	0
Propionate yield (fermentation, high H2) [-]	0.7000	0.7000
CO2 yield (fermentation, low H2) [-]	0.7000	0.7000
CO2 yield (fermentation, high H2) [-]	0	0
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Endogenous fraction - aerobic [-]	0.0800	0.0800
Endogenous fraction - anoxic [-]	0.1030	0.1030
Endogenous fraction - anaerobic [-]	0.1840	0.1840
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield (anoxic) [-]	0.5400	0.5400
Yield propionic (aerobic) [-]	0.6400	0.6400
Yield propionic (anoxic) [-]	0.4600	0.4600

Yield acetic (aerobic) [-]	0.6000	0.6000
Yield acetic (anoxic) [-]	0.4300	0.4300
Yield methanol (aerobic) [-]	0.5000	0.5000
Adsorp. max. [-]	1.0000	1.0000
Max fraction to N2O at high FNA over nitrate [-]	0.0500	0.0500
Max fraction to N2O at high FNA over nitrite [-]	0.1000	0.1000

Methylotrophs

Name	Default	Value
Yield (anoxic) [-]	0.4000	0.4000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Max fraction to N2O at high FNA over nitrate [-]	0.1000	0.1000
Max fraction to N2O at high FNA over nitrite [-]	0.1500	0.1500

PAO

Name	Default	Value
Yield (aerobic) [-]	0.6390	0.6390
Yield (anoxic) [-]	0.5200	0.5200
Aerobic P/PHA uptake [mgP/mgCOD]	0.9300	0.9500
Anoxic P/PHA uptake [mgP/mgCOD]	0.3500	0.3500
Yield of PHA on sequestration [-]	0.8890	0.8890
N in biomass [mgN/mgCOD]	0.0700	0.0700
N in sol. inert [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous part. [-]	0.2500	0.2500
Inert fraction of endogenous sol. [-]	0.2000	0.2000

P/Ac release ratio [mgP/mgCOD]	0.5100	0.4900
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield of low PP [-]	0.9400	0.9400

Acetogens

Name	Default	Value
Yield [-]	0.1000	0.1000
H2 yield [-]	0.4000	0.4000
CO2 yield [-]	1.0000	1.0000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

Methanogens

Name	Default	Value
Acetoclastic yield [-]	0.1000	0.1000
Methanol acetoclastic yield [-]	0.1000	0.1000
H2-utilizing yield [-]	0.1000	0.1000
Methanol H2-utilizing yield [-]	0.1000	0.1000
N in acetoclastic biomass [mgN/mgCOD]	0.0700	0.0700
N in H2-utilizing biomass [mgN/mgCOD]	0.0700	0.0700
P in acetoclastic biomass [mgP/mgCOD]	0.0220	0.0220
P in H2-utilizing biomass [mgP/mgCOD]	0.0220	0.0220
Acetoclastic fraction to endog. residue [-]	0.0800	0.0800
H2-utilizing fraction to endog. residue [-]	0.0800	0.0800
Acetoclastic COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
H2-utilizing COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

General

Name	Default	Value
Molecular weight of other anions [mg/mmol]	35.5000	35.5000
Molecular weight of other cations [mg/mmol]	39.1000	39.1000
Mg to P mole ratio in polyphosphate [mmolMg/mmolP]	0.3000	0.3000
Cation to P mole ratio in polyphosphate [meq/mmolP]	0.1500	0.3000
Ca to P mole ratio in polyphosphate [mmolCa/mmolP]	0.0500	0.0500
Cation to P mole ratio in organic phosphate [meq/mmolP]	0.0100	0.0100
Bubble rise velocity (anaerobic digester) [cm/s]	23.9000	23.9000
Bubble Sauter mean diameter (anaerobic digester) [cm]	0.3500	0.3500
Anaerobic digester gas hold-up factor []	1.0000	1.0000
Tank head loss per metre of length (from flow) [m/m]	0.0025	0.0025

Mass transfer

Name	Default	Value	
Kl for H2 [m/d]	17.0000	17.0000	1.0240
Kl for CO2 [m/d]	10.0000	10.0000	1.0240
Kl for NH3 [m/d]	1.0000	1.0000	1.0240
Kl for CH4 [m/d]	8.0000	8.0000	1.0240
Kl for N2 [m/d]	15.0000	15.0000	1.0240
Kl for N2O [m/d]	8.0000	8.0000	1.0240
Kl for O2 [m/d]	13.0000	13.0000	1.0240

Henry's law constants

Name	Default	Value	
CO2 [M/atm]	0.0340	0.0340	2400.0000
O2 [M/atm]	0.0013	0.0013	1500.0000
N2 [M/atm]	6.500E-4	6.500E-4	1300.0000
N2O [M/atm]	0.0250	0.0250	2600.0000
NH3 [M/atm]	58.0000	58.0000	4100.0000

CH4 [M/atm]	0.0014	0.0014	1600.0000
H2 [M/atm]	7.800E-4	7.800E-4	500.0000

Physico-chemical rates

Name	Default	Value	
Struvite precipitation rate [1/d]	3.000E+10	3.000E+10	1.0240
Struvite redissolution rate [1/d]	3.000E+11	3.000E+11	1.0240
Struvite half sat. [mgTSS/L]	1.0000	1.0000	1.0000
HDP precipitation rate [L/(molP d)]	1.000E+8	1.000E+8	1.0000
HDP redissolution rate [L/(mol P d)]	1.000E+8	1.000E+8	1.0000
HAP precipitation rate [molHDP/(L d)]	5.000E-4	5.000E-4	1.0000

Physico-chemical constants

Name	Default	Value
Struvite solubility constant [mol/L]	6.918E-14	6.918E-14
HDP solubility product [mol/L]	2.750E-22	2.750E-22
HDP half sat. [mgTSS/L]	1.0000	1.0000
Equilibrium soluble PO4 with Al dosing at pH 7 [mgP/L]	0.0100	0.0100
Al to P ratio [molAl/molP]	0.8000	0.8000
Al(OH)3 solubility product [mol/L]	1.259E+9	1.259E+9
AlHPO4+ dissociation constant [mol/L]	7.943E-13	7.943E-13
Equilibrium soluble PO4 with Fe dosing at pH 7 [mgP/L]	0.0100	0.0100
Fe to P ratio [molFe/molP]	1.6000	1.6000
Fe(OH)3 solubility product [mol/L]	0.0500	0.0500
FeH2PO4++ dissociation constant [mol/L]	5.012E-22	5.012E-22

Aeration

Name	Default	Value
Alpha (surf) OR Alpha F (diff) [-]	0.5000	0.5000

Beta [-]	0.9500	0.9500
Surface pressure [kPa]	101.3250	101.3250
Fractional effective saturation depth (Fed) [-]	0.3250	0.3250
Supply gas CO2 content [vol. %]	0.0350	0.0350
Supply gas O2 [vol. %]	20.9500	20.9500
Off-gas CO2 [vol. %]	2.0000	2.0000
Off-gas O2 [vol. %]	18.8000	18.8000
Off-gas H2 [vol. %]	0	0
Off-gas NH3 [vol. %]	0	0
Off-gas CH4 [vol. %]	0	0
Surface turbulence factor [-]	2.0000	2.0000
Set point controller gain []	1.0000	1.0000

Modified Vesilind

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.387	0.387
Vesilind hindered zone settling parameter (K) [L/g]	0.370	0.370
Clarification switching function [mg/L]	100.000	100.000
Specified TSS conc.for height calc. [mg/L]	2500.000	2500.000
Maximum compactability constant [mg/L]	15000.000	15000.000

Double exponential

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.934	0.934
Maximum (practical) settling velocity (Vo') [ft/min]	0.615	0.615
Hindered zone settling parameter (Kh) [L/g]	0.400	0.400
Flocculent zone settling parameter (Kf) [L/g]	2.500	2.500
Maximum non-settleable TSS [mg/L]	20.0000	20.0000
Non-settleable fraction [-]	0.0010	0.0010

Specified TSS conc. for height calc. [mg/L]	2500.0000	2500.0000

Emission factors

Name	Default	Value
Carbon dioxide equivalence of nitrous oxide	296.0000	296.0000
Carbon dioxide equivalence of methane	23.0000	23.0000

Biofilm general

Name	Default	Value	
Attachment rate [g / (m2 d)]	80.0000	80.0000	1.0000
Attachment TSS half sat. [mg/L]	100.0000	100.0000	1.0000
Detachment rate [g/(m3 d)]	8.000E+4	8.000E+4	1.0000
Solids movement factor []	10.0000	10.0000	1.0000
Diffusion neta []	0.8000	0.8000	1.0000
Thin film limit [mm]	0.5000	0.5000	1.0000
Thick film limit [mm]	3.0000	3.0000	1.0000
Assumed Film thickness for tank volume correction (temp independant) [mm]	0.7500	0.7500	1.0000
Film surface area to media area ratio - Max.[ ]	1.0000	1.0000	1.0000
Minimum biofilm conc. for streamer formation [gTSS/m2]	4.0000	4.0000	1.0000

Maximum biofilm concentrations [mg/L]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	5.000E+4	5.000E+4	1.0000
Methylotrophs	5.000E+4	5.000E+4	1.0000
Ammonia oxidizing biomass (AOB)	1.000E+5	1.000E+5	1.0000
Nitrite oxidizing biomass (NOB)	1.000E+5	1.000E+5	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E+4	5.000E+4	1.0000
Polyphosphate accumulating organisms (PAO)	5.000E+4	5.000E+4	1.0000
Propionic acetogens	5.000E+4	5.000E+4	1.0000

Methanogens - acetoclastic	5.000E+4	5.000E+4	1.0000
Methanogens - hydrogenotrophic	5.000E+4	5.000E+4	1.0000
Endogenous products	3.000E+4	3.000E+4	1.0000
Slowly bio. COD (part.)	5000.0000	5000.0000	1.0000
Slowly bio. COD (colloid.)	4000.0000	4000.0000	1.0000
Part. inert. COD	5000.0000	5000.0000	1.0000
Part. bio. org. N	0	0	1.0000
Part. bio. org. P	0	0	1.0000
Part. inert N	0	0	1.0000
Part. inert P	0	0	1.0000
Stored PHA	5000.0000	5000.0000	1.0000
Releasable stored polyP	1.150E+6	1.150E+6	1.0000
Fixed stored polyP	1.150E+6	1.150E+6	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.000E+10	1.000E+10	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	1.300E+6	1.300E+6	1.0000
Struvite	8.500E+5	8.500E+5	1.0000
Hydroxy-dicalcium-phosphate	1.150E+6	1.150E+6	1.0000

Hydroxy-apatite	1.600E+6	1.600E+6	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.000E+10	1.000E+10	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	5.000E+4	5.000E+4	1.0000
User defined 4	5.000E+4	5.000E+4	1.0000
Dissolved oxygen	0	0	1.0000

Effective diffusivities [m2/s]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	5.000E-14	5.000E-14	1.0290
Methylotrophs	5.000E-14	5.000E-14	1.0290
Ammonia oxidizing biomass (AOB)	5.000E-14	5.000E-14	1.0290
Nitrite oxidizing biomass (NOB)	5.000E-14	5.000E-14	1.0290
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E-14	5.000E-14	1.0290
Polyphosphate accumulating organisms (PAO)	5.000E-14	5.000E-14	1.0290
Propionic acetogens	5.000E-14	5.000E-14	1.0290
Methanogens - acetoclastic	5.000E-14	5.000E-14	1.0290
Methanogens - hydrogenotrophic	5.000E-14	5.000E-14	1.0290
Endogenous products	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (part.)	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (colloid.)	5.000E-12	5.000E-12	1.0290
Part. inert. COD	5.000E-14	5.000E-14	1.0290
Part. bio. org. N	5.000E-14	5.000E-14	1.0290
Part. bio. org. P	5.000E-14	5.000E-14	1.0290

Part. inert N	5.000E-14	5.000E-14	1.0290
Part. inert P	5.000E-14	5.000E-14	1.0290
Stored PHA	5.000E-14	5.000E-14	1.0290
Releasable stored polyP	5.000E-14	5.000E-14	1.0290
Fixed stored polyP	5.000E-14	5.000E-14	1.0290
Readily bio. COD (complex)	6.900E-10	6.900E-10	1.0290
Acetate	1.240E-9	1.240E-9	1.0290
Propionate	8.300E-10	8.300E-10	1.0290
Methanol	1.600E-9	1.600E-9	1.0290
Dissolved H2	5.850E-9	5.850E-9	1.0290
Dissolved methane	1.963E-9	1.963E-9	1.0290
Ammonia N	2.000E-9	2.000E-9	1.0290
Sol. bio. org. N	1.370E-9	1.370E-9	1.0290
Nitrous Oxide N	1.607E-9	1.607E-9	1.0290
Nitrite N	2.980E-9	2.980E-9	1.0290
Nitrate N	2.980E-9	2.980E-9	1.0290
Dissolved nitrogen gas	1.900E-9	1.900E-9	1.0290
PO4-P (Sol. & Me Complexed)	2.000E-9	2.000E-9	1.0290
Sol. inert COD	6.900E-10	6.900E-10	1.0290
Sol. inert TKN	6.850E-10	6.850E-10	1.0290
ISS Influent	5.000E-14	5.000E-14	1.0290
Struvite	5.000E-14	5.000E-14	1.0290
Hydroxy-dicalcium-phosphate	5.000E-14	5.000E-14	1.0290
Hydroxy-apatite	5.000E-14	5.000E-14	1.0290
Magnesium	7.200E-10	7.200E-10	1.0290
Calcium	7.200E-10	7.200E-10	1.0290
Metal	4.800E-10	4.800E-10	1.0290
Other Cations (strong bases)	1.440E-9	1.440E-9	1.0290
Other Anions (strong acids)	1.440E-9	1.440E-9	1.0290
Total CO2	1.960E-9	1.960E-9	1.0290
User defined 1	6.900E-10	6.900E-10	1.0290

User defined 2	6.900E-10	6.900E-10	1.0290
User defined 3	5.000E-14	5.000E-14	1.0290
User defined 4	5.000E-14	5.000E-14	1.0290
Dissolved oxygen	2.500E-9	2.500E-9	1.0290

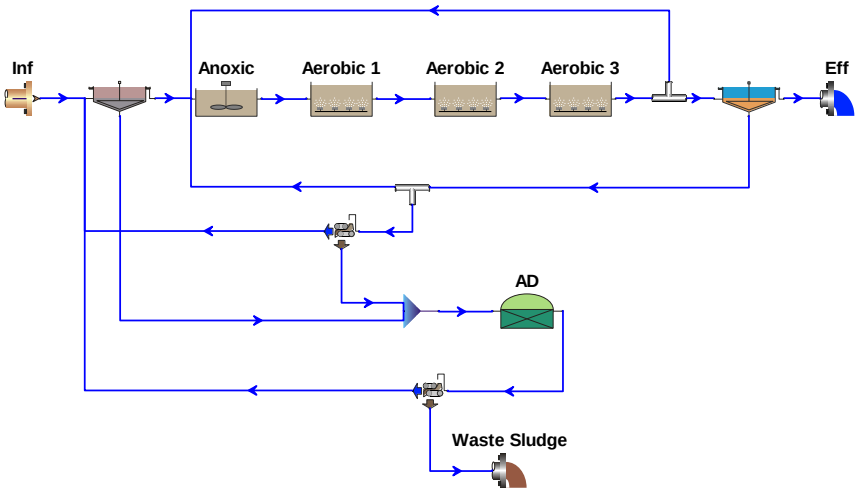
EPS Strength coefficients [ ]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	1.0000	1.0000	1.0000
Methylotrophs	1.0000	1.0000	1.0000
Ammonia oxidizing biomass (AOB)	5.0000	1.0000	1.0000
Nitrite oxidizing biomass (NOB)	25.0000	1.0000	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	10.0000	1.0000	1.0000
Polyphosphate accumulating organisms (PAO)	1.0000	1.0000	1.0000
Propionic acetogens	1.0000	1.0000	1.0000
Methanogens - acetoclastic	1.0000	1.0000	1.0000
Methanogens - hydrogenotrophic	1.0000	1.0000	1.0000
Endogenous products	1.0000	1.0000	1.0000
Slowly bio. COD (part.)	1.0000	1.0000	1.0000
Slowly bio. COD (colloid.)	1.0000	1.0000	1.0000
Part. inert. COD	1.0000	1.0000	1.0000
Part. bio. org. N	1.0000	1.0000	1.0000
Part. bio. org. P	1.0000	1.0000	1.0000
Part. inert N	1.0000	1.0000	1.0000
Part. inert P	1.0000	1.0000	1.0000
Stored PHA	1.0000	1.0000	1.0000
Releasable stored polyP	1.0000	1.0000	1.0000
Fixed stored polyP	1.0000	1.0000	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000

Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.0000	1.0000	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	0.3300	0.3300	1.0000
Struvite	1.0000	1.0000	1.0000
Hydroxy-dicalcium-phosphate	1.0000	1.0000	1.0000
Hydroxy-apatite	1.0000	1.0000	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.0000	1.0000	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	1.0000	1.0000	1.0000
User defined 4	1.0000	1.0000	1.0000
Dissolved oxygen	0	0	1.0000

FAIRHAVEN, MA

Case Study No. 1
MLE w/Anaerobic Digestion
Flow = 5.0 MGD @ 18^{0}C



Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Primary Clarifier 1,2	0.5565	6636.0000	11.210

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Primary Clarifier 1,2	Flowrate [Under]	0.016

Element name	Percent removal	Blanket fraction
Primary Clarifier 1,2	60.00	0.85

Configuration information for all Anaerobic Digester units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	Head space volume
AD	0.6200	4144.0975	20.000	0.5

Operating data Average (flow/time weighted as required)

Element name	Pressure [psi]	pH
AD	14.9	-

Element name	Average Temperature
AD	35.0

Configuration information for all Bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Anoxic	0.3112	3200.0000	13.000	Un-aerated
Aerobic 1	0.3112	3200.0000	13.000	456
Aerobic 2	0.3112	3200.0000	13.000	456
Aerobic 3	0.2379	3180.0000	10.000	453

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
Anoxic	0
Aerobic 1	2.0
Aerobic 2	2.0
Aerobic 3	2.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^0.25 + k2	k2 in C = k1(PC)^0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	% of tank area covered by diffusers [%]
Anoxic	2.5656	0.0432	0.8200	0.4413	6.2900
Aerobic 1	2.5656	0.0432	0.8200	0.4413	6.2900
Aerobic 2	2.5656	0.0432	0.8200	0.4413	6.2900
Aerobic 3	2.5656	0.0432	0.8200	0.4413	6.2900

Element name	Alpha (surf) OR Alpha F (diff) [-]	Beta [-]	Surface pressure [kPa]	Fractional effective saturation depth (Fed) [-]
Aerobic 1	0.5000	0.9500	101.3250	0.3250
Aerobic 2	0.5000	0.9500	101.3250	0.3250

Aerobic 3	0.5000	0.9500	101.3250	0.3250	

Element name	Supply gas CO2 content [vol. %]	Supply gas O2 [vol. %]	Off-gas CO2 [vol. %]	Off-gas O2 [vol. %]	Off-gas H2 [vol. %]	Off-gas NH3 [vol. %]	Off-gas CH4 [vol. %]	Surface turbulence factor [-]
Aerobic 1	0.0350	20.9500	2.0000	18.8000	0	0	0	2.0000
Aerobic 2	0.0350	20.9500	2.0000	18.8000	0	0	0	2.0000
Aerobic 3	0.0350	20.9500	2.0000	18.8000	0	0	0	2.0000

Configuration information for all BOD Influent units

Operating data Average (flow/time weighted as required)

Element name	Inf
Flow	5.00077666578962
Total Carbonaceous BOD mgBOD/L	180.00
Volatile suspended solids mgVSS/L	110.00
Total suspended solids mgTSS/L	145.00
Total Kjeldahl Nitrogen mgN/L	36.00
Total P mgP/L	5.00
Nitrate N mgN/L	0
pH	7.00
Alkalinity mmol/L	10.00
Calcium mg/L	80.00
Magnesium mg/L	15.00
Dissolved oxygen mg/L	1.10

Element name	Inf
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.1600
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1500
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.5634
Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0500
Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.1300
Fna - Ammonia [gNH3-N/gTKN]	0.6600
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.5000
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0350
Fpo4 - Phosphate [gPO4-P/gTP]	0.5000
FupP - P:COD ratio for unbiodegradable part. COD [gP/gCOD]	0.0110
FZbh - OHO COD fraction [gCOD/g of total COD]	1.000E-4
FZbm - Methylotroph COD fraction [gCOD/g of total COD]	1.000E-4

FZaob - AOB COD fraction [gCOD/g of total COD]	1.000E-4
FZnob - NOB COD fraction [gCOD/g of total COD]	1.000E-4
FZamob - ANAMMOX COD fraction [gCOD/g of total COD]	1.000E-4
FZbp - PAO COD fraction [gCOD/g of total COD]	1.000E-4
FZbpa - Propionic acetogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbam - Acetoclastic methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbhm - H2-utilizing methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZe - Endogenous products COD fraction [gCOD/g of total COD]	0

Configuration information for all Effluent units

Configuration information for all Ideal clarifier units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Sec. Clarifier 1,2	0.8593	8836.0000	13.000

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Sec. Clarifier 1,2	Flow paced	200.00 %

Element name	Average Temperature	Reactive	Percent removal	Blanket fraction
Sec. Clarifier 1,2	Uses global setting	No	99.95	0.05

Configuration information for all Dewatering unit units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Dewatering unit3	Flowrate [Under]	0.01
Dewatering unit32	Flowrate [Under]	0.01

Element name	Percent removal
Dewatering unit3	90.00
Dewatering unit32	95.00

Configuration information for all Sludge units

Configuration information for all Splitter units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
	Flowrate [Side]	0.053
Splitter8	Flow paced	200.00 %

BioWin Album

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Elements	Ammonia N [mgN/L]	Total Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Total P [mgP/L]
Inf	23.76	180.00	145.03	5.00
Eff	0.06	2.85	6.47	3.14

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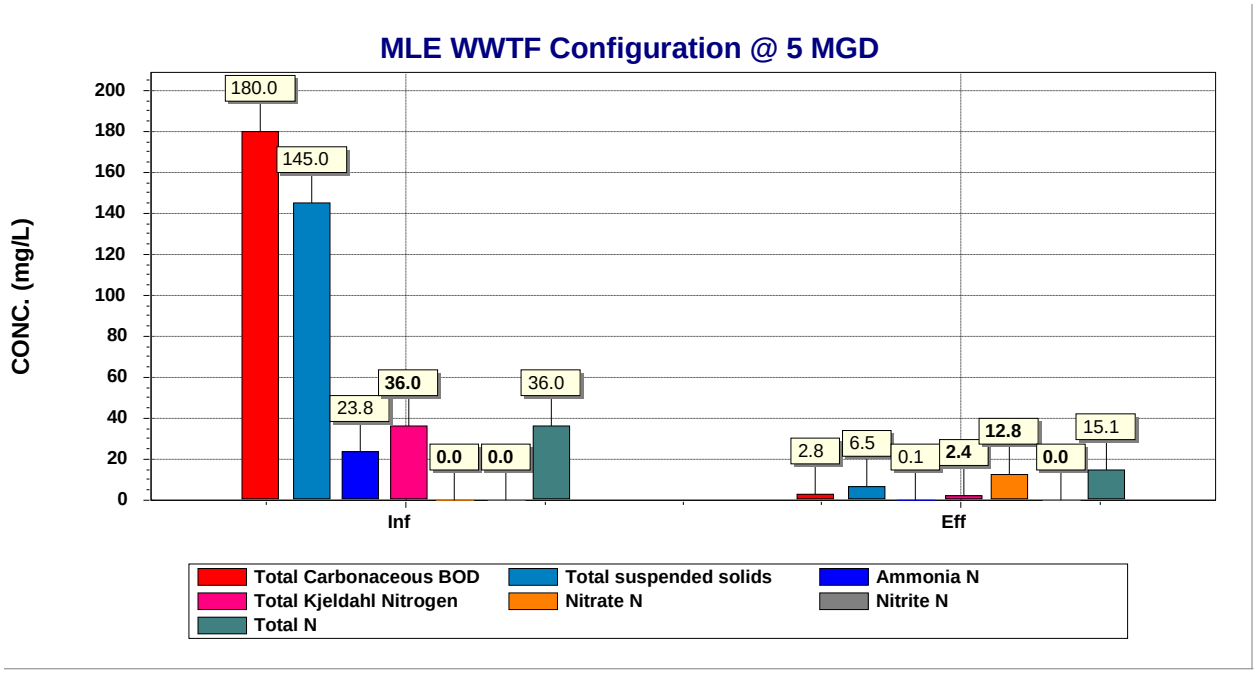

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Inf			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	110.00	4590.69	
Total suspended solids	145.03	6052.61	
Particulate COD	175.96	7343.43	

Filtered COD	174.41	7278.60	
Total COD	350.37	14622.03	
Soluble PO4-P	2.50	104.33	
Total P	5.00	208.67	
Filtered TKN	29.43	1228.30	
Particulate TKN	6.57	274.11	
Total Kjeldahl Nitrogen	36.00	1502.41	
Filtered Carbonaceous BOD	111.06	4634.87	
Total Carbonaceous BOD	180.00	7512.03	
Nitrite + Nitrate	0	0	
Total N	36.00	1502.41	
Total inorganic N	23.76	991.59	
Alkalinity	10.00	189.30	mmol/L and kmol/d
pH	7.00		
Volatile fatty acids	8.41	350.93	
ISS precipitate	0	0	
ISS cellular	0.03	1.25	
ISS Total	35.03	1461.93	
Ammonia N	23.76	991.59	
Nitrate N	0	0	

Parameters	Value	Units

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Anoxic			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	3227.53	673211.14	
Total suspended solids	4317.54	900570.92	
Particulate COD	4726.68	985909.33	
Filtered COD	20.40	4255.22	
Total COD	4747.08	990164.55	
Soluble PO4-P	2.99	624.26	
Total P	93.40	19481.26	
Filtered TKN	7.61	1586.61	
Particulate TKN	287.22	59908.89	
Total Kjeldahl Nitrogen	294.82	61495.50	
Filtered Carbonaceous BOD	1.94	404.96	
Total Carbonaceous BOD	1319.93	275315.74	
Nitrite + Nitrate	7.33	1528.24	
Total N	302.15	63023.74	
Total inorganic N	13.09	2730.39	
Alkalinity	8.20	776.28	mmol/L and kmol/d

pH	7.14	
Volatile fatty acids	0.14	29.64
ISS precipitate	0	0.00
ISS cellular	211.48	44112.04
ISS Total	1090.02	227359.77
Ammonia N	5.76	1202.15
Nitrate N	7.22	1506.52

Parameters	Value	Units
Hydraulic residence time	0.3	hours
Velocity gradient	76.33	1/s
VSS destruction	0	%
Total solids mass	11212.68	lb
Total readily biodegradable COD	1.65	mg/L
OUR - Total	0.00	mgO/L/hr
OUR - Carbonaceous	0.00	mgO/L/hr
OUR - Nitrification	0.00	mgO/L/hr
Nit - Ammonia removal rate	0.00	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	0.00	mgN/L/hr
Nit - Nitrate production rate	0.00	mgN/L/hr
Denit - Nitrate removal rate	9.97	mgN/L/hr
Denit - Nitrite removal rate	4.63	mgN/L/hr
Denit - N2 production rate	9.66	mgN/L/hr
Off gas flow rate (dry)	2.50	ft3/min
Off gas Oxygen	0	%
Off gas Carbon dioxide	84.21	%
Off gas Ammonia	0.01	%
Off gas Hydrogen	0.96	%
Off gas Methane	0.05	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	9.19	mg/L
OTR	0	lb/hr
SOTR	0	lb/hr
OTE	100.00	%
SOTE	100.00	%
Air flow rate	0	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0	ft3/min (20C, 1 atm)
# of diffusers	456.00	

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Aerobic 1

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	3223.83	672439.26	
Total suspended solids	4314.07	899845.63	
Particulate COD	4720.29	984578.09	
Filtered COD	18.99	3962.03	
Total COD	4739.29	988540.12	
Soluble PO4-P	2.97	619.68	
Total P	93.40	19481.26	
Filtered TKN	3.77	787.36	
Particulate TKN	287.33	59931.62	
Total Kjeldahl Nitrogen	291.10	60718.98	
Filtered Carbonaceous BOD	1.02	213.71	
Total Carbonaceous BOD	1315.06	274301.27	
Nitrite + Nitrate	10.99	2291.42	
Total N	302.09	63010.41	
Total inorganic N	12.90	2691.67	
Alkalinity	7.67	725.71	mmol/L and kmol/d
pH	7.16		
Volatile fatty acids	0.01	1.43	
ISS precipitate	0	0.00	
ISS cellular	211.71	44158.64	
ISS Total	1090.24	227406.36	
Ammonia N	1.92	400.25	
Nitrate N	10.40	2168.27	

Parameters	Value	Units
Hydraulic residence time	0.3	hours
Velocity gradient	251.05	1/s
VSS destruction	0.11	%
Total solids mass	11203.64	lb
Total readily biodegradable COD	1.39	mg/L
OUR - Total	80.12	mgO/L/hr
OUR - Carbonaceous	27.93	mgO/L/hr
OUR - Nitrification	52.18	mgO/L/hr
Nit - Ammonia removal rate	12.58	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	12.45	mgN/L/hr
Nit - Nitrate production rate	10.82	mgN/L/hr
Denit - Nitrate removal rate	0.20	mgN/L/hr
Denit - Nitrite removal rate	0.10	mgN/L/hr
Denit - N2 production rate	0.21	mgN/L/hr
Off gas flow rate (dry)	3216.52	ft3/min
Off gas Oxygen	19.49	%

Off gas Carbon dioxide	1.58	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.01	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	9.19	mg/L
OTR	225.44	lb/hr
SOTR	682.76	lb/hr
OTE	6.69	%
SOTE	20.72	%
Air flow rate	3229.28	ft3/min (20C, 1 atm)
Air flow rate / diffuser	7.08	ft3/min (20C, 1 atm)
# of diffusers	456.00	

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Aerobic 2			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	3219.31	671496.00	
Total suspended solids	4309.69	898933.04	
Particulate COD	4712.75	983005.57	
Filtered COD	18.84	3929.27	
Total COD	4731.59	986934.84	
Soluble PO4-P	2.98	621.31	
Total P	93.40	19481.26	
Filtered TKN	2.18	455.71	
Particulate TKN	287.33	59933.45	
Total Kjeldahl Nitrogen	289.52	60389.17	
Filtered Carbonaceous BOD	0.93	192.99	
Total Carbonaceous BOD	1310.37	273321.81	
Nitrite + Nitrate	12.51	2609.39	
Total N	302.03	62998.56	
Total inorganic N	12.83	2675.28	
Alkalinity	7.45	704.56	mmol/L and kmol/d
pH	7.16		
Volatile fatty acids	0.00	0.10	
ISS precipitate	0	0.00	
ISS cellular	211.85	44189.31	
ISS Total	1090.39	227437.04	
Ammonia N	0.32	65.89	
Nitrate N	12.39	2584.94	

Parameters	Value	Units

Hydraulic residence time	0.3	hours
Velocity gradient	189.07	1/s
VSS destruction	0.14	%
Total solids mass	11192.28	lb
Total readily biodegradable COD	1.31	mg/L
OUR - Total	51.14	mgO/L/hr
OUR - Carbonaceous	26.55	mgO/L/hr
OUR - Nitrification	24.58	mgO/L/hr
Nit - Ammonia removal rate	5.35	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	5.29	mgN/L/hr
Nit - Nitrate production rate	6.88	mgN/L/hr
Denit - Nitrate removal rate	0.20	mgN/L/hr
Denit - Nitrite removal rate	0.09	mgN/L/hr
Denit - N2 production rate	0.19	mgN/L/hr
Off gas flow rate (dry)	1683.69	ft3/min
Off gas Oxygen	19.36	%
Off gas Carbon dioxide	1.66	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.00	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	9.19	mg/L
OTR	132.80	lb/hr
SOTR	402.18	lb/hr
OTE	7.51	%
SOTE	23.27	%
Air flow rate	1693.58	ft3/min (20C, 1 atm)
Air flow rate / diffuser	3.71	ft3/min (20C, 1 atm)
# of diffusers	456.00	

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Aerobic 3			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	3215.74	670752.82	
Total suspended solids	4306.20	898204.83	
Particulate COD	4706.91	981785.64	
Filtered COD	18.78	3917.24	
Total COD	4725.69	985702.87	
Soluble PO4-P	3.00	625.74	
Total P	93.40	19481.26	
Filtered TKN	1.94	403.67	
Particulate TKN	287.29	59924.07	

Total Kjeldahl Nitrogen	289.23	60327.74	
Filtered Carbonaceous BOD	0.89	184.95	
Total Carbonaceous BOD	1306.75	272567.21	
Nitrite + Nitrate	12.77	2663.47	
Total N	301.99	62991.21	
Total inorganic N	12.83	2675.52	
Alkalinity	7.41	701.00	mmol/L and kmol/d
pH	7.17		
Volatile fatty acids	0.00	0.03	
ISS precipitate	0	0.00	
ISS cellular	211.93	44204.28	
ISS Total	1090.46	227452.01	
Ammonia N	0.06	12.05	
Nitrate N	12.75	2660.10	

Parameters	Value	Units
Hydraulic residence time	0.2	hours
Velocity gradient	150.62	1/s
VSS destruction	0.11	%
Total solids mass	8548.71	lb
Total readily biodegradable COD	1.26	mg/L
OUR - Total	31.79	mgO/L/hr
OUR - Carbonaceous	25.68	mgO/L/hr
OUR - Nitrification	6.11	mgO/L/hr
Nit - Ammonia removal rate	1.31	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	1.30	mgN/L/hr
Nit - Nitrate production rate	1.77	mgN/L/hr
Denit - Nitrate removal rate	0.19	mgN/L/hr
Denit - Nitrite removal rate	0.06	mgN/L/hr
Denit - N2 production rate	0.15	mgN/L/hr
Off gas flow rate (dry)	978.11	ft3/min
Off gas Oxygen	19.62	%
Off gas Carbon dioxide	1.47	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.00	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	8.95	mg/L
OTR	63.11	lb/hr
SOTR	192.57	lb/hr
OTE	6.15	%
SOTE	19.21	%

Air flow rate	982.67	ft3/min (20C, 1 atm)
Air flow rate / diffuser	2.17	ft3/min (20C, 1 atm)
# of diffusers	453.00	

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Sec. Clarifier 1,2			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	4.83	201.17	
Total suspended solids	6.47	269.39	
Particulate COD	7.07	294.46	
Filtered COD	18.78	782.19	
Total COD	25.85	1076.65	
Soluble PO4-P	3.00	124.95	
Total P	3.14	130.60	
Filtered TKN	1.94	80.60	
Particulate TKN	0.43	17.97	
Total Kjeldahl Nitrogen	2.37	98.58	
Filtered Carbonaceous BOD	0.89	36.93	
Total Carbonaceous BOD	2.85	118.62	
Nitrite + Nitrate	12.77	531.84	
Total N	15.14	630.42	
Total inorganic N	12.83	534.25	
Alkalinity	7.41	139.98	mmol/L and kmol/d
pH	7.17		
Volatile fatty acids	0.00	0.01	
ISS precipitate	0	0.00	
ISS cellular	0.32	13.26	
ISS Total	1.64	68.22	
Ammonia N	0.06	2.41	
Nitrate N	12.75	531.17	

Parameters	Value	Units
Hydraulic residence time	1.38	hours
Percent removal	99.95	%
Height of specified concentration	0.65	ft
Total solids mass	2357.34	lb
Surface overflow rate	564.82	gal/(ft2 d)
Solids loading rate	60.98	lb/(ft2 d)

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Eff			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	4.83	201.17	
Total suspended solids	6.47	269.39	
Particulate COD	7.07	294.46	
Filtered COD	18.78	782.19	
Total COD	25.85	1076.65	
Soluble PO4-P	3.00	124.95	
Total P	3.14	130.60	
Filtered TKN	1.94	80.60	
Particulate TKN	0.43	17.97	
Total Kjeldahl Nitrogen	2.37	98.58	
Filtered Carbonaceous BOD	0.89	36.93	
Total Carbonaceous BOD	2.85	118.62	
Nitrite + Nitrate	12.77	531.84	
Total N	15.14	630.42	
Total inorganic N	12.83	534.25	
Alkalinity	7.41	139.98	mmol/L and kmol/d
pH	7.17		
Volatile fatty acids	0.00	0.01	
ISS precipitate	0	0.00	
ISS cellular	0.32	13.26	
ISS Total	1.64	68.22	
Ammonia N	0.06	2.41	
Nitrate N	12.75	531.17	
Parameters	Value	Units	

Global Parameters

AOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9000	0.9000	1.0720
Substrate (NH4) half sat. [mgN/L]	0.7000	0.7000	1.0000
Byproduct NH4 logistic slope [-]	50.0000	50.0000	1.0000
Byproduct NH4 inflection point [mgN/L]	1.4000	1.4000	1.0000

AOB denite DO half sat. [mg/L]	0.1000	0.1000	1.0000
AOB denite HNO2 half sat. [mgN/L]	5.000E-6	5.000E-6	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiHNO2 [mmol/L]	0.0050	0.0050	1.0000

NOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.7000	0.7000	1.0600
Substrate (NO2) half sat. [mgN/L]	0.1000	0.1000	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiNH3 [mmol/L]	0.0750	0.0750	1.0000

ANAMMOX

Name	Default	Value	
Max. spec. growth rate [1/d]	0.1000	0.1000	1.1000
Substrate (NH4) half sat. [mgN/L]	2.0000	2.0000	1.0000
Substrate (NO2) half sat. [mgN/L]	1.0000	1.0000	1.0000
Aerobic decay rate [1/d]	0.0190	0.0190	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0095	0.0095	1.0290
Ki Nitrite [mgN/L]	1000.0000	1000.0000	1.0000
Nitrite sensitivity constant [L / (d mgN)]	0.0160	0.0160	1.0000

OHO

Name	Default	Value	
Max. spec. growth rate [1/d]	3.2000	3.2000	1.0290
Substrate half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Anoxic growth factor [-]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.6200	0.6200	1.0290
Anoxic decay rate [1/d]	0.2330	0.2330	1.0290
Anaerobic decay rate [1/d]	0.1310	0.1310	1.0290
Hydrolysis rate [1/d]	2.1000	2.1000	1.0290
Hydrolysis half sat. [-]	0.0600	0.0600	1.0000
Anoxic hydrolysis factor [-]	0.2800	0.2800	1.0000
Anaerobic hydrolysis factor (AS) [-]	0.0400	0.0400	1.0000
Anaerobic hydrolysis factor (AD) [-]	0.2000	0.5000	1.0000
Adsorption rate of colloids [L/(mgCOD d)]	0.1500	0.8000	1.0290
Ammonification rate [L/(mgN d)]	0.0400	0.0400	1.0290
Assimilative nitrate/nitrite reduction rate [1/d]	0.5000	0.5000	1.0000
Fermentation rate [1/d]	1.6000	3.2000	1.0290
Fermentation half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Fermentation growth factor (AS) [-]	0.2500	0.1250	1.0000
Endogenous products decay rate[1/d]	0	0	1.0000
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

Methylotrophs

Name	Default	Value	
Max. spec. growth rate [1/d]	1.3000	1.3000	1.0720

Methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.0400	0.0400	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0300	0.0300	1.0290
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

PAO

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9500	0.9500	1.0000
Max. spec. growth rate, P-limited [1/d]	0.4200	0.4200	1.0000
Substrate half sat. [mgCOD(PHB)/mgCOD(Zbp)]	0.1000	0.1000	1.0000
Substrate half sat., P-limited [mgCOD(PHB)/mgCOD(Zbp)]	0.0500	0.0500	1.0000
Magnesium half sat. [mgMg/L]	0.1000	0.1000	1.0000
Cation half sat. [mmol/L]	0.1000	0.1000	1.0000
Calcium half sat. [mgCa/L]	0.1000	0.1000	1.0000
Aerobic/anoxic decay rate [1/d]	0.1000	0.1000	1.0000
Aerobic/anoxic maintenance rate [1/d]	0	0	1.0000
Anaerobic decay rate [1/d]	0.0400	0.0400	1.0000
Anaerobic maintenance rate [1/d]	0	0	1.0000
Sequestration rate [1/d]	4.5000	6.0000	1.0000
Anoxic growth factor [-]	0.3300	0.3300	1.0000

Acetogens

Name	Default	Value	
Max. spec. growth rate [1/d]	0.2500	0.2500	1.0290

Substrate half sat. [mgCOD/L]	10.0000	10.0000	1.0000
Acetate inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Anaerobic decay rate [1/d]	0.0500	0.0500	1.0290
Aerobic/anoxic decay rate [1/d]	0.5200	0.5200	1.0290

Methanogens

Name	Default	Value	
Acetoclastic max. spec. growth rate [1/d]	0.3000	0.3000	1.0290
H2-utilizing max. spec. growth rate [1/d]	1.4000	1.4000	1.0290
Acetoclastic substrate half sat. [mgCOD/L]	100.0000	100.0000	1.0000
Acetoclastic methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
H2-utilizing CO2 half sat. [mmol/L]	0.1000	0.1000	1.0000
H2-utilizing substrate half sat. [mgCOD/L]	0.1000	0.1000	1.0000
H2-utilizing methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Acetoclastic propionic inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Acetoclastic anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
Acetoclastic aerobic/anoxic decay rate [1/d]	0.6000	0.6000	1.0290
H2-utilizing anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
H2-utilizing aerobic/anoxic decay rate [1/d]	2.8000	0.6000	1.0290

pH

Name	Default	Value
OHO low pH limit [-]	4.0000	4.0000
OHO high pH limit [-]	10.0000	10.0000
Methylotrophs low pH limit [-]	4.0000	4.0000

Methylotrophs high pH limit [-]	10.0000	10.0000
Autotrophs low pH limit [-]	5.5000	5.5000
Autotrophs high pH limit [-]	9.5000	9.5000
PAO low pH limit [-]	4.0000	4.0000
PAO high pH limit [-]	10.0000	10.0000
OHO low pH limit (anaerobic) [-]	5.5000	5.5000
OHO high pH limit (anaerobic) [-]	8.5000	8.5000
Propionic acetogens low pH limit [-]	4.0000	4.0000
Propionic acetogens high pH limit [-]	10.0000	10.0000
Acetoclastic methanogens low pH limit [-]	5.0000	5.0000
Acetoclastic methanogens high pH limit [-]	9.0000	9.0000
H2-utilizing methanogens low pH limit [-]	5.0000	5.0000
H2-utilizing methanogens high pH limit [-]	9.0000	9.0000

Switches

Name	Default	Value
Aerobic/anoxic DO half sat. [mgO2/L]	0.0500	0.0500
Anoxic/anaerobic NOx half sat. [mgN/L]	0.1500	0.1500
AOB DO half sat. [mgO2/L]	0.2500	0.2500
NOB DO half sat. [mgO2/L]	0.5000	0.5000
ANAMMOX DO half sat. [mgO2/L]	0.0100	0.0100
Anoxic NO3(->NO2) half sat. [mgN/L]	0.1000	0.1000
Anoxic NO3(->N2) half sat. [mgN/L]	0.0500	0.0500
Anoxic NO2(->N2) half sat. (mgN/L)	0.0100	0.0100
NH3 nutrient half sat. [mgN/L]	0.0050	1.000E-4
PolyP half sat. [mgP/mgCOD]	0.0100	0.0100
VFA sequestration half sat. [mgCOD/L]	5.0000	5.0000
P uptake half sat. [mgP/L]	0.1500	0.1500

P nutrient half sat. [mgP/L]	0.0010	0.0010
Autotroph CO2 half sat. [mmol/L]	0.1000	0.1000
H2 low/high half sat. [mgCOD/L]	1.0000	1.0000
Propionic acetogens H2 inhibition [mgCOD/L]	5.0000	5.0000
Synthesis anion/cation half sat. [meq/L]	0.0100	0.0100

Common

Name	Default	Value
Biomass volatile fraction (VSS/TSS)	0.9200	0.9200
Endogenous residue volatile fraction (VSS/TSS)	0.9200	0.9200
N in endogenous residue [mgN/mgCOD]	0.0700	0.0700
P in endogenous residue [mgP/mgCOD]	0.0220	0.0220
Endogenous residue COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Particulate substrate COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000
Particulate inert COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000

AOB

Name	Default	Value
Yield [mgCOD/mgN]	0.1500	0.1500
AOB denite NO2 fraction as TEA [-]	0.5000	0.5000
Byproduct NH4 fraction to N2O [-]	0.0025	0.0025
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

NOB

Name	Default	Value
Yield [mgCOD/mgN]	0.0900	0.0900
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

ANAMMOX

Name	Default	Value
Yield [mgCOD/mgN]	0.1140	0.1140
Nitrate production [mgN/mgBiomassCOD]	2.2800	2.2800
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

OHO

Name	Default	Value
Yield (aerobic) [-]	0.6660	0.6660
Yield (fermentation, low H2) [-]	0.1000	0.1000

Yield (fermentation, high H2) [-]	0.1000	0.1000
H2 yield (fermentation low H2) [-]	0.3500	0.3500
H2 yield (fermentation high H2) [-]	0	0
Propionate yield (fermentation, low H2) [-]	0	0
Propionate yield (fermentation, high H2) [-]	0.7000	0.7000
CO2 yield (fermentation, low H2) [-]	0.7000	0.7000
CO2 yield (fermentation, high H2) [-]	0	0
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Endogenous fraction - aerobic [-]	0.0800	0.0800
Endogenous fraction - anoxic [-]	0.1030	0.1030
Endogenous fraction - anaerobic [-]	0.1840	0.1840
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield (anoxic) [-]	0.5400	0.5400
Yield propionic (aerobic) [-]	0.6400	0.6400
Yield propionic (anoxic) [-]	0.4600	0.4600
Yield acetic (aerobic) [-]	0.6000	0.6000
Yield acetic (anoxic) [-]	0.4300	0.4300
Yield methanol (aerobic) [-]	0.5000	0.5000
Adsorp. max. [-]	1.0000	1.0000
Max fraction to N2O at high FNA over nitrate [-]	0.0500	0.0500
Max fraction to N2O at high FNA over nitrite [-]	0.1000	0.1000

Methylotrophs

Name	Default	Value
Yield (anoxic) [-]	0.4000	0.4000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220

Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Max fraction to N2O at high FNA over nitrate [-]	0.1000	0.1000
Max fraction to N2O at high FNA over nitrite [-]	0.1500	0.1500

PAO

Name	Default	Value
Yield (aerobic) [-]	0.6390	0.6390
Yield (anoxic) [-]	0.5200	0.5200
Aerobic P/PHA uptake [mgP/mgCOD]	0.9300	0.9500
Anoxic P/PHA uptake [mgP/mgCOD]	0.3500	0.3500
Yield of PHA on sequestration [-]	0.8890	0.8890
N in biomass [mgN/mgCOD]	0.0700	0.0700
N in sol. inert [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous part. [-]	0.2500	0.2500
Inert fraction of endogenous sol. [-]	0.2000	0.2000
P/Ac release ratio [mgP/mgCOD]	0.5100	0.4900
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield of low PP [-]	0.9400	0.9400

Acetogens

Name	Default	Value
Yield [-]	0.1000	0.1000
H2 yield [-]	0.4000	0.4000

CO2 yield [-]	1.0000	1.0000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

Methanogens

Name	Default	Value
Acetoclastic yield [-]	0.1000	0.1000
Methanol acetoclastic yield [-]	0.1000	0.1000
H2-utilizing yield [-]	0.1000	0.1000
Methanol H2-utilizing yield [-]	0.1000	0.1000
N in acetoclastic biomass [mgN/mgCOD]	0.0700	0.0700
N in H2-utilizing biomass [mgN/mgCOD]	0.0700	0.0700
P in acetoclastic biomass [mgP/mgCOD]	0.0220	0.0220
P in H2-utilizing biomass [mgP/mgCOD]	0.0220	0.0220
Acetoclastic fraction to endog. residue [-]	0.0800	0.0800
H2-utilizing fraction to endog. residue [-]	0.0800	0.0800
Acetoclastic COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
H2-utilizing COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

General

Name	Default	Value
Molecular weight of other anions [mg/mmol]	35.5000	35.5000
Molecular weight of other cations [mg/mmol]	39.1000	39.1000

Mg to P mole ratio in polyphosphate [mmolMg/mmolP]	0.3000	0.3000
Cation to P mole ratio in polyphosphate [meq/mmolP]	0.1500	0.3000
Ca to P mole ratio in polyphosphate [mmolCa/mmolP]	0.0500	0.0500
Cation to P mole ratio in organic phosphate [meq/mmolP]	0.0100	0.0100
Bubble rise velocity (anaerobic digester) [cm/s]	23.9000	23.9000
Bubble Sauter mean diameter (anaerobic digester) [cm]	0.3500	0.3500
Anaerobic digester gas hold-up factor []	1.0000	1.0000
Tank head loss per metre of length (from flow) [m/m]	0.0025	0.0025

Mass transfer

Name	Default	Value	
Kl for H2 [m/d]	17.0000	17.0000	1.0240
Kl for CO2 [m/d]	10.0000	10.0000	1.0240
Kl for NH3 [m/d]	1.0000	1.0000	1.0240
Kl for CH4 [m/d]	8.0000	8.0000	1.0240
Kl for N2 [m/d]	15.0000	15.0000	1.0240
Kl for N2O [m/d]	8.0000	8.0000	1.0240
Kl for O2 [m/d]	13.0000	13.0000	1.0240

Henry's law constants

Name	Default	Value	
CO2 [M/atm]	0.0340	0.0340	2400.0000
O2 [M/atm]	0.0013	0.0013	1500.0000
N2 [M/atm]	6.500E-4	6.500E-4	1300.0000
N2O [M/atm]	0.0250	0.0250	2600.0000

NH3 [M/atm]	58.0000	58.0000	4100.0000
CH4 [M/atm]	0.0014	0.0014	1600.0000
H2 [M/atm]	7.800E-4	7.800E-4	500.0000

Physico-chemical rates

Name	Default	Value	
Struvite precipitation rate [1/d]	3.000E+10	3.000E+10	1.0240
Struvite redissolution rate [1/d]	3.000E+11	3.000E+11	1.0240
Struvite half sat. [mgTSS/L]	1.0000	1.0000	1.0000
HDP precipitation rate [L/(molP d)]	1.000E+8	1.000E+8	1.0000
HDP redissolution rate [L/(mol P d)]	1.000E+8	1.000E+8	1.0000
HAP precipitation rate [molHDP/(L d)]	5.000E-4	5.000E-4	1.0000

Physico-chemical constants

Name	Default	Value
Struvite solubility constant [mol/L]	6.918E-14	6.918E-14
HDP solubility product [mol/L]	2.750E-22	2.750E-22
HDP half sat. [mgTSS/L]	1.0000	1.0000
Equilibrium soluble PO4 with Al dosing at pH 7 [mgP/L]	0.0100	0.0100
Al to P ratio [molAl/molP]	0.8000	0.8000
Al(OH)3 solubility product [mol/L]	1.259E+9	1.259E+9
AlHPO4+ dissociation constant [mol/L]	7.943E-13	7.943E-13
Equilibrium soluble PO4 with Fe dosing at pH 7 [mgP/L]	0.0100	0.0100
Fe to P ratio [molFe/molP]	1.6000	1.6000
Fe(OH)3 solubility product [mol/L]	0.0500	0.0500

FeH2PO4++ dissociation constant [mol/L]	5.012E-22	5.012E-22

Aeration

Name	Default	Value
Alpha (surf) OR Alpha F (diff) [-]	0.5000	0.5000
Beta [-]	0.9500	0.9500
Surface pressure [kPa]	101.3250	101.3250
Fractional effective saturation depth (Fed) [-]	0.3250	0.3250
Supply gas CO2 content [vol. %]	0.0350	0.0350
Supply gas O2 [vol. %]	20.9500	20.9500
Off-gas CO2 [vol. %]	2.0000	2.0000
Off-gas O2 [vol. %]	18.8000	18.8000
Off-gas H2 [vol. %]	0	0
Off-gas NH3 [vol. %]	0	0
Off-gas CH4 [vol. %]	0	0
Surface turbulence factor [-]	2.0000	2.0000
Set point controller gain []	1.0000	1.0000

Modified Vesilind

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.387	0.387
Vesilind hindered zone settling parameter (K) [L/g]	0.370	0.370
Clarification switching function [mg/L]	100.000	100.000
Specified TSS conc.for height calc. [mg/L]	2500.000	2500.000
Maximum compactability constant [mg/L]	15000.000	15000.000

Double exponential

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.934	0.934
Maximum (practical) settling velocity (Vo') [ft/min]	0.615	0.615
Hindered zone settling parameter (Kh) [L/g]	0.400	0.400
Flocculent zone settling parameter (Kf) [L/g]	2.500	2.500
Maximum non-settleable TSS [mg/L]	20.0000	20.0000
Non-settleable fraction [-]	0.0010	0.0010
Specified TSS conc. for height calc. [mg/L]	2500.0000	2500.0000

Emission factors

Name	Default	Value
Carbon dioxide equivalence of nitrous oxide	296.0000	296.0000
Carbon dioxide equivalence of methane	23.0000	23.0000

Biofilm general

Name	Default	Value	
Attachment rate [g / (m2 d)]	80.0000	80.0000	1.0000
Attachment TSS half sat. [mg/L]	100.0000	100.0000	1.0000
Detachment rate [g/(m3 d)]	8.000E+4	8.000E+4	1.0000
Solids movement factor []	10.0000	10.0000	1.0000

Diffusion neta []	0.8000	0.8000	1.0000
Thin film limit [mm]	0.5000	0.5000	1.0000
Thick film limit [mm]	3.0000	3.0000	1.0000
Assumed Film thickness for tank volume correction (temp independant) [mm]	0.7500	0.7500	1.0000
Film surface area to media area ratio - Max.[ ]	1.0000	1.0000	1.0000
Minimum biofilm conc. for streamer formation [gTSS/m2]	4.0000	4.0000	1.0000

Maximum biofilm concentrations [mg/L]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	5.000E+4	5.000E+4	1.0000
Methylotrophs	5.000E+4	5.000E+4	1.0000
Ammonia oxidizing biomass (AOB)	1.000E+5	1.000E+5	1.0000
Nitrite oxidizing biomass (NOB)	1.000E+5	1.000E+5	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E+4	5.000E+4	1.0000
Polyphosphate accumulating organisms (PAO)	5.000E+4	5.000E+4	1.0000
Propionic acetogens	5.000E+4	5.000E+4	1.0000
Methanogens - acetoclastic	5.000E+4	5.000E+4	1.0000
Methanogens - hydrogenotrophic	5.000E+4	5.000E+4	1.0000
Endogenous products	3.000E+4	3.000E+4	1.0000
Slowly bio. COD (part.)	5000.0000	5000.0000	1.0000
Slowly bio. COD (colloid.)	4000.0000	4000.0000	1.0000
Part. inert. COD	5000.0000	5000.0000	1.0000
Part. bio. org. N	0	0	1.0000
Part. bio. org. P	0	0	1.0000
Part. inert N	0	0	1.0000
Part. inert P	0	0	1.0000
Stored PHA	5000.0000	5000.0000	1.0000
Releasable stored polyP	1.150E+6	1.150E+6	1.0000

Fixed stored polyP	1.150E+6	1.150E+6	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.000E+10	1.000E+10	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	1.300E+6	1.300E+6	1.0000
Struvite	8.500E+5	8.500E+5	1.0000
Hydroxy-dicalcium-phosphate	1.150E+6	1.150E+6	1.0000
Hydroxy-apatite	1.600E+6	1.600E+6	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.000E+10	1.000E+10	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	5.000E+4	5.000E+4	1.0000
User defined 4	5.000E+4	5.000E+4	1.0000
Dissolved oxygen	0	0	1.0000

Effective diffusivities [m2/s]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	5.000E-14	5.000E-14	1.0290
Methylotrophs	5.000E-14	5.000E-14	1.0290
Ammonia oxidizing biomass (AOB)	5.000E-14	5.000E-14	1.0290
Nitrite oxidizing biomass (NOB)	5.000E-14	5.000E-14	1.0290
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E-14	5.000E-14	1.0290
Polyphosphate accumulating organisms (PAO)	5.000E-14	5.000E-14	1.0290
Propionic acetogens	5.000E-14	5.000E-14	1.0290
Methanogens - acetoclastic	5.000E-14	5.000E-14	1.0290
Methanogens - hydrogenotrophic	5.000E-14	5.000E-14	1.0290
Endogenous products	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (part.)	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (colloid.)	5.000E-12	5.000E-12	1.0290
Part. inert. COD	5.000E-14	5.000E-14	1.0290
Part. bio. org. N	5.000E-14	5.000E-14	1.0290
Part. bio. org. P	5.000E-14	5.000E-14	1.0290
Part. inert N	5.000E-14	5.000E-14	1.0290
Part. inert P	5.000E-14	5.000E-14	1.0290
Stored PHA	5.000E-14	5.000E-14	1.0290
Releasable stored polyP	5.000E-14	5.000E-14	1.0290
Fixed stored polyP	5.000E-14	5.000E-14	1.0290
Readily bio. COD (complex)	6.900E-10	6.900E-10	1.0290
Acetate	1.240E-9	1.240E-9	1.0290
Propionate	8.300E-10	8.300E-10	1.0290
Methanol	1.600E-9	1.600E-9	1.0290
Dissolved H2	5.850E-9	5.850E-9	1.0290

Dissolved methane	1.963E-9	1.963E-9	1.0290
Ammonia N	2.000E-9	2.000E-9	1.0290
Sol. bio. org. N	1.370E-9	1.370E-9	1.0290
Nitrous Oxide N	1.607E-9	1.607E-9	1.0290
Nitrite N	2.980E-9	2.980E-9	1.0290
Nitrate N	2.980E-9	2.980E-9	1.0290
Dissolved nitrogen gas	1.900E-9	1.900E-9	1.0290
PO4-P (Sol. & Me Complexed)	2.000E-9	2.000E-9	1.0290
Sol. inert COD	6.900E-10	6.900E-10	1.0290
Sol. inert TKN	6.850E-10	6.850E-10	1.0290
ISS Influent	5.000E-14	5.000E-14	1.0290
Struvite	5.000E-14	5.000E-14	1.0290
Hydroxy-dicalcium-phosphate	5.000E-14	5.000E-14	1.0290
Hydroxy-apatite	5.000E-14	5.000E-14	1.0290
Magnesium	7.200E-10	7.200E-10	1.0290
Calcium	7.200E-10	7.200E-10	1.0290
Metal	4.800E-10	4.800E-10	1.0290
Other Cations (strong bases)	1.440E-9	1.440E-9	1.0290
Other Anions (strong acids)	1.440E-9	1.440E-9	1.0290
Total CO2	1.960E-9	1.960E-9	1.0290
User defined 1	6.900E-10	6.900E-10	1.0290
User defined 2	6.900E-10	6.900E-10	1.0290
User defined 3	5.000E-14	5.000E-14	1.0290
User defined 4	5.000E-14	5.000E-14	1.0290
Dissolved oxygen	2.500E-9	2.500E-9	1.0290

EPS Strength coefficients [ ]

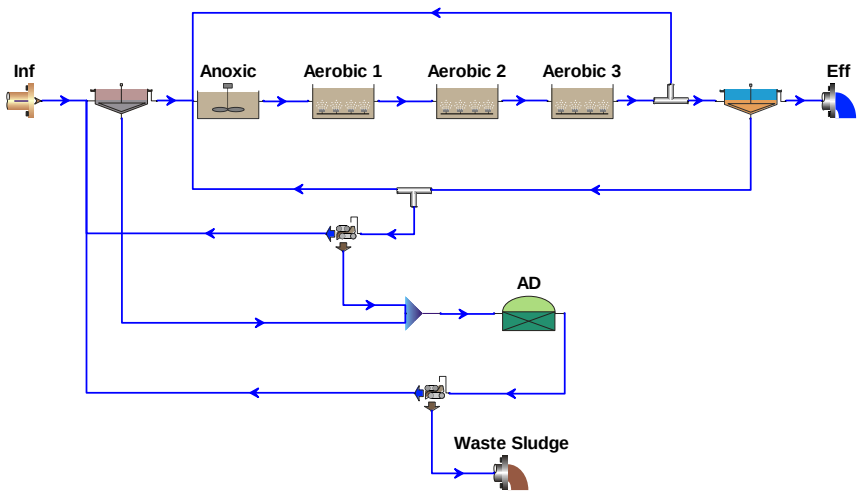
Name	Default	Value

Ordinary heterotrophic organisms (OHO)	1.0000	1.0000	1.0000
Methylotrophs	1.0000	1.0000	1.0000
Ammonia oxidizing biomass (AOB)	5.0000	1.0000	1.0000
Nitrite oxidizing biomass (NOB)	25.0000	1.0000	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	10.0000	1.0000	1.0000
Polyphosphate accumulating organisms (PAO)	1.0000	1.0000	1.0000
Propionic acetogens	1.0000	1.0000	1.0000
Methanogens - acetoclastic	1.0000	1.0000	1.0000
Methanogens - hydrogenotrophic	1.0000	1.0000	1.0000
Endogenous products	1.0000	1.0000	1.0000
Slowly bio. COD (part.)	1.0000	1.0000	1.0000
Slowly bio. COD (colloid.)	1.0000	1.0000	1.0000
Part. inert. COD	1.0000	1.0000	1.0000
Part. bio. org. N	1.0000	1.0000	1.0000
Part. bio. org. P	1.0000	1.0000	1.0000
Part. inert N	1.0000	1.0000	1.0000
Part. inert P	1.0000	1.0000	1.0000
Stored PHA	1.0000	1.0000	1.0000
Releasable stored polyP	1.0000	1.0000	1.0000
Fixed stored polyP	1.0000	1.0000	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000

Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.0000	1.0000	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	0.3300	0.3300	1.0000
Struvite	1.0000	1.0000	1.0000
Hydroxy-dicalcium-phosphate	1.0000	1.0000	1.0000
Hydroxy-apatite	1.0000	1.0000	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.0000	1.0000	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	1.0000	1.0000	1.0000
User defined 4	1.0000	1.0000	1.0000
Dissolved oxygen	0	0	1.0000

FAIRHAVEN, MA

Case Study No. 2
MLE w/Anaerobic Digestion
Flow = 5.0 MGD @ 11^{0}C



Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Primary Clarifier 1,2	0.5565	6636.0000	11.210

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Primary Clarifier 1,2	Flowrate [Under]	0.016

Element name	Percent removal	Blanket fraction
Primary Clarifier 1,2	60.00	0.85

Configuration information for all Anaerobic Digester units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	Head space volume
AD	0.6200	4144.0975	20.000	0.5

Operating data Average (flow/time weighted as required)

Element name	Pressure [psi]	pH
AD	14.9	-

Element name	Average Temperature
AD	35.0

Configuration information for all Bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Anoxic	0.3112	3200.0000	13.000	Un-aerated
Aerobic 1	0.3112	3200.0000	13.000	456
Aerobic 2	0.3112	3200.0000	13.000	456
Aerobic 3	0.2379	3180.0000	10.000	721

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
Anoxic	0
Aerobic 1	2.0
Aerobic 2	2.0
Aerobic 3	2.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^0.25 + k2	k2 in C = k1(PC)^0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	% of tank area covered by diffusers [%]
Anoxic	2.5656	0.0432	0.8200	0.4413	6.2900
Aerobic 1	2.5656	0.0432	0.8200	0.4413	6.2900
Aerobic 2	2.5656	0.0432	0.8200	0.4413	6.2900
Aerobic 3	2.5656	0.0432	0.8200	0.4413	10.0000

Configuration information for all BOD Influent units

Operating data Average (flow/time weighted as required)

Element name	Inf
Flow	5
Total Carbonaceous BOD mgBOD/L	94.00
Volatile suspended solids mgVSS/L	66.00
Total suspended solids mgTSS/L	88.00
Total Kjeldahl Nitrogen mgN/L	17.00
Total P mgP/L	5.00
Nitrate N mgN/L	0
pH	7.00
Alkalinity mmol/L	6.00
Calcium mg/L	80.00
Magnesium mg/L	15.00
Dissolved oxygen mg/L	4.20

Element name	Inf
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.1600
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1500
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.6580
Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0500
Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.1300
Fna - Ammonia [gNH3-N/gTKN]	0.6600
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.5000
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0350
Fpo4 - Phosphate [gPO4-P/gTP]	0.5000
FupP - P:COD ratio for unbiodegradable part. COD [gP/gCOD]	0.0110
FZbh - OHO COD fraction [gCOD/g of total COD]	1.000E-4
FZbm - Methylotroph COD fraction [gCOD/g of total COD]	1.000E-4
FZaob - AOB COD fraction [gCOD/g of total COD]	1.000E-4
FZnob - NOB COD fraction [gCOD/g of total COD]	1.000E-4
FZamob - ANAMMOX COD fraction [gCOD/g of total COD]	1.000E-4
FZbp - PAO COD fraction [gCOD/g of total COD]	1.000E-4
FZbpa - Propionic acetogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbam - Acetoclastic methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbhm - H2-utilizing methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZe - Endogenous products COD fraction [gCOD/g of total COD]	0

Configuration information for all Effluent units

Configuration information for all Ideal clarifier units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Sec. Clarifier 1,2	0.8593	8836.0000	13.000

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Sec. Clarifier 1,2	Flow paced	200.00 %

Element name	Average Temperature	Reactive	Percent removal	Blanket fraction
Sec. Clarifier 1,2	Uses global setting	No	99.95	0.05

Configuration information for all Dewatering unit units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Dewatering unit3	Flowrate [Under]	0.01
Dewatering unit32	Flowrate [Under]	0.01

Element name	Percent removal
Dewatering unit3	90.00
Dewatering unit32	95.00

Configuration information for all Sludge units

Configuration information for all Splitter units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
	Flowrate [Side]	0.053
Splitter8	Flow paced	200.00 %

BioWin Album

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Elements	Total Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Ammonia N [mgN/L]	Nitrite + Nitrate [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]
Inf	94.00	88.02	11.22	0	17.00	17.00
Eff	2.03	3.56	0.46	4.55	2.14	6.68

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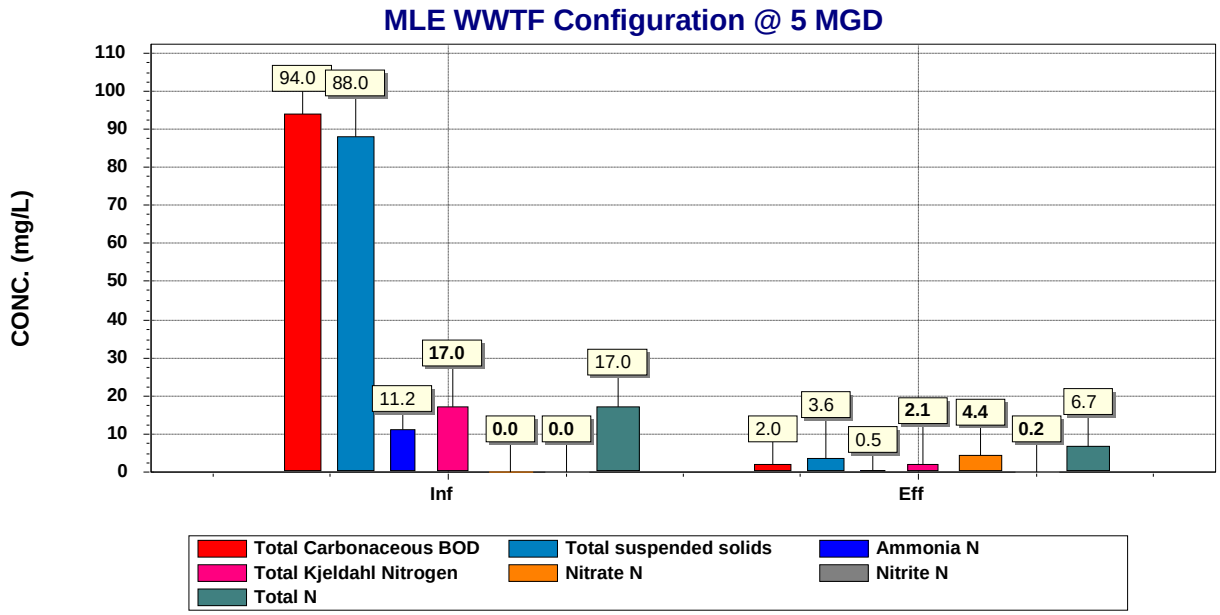

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Inf			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	66.00	2753.98	
Total suspended solids	88.02	3672.65	
Particulate COD	105.58	4405.48	
Filtered COD	81.43	3397.65	
Total COD	187.00	7803.13	
Soluble PO4-P	2.50	104.32	
Total P	5.00	208.64	
Filtered TKN	13.85	577.86	
Particulate TKN	3.15	131.50	
Total Kjeldahl Nitrogen	17.00	709.36	
Filtered Carbonaceous BOD	51.04	2129.71	
Total Carbonaceous BOD	94.00	3922.34	
Nitrite + Nitrate	0	0	
Total N	17.00	709.36	

Total inorganic N	11.22	468.18	
Alkalinity	6.00	113.56	mmol/L and kmol/d
pH	7.00		
Volatile fatty acids	4.49	187.28	
ISS precipitate	0	0	
ISS cellular	0.02	0.67	
ISS Total	22.02	918.66	
Ammonia N	11.22	468.18	
Nitrate N	0	0	

Parameters	Value	Units

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Anoxic			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	1712.06	357053.22	
Total suspended solids	2375.89	495496.43	
Particulate COD	2508.36	523122.66	
Filtered COD	12.19	2542.93	
Total COD	2520.55	525665.59	
Soluble PO4-P	3.58	747.29	
Total P	51.74	10790.12	
Filtered TKN	4.37	912.08	
Particulate TKN	152.13	31726.40	
Total Kjeldahl Nitrogen	156.50	32638.48	
Filtered Carbonaceous BOD	1.87	390.57	
Total Carbonaceous BOD	743.98	155157.54	
Nitrite + Nitrate	2.23	465.92	
Total N	158.73	33104.40	
Total inorganic N	5.25	1094.72	
Alkalinity	5.24	495.55	mmol/L and kmol/d
pH	7.00		
Volatile fatty acids	0.20	41.33	
ISS precipitate	0	0.00	
ISS cellular	111.69	23293.00	
ISS Total	663.83	138443.21	
Ammonia N	3.02	628.80	
Nitrate N	2.11	439.60	

Parameters	Value	Units
Hydraulic residence time	0.3	hours

Velocity gradient	68.28	1/s
VSS destruction	0	%
Total solids mass	6170.20	lb
Total readily biodegradable COD	1.72	mg/L
OUR - Total	0.00	mgO/L/hr
OUR - Carbonaceous	0.00	mgO/L/hr
OUR - Nitrification	0.00	mgO/L/hr
Nit - Ammonia removal rate	0.00	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	0.00	mgN/L/hr
Nit - Nitrate production rate	0.00	mgN/L/hr
Denit - Nitrate removal rate	4.63	mgN/L/hr
Denit - Nitrite removal rate	2.29	mgN/L/hr
Denit - N2 production rate	4.69	mgN/L/hr
Off gas flow rate (dry)	1.99	ft3/min
Off gas Oxygen	0	%
Off gas Carbon dioxide	89.02	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	1.45	%
Off gas Methane	0.05	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	10.50	mg/L
OTR	0	lb/hr
SOTR	0	lb/hr
OTE	100.00	%
SOTE	100.00	%
Air flow rate	0	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0	ft3/min (20C, 1 atm)
# of diffusers	456.00	

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Aerobic 1			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	1710.49	356725.52	
Total suspended solids	2374.43	495191.33	
Particulate COD	2505.62	522551.71	
Filtered COD	10.96	2285.51	
Total COD	2516.58	524837.22	
Soluble PO4-P	3.61	752.51	
Total P	51.74	10790.12	
Filtered TKN	3.23	674.54	
Particulate TKN	152.18	31738.11	
Total Kjeldahl Nitrogen	155.42	32412.66	

Filtered Carbonaceous BOD	1.09	227.08	
Total Carbonaceous BOD	741.48	154637.26	
Nitrite + Nitrate	3.29	685.58	
Total N	158.71	33098.24	
Total inorganic N	5.12	1068.58	
Alkalinity	5.08	480.48	mmol/L and kmol/d
pH	7.00		
Volatile fatty acids	0.02	4.13	
ISS precipitate	0	0.00	
ISS cellular	111.80	23315.60	
ISS Total	663.94	138465.81	
Ammonia N	1.84	382.99	
Nitrate N	2.97	618.41	

Parameters	Value	Units
Hydraulic residence time	0.3	hours
Velocity gradient	139.82	1/s
VSS destruction	0.09	%
Total solids mass	6166.40	lb
Total readily biodegradable COD	1.44	mg/L
OUR - Total	28.36	mgO/L/hr
OUR - Carbonaceous	13.38	mgO/L/hr
OUR - Nitrification	14.98	mgO/L/hr
Nit - Ammonia removal rate	3.66	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	3.62	mgN/L/hr
Nit - Nitrate production rate	2.96	mgN/L/hr
Denit - Nitrate removal rate	0.09	mgN/L/hr
Denit - Nitrite removal rate	0.05	mgN/L/hr
Denit - N2 production rate	0.10	mgN/L/hr
Off gas flow rate (dry)	1034.13	ft3/min
Off gas Oxygen	19.24	%
Off gas Carbon dioxide	1.59	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.04	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	10.50	mg/L
OTR	91.03	lb/hr
SOTR	275.40	lb/hr
OTE	8.17	%
SOTE	25.29	%
Air flow rate	1067.22	ft3/min (20C, 1 atm)

Air flow rate / diffuser	2.34	ft3/min (20C, 1 atm)
# of diffusers	456.00	

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Aerobic 2			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	1708.42	356293.19	
Total suspended solids	2372.44	494776.19	
Particulate COD	2502.14	521824.58	
Filtered COD	10.74	2240.25	
Total COD	2512.88	524064.83	
Soluble PO4-P	3.64	759.02	
Total P	51.74	10790.12	
Filtered TKN	2.36	492.15	
Particulate TKN	152.20	31742.45	
Total Kjeldahl Nitrogen	154.56	32234.59	
Filtered Carbonaceous BOD	0.96	200.64	
Total Carbonaceous BOD	739.24	154168.75	
Nitrite + Nitrate	4.11	857.87	
Total N	158.68	33092.46	
Total inorganic N	5.04	1051.98	
Alkalinity	4.95	468.69	mmol/L and kmol/d
pH	6.98		
Volatile fatty acids	0.00	0.49	
ISS precipitate	0	0.00	
ISS cellular	111.88	23332.79	
ISS Total	664.02	138483.00	
Ammonia N	0.93	194.10	
Nitrate N	3.81	794.93	

Parameters	Value	Units
Hydraulic residence time	0.3	hours
Velocity gradient	120.71	1/s
VSS destruction	0.12	%
Total solids mass	6161.23	lb
Total readily biodegradable COD	1.35	mg/L
OUR - Total	25.12	mgO/L/hr
OUR - Carbonaceous	12.69	mgO/L/hr
OUR - Nitrification	12.43	mgO/L/hr
Nit - Ammonia removal rate	2.89	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	2.86	mgN/L/hr

Nit - Nitrate production rate	2.92	mgN/L/hr
Denit - Nitrate removal rate	0.09	mgN/L/hr
Denit - Nitrite removal rate	0.05	mgN/L/hr
Denit - N2 production rate	0.09	mgN/L/hr
Off gas flow rate (dry)	689.27	ft3/min
Off gas Oxygen	19.10	%
Off gas Carbon dioxide	1.84	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.02	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	10.50	mg/L
OTR	65.24	lb/hr
SOTR	197.37	lb/hr
OTE	8.79	%
SOTE	27.21	%
Air flow rate	710.90	ft3/min (20C, 1 atm)
Air flow rate / diffuser	1.56	ft3/min (20C, 1 atm)
# of diffusers	456.00	

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Aerobic 3			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	1706.80	355955.55	
Total suspended solids	2370.87	494448.99	
Particulate COD	2499.44	521262.85	
Filtered COD	10.67	2225.13	
Total COD	2510.11	523487.99	
Soluble PO4-P	3.67	764.57	
Total P	51.74	10790.12	
Filtered TKN	1.91	397.92	
Particulate TKN	152.20	31742.13	
Total Kjeldahl Nitrogen	154.11	32140.05	
Filtered Carbonaceous BOD	0.92	191.88	
Total Carbonaceous BOD	737.55	153817.59	
Nitrite + Nitrate	4.55	948.18	
Total N	158.66	33088.23	
Total inorganic N	5.01	1043.97	
Alkalinity	4.89	462.51	mmol/L and kmol/d
pH	6.98		
Volatile fatty acids	0.00	0.14	
ISS precipitate	0	0.00	
ISS cellular	111.93	23343.23	

ISS Total	664.07	138493.44
Ammonia N	0.46	95.79
Nitrate N	4.37	910.36

Parameters	Value	Units
Hydraulic residence time	0.2	hours
Velocity gradient	108.72	1/s
VSS destruction	0.09	%
Total solids mass	4706.67	lb
Total readily biodegradable COD	1.30	mg/L
OUR - Total	21.46	mgO/L/hr
OUR - Carbonaceous	12.31	mgO/L/hr
OUR - Nitrification	9.14	mgO/L/hr
Nit - Ammonia removal rate	2.01	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	1.98	mgN/L/hr
Nit - Nitrate production rate	2.51	mgN/L/hr
Denit - Nitrate removal rate	0.09	mgN/L/hr
Denit - Nitrite removal rate	0.04	mgN/L/hr
Denit - N2 production rate	0.09	mgN/L/hr
Off gas flow rate (dry)	512.74	ft3/min
Off gas Oxygen	19.27	%
Off gas Carbon dioxide	1.83	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.01	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	10.23	mg/L
OTR	42.59	lb/hr
SOTR	129.66	lb/hr
OTE	7.74	%
SOTE	24.09	%
Air flow rate	527.38	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0.73	ft3/min (20C, 1 atm)
# of diffusers	721.00	

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Sec. Clarifier 1,2			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	2.56	106.76	
Total suspended solids	3.56	148.30	
Particulate COD	3.75	156.34	

Filtered COD	10.67	444.31	
Total COD	14.42	600.65	
Soluble PO4-P	3.67	152.67	
Total P	3.74	155.68	
Filtered TKN	1.91	79.46	
Particulate TKN	0.23	9.52	
Total Kjeldahl Nitrogen	2.14	88.98	
Filtered Carbonaceous BOD	0.92	38.31	
Total Carbonaceous BOD	2.03	84.39	
Nitrite + Nitrate	4.55	189.33	
Total N	6.68	278.31	
Total inorganic N	5.01	208.46	
Alkalinity	4.89	92.35	mmol/L and kmol/d
pH	6.98		
Volatile fatty acids	0.00	0.03	
ISS precipitate	0	0.00	
ISS cellular	0.17	7.00	
ISS Total	1.00	41.54	
Ammonia N	0.46	19.13	
Nitrate N	4.37	181.78	

Parameters	Value	Units
Hydraulic residence time	1.38	hours
Percent removal	99.95	%
Height of specified concentration	0.65	ft
Total solids mass	1297.88	lb
Surface overflow rate	564.74	gal/(ft2 d)
Solids loading rate	33.57	lb/(ft2 d)

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Eff			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	2.56	106.76	
Total suspended solids	3.56	148.30	
Particulate COD	3.75	156.34	
Filtered COD	10.67	444.31	
Total COD	14.42	600.65	
Soluble PO4-P	3.67	152.67	
Total P	3.74	155.68	
Filtered TKN	1.91	79.46	
Particulate TKN	0.23	9.52	
Total Kjeldahl Nitrogen	2.14	88.98	

Filtered Carbonaceous BOD	0.92	38.31	
Total Carbonaceous BOD	2.03	84.39	
Nitrite + Nitrate	4.55	189.33	
Total N	6.68	278.31	
Total inorganic N	5.01	208.46	
Alkalinity	4.89	92.35	mmol/L and kmol/d
pH	6.98		
Volatile fatty acids	0.00	0.03	
ISS precipitate	0	0.00	
ISS cellular	0.17	7.00	
ISS Total	1.00	41.54	
Ammonia N	0.46	19.13	
Nitrate N	4.37	181.78	

Parameters	Value	Units

Global Parameters

AOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9000	0.9000	1.0720
Substrate (NH4) half sat. [mgN/L]	0.7000	0.7000	1.0000
Byproduct NH4 logistic slope [-]	50.0000	50.0000	1.0000
Byproduct NH4 inflection point [mgN/L]	1.4000	1.4000	1.0000
AOB denite DO half sat. [mg/L]	0.1000	0.1000	1.0000
AOB denite HNO2 half sat. [mgN/L]	5.000E-6	5.000E-6	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiHNO2 [mmol/L]	0.0050	0.0050	1.0000

NOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.7000	0.7000	1.0600
Substrate (NO2) half sat. [mgN/L]	0.1000	0.1000	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiNH3 [mmol/L]	0.0750	0.0750	1.0000

ANAMMOX

Name	Default	Value	
Max. spec. growth rate [1/d]	0.1000	0.1000	1.1000
Substrate (NH4) half sat. [mgN/L]	2.0000	2.0000	1.0000
Substrate (NO2) half sat. [mgN/L]	1.0000	1.0000	1.0000
Aerobic decay rate [1/d]	0.0190	0.0190	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0095	0.0095	1.0290
Ki Nitrite [mgN/L]	1000.0000	1000.0000	1.0000
Nitrite sensitivity constant [L / (d mgN)]	0.0160	0.0160	1.0000

OHO

Name	Default	Value	
Max. spec. growth rate [1/d]	3.2000	3.2000	1.0290
Substrate half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Anoxic growth factor [-]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000

Aerobic decay rate [1/d]	0.6200	0.6200	1.0290
Anoxic decay rate [1/d]	0.2330	0.2330	1.0290
Anaerobic decay rate [1/d]	0.1310	0.1310	1.0290
Hydrolysis rate [1/d]	2.1000	2.1000	1.0290
Hydrolysis half sat. [-]	0.0600	0.0600	1.0000
Anoxic hydrolysis factor [-]	0.2800	0.2800	1.0000
Anaerobic hydrolysis factor (AS) [-]	0.0400	0.0400	1.0000
Anaerobic hydrolysis factor (AD) [-]	0.2000	0.5000	1.0000
Adsorption rate of colloids [L/(mgCOD d)]	0.1500	0.8000	1.0290
Ammonification rate [L/(mgN d)]	0.0400	0.0400	1.0290
Assimilative nitrate/nitrite reduction rate [1/d]	0.5000	0.5000	1.0000
Fermentation rate [1/d]	1.6000	3.2000	1.0290
Fermentation half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Fermentation growth factor (AS) [-]	0.2500	0.1250	1.0000
Endogenous products decay rate[1/d]	0	0	1.0000
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

Methylotrophs

Name	Default	Value	
Max. spec. growth rate [1/d]	1.3000	1.3000	1.0720
Methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.0400	0.0400	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0300	0.0300	1.0290
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

PAO

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9500	0.9500	1.0000
Max. spec. growth rate, P-limited [1/d]	0.4200	0.4200	1.0000
Substrate half sat. [mgCOD(PHB)/mgCOD(Zbp)]	0.1000	0.1000	1.0000
Substrate half sat., P-limited [mgCOD(PHB)/mgCOD(Zbp)]	0.0500	0.0500	1.0000
Magnesium half sat. [mgMg/L]	0.1000	0.1000	1.0000
Cation half sat. [mmol/L]	0.1000	0.1000	1.0000
Calcium half sat. [mgCa/L]	0.1000	0.1000	1.0000
Aerobic/anoxic decay rate [1/d]	0.1000	0.1000	1.0000
Aerobic/anoxic maintenance rate [1/d]	0	0	1.0000
Anaerobic decay rate [1/d]	0.0400	0.0400	1.0000
Anaerobic maintenance rate [1/d]	0	0	1.0000
Sequestration rate [1/d]	4.5000	6.0000	1.0000
Anoxic growth factor [-]	0.3300	0.3300	1.0000

Acetogens

Name	Default	Value	
Max. spec. growth rate [1/d]	0.2500	0.2500	1.0290
Substrate half sat. [mgCOD/L]	10.0000	10.0000	1.0000
Acetate inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Anaerobic decay rate [1/d]	0.0500	0.0500	1.0290
Aerobic/anoxic decay rate [1/d]	0.5200	0.5200	1.0290

Methanogens

Name	Default	Value	
Acetoclastic max. spec. growth rate [1/d]	0.3000	0.3000	1.0290
H2-utilizing max. spec. growth rate [1/d]	1.4000	1.4000	1.0290
Acetoclastic substrate half sat. [mgCOD/L]	100.0000	100.0000	1.0000
Acetoclastic methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
H2-utilizing CO2 half sat. [mmol/L]	0.1000	0.1000	1.0000
H2-utilizing substrate half sat. [mgCOD/L]	0.1000	0.1000	1.0000
H2-utilizing methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Acetoclastic propionic inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Acetoclastic anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
Acetoclastic aerobic/anoxic decay rate [1/d]	0.6000	0.6000	1.0290
H2-utilizing anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
H2-utilizing aerobic/anoxic decay rate [1/d]	2.8000	0.6000	1.0290

pH

Name	Default	Value
OHO low pH limit [-]	4.0000	4.0000
OHO high pH limit [-]	10.0000	10.0000
Methylotrophs low pH limit [-]	4.0000	4.0000
Methylotrophs high pH limit [-]	10.0000	10.0000
Autotrophs low pH limit [-]	5.5000	5.5000
Autotrophs high pH limit [-]	9.5000	9.5000
PAO low pH limit [-]	4.0000	4.0000
PAO high pH limit [-]	10.0000	10.0000
OHO low pH limit (anaerobic) [-]	5.5000	5.5000
OHO high pH limit (anaerobic) [-]	8.5000	8.5000
Propionic acetogens low pH limit [-]	4.0000	4.0000
Propionic acetogens high pH limit [-]	10.0000	10.0000

Acetoclastic methanogens low pH limit [-]	5.0000	5.0000
Acetoclastic methanogens high pH limit [-]	9.0000	9.0000
H2-utilizing methanogens low pH limit [-]	5.0000	5.0000
H2-utilizing methanogens high pH limit [-]	9.0000	9.0000

Switches

Name	Default	Value
Aerobic/anoxic DO half sat. [mgO2/L]	0.0500	0.0500
Anoxic/anaerobic NOx half sat. [mgN/L]	0.1500	0.1500
AOB DO half sat. [mgO2/L]	0.2500	0.2500
NOB DO half sat. [mgO2/L]	0.5000	0.5000
ANAMMOX DO half sat. [mgO2/L]	0.0100	0.0100
Anoxic NO3(->NO2) half sat. [mgN/L]	0.1000	0.1000
Anoxic NO3(->N2) half sat. [mgN/L]	0.0500	0.0500
Anoxic NO2(->N2) half sat. (mgN/L)	0.0100	0.0100
NH3 nutrient half sat. [mgN/L]	0.0050	1.000E-4
PolyP half sat. [mgP/mgCOD]	0.0100	0.0100
VFA sequestration half sat. [mgCOD/L]	5.0000	5.0000
P uptake half sat. [mgP/L]	0.1500	0.1500
P nutrient half sat. [mgP/L]	0.0010	0.0010
Autotroph CO2 half sat. [mmol/L]	0.1000	0.1000
H2 low/high half sat. [mgCOD/L]	1.0000	1.0000
Propionic acetogens H2 inhibition [mgCOD/L]	5.0000	5.0000
Synthesis anion/cation half sat. [meq/L]	0.0100	0.0100

Common

Name	Default	Value
Biomass volatile fraction (VSS/TSS)	0.9200	0.9200
Endogenous residue volatile fraction (VSS/TSS)	0.9200	0.9200
N in endogenous residue [mgN/mgCOD]	0.0700	0.0700
P in endogenous residue [mgP/mgCOD]	0.0220	0.0220
Endogenous residue COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Particulate substrate COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000
Particulate inert COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000

AOB

Name	Default	Value
Yield [mgCOD/mgN]	0.1500	0.1500
AOB denite NO2 fraction as TEA [-]	0.5000	0.5000
Byproduct NH4 fraction to N2O [-]	0.0025	0.0025
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

NOB

Name	Default	Value
Yield [mgCOD/mgN]	0.0900	0.0900
N in biomass [mgN/mgCOD]	0.0700	0.0700

P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

ANAMMOX

Name	Default	Value
Yield [mgCOD/mgN]	0.1140	0.1140
Nitrate production [mgN/mgBiomassCOD]	2.2800	2.2800
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

OHO

Name	Default	Value
Yield (aerobic) [-]	0.6660	0.6660
Yield (fermentation, low H2) [-]	0.1000	0.1000
Yield (fermentation, high H2) [-]	0.1000	0.1000
H2 yield (fermentation low H2) [-]	0.3500	0.3500
H2 yield (fermentation high H2) [-]	0	0
Propionate yield (fermentation, low H2) [-]	0	0
Propionate yield (fermentation, high H2) [-]	0.7000	0.7000
CO2 yield (fermentation, low H2) [-]	0.7000	0.7000
CO2 yield (fermentation, high H2) [-]	0	0
N in biomass [mgN/mgCOD]	0.0700	0.0700

P in biomass [mgP/mgCOD]	0.0220	0.0220
Endogenous fraction - aerobic [-]	0.0800	0.0800
Endogenous fraction - anoxic [-]	0.1030	0.1030
Endogenous fraction - anaerobic [-]	0.1840	0.1840
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield (anoxic) [-]	0.5400	0.5400
Yield propionic (aerobic) [-]	0.6400	0.6400
Yield propionic (anoxic) [-]	0.4600	0.4600
Yield acetic (aerobic) [-]	0.6000	0.6000
Yield acetic (anoxic) [-]	0.4300	0.4300
Yield methanol (aerobic) [-]	0.5000	0.5000
Adsorp. max. [-]	1.0000	1.0000
Max fraction to N2O at high FNA over nitrate [-]	0.0500	0.0500
Max fraction to N2O at high FNA over nitrite [-]	0.1000	0.1000

Methylotrophs

Name	Default	Value
Yield (anoxic) [-]	0.4000	0.4000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Max fraction to N2O at high FNA over nitrate [-]	0.1000	0.1000
Max fraction to N2O at high FNA over nitrite [-]	0.1500	0.1500

PAO

Name	Default	Value
Yield (aerobic) [-]	0.6390	0.6390
Yield (anoxic) [-]	0.5200	0.5200
Aerobic P/PHA uptake [mgP/mgCOD]	0.9300	0.9500
Anoxic P/PHA uptake [mgP/mgCOD]	0.3500	0.3500
Yield of PHA on sequestration [-]	0.8890	0.8890
N in biomass [mgN/mgCOD]	0.0700	0.0700
N in sol. inert [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous part. [-]	0.2500	0.2500
Inert fraction of endogenous sol. [-]	0.2000	0.2000
P/Ac release ratio [mgP/mgCOD]	0.5100	0.4900
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield of low PP [-]	0.9400	0.9400

Acetogens

Name	Default	Value
Yield [-]	0.1000	0.1000
H2 yield [-]	0.4000	0.4000
CO2 yield [-]	1.0000	1.0000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

Methanogens

Name	Default	Value
Acetoclastic yield [-]	0.1000	0.1000
Methanol acetoclastic yield [-]	0.1000	0.1000
H2-utilizing yield [-]	0.1000	0.1000
Methanol H2-utilizing yield [-]	0.1000	0.1000
N in acetoclastic biomass [mgN/mgCOD]	0.0700	0.0700
N in H2-utilizing biomass [mgN/mgCOD]	0.0700	0.0700
P in acetoclastic biomass [mgP/mgCOD]	0.0220	0.0220
P in H2-utilizing biomass [mgP/mgCOD]	0.0220	0.0220
Acetoclastic fraction to endog. residue [-]	0.0800	0.0800
H2-utilizing fraction to endog. residue [-]	0.0800	0.0800
Acetoclastic COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
H2-utilizing COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

General

Name	Default	Value
Molecular weight of other anions [mg/mmol]	35.5000	35.5000
Molecular weight of other cations [mg/mmol]	39.1000	39.1000
Mg to P mole ratio in polyphosphate [mmolMg/mmolP]	0.3000	0.3000
Cation to P mole ratio in polyphosphate [meq/mmolP]	0.1500	0.3000
Ca to P mole ratio in polyphosphate [mmolCa/mmolP]	0.0500	0.0500
Cation to P mole ratio in organic phosphate [meq/mmolP]	0.0100	0.0100
Bubble rise velocity (anaerobic digester) [cm/s]	23.9000	23.9000
Bubble Sauter mean diameter (anaerobic digester) [cm]	0.3500	0.3500
Anaerobic digester gas hold-up factor []	1.0000	1.0000

Tank head loss per metre of length (from flow) [m/m]	0.0025	0.0025

Mass transfer

Name	Default	Value	
Kl for H2 [m/d]	17.0000	17.0000	1.0240
Kl for CO2 [m/d]	10.0000	10.0000	1.0240
Kl for NH3 [m/d]	1.0000	1.0000	1.0240
Kl for CH4 [m/d]	8.0000	8.0000	1.0240
Kl for N2 [m/d]	15.0000	15.0000	1.0240
Kl for N2O [m/d]	8.0000	8.0000	1.0240
Kl for O2 [m/d]	13.0000	13.0000	1.0240

Henry's law constants

Name	Default	Value	
CO2 [M/atm]	0.0340	0.0340	2400.0000
O2 [M/atm]	0.0013	0.0013	1500.0000
N2 [M/atm]	6.500E-4	6.500E-4	1300.0000
N2O [M/atm]	0.0250	0.0250	2600.0000
NH3 [M/atm]	58.0000	58.0000	4100.0000
CH4 [M/atm]	0.0014	0.0014	1600.0000
H2 [M/atm]	7.800E-4	7.800E-4	500.0000

Physico-chemical rates

Name	Default	Value	
Struvite precipitation rate [1/d]	3.000E+10	3.000E+10	1.0240
Struvite redissolution rate [1/d]	3.000E+11	3.000E+11	1.0240
Struvite half sat. [mgTSS/L]	1.0000	1.0000	1.0000
HDP precipitation rate [L/(molP d)]	1.000E+8	1.000E+8	1.0000
HDP redissolution rate [L/(mol P d)]	1.000E+8	1.000E+8	1.0000
HAP precipitation rate [molHDP/(L d)]	5.000E-4	5.000E-4	1.0000

Physico-chemical constants

Name	Default	Value
Struvite solubility constant [mol/L]	6.918E-14	6.918E-14
HDP solubility product [mol/L]	2.750E-22	2.750E-22
HDP half sat. [mgTSS/L]	1.0000	1.0000
Equilibrium soluble PO4 with Al dosing at pH 7 [mgP/L]	0.0100	0.0100
Al to P ratio [molAl/molP]	0.8000	0.8000
Al(OH)3 solubility product [mol/L]	1.259E+9	1.259E+9
AlHPO4+ dissociation constant [mol/L]	7.943E-13	7.943E-13
Equilibrium soluble PO4 with Fe dosing at pH 7 [mgP/L]	0.0100	0.0100
Fe to P ratio [molFe/molP]	1.6000	1.6000
Fe(OH)3 solubility product [mol/L]	0.0500	0.0500
FeH2PO4++ dissociation constant [mol/L]	5.012E-22	5.012E-22

Aeration

Name	Default	Value
Alpha (surf) OR Alpha F (diff) [-]	0.5000	0.5000
Beta [-]	0.9500	0.9500
Surface pressure [kPa]	101.3250	101.3250
Fractional effective saturation depth (Fed) [-]	0.3250	0.3250
Supply gas CO2 content [vol. %]	0.0350	0.0350
Supply gas O2 [vol. %]	20.9500	20.9500
Off-gas CO2 [vol. %]	2.0000	2.0000
Off-gas O2 [vol. %]	18.8000	18.8000
Off-gas H2 [vol. %]	0	0
Off-gas NH3 [vol. %]	0	0
Off-gas CH4 [vol. %]	0	0
Surface turbulence factor [-]	2.0000	2.0000
Set point controller gain []	1.0000	1.0000

Modified Vesilind

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.387	0.387
Vesilind hindered zone settling parameter (K) [L/g]	0.370	0.370
Clarification switching function [mg/L]	100.000	100.000
Specified TSS conc.for height calc. [mg/L]	2500.000	2500.000
Maximum compactability constant [mg/L]	15000.000	15000.000

Double exponential

Name	Default	Value

Maximum Vesilind settling velocity (Vo) [ft/min]	0.934	0.934
Maximum (practical) settling velocity (Vo') [ft/min]	0.615	0.615
Hindered zone settling parameter (Kh) [L/g]	0.400	0.400
Flocculent zone settling parameter (Kf) [L/g]	2.500	2.500
Maximum non-settleable TSS [mg/L]	20.0000	20.0000
Non-settleable fraction [-]	0.0010	0.0010
Specified TSS conc. for height calc. [mg/L]	2500.0000	2500.0000

Emission factors

Name	Default	Value
Carbon dioxide equivalence of nitrous oxide	296.0000	296.0000
Carbon dioxide equivalence of methane	23.0000	23.0000

Biofilm general

Name	Default	Value	
Attachment rate [g / (m2 d)]	80.0000	80.0000	1.0000
Attachment TSS half sat. [mg/L]	100.0000	100.0000	1.0000
Detachment rate [g/(m3 d)]	8.000E+4	8.000E+4	1.0000
Solids movement factor []	10.0000	10.0000	1.0000
Diffusion neta []	0.8000	0.8000	1.0000
Thin film limit [mm]	0.5000	0.5000	1.0000
Thick film limit [mm]	3.0000	3.0000	1.0000
Assumed Film thickness for tank volume correction (temp independant) [mm]	0.7500	0.7500	1.0000
Film surface area to media area ratio - Max.[ ]	1.0000	1.0000	1.0000
Minimum biofilm conc. for streamer formation [gTSS/m2]	4.0000	4.0000	1.0000

Maximum biofilm concentrations [mg/L]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	5.000E+4	5.000E+4	1.0000
Methylotrophs	5.000E+4	5.000E+4	1.0000
Ammonia oxidizing biomass (AOB)	1.000E+5	1.000E+5	1.0000
Nitrite oxidizing biomass (NOB)	1.000E+5	1.000E+5	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E+4	5.000E+4	1.0000
Polyphosphate accumulating organisms (PAO)	5.000E+4	5.000E+4	1.0000
Propionic acetogens	5.000E+4	5.000E+4	1.0000
Methanogens - acetoclastic	5.000E+4	5.000E+4	1.0000
Methanogens - hydrogenotrophic	5.000E+4	5.000E+4	1.0000
Endogenous products	3.000E+4	3.000E+4	1.0000
Slowly bio. COD (part.)	5000.0000	5000.0000	1.0000
Slowly bio. COD (colloid.)	4000.0000	4000.0000	1.0000
Part. inert. COD	5000.0000	5000.0000	1.0000
Part. bio. org. N	0	0	1.0000
Part. bio. org. P	0	0	1.0000
Part. inert N	0	0	1.0000
Part. inert P	0	0	1.0000
Stored PHA	5000.0000	5000.0000	1.0000
Releasable stored polyP	1.150E+6	1.150E+6	1.0000
Fixed stored polyP	1.150E+6	1.150E+6	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000

Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.000E+10	1.000E+10	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	1.300E+6	1.300E+6	1.0000
Struvite	8.500E+5	8.500E+5	1.0000
Hydroxy-dicalcium-phosphate	1.150E+6	1.150E+6	1.0000
Hydroxy-apatite	1.600E+6	1.600E+6	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.000E+10	1.000E+10	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	5.000E+4	5.000E+4	1.0000
User defined 4	5.000E+4	5.000E+4	1.0000
Dissolved oxygen	0	0	1.0000

Effective diffusivities [m2/s]

Name	Default	Value

Ordinary heterotrophic organisms (OHO)	5.000E-14	5.000E-14	1.0290
Methylotrophs	5.000E-14	5.000E-14	1.0290
Ammonia oxidizing biomass (AOB)	5.000E-14	5.000E-14	1.0290
Nitrite oxidizing biomass (NOB)	5.000E-14	5.000E-14	1.0290
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E-14	5.000E-14	1.0290
Polyphosphate accumulating organisms (PAO)	5.000E-14	5.000E-14	1.0290
Propionic acetogens	5.000E-14	5.000E-14	1.0290
Methanogens - acetoclastic	5.000E-14	5.000E-14	1.0290
Methanogens - hydrogenotrophic	5.000E-14	5.000E-14	1.0290
Endogenous products	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (part.)	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (colloid.)	5.000E-12	5.000E-12	1.0290
Part. inert. COD	5.000E-14	5.000E-14	1.0290
Part. bio. org. N	5.000E-14	5.000E-14	1.0290
Part. bio. org. P	5.000E-14	5.000E-14	1.0290
Part. inert N	5.000E-14	5.000E-14	1.0290
Part. inert P	5.000E-14	5.000E-14	1.0290
Stored PHA	5.000E-14	5.000E-14	1.0290
Releasable stored polyP	5.000E-14	5.000E-14	1.0290
Fixed stored polyP	5.000E-14	5.000E-14	1.0290
Readily bio. COD (complex)	6.900E-10	6.900E-10	1.0290
Acetate	1.240E-9	1.240E-9	1.0290
Propionate	8.300E-10	8.300E-10	1.0290
Methanol	1.600E-9	1.600E-9	1.0290
Dissolved H2	5.850E-9	5.850E-9	1.0290
Dissolved methane	1.963E-9	1.963E-9	1.0290
Ammonia N	2.000E-9	2.000E-9	1.0290
Sol. bio. org. N	1.370E-9	1.370E-9	1.0290
Nitrous Oxide N	1.607E-9	1.607E-9	1.0290
Nitrite N	2.980E-9	2.980E-9	1.0290
Nitrate N	2.980E-9	2.980E-9	1.0290

Dissolved nitrogen gas	1.900E-9	1.900E-9	1.0290
PO4-P (Sol. & Me Complexed)	2.000E-9	2.000E-9	1.0290
Sol. inert COD	6.900E-10	6.900E-10	1.0290
Sol. inert TKN	6.850E-10	6.850E-10	1.0290
ISS Influent	5.000E-14	5.000E-14	1.0290
Struvite	5.000E-14	5.000E-14	1.0290
Hydroxy-dicalcium-phosphate	5.000E-14	5.000E-14	1.0290
Hydroxy-apatite	5.000E-14	5.000E-14	1.0290
Magnesium	7.200E-10	7.200E-10	1.0290
Calcium	7.200E-10	7.200E-10	1.0290
Metal	4.800E-10	4.800E-10	1.0290
Other Cations (strong bases)	1.440E-9	1.440E-9	1.0290
Other Anions (strong acids)	1.440E-9	1.440E-9	1.0290
Total CO2	1.960E-9	1.960E-9	1.0290
User defined 1	6.900E-10	6.900E-10	1.0290
User defined 2	6.900E-10	6.900E-10	1.0290
User defined 3	5.000E-14	5.000E-14	1.0290
User defined 4	5.000E-14	5.000E-14	1.0290
Dissolved oxygen	2.500E-9	2.500E-9	1.0290

EPS Strength coefficients [ ]

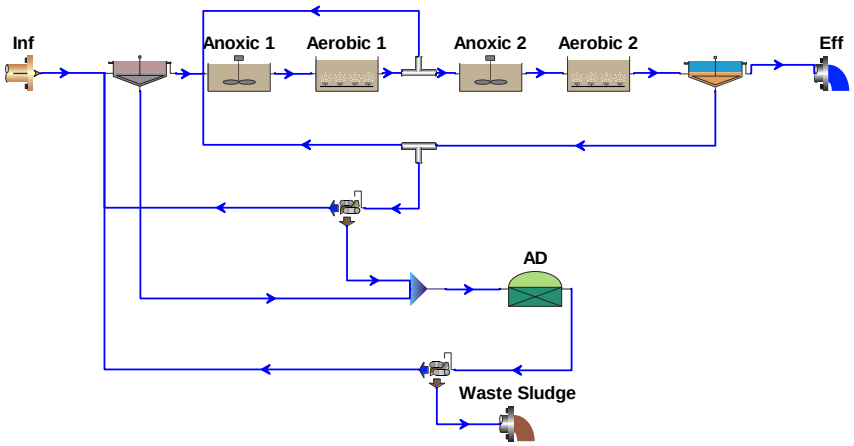
Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	1.0000	1.0000	1.0000
Methylotrophs	1.0000	1.0000	1.0000
Ammonia oxidizing biomass (AOB)	5.0000	1.0000	1.0000
Nitrite oxidizing biomass (NOB)	25.0000	1.0000	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	10.0000	1.0000	1.0000
Polyphosphate accumulating organisms (PAO)	1.0000	1.0000	1.0000

Propionic acetogens	1.0000	1.0000	1.0000
Methanogens - acetoclastic	1.0000	1.0000	1.0000
Methanogens - hydrogenotrophic	1.0000	1.0000	1.0000
Endogenous products	1.0000	1.0000	1.0000
Slowly bio. COD (part.)	1.0000	1.0000	1.0000
Slowly bio. COD (colloid.)	1.0000	1.0000	1.0000
Part. inert. COD	1.0000	1.0000	1.0000
Part. bio. org. N	1.0000	1.0000	1.0000
Part. bio. org. P	1.0000	1.0000	1.0000
Part. inert N	1.0000	1.0000	1.0000
Part. inert P	1.0000	1.0000	1.0000
Stored PHA	1.0000	1.0000	1.0000
Releasable stored polyP	1.0000	1.0000	1.0000
Fixed stored polyP	1.0000	1.0000	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.0000	1.0000	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	0.3300	0.3300	1.0000
Struvite	1.0000	1.0000	1.0000

Hydroxy-dicalcium-phosphate	1.0000	1.0000	1.0000
Hydroxy-apatite	1.0000	1.0000	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.0000	1.0000	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	1.0000	1.0000	1.0000
User defined 4	1.0000	1.0000	1.0000
Dissolved oxygen	0	0	1.0000

FAIRHAVEN, MA

Case Study No. 3
Bardenpho w/Anaerobic Digestion
Flow = 5.0 MGD @ 18^{0}C



Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Primary Clarifier 1,2	0.5565	6636.0000	11.210

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Primary Clarifier 1,2	Flowrate [Under]	0.016

Element name	Percent removal	Blanket fraction
Primary Clarifier 1,2	60.00	0.85

Configuration information for all Anaerobic Digester units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	Head space volume
AD	0.6200	4144.0975	20.000	0.5

Operating data Average (flow/time weighted as required)

Element name	Pressure [psi]	pH
AD	14.9	-

Element name	Average Temperature
AD	35.0

Configuration information for all Bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Anoxic 1	0.3112	3200.0000	13.000	Un-aerated
Aerobic 1	0.3112	3200.0000	13.000	456
Anoxic 2	0.3112	3200.0000	13.000	Un-aerated
Aerobic 2	0.2379	3180.0000	10.000	721

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
Anoxic 1	0
Aerobic 1	2.0
Anoxic 2	0
Aerobic 2	2.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^0.25 + k2	k2 in C = k1(PC)^0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	% of tank area covered by diffusers [%]
Anoxic 1	2.5656	0.0432	0.8200	0.4413	6.2900
Aerobic 1	2.5656	0.0432	0.8200	0.4413	6.2900
Anoxic 2	2.5656	0.0432	0.8200	0.4413	6.2900
Aerobic 2	2.5656	0.0432	0.8200	0.4413	10.0000

Configuration information for all BOD Influent units

Operating data Average (flow/time weighted as required)

Element name	Inf
Flow	5.00077666578962
Total Carbonaceous BOD mgBOD/L	180.00
Volatile suspended solids mgVSS/L	110.00
Total suspended solids mgTSS/L	145.00
Total Kjeldahl Nitrogen mgN/L	36.00
Total P mgP/L	5.00
Nitrate N mgN/L	0
pH	7.00

Alkalinity mmol/L	6.00
Calcium mg/L	80.00
Magnesium mg/L	15.00
Dissolved oxygen mg/L	1.10

Element name	Inf
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.1600
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1500
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.5634
Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0500
Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.1300
Fna - Ammonia [gNH3-N/gTKN]	0.6600
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.5000
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0350
Fpo4 - Phosphate [gPO4-P/gTP]	0.5000
FupP - P:COD ratio for unbiodegradable part. COD [gP/gCOD]	0.0110
FZbh - OHO COD fraction [gCOD/g of total COD]	1.000E-4
FZbm - Methylotroph COD fraction [gCOD/g of total COD]	1.000E-4
FZaob - AOB COD fraction [gCOD/g of total COD]	1.000E-4
FZnob - NOB COD fraction [gCOD/g of total COD]	1.000E-4
FZamob - ANAMMOX COD fraction [gCOD/g of total COD]	1.000E-4
FZbp - PAO COD fraction [gCOD/g of total COD]	1.000E-4
FZbpa - Propionic acetogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbam - Acetoclastic methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbhm - H2-utilizing methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZe - Endogenous products COD fraction [gCOD/g of total COD]	0

Configuration information for all Effluent units

Configuration information for all Ideal clarifier units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Sec. Clarifier 1,2	0.8593	8836.0000	13.000

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Sec. Clarifier 1,2	Flow paced	200.00 %

Element name	Average Temperature	Reactive	Percent removal	Blanket fraction
Sec. Clarifier 1,2	Uses global setting	No	99.95	0.05

Configuration information for all Dewatering unit units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Dewatering unit3	Flowrate [Under]	0.01
Dewatering unit32	Flowrate [Under]	0.01

Element name	Percent removal
Dewatering unit3	90.00
Dewatering unit32	95.00

Configuration information for all Sludge units

Configuration information for all Splitter units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
	Flowrate [Side]	0.053
Splitter8	Flow paced	200.00 %

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Elements	Total Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Nitrite N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]
Inf	180.00	145.03	23.76	0	0	36.00
Eff	3.15	6.61	0.32	4.35	0.16	2.48

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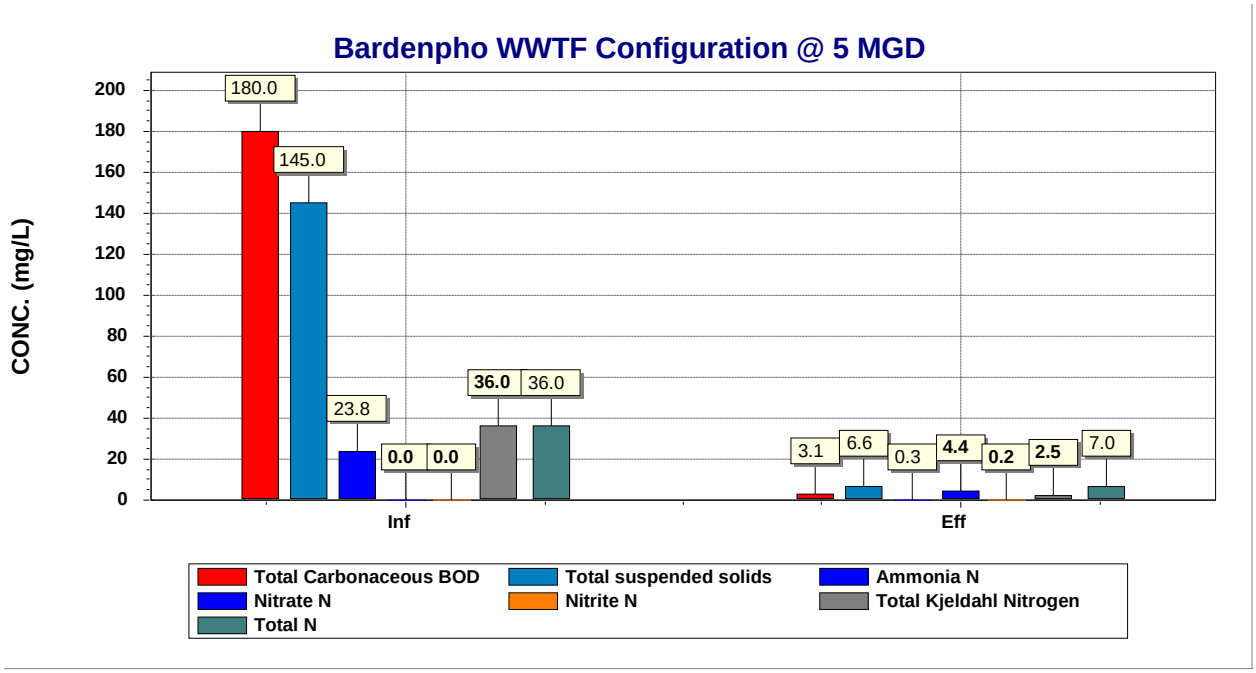

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Inf			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	110.00	4590.69	
Total suspended solids	145.03	6052.61	
Particulate COD	175.96	7343.43	
Filtered COD	174.41	7278.60	
Total COD	350.37	14622.03	
Soluble PO4-P	2.50	104.33	
Total P	5.00	208.67	
Filtered TKN	29.43	1228.30	
Particulate TKN	6.57	274.11	
Total Kjeldahl Nitrogen	36.00	1502.41	
Filtered Carbonaceous BOD	111.06	4634.87	
Total Carbonaceous BOD	180.00	7512.03	
Nitrite + Nitrate	0	0	
Total N	36.00	1502.41	
Total inorganic N	23.76	991.59	
Alkalinity	6.00	113.58	mmol/L and kmol/d
pH	7.00		
Volatile fatty acids	8.41	350.93	
ISS precipitate	0	0	
ISS cellular	0.03	1.25	
ISS Total	35.03	1461.93	
Ammonia N	23.76	991.59	

Nitrate N	0	0

Parameters	Value	Units

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Anoxic 1			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	3318.40	692165.32	
Total suspended solids	4413.76	920639.46	
Particulate COD	4861.09	1013946.82	
Filtered COD	20.93	4366.34	
Total COD	4882.03	1018313.16	
Soluble PO4-P	2.97	619.62	
Total P	95.88	19999.14	
Filtered TKN	8.57	1787.16	
Particulate TKN	295.05	61542.01	
Total Kjeldahl Nitrogen	303.61	63329.17	
Filtered Carbonaceous BOD	1.85	386.22	
Total Carbonaceous BOD	1450.14	302475.81	
Nitrite + Nitrate	0.65	135.85	
Total N	304.27	63465.02	
Total inorganic N	7.46	1556.06	
Alkalinity	4.76	450.54	mmol/L and kmol/d
pH	6.98		
Volatile fatty acids	0.33	68.43	
ISS precipitate	0	0.00	
ISS cellular	216.83	45226.31	
ISS Total	1095.36	228474.14	
Ammonia N	6.81	1420.20	
Nitrate N	0.54	111.60	

Parameters	Value	Units
Hydraulic residence time	0.3	hours
Velocity gradient	76.33	1/s
VSS destruction	0	%
Total solids mass	11462.54	lb
Total readily biodegradable COD	1.57	mg/L
OUR - Total	0.00	mgO/L/hr
OUR - Carbonaceous	0.00	mgO/L/hr
OUR - Nitrification	0.00	mgO/L/hr
Nit - Ammonia removal rate	0.00	mgN/L/hr

Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	0.00	mgN/L/hr
Nit - Nitrate production rate	0.00	mgN/L/hr
Denit - Nitrate removal rate	9.01	mgN/L/hr
Denit - Nitrite removal rate	5.16	mgN/L/hr
Denit - N2 production rate	10.29	mgN/L/hr
Off gas flow rate (dry)	2.38	ft3/min
Off gas Oxygen	0	%
Off gas Carbon dioxide	76.31	%
Off gas Ammonia	0.01	%
Off gas Hydrogen	5.94	%
Off gas Methane	0.06	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	9.19	mg/L
OTR	0	lb/hr
SOTR	0	lb/hr
OTE	100.00	%
SOTE	100.00	%
Air flow rate	0	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0	ft3/min (20C, 1 atm)
# of diffusers	456.00	

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Aerobic 1			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	3313.68	691180.15	
Total suspended solids	4409.39	919728.59	
Particulate COD	4852.80	1012217.60	
Filtered COD	19.27	4019.54	
Total COD	4872.07	1016237.14	
Soluble PO4-P	2.93	612.14	
Total P	95.88	19999.14	
Filtered TKN	4.17	870.41	
Particulate TKN	295.21	61576.08	
Total Kjeldahl Nitrogen	299.38	62446.49	
Filtered Carbonaceous BOD	1.15	239.80	
Total Carbonaceous BOD	1444.49	301297.03	
Nitrite + Nitrate	4.81	1002.77	
Total N	304.19	63449.26	
Total inorganic N	7.12	1486.12	
Alkalinity	4.15	392.35	mmol/L and kmol/d
pH	6.91		
Volatile fatty acids	0.02	3.21	

ISS precipitate	0	0.00
ISS cellular	217.18	45300.61
ISS Total	1095.71	228548.44
Ammonia N	2.32	483.35
Nitrate N	3.72	775.08

Parameters	Value	Units
Hydraulic residence time	0.3	hours
Velocity gradient	268.67	1/s
VSS destruction	0.14	%
Total solids mass	11451.20	lb
Total readily biodegradable COD	1.57	mg/L
OUR - Total	91.26	mgO/L/hr
OUR - Carbonaceous	33.44	mgO/L/hr
OUR - Nitrification	57.81	mgO/L/hr
Nit - Ammonia removal rate	14.30	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	14.16	mgN/L/hr
Nit - Nitrate production rate	10.86	mgN/L/hr
Denit - Nitrate removal rate	0.22	mgN/L/hr
Denit - Nitrite removal rate	0.12	mgN/L/hr
Denit - N2 production rate	0.25	mgN/L/hr
Off gas flow rate (dry)	3722.07	ft3/min
Off gas Oxygen	19.55	%
Off gas Carbon dioxide	1.36	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.06	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	9.19	mg/L
OTR	254.38	lb/hr
SOTR	770.40	lb/hr
OTE	6.51	%
SOTE	20.18	%
Air flow rate	3741.70	ft3/min (20C, 1 atm)
Air flow rate / diffuser	8.21	ft3/min (20C, 1 atm)
# of diffusers	456.00	

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Anoxic 2			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	3309.89	414124.19	

Total suspended solids	4405.51	551204.08	
Particulate COD	4846.96	606437.29	
Filtered COD	18.56	2322.25	
Total COD	4865.52	608759.55	
Soluble PO4-P	2.96	370.78	
Total P	95.88	11996.28	
Filtered TKN	4.24	530.50	
Particulate TKN	295.14	36927.09	
Total Kjeldahl Nitrogen	299.38	37457.59	
Filtered Carbonaceous BOD	0.46	57.98	
Total Carbonaceous BOD	1440.05	180175.32	
Nitrite + Nitrate	2.36	295.62	
Total N	301.74	37753.21	
Total inorganic N	5.26	657.78	
Alkalinity	4.36	247.54	mmol/L and kmol/d
pH	6.96		
Volatile fatty acids	0.03	3.58	
ISS precipitate	0	0.00	
ISS cellular	217.08	27160.52	
ISS Total	1095.61	137079.90	
Ammonia N	2.89	362.16	
Nitrate N	1.67	209.16	

Parameters	Value	Units
Hydraulic residence time	0.5	hours
Velocity gradient	72.64	1/s
VSS destruction	0.11	%
Total solids mass	11441.12	lb
Total readily biodegradable COD	0.65	mg/L
OUR - Total	0.00	mgO/L/hr
OUR - Carbonaceous	0.00	mgO/L/hr
OUR - Nitrification	0.00	mgO/L/hr
Nit - Ammonia removal rate	0.00	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	0.00	mgN/L/hr
Nit - Nitrate production rate	0.00	mgN/L/hr
Denit - Nitrate removal rate	4.10	mgN/L/hr
Denit - Nitrite removal rate	2.47	mgN/L/hr
Denit - N2 production rate	4.90	mgN/L/hr
Off gas flow rate (dry)	2.20	ft3/min
Off gas Oxygen	0	%
Off gas Carbon dioxide	79.23	%
Off gas Ammonia	0.00	%

Off gas Hydrogen	3.07	%
Off gas Methane	0.02	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	9.19	mg/L
OTR	0	lb/hr
SOTR	0	lb/hr
OTE	100.00	%
SOTE	100.00	%
Air flow rate	0	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0	ft3/min (20C, 1 atm)
# of diffusers	456.00	

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Aerobic 2			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	3302.70	413223.90	
Total suspended solids	4398.60	550340.24	
Particulate COD	4834.85	604921.92	
Filtered COD	19.00	2377.51	
Total COD	4853.85	607299.42	
Soluble PO4-P	2.99	373.71	
Total P	95.88	11996.28	
Filtered TKN	2.04	254.71	
Particulate TKN	295.12	36924.03	
Total Kjeldahl Nitrogen	297.15	37178.74	
Filtered Carbonaceous BOD	1.00	124.85	
Total Carbonaceous BOD	1433.38	179340.63	
Nitrite + Nitrate	4.51	563.95	
Total N	301.66	37742.70	
Total inorganic N	4.83	604.52	
Alkalinity	4.02	228.39	mmol/L and kmol/d
pH	6.92		
Volatile fatty acids	0.00	0.18	
ISS precipitate	0	0.00	
ISS cellular	217.37	27196.97	
ISS Total	1095.90	137116.34	
Ammonia N	0.32	40.56	
Nitrate N	4.35	544.50	

Parameters	Value	Units
Hydraulic residence time	0.4	hours
Velocity gradient	198.53	1/s

VSS destruction	0.22	%
Total solids mass	8732.15	lb
Total readily biodegradable COD	1.41	mg/L
OUR - Total	57.51	mgO/L/hr
OUR - Carbonaceous	30.69	mgO/L/hr
OUR - Nitrification	26.82	mgO/L/hr
Nit - Ammonia removal rate	5.91	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	5.85	mgN/L/hr
Nit - Nitrate production rate	7.26	mgN/L/hr
Denit - Nitrate removal rate	0.22	mgN/L/hr
Denit - Nitrite removal rate	0.11	mgN/L/hr
Denit - N2 production rate	0.22	mgN/L/hr
Off gas flow rate (dry)	1946.64	ft3/min
Off gas Oxygen	19.66	%
Off gas Carbon dioxide	1.21	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.03	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	8.95	mg/L
OTR	124.60	lb/hr
SOTR	380.18	lb/hr
OTE	6.10	%
SOTE	19.03	%
Air flow rate	1958.24	ft3/min (20C, 1 atm)
Air flow rate / diffuser	2.72	ft3/min (20C, 1 atm)
# of diffusers	721.00	

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Sec. Clarifier 1,2			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	4.96	206.61	
Total suspended solids	6.61	275.17	
Particulate COD	7.26	302.46	
Filtered COD	19.00	791.44	
Total COD	26.26	1093.91	
Soluble PO4-P	2.99	124.40	
Total P	3.13	130.21	
Filtered TKN	2.04	84.79	
Particulate TKN	0.44	18.46	
Total Kjeldahl Nitrogen	2.48	103.25	
Filtered Carbonaceous BOD	1.00	41.56	

Total Carbonaceous BOD	3.15	131.17	
Nitrite + Nitrate	4.51	187.73	
Total N	6.99	290.99	
Total inorganic N	4.83	201.24	
Alkalinity	4.02	76.03	mmol/L and kmol/d
pH	6.92		
Volatile fatty acids	0.00	0.06	
ISS precipitate	0	0.00	
ISS cellular	0.33	13.60	
ISS Total	1.65	68.56	
Ammonia N	0.32	13.50	
Nitrate N	4.35	181.26	

Parameters	Value	Units
Hydraulic residence time	1.38	hours
Percent removal	99.95	%
Height of specified concentration	0.65	ft
Total solids mass	2407.92	lb
Surface overflow rate	564.82	gal/(ft2 d)
Solids loading rate	62.28	lb/(ft2 d)

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Eff			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	4.96	206.61	
Total suspended solids	6.61	275.17	
Particulate COD	7.26	302.46	
Filtered COD	19.00	791.44	
Total COD	26.26	1093.91	
Soluble PO4-P	2.99	124.40	
Total P	3.13	130.21	
Filtered TKN	2.04	84.79	
Particulate TKN	0.44	18.46	
Total Kjeldahl Nitrogen	2.48	103.25	
Filtered Carbonaceous BOD	1.00	41.56	
Total Carbonaceous BOD	3.15	131.17	
Nitrite + Nitrate	4.51	187.73	
Total N	6.99	290.99	
Total inorganic N	4.83	201.24	
Alkalinity	4.02	76.03	mmol/L and kmol/d
pH	6.92		
Volatile fatty acids	0.00	0.06	

ISS precipitate	0	0.00
ISS cellular	0.33	13.60
ISS Total	1.65	68.56
Ammonia N	0.32	13.50
Nitrate N	4.35	181.26

Parameters	Value	Units

Global Parameters

AOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9000	0.9000	1.0720
Substrate (NH4) half sat. [mgN/L]	0.7000	0.7000	1.0000
Byproduct NH4 logistic slope [-]	50.0000	50.0000	1.0000
Byproduct NH4 inflection point [mgN/L]	1.4000	1.4000	1.0000
AOB denite DO half sat. [mg/L]	0.1000	0.1000	1.0000
AOB denite HNO2 half sat. [mgN/L]	5.000E-6	5.000E-6	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiHNO2 [mmol/L]	0.0050	0.0050	1.0000

NOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.7000	0.7000	1.0600
Substrate (NO2) half sat. [mgN/L]	0.1000	0.1000	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290

KiNH3 [mmol/L]	0.0750	0.0750	1.0000

ANAMMOX

Name	Default	Value	
Max. spec. growth rate [1/d]	0.1000	0.1000	1.1000
Substrate (NH4) half sat. [mgN/L]	2.0000	2.0000	1.0000
Substrate (NO2) half sat. [mgN/L]	1.0000	1.0000	1.0000
Aerobic decay rate [1/d]	0.0190	0.0190	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0095	0.0095	1.0290
Ki Nitrite [mgN/L]	1000.0000	1000.0000	1.0000
Nitrite sensitivity constant [L / (d mgN)]	0.0160	0.0160	1.0000

OHO

Name	Default	Value	
Max. spec. growth rate [1/d]	3.2000	3.2000	1.0290
Substrate half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Anoxic growth factor [-]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.6200	0.6200	1.0290
Anoxic decay rate [1/d]	0.2330	0.2330	1.0290
Anaerobic decay rate [1/d]	0.1310	0.1310	1.0290
Hydrolysis rate [1/d]	2.1000	2.1000	1.0290
Hydrolysis half sat. [-]	0.0600	0.0600	1.0000
Anoxic hydrolysis factor [-]	0.2800	0.2800	1.0000
Anaerobic hydrolysis factor (AS) [-]	0.0400	0.0400	1.0000

Anaerobic hydrolysis factor (AD) [-]	0.2000	0.5000	1.0000
Adsorption rate of colloids [L/(mgCOD d)]	0.1500	0.8000	1.0290
Ammonification rate [L/(mgN d)]	0.0400	0.0400	1.0290
Assimilative nitrate/nitrite reduction rate [1/d]	0.5000	0.5000	1.0000
Fermentation rate [1/d]	1.6000	3.2000	1.0290
Fermentation half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Fermentation growth factor (AS) [-]	0.2500	0.1250	1.0000
Endogenous products decay rate[1/d]	0	0	1.0000
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

Methylotrophs

Name	Default	Value	
Max. spec. growth rate [1/d]	1.3000	1.3000	1.0720
Methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.0400	0.0400	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0300	0.0300	1.0290
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

PAO

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9500	0.9500	1.0000
Max. spec. growth rate, P-limited [1/d]	0.4200	0.4200	1.0000
Substrate half sat. [mgCOD(PHB)/mgCOD(Zbp)]	0.1000	0.1000	1.0000
Substrate half sat., P-limited [mgCOD(PHB)/mgCOD(Zbp)]	0.0500	0.0500	1.0000

Magnesium half sat. [mgMg/L]	0.1000	0.1000	1.0000
Cation half sat. [mmol/L]	0.1000	0.1000	1.0000
Calcium half sat. [mgCa/L]	0.1000	0.1000	1.0000
Aerobic/anoxic decay rate [1/d]	0.1000	0.1000	1.0000
Aerobic/anoxic maintenance rate [1/d]	0	0	1.0000
Anaerobic decay rate [1/d]	0.0400	0.0400	1.0000
Anaerobic maintenance rate [1/d]	0	0	1.0000
Sequestration rate [1/d]	4.5000	6.0000	1.0000
Anoxic growth factor [-]	0.3300	0.3300	1.0000

Acetogens

Name	Default	Value	
Max. spec. growth rate [1/d]	0.2500	0.2500	1.0290
Substrate half sat. [mgCOD/L]	10.0000	10.0000	1.0000
Acetate inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Anaerobic decay rate [1/d]	0.0500	0.0500	1.0290
Aerobic/anoxic decay rate [1/d]	0.5200	0.5200	1.0290

Methanogens

Name	Default	Value	
Acetoclastic max. spec. growth rate [1/d]	0.3000	0.3000	1.0290
H2-utilizing max. spec. growth rate [1/d]	1.4000	1.4000	1.0290
Acetoclastic substrate half sat. [mgCOD/L]	100.0000	100.0000	1.0000
Acetoclastic methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
H2-utilizing CO2 half sat. [mmol/L]	0.1000	0.1000	1.0000

H2-utilizing substrate half sat. [mgCOD/L]	0.1000	0.1000	1.0000
H2-utilizing methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Acetoclastic propionic inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Acetoclastic anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
Acetoclastic aerobic/anoxic decay rate [1/d]	0.6000	0.6000	1.0290
H2-utilizing anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
H2-utilizing aerobic/anoxic decay rate [1/d]	2.8000	0.6000	1.0290

pH

Name	Default	Value
OHO low pH limit [-]	4.0000	4.0000
OHO high pH limit [-]	10.0000	10.0000
Methylotrophs low pH limit [-]	4.0000	4.0000
Methylotrophs high pH limit [-]	10.0000	10.0000
Autotrophs low pH limit [-]	5.5000	5.5000
Autotrophs high pH limit [-]	9.5000	9.5000
PAO low pH limit [-]	4.0000	4.0000
PAO high pH limit [-]	10.0000	10.0000
OHO low pH limit (anaerobic) [-]	5.5000	5.5000
OHO high pH limit (anaerobic) [-]	8.5000	8.5000
Propionic acetogens low pH limit [-]	4.0000	4.0000
Propionic acetogens high pH limit [-]	10.0000	10.0000
Acetoclastic methanogens low pH limit [-]	5.0000	5.0000
Acetoclastic methanogens high pH limit [-]	9.0000	9.0000
H2-utilizing methanogens low pH limit [-]	5.0000	5.0000
H2-utilizing methanogens high pH limit [-]	9.0000	9.0000

Switches

Name	Default	Value
Aerobic/anoxic DO half sat. [mgO2/L]	0.0500	0.0500
Anoxic/anaerobic NOx half sat. [mgN/L]	0.1500	0.1500
AOB DO half sat. [mgO2/L]	0.2500	0.2500
NOB DO half sat. [mgO2/L]	0.5000	0.5000
ANAMMOX DO half sat. [mgO2/L]	0.0100	0.0100
Anoxic NO3(->NO2) half sat. [mgN/L]	0.1000	0.1000
Anoxic NO3(->N2) half sat. [mgN/L]	0.0500	0.0500
Anoxic NO2(->N2) half sat. (mgN/L)	0.0100	0.0100
NH3 nutrient half sat. [mgN/L]	0.0050	1.000E-4
PolyP half sat. [mgP/mgCOD]	0.0100	0.0100
VFA sequestration half sat. [mgCOD/L]	5.0000	5.0000
P uptake half sat. [mgP/L]	0.1500	0.1500
P nutrient half sat. [mgP/L]	0.0010	0.0010
Autotroph CO2 half sat. [mmol/L]	0.1000	0.1000
H2 low/high half sat. [mgCOD/L]	1.0000	1.0000
Propionic acetogens H2 inhibition [mgCOD/L]	5.0000	5.0000
Synthesis anion/cation half sat. [meq/L]	0.0100	0.0100

Common

Name	Default	Value
Biomass volatile fraction (VSS/TSS)	0.9200	0.9200
Endogenous residue volatile fraction (VSS/TSS)	0.9200	0.9200
N in endogenous residue [mgN/mgCOD]	0.0700	0.0700
P in endogenous residue [mgP/mgCOD]	0.0220	0.0220

Endogenous residue COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Particulate substrate COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000
Particulate inert COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000

AOB

Name	Default	Value
Yield [mgCOD/mgN]	0.1500	0.1500
AOB denite NO2 fraction as TEA [-]	0.5000	0.5000
Byproduct NH4 fraction to N2O [-]	0.0025	0.0025
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

NOB

Name	Default	Value
Yield [mgCOD/mgN]	0.0900	0.0900
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

ANAMMOX

Name	Default	Value
Yield [mgCOD/mgN]	0.1140	0.1140
Nitrate production [mgN/mgBiomassCOD]	2.2800	2.2800
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

OHO

Name	Default	Value
Yield (aerobic) [-]	0.6660	0.6660
Yield (fermentation, low H2) [-]	0.1000	0.1000
Yield (fermentation, high H2) [-]	0.1000	0.1000
H2 yield (fermentation low H2) [-]	0.3500	0.3500
H2 yield (fermentation high H2) [-]	0	0
Propionate yield (fermentation, low H2) [-]	0	0
Propionate yield (fermentation, high H2) [-]	0.7000	0.7000
CO2 yield (fermentation, low H2) [-]	0.7000	0.7000
CO2 yield (fermentation, high H2) [-]	0	0
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Endogenous fraction - aerobic [-]	0.0800	0.0800
Endogenous fraction - anoxic [-]	0.1030	0.1030
Endogenous fraction - anaerobic [-]	0.1840	0.1840
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield (anoxic) [-]	0.5400	0.5400

Yield propionic (aerobic) [-]	0.6400	0.6400
Yield propionic (anoxic) [-]	0.4600	0.4600
Yield acetic (aerobic) [-]	0.6000	0.6000
Yield acetic (anoxic) [-]	0.4300	0.4300
Yield methanol (aerobic) [-]	0.5000	0.5000
Adsorp. max. [-]	1.0000	1.0000
Max fraction to N2O at high FNA over nitrate [-]	0.0500	0.0500
Max fraction to N2O at high FNA over nitrite [-]	0.1000	0.1000

Methylotrophs

Name	Default	Value
Yield (anoxic) [-]	0.4000	0.4000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Max fraction to N2O at high FNA over nitrate [-]	0.1000	0.1000
Max fraction to N2O at high FNA over nitrite [-]	0.1500	0.1500

PAO

Name	Default	Value
Yield (aerobic) [-]	0.6390	0.6390
Yield (anoxic) [-]	0.5200	0.5200
Aerobic P/PHA uptake [mgP/mgCOD]	0.9300	0.9500
Anoxic P/PHA uptake [mgP/mgCOD]	0.3500	0.3500

Yield of PHA on sequestration [-]	0.8890	0.8890
N in biomass [mgN/mgCOD]	0.0700	0.0700
N in sol. inert [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous part. [-]	0.2500	0.2500
Inert fraction of endogenous sol. [-]	0.2000	0.2000
P/Ac release ratio [mgP/mgCOD]	0.5100	0.4900
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield of low PP [-]	0.9400	0.9400

Acetogens

Name	Default	Value
Yield [-]	0.1000	0.1000
H2 yield [-]	0.4000	0.4000
CO2 yield [-]	1.0000	1.0000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

Methanogens

Name	Default	Value
Acetoclastic yield [-]	0.1000	0.1000
Methanol acetoclastic yield [-]	0.1000	0.1000
H2-utilizing yield [-]	0.1000	0.1000

Methanol H2-utilizing yield [-]	0.1000	0.1000
N in acetoclastic biomass [mgN/mgCOD]	0.0700	0.0700
N in H2-utilizing biomass [mgN/mgCOD]	0.0700	0.0700
P in acetoclastic biomass [mgP/mgCOD]	0.0220	0.0220
P in H2-utilizing biomass [mgP/mgCOD]	0.0220	0.0220
Acetoclastic fraction to endog. residue [-]	0.0800	0.0800
H2-utilizing fraction to endog. residue [-]	0.0800	0.0800
Acetoclastic COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
H2-utilizing COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

General

Name	Default	Value
Molecular weight of other anions [mg/mmol]	35.5000	35.5000
Molecular weight of other cations [mg/mmol]	39.1000	39.1000
Mg to P mole ratio in polyphosphate [mmolMg/mmolP]	0.3000	0.3000
Cation to P mole ratio in polyphosphate [meq/mmolP]	0.1500	0.3000
Ca to P mole ratio in polyphosphate [mmolCa/mmolP]	0.0500	0.0500
Cation to P mole ratio in organic phosphate [meq/mmolP]	0.0100	0.0100
Bubble rise velocity (anaerobic digester) [cm/s]	23.9000	23.9000
Bubble Sauter mean diameter (anaerobic digester) [cm]	0.3500	0.3500
Anaerobic digester gas hold-up factor []	1.0000	1.0000
Tank head loss per metre of length (from flow) [m/m]	0.0025	0.0025

Mass transfer

Name	Default	Value

Kl for H2 [m/d]	17.0000	17.0000	1.0240
Kl for CO2 [m/d]	10.0000	10.0000	1.0240
Kl for NH3 [m/d]	1.0000	1.0000	1.0240
Kl for CH4 [m/d]	8.0000	8.0000	1.0240
Kl for N2 [m/d]	15.0000	15.0000	1.0240
Kl for N2O [m/d]	8.0000	8.0000	1.0240
Kl for O2 [m/d]	13.0000	13.0000	1.0240

Henry's law constants

Name	Default	Value	
CO2 [M/atm]	0.0340	0.0340	2400.0000
O2 [M/atm]	0.0013	0.0013	1500.0000
N2 [M/atm]	6.500E-4	6.500E-4	1300.0000
N2O [M/atm]	0.0250	0.0250	2600.0000
NH3 [M/atm]	58.0000	58.0000	4100.0000
CH4 [M/atm]	0.0014	0.0014	1600.0000
H2 [M/atm]	7.800E-4	7.800E-4	500.0000

Physico-chemical rates

Name	Default	Value	
Struvite precipitation rate [1/d]	3.000E+10	3.000E+10	1.0240
Struvite redissolution rate [1/d]	3.000E+11	3.000E+11	1.0240
Struvite half sat. [mgTSS/L]	1.0000	1.0000	1.0000
HDP precipitation rate [L/(molP d)]	1.000E+8	1.000E+8	1.0000
HDP redissolution rate [L/(mol P d)]	1.000E+8	1.000E+8	1.0000

HAP precipitation rate [molHDP/(L d)]	5.000E-4	5.000E-4	1.0000

Physico-chemical constants

Name	Default	Value
Struvite solubility constant [mol/L]	6.918E-14	6.918E-14
HDP solubility product [mol/L]	2.750E-22	2.750E-22
HDP half sat. [mgTSS/L]	1.0000	1.0000
Equilibrium soluble PO4 with Al dosing at pH 7 [mgP/L]	0.0100	0.0100
Al to P ratio [molAl/molP]	0.8000	0.8000
Al(OH)3 solubility product [mol/L]	1.259E+9	1.259E+9
AlHPO4+ dissociation constant [mol/L]	7.943E-13	7.943E-13
Equilibrium soluble PO4 with Fe dosing at pH 7 [mgP/L]	0.0100	0.0100
Fe to P ratio [molFe/molP]	1.6000	1.6000
Fe(OH)3 solubility product [mol/L]	0.0500	0.0500
FeH2PO4++ dissociation constant [mol/L]	5.012E-22	5.012E-22

Aeration

Name	Default	Value
Alpha (surf) OR Alpha F (diff) [-]	0.5000	0.5000
Beta [-]	0.9500	0.9500
Surface pressure [kPa]	101.3250	101.3250
Fractional effective saturation depth (Fed) [-]	0.3250	0.3250
Supply gas CO2 content [vol. %]	0.0350	0.0350
Supply gas O2 [vol. %]	20.9500	20.9500
Off-gas CO2 [vol. %]	2.0000	2.0000

Off-gas O2 [vol. %]	18.8000	18.8000
Off-gas H2 [vol. %]	0	0
Off-gas NH3 [vol. %]	0	0
Off-gas CH4 [vol. %]	0	0
Surface turbulence factor [-]	2.0000	2.0000
Set point controller gain []	1.0000	1.0000

Modified Vesilind

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.387	0.387
Vesilind hindered zone settling parameter (K) [L/g]	0.370	0.370
Clarification switching function [mg/L]	100.000	100.000
Specified TSS conc.for height calc. [mg/L]	2500.000	2500.000
Maximum compactability constant [mg/L]	15000.000	15000.000

Double exponential

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.934	0.934
Maximum (practical) settling velocity (Vo') [ft/min]	0.615	0.615
Hindered zone settling parameter (Kh) [L/g]	0.400	0.400
Flocculent zone settling parameter (Kf) [L/g]	2.500	2.500
Maximum non-settleable TSS [mg/L]	20.0000	20.0000
Non-settleable fraction [-]	0.0010	0.0010
Specified TSS conc. for height calc. [mg/L]	2500.0000	2500.0000

Emission factors

Name	Default	Value
Carbon dioxide equivalence of nitrous oxide	296.0000	296.0000
Carbon dioxide equivalence of methane	23.0000	23.0000

Biofilm general

Name	Default	Value	
Attachment rate [g / (m2 d)]	80.0000	80.0000	1.0000
Attachment TSS half sat. [mg/L]	100.0000	100.0000	1.0000
Detachment rate [g/(m3 d)]	8.000E+4	8.000E+4	1.0000
Solids movement factor []	10.0000	10.0000	1.0000
Diffusion neta []	0.8000	0.8000	1.0000
Thin film limit [mm]	0.5000	0.5000	1.0000
Thick film limit [mm]	3.0000	3.0000	1.0000
Assumed Film thickness for tank volume correction (temp independant) [mm]	0.7500	0.7500	1.0000
Film surface area to media area ratio - Max.[ ]	1.0000	1.0000	1.0000
Minimum biofilm conc. for streamer formation [gTSS/m2]	4.0000	4.0000	1.0000

Maximum biofilm concentrations [mg/L]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	5.000E+4	5.000E+4	1.0000
Methylotrophs	5.000E+4	5.000E+4	1.0000

Ammonia oxidizing biomass (AOB)	1.000E+5	1.000E+5	1.0000
Nitrite oxidizing biomass (NOB)	1.000E+5	1.000E+5	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E+4	5.000E+4	1.0000
Polyphosphate accumulating organisms (PAO)	5.000E+4	5.000E+4	1.0000
Propionic acetogens	5.000E+4	5.000E+4	1.0000
Methanogens - acetoclastic	5.000E+4	5.000E+4	1.0000
Methanogens - hydrogenotrophic	5.000E+4	5.000E+4	1.0000
Endogenous products	3.000E+4	3.000E+4	1.0000
Slowly bio. COD (part.)	5000.0000	5000.0000	1.0000
Slowly bio. COD (colloid.)	4000.0000	4000.0000	1.0000
Part. inert. COD	5000.0000	5000.0000	1.0000
Part. bio. org. N	0	0	1.0000
Part. bio. org. P	0	0	1.0000
Part. inert N	0	0	1.0000
Part. inert P	0	0	1.0000
Stored PHA	5000.0000	5000.0000	1.0000
Releasable stored polyP	1.150E+6	1.150E+6	1.0000
Fixed stored polyP	1.150E+6	1.150E+6	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.000E+10	1.000E+10	1.0000

Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	1.300E+6	1.300E+6	1.0000
Struvite	8.500E+5	8.500E+5	1.0000
Hydroxy-dicalcium-phosphate	1.150E+6	1.150E+6	1.0000
Hydroxy-apatite	1.600E+6	1.600E+6	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.000E+10	1.000E+10	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	5.000E+4	5.000E+4	1.0000
User defined 4	5.000E+4	5.000E+4	1.0000
Dissolved oxygen	0	0	1.0000

Effective diffusivities [m2/s]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	5.000E-14	5.000E-14	1.0290
Methylotrophs	5.000E-14	5.000E-14	1.0290
Ammonia oxidizing biomass (AOB)	5.000E-14	5.000E-14	1.0290
Nitrite oxidizing biomass (NOB)	5.000E-14	5.000E-14	1.0290
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E-14	5.000E-14	1.0290
Polyphosphate accumulating organisms (PAO)	5.000E-14	5.000E-14	1.0290
Propionic acetogens	5.000E-14	5.000E-14	1.0290
Methanogens - acetoclastic	5.000E-14	5.000E-14	1.0290

Methanogens - hydrogenotrophic	5.000E-14	5.000E-14	1.0290
Endogenous products	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (part.)	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (colloid.)	5.000E-12	5.000E-12	1.0290
Part. inert. COD	5.000E-14	5.000E-14	1.0290
Part. bio. org. N	5.000E-14	5.000E-14	1.0290
Part. bio. org. P	5.000E-14	5.000E-14	1.0290
Part. inert N	5.000E-14	5.000E-14	1.0290
Part. inert P	5.000E-14	5.000E-14	1.0290
Stored PHA	5.000E-14	5.000E-14	1.0290
Releasable stored polyP	5.000E-14	5.000E-14	1.0290
Fixed stored polyP	5.000E-14	5.000E-14	1.0290
Readily bio. COD (complex)	6.900E-10	6.900E-10	1.0290
Acetate	1.240E-9	1.240E-9	1.0290
Propionate	8.300E-10	8.300E-10	1.0290
Methanol	1.600E-9	1.600E-9	1.0290
Dissolved H2	5.850E-9	5.850E-9	1.0290
Dissolved methane	1.963E-9	1.963E-9	1.0290
Ammonia N	2.000E-9	2.000E-9	1.0290
Sol. bio. org. N	1.370E-9	1.370E-9	1.0290
Nitrous Oxide N	1.607E-9	1.607E-9	1.0290
Nitrite N	2.980E-9	2.980E-9	1.0290
Nitrate N	2.980E-9	2.980E-9	1.0290
Dissolved nitrogen gas	1.900E-9	1.900E-9	1.0290
PO4-P (Sol. & Me Complexed)	2.000E-9	2.000E-9	1.0290
Sol. inert COD	6.900E-10	6.900E-10	1.0290
Sol. inert TKN	6.850E-10	6.850E-10	1.0290
ISS Influent	5.000E-14	5.000E-14	1.0290
Struvite	5.000E-14	5.000E-14	1.0290
Hydroxy-dicalcium-phosphate	5.000E-14	5.000E-14	1.0290
Hydroxy-apatite	5.000E-14	5.000E-14	1.0290

Magnesium	7.200E-10	7.200E-10	1.0290
Calcium	7.200E-10	7.200E-10	1.0290
Metal	4.800E-10	4.800E-10	1.0290
Other Cations (strong bases)	1.440E-9	1.440E-9	1.0290
Other Anions (strong acids)	1.440E-9	1.440E-9	1.0290
Total CO2	1.960E-9	1.960E-9	1.0290
User defined 1	6.900E-10	6.900E-10	1.0290
User defined 2	6.900E-10	6.900E-10	1.0290
User defined 3	5.000E-14	5.000E-14	1.0290
User defined 4	5.000E-14	5.000E-14	1.0290
Dissolved oxygen	2.500E-9	2.500E-9	1.0290

EPS Strength coefficients [ ]

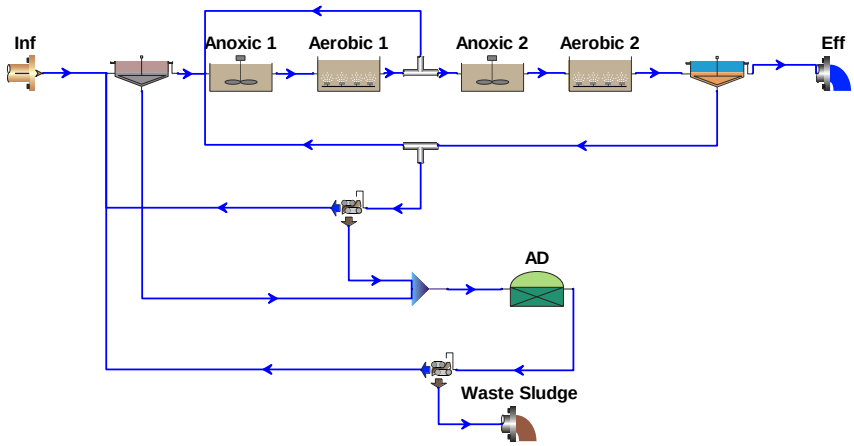
Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	1.0000	1.0000	1.0000
Methylotrophs	1.0000	1.0000	1.0000
Ammonia oxidizing biomass (AOB)	5.0000	1.0000	1.0000
Nitrite oxidizing biomass (NOB)	25.0000	1.0000	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	10.0000	1.0000	1.0000
Polyphosphate accumulating organisms (PAO)	1.0000	1.0000	1.0000
Propionic acetogens	1.0000	1.0000	1.0000
Methanogens - acetoclastic	1.0000	1.0000	1.0000
Methanogens - hydrogenotrophic	1.0000	1.0000	1.0000
Endogenous products	1.0000	1.0000	1.0000
Slowly bio. COD (part.)	1.0000	1.0000	1.0000
Slowly bio. COD (colloid.)	1.0000	1.0000	1.0000
Part. inert. COD	1.0000	1.0000	1.0000
Part. bio. org. N	1.0000	1.0000	1.0000

Part. bio. org. P	1.0000	1.0000	1.0000
Part. inert N	1.0000	1.0000	1.0000
Part. inert P	1.0000	1.0000	1.0000
Stored PHA	1.0000	1.0000	1.0000
Releasable stored polyP	1.0000	1.0000	1.0000
Fixed stored polyP	1.0000	1.0000	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.0000	1.0000	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	0.3300	0.3300	1.0000
Struvite	1.0000	1.0000	1.0000
Hydroxy-dicalcium-phosphate	1.0000	1.0000	1.0000
Hydroxy-apatite	1.0000	1.0000	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.0000	1.0000	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000

User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	1.0000	1.0000	1.0000
User defined 4	1.0000	1.0000	1.0000
Dissolved oxygen	0	0	1.0000

FAIRHAVEN, MA

Case Study No. 4
Bardenpho w/Anaerobic Digestion
Flow = 5.0 MGD @ 11^{0}C



Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Primary Clarifier 1,2	0.5565	6636.0000	11.210

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Primary Clarifier 1,2	Flowrate [Under]	0.016

Element name	Percent removal	Blanket fraction
Primary Clarifier 1,2	60.00	0.85

Configuration information for all Anaerobic Digester units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	Head space volume
AD	0.6200	4144.0975	20.000	0.5

Operating data Average (flow/time weighted as required)

Element name	Pressure [psi]	pH
AD	14.9	-

Element name	Average Temperature
AD	35.0

Configuration information for all Bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Anoxic 1	0.3112	3200.0000	13.000	Un-aerated
Aerobic 1	0.3112	3200.0000	13.000	456
Anoxic 2	0.3112	3200.0000	13.000	Un-aerated
Aerobic 2	0.2379	3180.0000	10.000	721

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
Anoxic 1	0
Aerobic 1	2.0
Anoxic 2	0
Aerobic 2	2.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^0.25 + k2	k2 in C = k1(PC)^0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	% of tank area covered by diffusers [%]
Anoxic 1	2.5656	0.0432	0.8200	0.4413	6.2900
Aerobic 1	2.5656	0.0432	0.8200	0.4413	6.2900
Anoxic 2	2.5656	0.0432	0.8200	0.4413	6.2900
Aerobic 2	2.5656	0.0432	0.8200	0.4413	10.0000

Configuration information for all BOD Influent units

Operating data Average (flow/time weighted as required)

Element name	Inf

Flow	5.00077666578962
Total Carbonaceous BOD mgBOD/L	94.00
Volatile suspended solids mgVSS/L	66.00
Total suspended solids mgTSS/L	88.00
Total Kjeldahl Nitrogen mgN/L	17.00
Total P mgP/L	5.00
Nitrate N mgN/L	0
pH	7.00
Alkalinity mmol/L	6.00
Calcium mg/L	80.00
Magnesium mg/L	15.00
Dissolved oxygen mg/L	4.20

Element name	Inf
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.1600
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1500
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.6580
Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0500
Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.1300
Fna - Ammonia [gNH3-N/gTKN]	0.6600
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.5000
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0350
Fpo4 - Phosphate [gPO4-P/gTP]	0.5000
FupP - P:COD ratio for unbiodegradable part. COD [gP/gCOD]	0.0110
FZbh - OHO COD fraction [gCOD/g of total COD]	1.000E-4
FZbm - Methylotroph COD fraction [gCOD/g of total COD]	1.000E-4
FZaob - AOB COD fraction [gCOD/g of total COD]	1.000E-4
FZnob - NOB COD fraction [gCOD/g of total COD]	1.000E-4
FZamob - ANAMMOX COD fraction [gCOD/g of total COD]	1.000E-4
FZbp - PAO COD fraction [gCOD/g of total COD]	1.000E-4
FZbpa - Propionic acetogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbam - Acetoclastic methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbhm - H2-utilizing methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZe - Endogenous products COD fraction [gCOD/g of total COD]	0

Configuration information for all Effluent units

Configuration information for all Ideal clarifier units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]

Sec. Clarifier 1,2	0.8593	8836.0000	13.000

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Sec. Clarifier 1,2	Flow paced	200.00 %

Element name	Average Temperature	Reactive	Percent removal	Blanket fraction
Sec. Clarifier 1,2	Uses global setting	No	99.95	0.05

Configuration information for all Dewatering unit units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Dewatering unit3	Flowrate [Under]	0.01
Dewatering unit32	Flowrate [Under]	0.01

Element name	Percent removal
Dewatering unit3	90.00
Dewatering unit32	95.00

Configuration information for all Sludge units

Configuration information for all Splitter units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
	Flowrate [Side]	0.053
Splitter8	Flow paced	200.00 %

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Elements	Total Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Nitrite N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]
Inf	94.00	88.02	11.22	0	0	17.00
Eff	2.44	4.13	2.58	0.08	1.52	3.95

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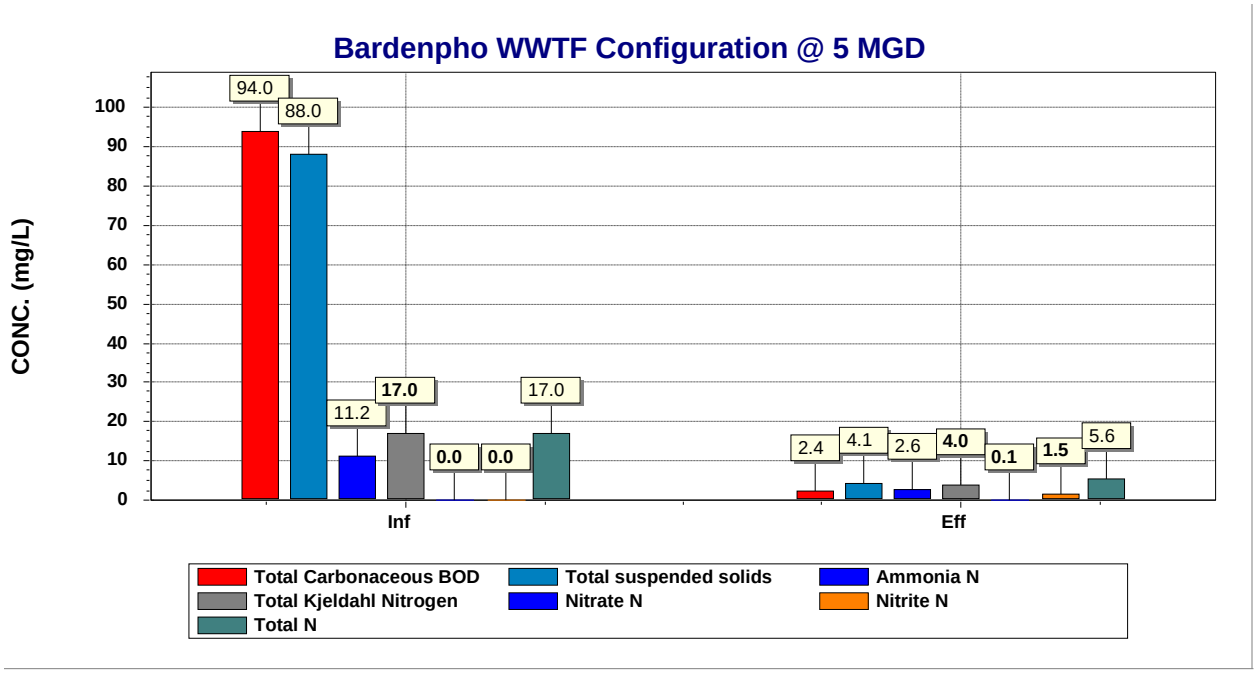

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Inf			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	66.00	2754.41	
Total suspended solids	88.02	3673.22	
Particulate COD	105.58	4406.17	
Filtered COD	81.43	3398.18	
Total COD	187.00	7804.35	
Soluble PO4-P	2.50	104.33	
Total P	5.00	208.67	
Filtered TKN	13.85	577.95	
Particulate TKN	3.15	131.52	
Total Kjeldahl Nitrogen	17.00	709.47	
Filtered Carbonaceous BOD	51.04	2130.05	
Total Carbonaceous BOD	94.00	3922.95	
Nitrite + Nitrate	0	0	
Total N	17.00	709.47	
Total inorganic N	11.22	468.25	
Alkalinity	6.00	113.58	mmol/L and kmol/d
pH	7.00		
Volatile fatty acids	4.49	187.30	
ISS precipitate	0	0	
ISS cellular	0.02	0.67	
ISS Total	22.02	918.81	
Ammonia N	11.22	468.25	

Nitrate N	0	0

Parameters	Value	Units

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Anoxic 1			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	1807.64	377044.20	
Total suspended solids	2751.26	573868.01	
Particulate COD	2647.63	552253.13	
Filtered COD	15.07	3143.16	
Total COD	2662.70	555396.29	
Soluble PO4-P	4.46	930.13	
Total P	144.35	30108.88	
Filtered TKN	6.50	1355.57	
Particulate TKN	160.05	33384.85	
Total Kjeldahl Nitrogen	166.55	34740.42	
Filtered Carbonaceous BOD	2.27	473.66	
Total Carbonaceous BOD	844.40	176128.77	
Nitrite + Nitrate	0.12	24.82	
Total N	166.67	34765.23	
Total inorganic N	5.47	1141.55	
Alkalinity	5.56	525.60	mmol/L and kmol/d
pH	7.04		
Volatile fatty acids	0.91	190.52	
ISS precipitate	0	0.00	
ISS cellular	391.40	81639.46	
ISS Total	943.62	196823.81	
Ammonia N	5.35	1116.73	
Nitrate N	0.00	0.60	

Parameters	Value	Units
Hydraulic residence time	0.3	hours
Velocity gradient	68.28	1/s
VSS destruction	0	%
Total solids mass	7145.02	lb
Total readily biodegradable COD	2.36	mg/L
OUR - Total	0.00	mgO/L/hr
OUR - Carbonaceous	0.00	mgO/L/hr
OUR - Nitrification	0.00	mgO/L/hr
Nit - Ammonia removal rate	0.00	mgN/L/hr

Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	0.00	mgN/L/hr
Nit - Nitrate production rate	0	mgN/L/hr
Denit - Nitrate removal rate	0.19	mgN/L/hr
Denit - Nitrite removal rate	3.26	mgN/L/hr
Denit - N2 production rate	3.44	mgN/L/hr
Off gas flow rate (dry)	2.18	ft3/min
Off gas Oxygen	0	%
Off gas Carbon dioxide	79.72	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	12.14	%
Off gas Methane	0.08	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	10.50	mg/L
OTR	0	lb/hr
SOTR	0	lb/hr
OTE	100.00	%
SOTE	100.00	%
Air flow rate	0	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0	ft3/min (20C, 1 atm)
# of diffusers	456.00	

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Aerobic 1			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	1805.40	376576.94	
Total suspended solids	2752.28	574081.60	
Particulate COD	2643.51	551395.05	
Filtered COD	12.74	2656.79	
Total COD	2656.25	554051.84	
Soluble PO4-P	3.49	726.94	
Total P	144.35	30108.88	
Filtered TKN	5.16	1075.79	
Particulate TKN	160.22	33419.85	
Total Kjeldahl Nitrogen	165.38	34495.64	
Filtered Carbonaceous BOD	1.43	299.11	
Total Carbonaceous BOD	841.18	175455.95	
Nitrite + Nitrate	1.26	263.06	
Total N	166.64	34758.70	
Total inorganic N	5.18	1080.54	
Alkalinity	5.37	508.42	mmol/L and kmol/d
pH	7.02		
Volatile fatty acids	0.08	16.05	

ISS precipitate	0	0.00
ISS cellular	394.66	82320.31
ISS Total	946.88	197504.66
Ammonia N	3.92	817.48
Nitrate N	0.06	13.40

Parameters	Value	Units
Hydraulic residence time	0.3	hours
Velocity gradient	144.29	1/s
VSS destruction	0.12	%
Total solids mass	7147.68	lb
Total readily biodegradable COD	1.95	mg/L
OUR - Total	30.73	mgO/L/hr
OUR - Carbonaceous	17.62	mgO/L/hr
OUR - Nitrification	13.11	mgO/L/hr
Nit - Ammonia removal rate	3.97	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	3.92	mgN/L/hr
Nit - Nitrate production rate	0.24	mgN/L/hr
Denit - Nitrate removal rate	0.04	mgN/L/hr
Denit - Nitrite removal rate	0.07	mgN/L/hr
Denit - N2 production rate	0.10	mgN/L/hr
Off gas flow rate (dry)	1123.77	ft3/min
Off gas Oxygen	19.21	%
Off gas Carbon dioxide	1.55	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.39	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	10.50	mg/L
OTR	97.20	lb/hr
SOTR	294.07	lb/hr
OTE	8.05	%
SOTE	24.93	%
Air flow rate	1156.08	ft3/min (20C, 1 atm)
Air flow rate / diffuser	2.54	ft3/min (20C, 1 atm)
# of diffusers	456.00	

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Anoxic 2			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	1804.11	225724.36	

Total suspended solids	2749.16	343967.11	
Particulate COD	2641.60	330509.27	
Filtered COD	12.73	1592.83	
Total COD	2654.33	332102.09	
Soluble PO4-P	4.09	511.77	
Total P	144.35	18060.51	
Filtered TKN	5.20	651.09	
Particulate TKN	160.18	20040.72	
Total Kjeldahl Nitrogen	165.38	20691.82	
Filtered Carbonaceous BOD	0.77	96.08	
Total Carbonaceous BOD	839.16	104993.59	
Nitrite + Nitrate	0.26	32.04	
Total N	165.64	20723.86	
Total inorganic N	4.53	567.28	
Alkalinity	5.47	310.40	mmol/L and kmol/d
pH	7.05		
Volatile fatty acids	0.29	35.93	
ISS precipitate	0	0.00	
ISS cellular	392.84	49150.57	
ISS Total	945.06	118242.75	
Ammonia N	4.28	535.24	
Nitrate N	0.00	0.43	

Parameters	Value	Units
Hydraulic residence time	0.5	hours
Velocity gradient	64.98	1/s
VSS destruction	0.07	%
Total solids mass	7139.58	lb
Total readily biodegradable COD	1.07	mg/L
OUR - Total	0.00	mgO/L/hr
OUR - Carbonaceous	0.00	mgO/L/hr
OUR - Nitrification	0.00	mgO/L/hr
Nit - Ammonia removal rate	0.00	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	0.00	mgN/L/hr
Nit - Nitrate production rate	0	mgN/L/hr
Denit - Nitrate removal rate	0.12	mgN/L/hr
Denit - Nitrite removal rate	1.90	mgN/L/hr
Denit - N2 production rate	2.02	mgN/L/hr
Off gas flow rate (dry)	2.08	ft3/min
Off gas Oxygen	0	%
Off gas Carbon dioxide	79.19	%
Off gas Ammonia	0.00	%

Off gas Hydrogen	10.39	%
Off gas Methane	0.06	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	10.50	mg/L
OTR	0	lb/hr
SOTR	0	lb/hr
OTE	100.00	%
SOTE	100.00	%
Air flow rate	0	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0	ft3/min (20C, 1 atm)
# of diffusers	456.00	

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Aerobic 2			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	1800.33	225251.59	
Total suspended solids	2749.44	344001.43	
Particulate COD	2635.05	329689.83	
Filtered COD	12.33	1542.22	
Total COD	2647.38	331232.05	
Soluble PO4-P	2.88	360.18	
Total P	144.35	18060.51	
Filtered TKN	3.71	464.50	
Particulate TKN	160.28	20053.65	
Total Kjeldahl Nitrogen	163.99	20518.14	
Filtered Carbonaceous BOD	1.18	148.13	
Total Carbonaceous BOD	835.80	104573.11	
Nitrite + Nitrate	1.61	201.15	
Total N	165.60	20719.29	
Total inorganic N	4.19	523.96	
Alkalinity	5.25	298.03	mmol/L and kmol/d
pH	7.03		
Volatile fatty acids	0.02	2.54	
ISS precipitate	0	0.00	
ISS cellular	396.89	49657.66	
ISS Total	949.11	118749.84	
Ammonia N	2.58	322.82	
Nitrate N	0.08	10.48	

Parameters	Value	Units
Hydraulic residence time	0.4	hours
Velocity gradient	129.58	1/s

VSS destruction	0.21	%
Total solids mass	5458.21	lb
Total readily biodegradable COD	1.68	mg/L
OUR - Total	27.96	mgO/L/hr
OUR - Carbonaceous	15.76	mgO/L/hr
OUR - Nitrification	12.20	mgO/L/hr
Nit - Ammonia removal rate	3.68	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	3.64	mgN/L/hr
Nit - Nitrate production rate	0.25	mgN/L/hr
Denit - Nitrate removal rate	0.04	mgN/L/hr
Denit - Nitrite removal rate	0.06	mgN/L/hr
Denit - N2 production rate	0.09	mgN/L/hr
Off gas flow rate (dry)	873.14	ft3/min
Off gas Oxygen	19.43	%
Off gas Carbon dioxide	1.36	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.25	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	10.23	mg/L
OTR	65.93	lb/hr
SOTR	200.71	lb/hr
OTE	7.03	%
SOTE	21.89	%
Air flow rate	898.56	ft3/min (20C, 1 atm)
Air flow rate / diffuser	1.25	ft3/min (20C, 1 atm)
# of diffusers	721.00	

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Sec. Clarifier 1,2			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	2.70	112.63	
Total suspended solids	4.13	172.00	
Particulate COD	3.96	164.84	
Filtered COD	12.33	513.39	
Total COD	16.28	678.23	
Soluble PO4-P	2.88	119.90	
Total P	3.09	128.75	
Filtered TKN	3.71	154.63	
Particulate TKN	0.24	10.03	
Total Kjeldahl Nitrogen	3.95	164.65	
Filtered Carbonaceous BOD	1.18	49.31	

Total Carbonaceous BOD	2.44	101.52	
Nitrite + Nitrate	1.61	66.96	
Total N	5.56	231.61	
Total inorganic N	4.19	174.42	
Alkalinity	5.25	99.21	mmol/L and kmol/d
pH	7.03		
Volatile fatty acids	0.02	0.85	
ISS precipitate	0	0.00	
ISS cellular	0.60	24.83	
ISS Total	1.43	59.37	
Ammonia N	2.58	107.46	
Nitrate N	0.08	3.49	

Parameters	Value	Units
Hydraulic residence time	1.38	hours
Percent removal	99.95	%
Height of specified concentration	0.65	ft
Total solids mass	1505.12	lb
Surface overflow rate	564.82	gal/(ft2 d)
Solids loading rate	38.93	lb/(ft2 d)

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Eff			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	2.70	112.63	
Total suspended solids	4.13	172.00	
Particulate COD	3.96	164.84	
Filtered COD	12.33	513.39	
Total COD	16.28	678.23	
Soluble PO4-P	2.88	119.90	
Total P	3.09	128.75	
Filtered TKN	3.71	154.63	
Particulate TKN	0.24	10.03	
Total Kjeldahl Nitrogen	3.95	164.65	
Filtered Carbonaceous BOD	1.18	49.31	
Total Carbonaceous BOD	2.44	101.52	
Nitrite + Nitrate	1.61	66.96	
Total N	5.56	231.61	
Total inorganic N	4.19	174.42	
Alkalinity	5.25	99.21	mmol/L and kmol/d
pH	7.03		
Volatile fatty acids	0.02	0.85	

ISS precipitate	0	0.00
ISS cellular	0.60	24.83
ISS Total	1.43	59.37
Ammonia N	2.58	107.46
Nitrate N	0.08	3.49

Parameters	Value	Units

Global Parameters

AOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9000	0.9000	1.0720
Substrate (NH4) half sat. [mgN/L]	0.7000	0.7000	1.0000
Byproduct NH4 logistic slope [-]	50.0000	50.0000	1.0000
Byproduct NH4 inflection point [mgN/L]	1.4000	1.4000	1.0000
AOB denite DO half sat. [mg/L]	0.1000	0.1000	1.0000
AOB denite HNO2 half sat. [mgN/L]	5.000E-6	5.000E-6	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiHNO2 [mmol/L]	0.0050	0.0050	1.0000

NOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.7000	0.7000	1.0600
Substrate (NO2) half sat. [mgN/L]	0.1000	0.1000	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290

Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiNH3 [mmol/L]	0.0750	0.0750	1.0000

ANAMMOX

Name	Default	Value	
Max. spec. growth rate [1/d]	0.1000	0.1000	1.1000
Substrate (NH4) half sat. [mgN/L]	2.0000	2.0000	1.0000
Substrate (NO2) half sat. [mgN/L]	1.0000	1.0000	1.0000
Aerobic decay rate [1/d]	0.0190	0.0190	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0095	0.0095	1.0290
Ki Nitrite [mgN/L]	1000.0000	1000.0000	1.0000
Nitrite sensitivity constant [L / (d mgN)]	0.0160	0.0160	1.0000

OHO

Name	Default	Value	
Max. spec. growth rate [1/d]	3.2000	3.2000	1.0290
Substrate half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Anoxic growth factor [-]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.6200	0.6200	1.0290
Anoxic decay rate [1/d]	0.2330	0.2330	1.0290
Anaerobic decay rate [1/d]	0.1310	0.1310	1.0290
Hydrolysis rate [1/d]	2.1000	2.1000	1.0290
Hydrolysis half sat. [-]	0.0600	0.0600	1.0000
Anoxic hydrolysis factor [-]	0.2800	0.2800	1.0000

Anaerobic hydrolysis factor (AS) [-]	0.0400	0.0400	1.0000
Anaerobic hydrolysis factor (AD) [-]	0.2000	0.5000	1.0000
Adsorption rate of colloids [L/(mgCOD d)]	0.1500	0.8000	1.0290
Ammonification rate [L/(mgN d)]	0.0400	0.0400	1.0290
Assimilative nitrate/nitrite reduction rate [1/d]	0.5000	0.5000	1.0000
Fermentation rate [1/d]	1.6000	3.2000	1.0290
Fermentation half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Fermentation growth factor (AS) [-]	0.2500	0.1250	1.0000
Endogenous products decay rate[1/d]	0	0	1.0000
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

Methylotrophs

Name	Default	Value	
Max. spec. growth rate [1/d]	1.3000	1.3000	1.0720
Methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.0400	0.0400	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0300	0.0300	1.0290
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

PAO

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9500	0.9500	1.0000
Max. spec. growth rate, P-limited [1/d]	0.4200	0.4200	1.0000
Substrate half sat. [mgCOD(PHB)/mgCOD(Zbp)]	0.1000	0.1000	1.0000

Substrate half sat., P-limited [mgCOD(PHB)/mgCOD(Zbp)]	0.0500	0.0500	1.0000
Magnesium half sat. [mgMg/L]	0.1000	0.1000	1.0000
Cation half sat. [mmol/L]	0.1000	0.1000	1.0000
Calcium half sat. [mgCa/L]	0.1000	0.1000	1.0000
Aerobic/anoxic decay rate [1/d]	0.1000	0.1000	1.0000
Aerobic/anoxic maintenance rate [1/d]	0	0	1.0000
Anaerobic decay rate [1/d]	0.0400	0.0400	1.0000
Anaerobic maintenance rate [1/d]	0	0	1.0000
Sequestration rate [1/d]	4.5000	6.0000	1.0000
Anoxic growth factor [-]	0.3300	0.3300	1.0000

Acetogens

Name	Default	Value	
Max. spec. growth rate [1/d]	0.2500	0.2500	1.0290
Substrate half sat. [mgCOD/L]	10.0000	10.0000	1.0000
Acetate inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Anaerobic decay rate [1/d]	0.0500	0.0500	1.0290
Aerobic/anoxic decay rate [1/d]	0.5200	0.5200	1.0290

Methanogens

Name	Default	Value	
Acetoclastic max. spec. growth rate [1/d]	0.3000	0.3000	1.0290
H2-utilizing max. spec. growth rate [1/d]	1.4000	1.4000	1.0290
Acetoclastic substrate half sat. [mgCOD/L]	100.0000	100.0000	1.0000
Acetoclastic methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000

H2-utilizing CO2 half sat. [mmol/L]	0.1000	0.1000	1.0000
H2-utilizing substrate half sat. [mgCOD/L]	0.1000	0.1000	1.0000
H2-utilizing methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Acetoclastic propionic inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Acetoclastic anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
Acetoclastic aerobic/anoxic decay rate [1/d]	0.6000	0.6000	1.0290
H2-utilizing anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
H2-utilizing aerobic/anoxic decay rate [1/d]	2.8000	0.6000	1.0290

pH

Name	Default	Value
OHO low pH limit [-]	4.0000	4.0000
OHO high pH limit [-]	10.0000	10.0000
Methylotrophs low pH limit [-]	4.0000	4.0000
Methylotrophs high pH limit [-]	10.0000	10.0000
Autotrophs low pH limit [-]	5.5000	5.5000
Autotrophs high pH limit [-]	9.5000	9.5000
PAO low pH limit [-]	4.0000	4.0000
PAO high pH limit [-]	10.0000	10.0000
OHO low pH limit (anaerobic) [-]	5.5000	5.5000
OHO high pH limit (anaerobic) [-]	8.5000	8.5000
Propionic acetogens low pH limit [-]	4.0000	4.0000
Propionic acetogens high pH limit [-]	10.0000	10.0000
Acetoclastic methanogens low pH limit [-]	5.0000	5.0000
Acetoclastic methanogens high pH limit [-]	9.0000	9.0000
H2-utilizing methanogens low pH limit [-]	5.0000	5.0000
H2-utilizing methanogens high pH limit [-]	9.0000	9.0000

Switches

Name	Default	Value
Aerobic/anoxic DO half sat. [mgO2/L]	0.0500	0.0500
Anoxic/anaerobic NOx half sat. [mgN/L]	0.1500	0.1500
AOB DO half sat. [mgO2/L]	0.2500	0.2500
NOB DO half sat. [mgO2/L]	0.5000	0.5000
ANAMMOX DO half sat. [mgO2/L]	0.0100	0.0100
Anoxic NO3(->NO2) half sat. [mgN/L]	0.1000	0.1000
Anoxic NO3(->N2) half sat. [mgN/L]	0.0500	0.0500
Anoxic NO2(->N2) half sat. (mgN/L)	0.0100	0.0100
NH3 nutrient half sat. [mgN/L]	0.0050	1.000E-4
PolyP half sat. [mgP/mgCOD]	0.0100	0.0100
VFA sequestration half sat. [mgCOD/L]	5.0000	5.0000
P uptake half sat. [mgP/L]	0.1500	0.1500
P nutrient half sat. [mgP/L]	0.0010	0.0010
Autotroph CO2 half sat. [mmol/L]	0.1000	0.1000
H2 low/high half sat. [mgCOD/L]	1.0000	1.0000
Propionic acetogens H2 inhibition [mgCOD/L]	5.0000	5.0000
Synthesis anion/cation half sat. [meq/L]	0.0100	0.0100

Common

Name	Default	Value
Biomass volatile fraction (VSS/TSS)	0.9200	0.9200
Endogenous residue volatile fraction (VSS/TSS)	0.9200	0.9200
N in endogenous residue [mgN/mgCOD]	0.0700	0.0700

P in endogenous residue [mgP/mgCOD]	0.0220	0.0220
Endogenous residue COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Particulate substrate COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000
Particulate inert COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000

AOB

Name	Default	Value
Yield [mgCOD/mgN]	0.1500	0.1500
AOB denite NO2 fraction as TEA [-]	0.5000	0.5000
Byproduct NH4 fraction to N2O [-]	0.0025	0.0025
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

NOB

Name	Default	Value
Yield [mgCOD/mgN]	0.0900	0.0900
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

ANAMMOX

Name	Default	Value
Yield [mgCOD/mgN]	0.1140	0.1140
Nitrate production [mgN/mgBiomassCOD]	2.2800	2.2800
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

OHO

Name	Default	Value
Yield (aerobic) [-]	0.6660	0.6660
Yield (fermentation, low H2) [-]	0.1000	0.1000
Yield (fermentation, high H2) [-]	0.1000	0.1000
H2 yield (fermentation low H2) [-]	0.3500	0.3500
H2 yield (fermentation high H2) [-]	0	0
Propionate yield (fermentation, low H2) [-]	0	0
Propionate yield (fermentation, high H2) [-]	0.7000	0.7000
CO2 yield (fermentation, low H2) [-]	0.7000	0.7000
CO2 yield (fermentation, high H2) [-]	0	0
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Endogenous fraction - aerobic [-]	0.0800	0.0800
Endogenous fraction - anoxic [-]	0.1030	0.1030
Endogenous fraction - anaerobic [-]	0.1840	0.1840
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

Yield (anoxic) [-]	0.5400	0.5400
Yield propionic (aerobic) [-]	0.6400	0.6400
Yield propionic (anoxic) [-]	0.4600	0.4600
Yield acetic (aerobic) [-]	0.6000	0.6000
Yield acetic (anoxic) [-]	0.4300	0.4300
Yield methanol (aerobic) [-]	0.5000	0.5000
Adsorp. max. [-]	1.0000	1.0000
Max fraction to N2O at high FNA over nitrate [-]	0.0500	0.0500
Max fraction to N2O at high FNA over nitrite [-]	0.1000	0.1000

Methylotrophs

Name	Default	Value
Yield (anoxic) [-]	0.4000	0.4000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Max fraction to N2O at high FNA over nitrate [-]	0.1000	0.1000
Max fraction to N2O at high FNA over nitrite [-]	0.1500	0.1500

PAO

Name	Default	Value
Yield (aerobic) [-]	0.6390	0.6390
Yield (anoxic) [-]	0.5200	0.5200
Aerobic P/PHA uptake [mgP/mgCOD]	0.9300	0.9500

Anoxic P/PHA uptake [mgP/mgCOD]	0.3500	0.3500
Yield of PHA on sequestration [-]	0.8890	0.8890
N in biomass [mgN/mgCOD]	0.0700	0.0700
N in sol. inert [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous part. [-]	0.2500	0.2500
Inert fraction of endogenous sol. [-]	0.2000	0.2000
P/Ac release ratio [mgP/mgCOD]	0.5100	0.4900
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield of low PP [-]	0.9400	0.9400

Acetogens

Name	Default	Value
Yield [-]	0.1000	0.1000
H2 yield [-]	0.4000	0.4000
CO2 yield [-]	1.0000	1.0000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

Methanogens

Name	Default	Value
Acetoclastic yield [-]	0.1000	0.1000
Methanol acetoclastic yield [-]	0.1000	0.1000

H2-utilizing yield [-]	0.1000	0.1000
Methanol H2-utilizing yield [-]	0.1000	0.1000
N in acetoclastic biomass [mgN/mgCOD]	0.0700	0.0700
N in H2-utilizing biomass [mgN/mgCOD]	0.0700	0.0700
P in acetoclastic biomass [mgP/mgCOD]	0.0220	0.0220
P in H2-utilizing biomass [mgP/mgCOD]	0.0220	0.0220
Acetoclastic fraction to endog. residue [-]	0.0800	0.0800
H2-utilizing fraction to endog. residue [-]	0.0800	0.0800
Acetoclastic COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
H2-utilizing COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

General

Name	Default	Value
Molecular weight of other anions [mg/mmol]	35.5000	35.5000
Molecular weight of other cations [mg/mmol]	39.1000	39.1000
Mg to P mole ratio in polyphosphate [mmolMg/mmolP]	0.3000	0.3000
Cation to P mole ratio in polyphosphate [meq/mmolP]	0.1500	0.3000
Ca to P mole ratio in polyphosphate [mmolCa/mmolP]	0.0500	0.0500
Cation to P mole ratio in organic phosphate [meq/mmolP]	0.0100	0.0100
Bubble rise velocity (anaerobic digester) [cm/s]	23.9000	23.9000
Bubble Sauter mean diameter (anaerobic digester) [cm]	0.3500	0.3500
Anaerobic digester gas hold-up factor []	1.0000	1.0000
Tank head loss per metre of length (from flow) [m/m]	0.0025	0.0025

Mass transfer

Name	Default	Value	
Kl for H2 [m/d]	17.0000	17.0000	1.0240
Kl for CO2 [m/d]	10.0000	10.0000	1.0240
Kl for NH3 [m/d]	1.0000	1.0000	1.0240
Kl for CH4 [m/d]	8.0000	8.0000	1.0240
Kl for N2 [m/d]	15.0000	15.0000	1.0240
Kl for N2O [m/d]	8.0000	8.0000	1.0240
Kl for O2 [m/d]	13.0000	13.0000	1.0240

Henry's law constants

Name	Default	Value	
CO2 [M/atm]	0.0340	0.0340	2400.0000
O2 [M/atm]	0.0013	0.0013	1500.0000
N2 [M/atm]	6.500E-4	6.500E-4	1300.0000
N2O [M/atm]	0.0250	0.0250	2600.0000
NH3 [M/atm]	58.0000	58.0000	4100.0000
CH4 [M/atm]	0.0014	0.0014	1600.0000
H2 [M/atm]	7.800E-4	7.800E-4	500.0000

Physico-chemical rates

Name	Default	Value	
Struvite precipitation rate [1/d]	3.000E+10	3.000E+10	1.0240
Struvite redissolution rate [1/d]	3.000E+11	3.000E+11	1.0240
Struvite half sat. [mgTSS/L]	1.0000	1.0000	1.0000
HDP precipitation rate [L/(molP d)]	1.000E+8	1.000E+8	1.0000

HDP redissolution rate [L/(mol P d)]	1.000E+8	1.000E+8	1.0000
HAP precipitation rate [molHDP/(L d)]	5.000E-4	5.000E-4	1.0000

Physico-chemical constants

Name	Default	Value
Struvite solubility constant [mol/L]	6.918E-14	6.918E-14
HDP solubility product [mol/L]	2.750E-22	2.750E-22
HDP half sat. [mgTSS/L]	1.0000	1.0000
Equilibrium soluble PO4 with Al dosing at pH 7 [mgP/L]	0.0100	0.0100
Al to P ratio [molAl/molP]	0.8000	0.8000
Al(OH)3 solubility product [mol/L]	1.259E+9	1.259E+9
AlHPO4+ dissociation constant [mol/L]	7.943E-13	7.943E-13
Equilibrium soluble PO4 with Fe dosing at pH 7 [mgP/L]	0.0100	0.0100
Fe to P ratio [molFe/molP]	1.6000	1.6000
Fe(OH)3 solubility product [mol/L]	0.0500	0.0500
FeH2PO4++ dissociation constant [mol/L]	5.012E-22	5.012E-22

Aeration

Name	Default	Value
Alpha (surf) OR Alpha F (diff) [-]	0.5000	0.5000
Beta [-]	0.9500	0.9500
Surface pressure [kPa]	101.3250	101.3250
Fractional effective saturation depth (Fed) [-]	0.3250	0.3250
Supply gas CO2 content [vol. %]	0.0350	0.0350
Supply gas O2 [vol. %]	20.9500	20.9500

Off-gas CO2 [vol. %]	2.0000	2.0000
Off-gas O2 [vol. %]	18.8000	18.8000
Off-gas H2 [vol. %]	0	0
Off-gas NH3 [vol. %]	0	0
Off-gas CH4 [vol. %]	0	0
Surface turbulence factor [-]	2.0000	2.0000
Set point controller gain []	1.0000	1.0000

Modified Vesilind

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.387	0.387
Vesilind hindered zone settling parameter (K) [L/g]	0.370	0.370
Clarification switching function [mg/L]	100.000	100.000
Specified TSS conc.for height calc. [mg/L]	2500.000	2500.000
Maximum compactability constant [mg/L]	15000.000	15000.000

Double exponential

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.934	0.934
Maximum (practical) settling velocity (Vo') [ft/min]	0.615	0.615
Hindered zone settling parameter (Kh) [L/g]	0.400	0.400
Flocculent zone settling parameter (Kf) [L/g]	2.500	2.500
Maximum non-settleable TSS [mg/L]	20.0000	20.0000
Non-settleable fraction [-]	0.0010	0.0010
Specified TSS conc. for height calc. [mg/L]	2500.0000	2500.0000

Emission factors

Name	Default	Value
Carbon dioxide equivalence of nitrous oxide	296.0000	296.0000
Carbon dioxide equivalence of methane	23.0000	23.0000

Biofilm general

Name	Default	Value	
Attachment rate [g / (m2 d)]	80.0000	80.0000	1.0000
Attachment TSS half sat. [mg/L]	100.0000	100.0000	1.0000
Detachment rate [g/(m3 d)]	8.000E+4	8.000E+4	1.0000
Solids movement factor []	10.0000	10.0000	1.0000
Diffusion neta []	0.8000	0.8000	1.0000
Thin film limit [mm]	0.5000	0.5000	1.0000
Thick film limit [mm]	3.0000	3.0000	1.0000
Assumed Film thickness for tank volume correction (temp independant) [mm]	0.7500	0.7500	1.0000
Film surface area to media area ratio - Max.[ ]	1.0000	1.0000	1.0000
Minimum biofilm conc. for streamer formation [gTSS/m2]	4.0000	4.0000	1.0000

Maximum biofilm concentrations [mg/L]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	5.000E+4	5.000E+4	1.0000

Methylotrophs	5.000E+4	5.000E+4	1.0000
Ammonia oxidizing biomass (AOB)	1.000E+5	1.000E+5	1.0000
Nitrite oxidizing biomass (NOB)	1.000E+5	1.000E+5	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E+4	5.000E+4	1.0000
Polyphosphate accumulating organisms (PAO)	5.000E+4	5.000E+4	1.0000
Propionic acetogens	5.000E+4	5.000E+4	1.0000
Methanogens - acetoclastic	5.000E+4	5.000E+4	1.0000
Methanogens - hydrogenotrophic	5.000E+4	5.000E+4	1.0000
Endogenous products	3.000E+4	3.000E+4	1.0000
Slowly bio. COD (part.)	5000.0000	5000.0000	1.0000
Slowly bio. COD (colloid.)	4000.0000	4000.0000	1.0000
Part. inert. COD	5000.0000	5000.0000	1.0000
Part. bio. org. N	0	0	1.0000
Part. bio. org. P	0	0	1.0000
Part. inert N	0	0	1.0000
Part. inert P	0	0	1.0000
Stored PHA	5000.0000	5000.0000	1.0000
Releasable stored polyP	1.150E+6	1.150E+6	1.0000
Fixed stored polyP	1.150E+6	1.150E+6	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000

PO4-P (Sol. & Me Complexed)	1.000E+10	1.000E+10	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	1.300E+6	1.300E+6	1.0000
Struvite	8.500E+5	8.500E+5	1.0000
Hydroxy-dicalcium-phosphate	1.150E+6	1.150E+6	1.0000
Hydroxy-apatite	1.600E+6	1.600E+6	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.000E+10	1.000E+10	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	5.000E+4	5.000E+4	1.0000
User defined 4	5.000E+4	5.000E+4	1.0000
Dissolved oxygen	0	0	1.0000

Effective diffusivities [m2/s]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	5.000E-14	5.000E-14	1.0290
Methylotrophs	5.000E-14	5.000E-14	1.0290
Ammonia oxidizing biomass (AOB)	5.000E-14	5.000E-14	1.0290
Nitrite oxidizing biomass (NOB)	5.000E-14	5.000E-14	1.0290
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E-14	5.000E-14	1.0290
Polyphosphate accumulating organisms (PAO)	5.000E-14	5.000E-14	1.0290
Propionic acetogens	5.000E-14	5.000E-14	1.0290

Methanogens - acetoclastic	5.000E-14	5.000E-14	1.0290
Methanogens - hydrogenotrophic	5.000E-14	5.000E-14	1.0290
Endogenous products	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (part.)	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (colloid.)	5.000E-12	5.000E-12	1.0290
Part. inert. COD	5.000E-14	5.000E-14	1.0290
Part. bio. org. N	5.000E-14	5.000E-14	1.0290
Part. bio. org. P	5.000E-14	5.000E-14	1.0290
Part. inert N	5.000E-14	5.000E-14	1.0290
Part. inert P	5.000E-14	5.000E-14	1.0290
Stored PHA	5.000E-14	5.000E-14	1.0290
Releasable stored polyP	5.000E-14	5.000E-14	1.0290
Fixed stored polyP	5.000E-14	5.000E-14	1.0290
Readily bio. COD (complex)	6.900E-10	6.900E-10	1.0290
Acetate	1.240E-9	1.240E-9	1.0290
Propionate	8.300E-10	8.300E-10	1.0290
Methanol	1.600E-9	1.600E-9	1.0290
Dissolved H2	5.850E-9	5.850E-9	1.0290
Dissolved methane	1.963E-9	1.963E-9	1.0290
Ammonia N	2.000E-9	2.000E-9	1.0290
Sol. bio. org. N	1.370E-9	1.370E-9	1.0290
Nitrous Oxide N	1.607E-9	1.607E-9	1.0290
Nitrite N	2.980E-9	2.980E-9	1.0290
Nitrate N	2.980E-9	2.980E-9	1.0290
Dissolved nitrogen gas	1.900E-9	1.900E-9	1.0290
PO4-P (Sol. & Me Complexed)	2.000E-9	2.000E-9	1.0290
Sol. inert COD	6.900E-10	6.900E-10	1.0290
Sol. inert TKN	6.850E-10	6.850E-10	1.0290
ISS Influent	5.000E-14	5.000E-14	1.0290
Struvite	5.000E-14	5.000E-14	1.0290
Hydroxy-dicalcium-phosphate	5.000E-14	5.000E-14	1.0290

Hydroxy-apatite	5.000E-14	5.000E-14	1.0290
Magnesium	7.200E-10	7.200E-10	1.0290
Calcium	7.200E-10	7.200E-10	1.0290
Metal	4.800E-10	4.800E-10	1.0290
Other Cations (strong bases)	1.440E-9	1.440E-9	1.0290
Other Anions (strong acids)	1.440E-9	1.440E-9	1.0290
Total CO2	1.960E-9	1.960E-9	1.0290
User defined 1	6.900E-10	6.900E-10	1.0290
User defined 2	6.900E-10	6.900E-10	1.0290
User defined 3	5.000E-14	5.000E-14	1.0290
User defined 4	5.000E-14	5.000E-14	1.0290
Dissolved oxygen	2.500E-9	2.500E-9	1.0290

EPS Strength coefficients [ ]

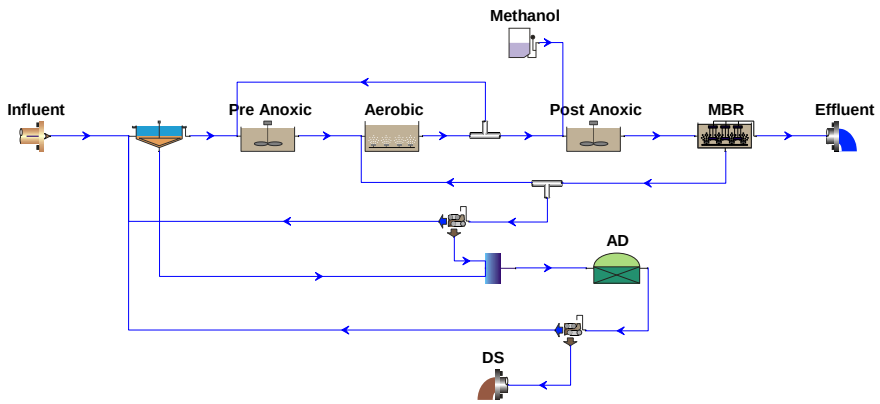
Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	1.0000	1.0000	1.0000
Methylotrophs	1.0000	1.0000	1.0000
Ammonia oxidizing biomass (AOB)	5.0000	1.0000	1.0000
Nitrite oxidizing biomass (NOB)	25.0000	1.0000	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	10.0000	1.0000	1.0000
Polyphosphate accumulating organisms (PAO)	1.0000	1.0000	1.0000
Propionic acetogens	1.0000	1.0000	1.0000
Methanogens - acetoclastic	1.0000	1.0000	1.0000
Methanogens - hydrogenotrophic	1.0000	1.0000	1.0000
Endogenous products	1.0000	1.0000	1.0000
Slowly bio. COD (part.)	1.0000	1.0000	1.0000
Slowly bio. COD (colloid.)	1.0000	1.0000	1.0000
Part. inert. COD	1.0000	1.0000	1.0000

Part. bio. org. N	1.0000	1.0000	1.0000
Part. bio. org. P	1.0000	1.0000	1.0000
Part. inert N	1.0000	1.0000	1.0000
Part. inert P	1.0000	1.0000	1.0000
Stored PHA	1.0000	1.0000	1.0000
Releasable stored polyP	1.0000	1.0000	1.0000
Fixed stored polyP	1.0000	1.0000	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.0000	1.0000	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	0.3300	0.3300	1.0000
Struvite	1.0000	1.0000	1.0000
Hydroxy-dicalcium-phosphate	1.0000	1.0000	1.0000
Hydroxy-apatite	1.0000	1.0000	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.0000	1.0000	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000

Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	1.0000	1.0000	1.0000
User defined 4	1.0000	1.0000	1.0000
Dissolved oxygen	0	0	1.0000

FAIRHAVEN, MA

Case Study No. 5
Bardenpho/MBR w/Anaerobic Digestion
Flow = 5.0 MGD @ 18^{0}C



Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	Head space volume
AD	0.6200	4144.0975	20.000	0.5

Operating data Average (flow/time weighted as required)

Element name	Pressure [psi]	pH
AD	14.9	-

Element name	Average Temperature
AD	35.0

Configuration information for all Bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Pre Anoxic	0.3112	3200.0000	13.000	Un-aerated
Post Anoxic	0.4297	4418.6568	13.000	Un-aerated
Aerobic	0.8600	9580.0000	12.000	1365

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
Pre Anoxic	0
Post Anoxic	0
Aerobic	2.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^0.25 + k2	k2 in C = k1(PC)^0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	% of tank area covered by diffusers [%]
Pre Anoxic	2.5656	0.0432	0.8200	0.4413	6.2900
Post Anoxic	2.5656	0.0432	0.8200	0.4413	10.0000
Aerobic	2.5656	0.0432	0.8200	0.4413	6.2900

Configuration information for all Membrane bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers	# of cassettes	Displaced volume / cassette [ft3/cassette]	Membrane area / cassette [ft2/cassette]	Total displaced volume [Mil. Gal]	Membrane surface area [ft2]
MBR	0.1777	1980.0000	12.000	552	26.00	59.682	16320.03	0.01	424320.70

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
MBR	Flow paced	200.00 %

Element name	Average Air flow rate [ft3/min (20C, 1 atm)]
MBR	5407.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^0.25 + k2	k2 in C = k1(PC)^0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	% of tank area covered by diffusers [%]
MBR	0.0500	0.3800	1.0500	0.5382	15.0000

Element name	Alpha (surf) OR Alpha F (diff) [-]	Beta [-]	Surface pressure [kPa]	Fractional effective saturation depth (Fed) [-]
MBR	0.7000	0.9500	101.3250	0.3000

Element name	Supply gas CO2 content [vol. %]	Supply gas O2 [vol. %]	Off-gas CO2 [vol. %]	Off-gas O2 [vol. %]	Off-gas H2 [vol. %]	Off-gas NH3 [vol. %]	Off-gas CH4 [vol. %]	Surface turbulence factor [-]
MBR	0.0350	20.9500	1.2000	19.9000	0	0	0	2.0000

Configuration information for all BOD Influent units

Operating data Average (flow/time weighted as required)

Element name	Influent

Flow	5
Total Carbonaceous BOD mgBOD/L	180.00
Volatile suspended solids mgVSS/L	110.00
Total suspended solids mgTSS/L	145.00
Total Kjeldahl Nitrogen mgN/L	36.00
Total P mgP/L	5.00
Nitrate N mgN/L	0
pH	7.00
Alkalinity mmol/L	6.00
Calcium mg/L	80.00
Magnesium mg/L	15.00
Dissolved oxygen mg/L	1.10

Element name	Influent
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.1600
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1500
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.5472
Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0500
Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.1300
Fna - Ammonia [gNH3-N/gTKN]	0.6600
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.5000
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0350
Fpo4 - Phosphate [gPO4-P/gTP]	0.5000
FupP - P:COD ratio for unbiodegradable part. COD [gP/gCOD]	0.0110
FZbh - OHO COD fraction [gCOD/g of total COD]	0.0200
FZbm - Methylotroph COD fraction [gCOD/g of total COD]	1.000E-4
FZaob - AOB COD fraction [gCOD/g of total COD]	1.000E-4
FZnob - NOB COD fraction [gCOD/g of total COD]	1.000E-4
FZamob - ANAMMOX COD fraction [gCOD/g of total COD]	1.000E-4
FZbp - PAO COD fraction [gCOD/g of total COD]	1.000E-4
FZbpa - Propionic acetogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbam - Acetoclastic methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbhm - H2-utilizing methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZe - Endogenous products COD fraction [gCOD/g of total COD]	0

Configuration information for all Methanol addition units

Operating data Average (flow/time weighted as required)

Element name	Methanol
Ordinary heterotrophic organisms (OHO) mgCOD/L	0
Methylotrophs mgCOD/L	0
Ammonia oxidizing biomass (AOB) mgCOD/L	0
Nitrite oxidizing biomass (NOB) mgCOD/L	0

Anaerobic ammonia oxidizers (ANAMMOX) mgCOD/L	0
Polyphosphate accumulating organisms (PAO) mgCOD/L	0
Propionic acetogens mgCOD/L	0
Methanogens - acetoclastic mgCOD/L	0
Methanogens - hydrogenotrophic mgCOD/L	0
Endogenous products mgCOD/L	0
Slowly bio. COD (part.) mgCOD/L	0
Slowly bio. COD (colloid.) mgCOD/L	0
Part. inert. COD mgCOD/L	0
Part. bio. org. N mgN/L	0
Part. bio. org. P mgP/L	0
Part. inert N mgN/L	0
Part. inert P mgP/L	0
Stored PHA mgCOD/L	0
Releasable stored polyP mgP/L	0
Fixed stored polyP mgP/L	0
Readily bio. COD (complex) mgCOD/L	0
Acetate mgCOD/L	0
Propionate mgCOD/L	0
Methanol mgCOD/L	1188000.00
Dissolved H2 mgCOD/L	0
Dissolved methane mg/L	0
Ammonia N mgN/L	0
Sol. bio. org. N mgN/L	0
Nitrous Oxide N mgN/L	0
Nitrite N mgN/L	0
Nitrate N mgN/L	0
Dissolved nitrogen gas mgN/L	0
PO4-P (Sol. & Me Complexed) mgP/L	0
Sol. inert COD mgCOD/L	0
Sol. inert TKN mgN/L	0
ISS Influent mgISS/L	0
Struvite mgISS/L	0
Hydroxy-dicalcium-phosphate mgISS/L	0
Hydroxy-apatite mgISS/L	0
Magnesium mg/L	0
Calcium mg/L	0
Metal mg/L	0
Other Cations (strong bases) meq/L	0
Other Anions (strong acids) meq/L	0
Total CO2 mmol/L	0
User defined 1 mg/L	0
User defined 2 mg/L	0
User defined 3 mgVSS/L	0

User defined 4 mgISS/L	0
Dissolved oxygen mg/L	0
Flow	0.00025

Configuration information for all Effluent units

Configuration information for all Ideal clarifier units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Ideal clarifier1	0.5460	6636.0000	11.000

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Ideal clarifier1	Flowrate [Under]	0.01

Element name	Average Temperature	Reactive	Percent removal	Blanket fraction
Ideal clarifier1	Uses global setting	No	50.00	0.50

Configuration information for all Dewatering unit units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Dewatering unit25	Flowrate [Under]	0.016
Dewatering unit29	Flowrate [Under]	0.0026

Element name	Percent removal
Dewatering unit25	90.00
Dewatering unit29	95.00

Configuration information for all Sludge units

Configuration information for all Splitter units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
	Flowrate [Side]	0.083
	Flow paced	200.00 %

BioWin Album

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Influent			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	110.00	4589.97	

Total suspended solids	145.46	6069.45	
Particulate COD	175.08	7305.48	
Filtered COD	174.68	7288.75	
Total COD	349.75	14594.23	
Soluble PO4-P	2.50	104.32	
Total P	5.00	208.64	
Filtered TKN	29.19	1218.00	
Particulate TKN	6.81	284.17	
Total Kjeldahl Nitrogen	36.00	1502.17	
Filtered Carbonaceous BOD	111.27	4643.00	
Total Carbonaceous BOD	180.00	7510.86	
Nitrite + Nitrate	0	0	
Total N	36.00	1502.17	
Total inorganic N	23.76	991.43	
Alkalinity	6.00	113.56	mmol/L and kmol/d
pH	7.00		
Volatile fatty acids	8.39	350.26	
ISS precipitate	0	0	
ISS cellular	0.46	19.04	
ISS Total	35.46	1479.48	
Ammonia N	23.76	991.43	
Nitrate N	0	0	
Parameters	Value	Units	

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Elements	Total Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Nitrite N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]
Influent	180.00	145.46	23.76	0	0	36.00	36.00
Effluent	0.88	0.00	0.09	0.95	0.02	1.77	2.73

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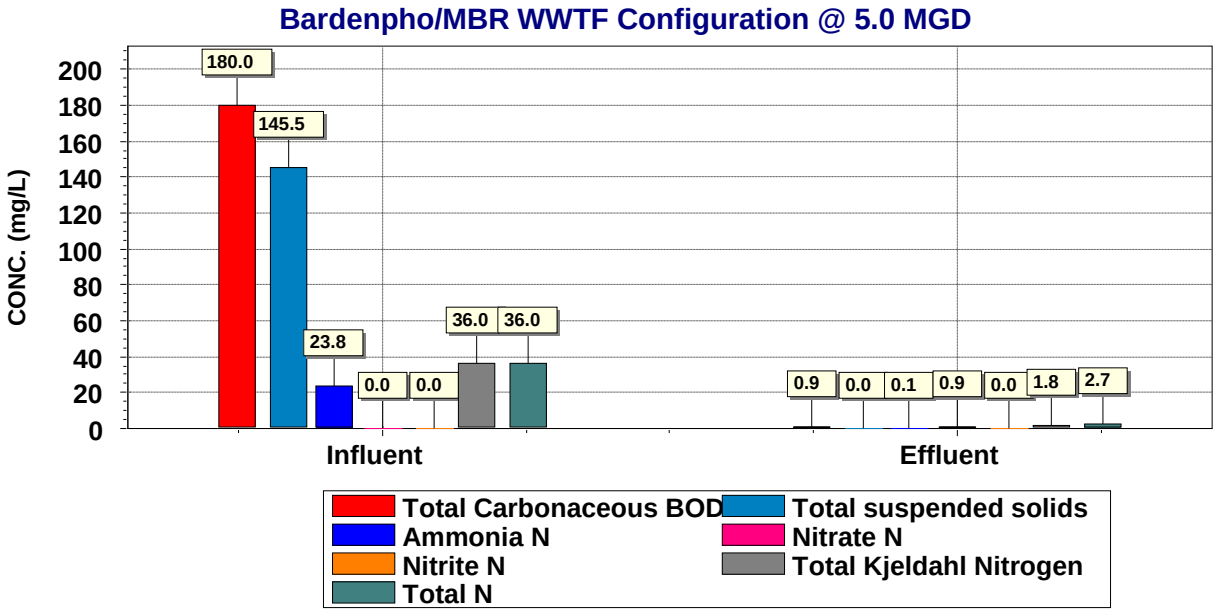

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Ideal clarifier1

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	59.55	2524.71	
Total suspended solids	79.19	3357.40	
Particulate COD	94.14	3991.20	
Filtered COD	172.42	7310.37	
Total COD	266.56	11301.57	
Soluble PO4-P	3.97	168.11	
Total P	5.34	226.56	
Filtered TKN	32.86	1393.24	
Particulate TKN	3.82	162.07	
Total Kjeldahl Nitrogen	36.68	1555.32	
Filtered Carbonaceous BOD	109.69	4650.50	
Total Carbonaceous BOD	145.45	6166.67	
Nitrite + Nitrate	0.01	0.54	
Total N	36.70	1555.86	
Total inorganic N	27.51	1166.49	
Alkalinity	6.22	119.58	mmol/L and kmol/d
pH	7.00		
Volatile fatty acids	8.76	371.51	
ISS precipitate	0	0.00	
ISS cellular	0.56	23.59	
ISS Total	19.64	832.70	
Ammonia N	27.50	1165.95	

Nitrate N	0.01	0.53

Parameters	Value	Units
Hydraulic residence time	2.57	hours
Percent removal	50.00	%
Height of specified concentration	5.50	ft
Total solids mass	91845.58	lb
Surface overflow rate	765.58	gal/(ft2 d)
Solids loading rate	1.01	lb/(ft2 d)

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Pre Anoxic

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	2077.11	261408.09	
Total suspended solids	2736.66	344414.68	
Particulate COD	3040.90	382702.84	
Filtered COD	23.67	2978.58	
Total COD	3064.56	385681.41	
Soluble PO4-P	3.33	419.43	
Total P	61.52	7742.41	
Filtered TKN	12.17	1531.43	
Particulate TKN	184.66	23239.88	
Total Kjeldahl Nitrogen	196.83	24771.31	
Filtered Carbonaceous BOD	3.75	472.45	
Total Carbonaceous BOD	945.30	118968.12	
Nitrite + Nitrate	0.60	75.18	
Total N	197.43	24846.49	
Total inorganic N	10.60	1334.42	
Alkalinity	4.98	284.36	mmol/L and kmol/d
pH	6.97		
Volatile fatty acids	0.65	81.85	
ISS precipitate	0	0.00	
ISS cellular	136.65	17197.37	
ISS Total	659.56	83006.60	
Ammonia N	10.01	1259.24	
Nitrate N	0.54	67.50	

Parameters	Value	Units
Hydraulic residence time	0.5	hours
Velocity gradient	71.51	1/s
VSS destruction	0	%
Total solids mass	7107.12	lb

Total readily biodegradable COD	3.03	mg/L
OUR - Total	3.46	mgO/L/hr
OUR - Carbonaceous	2.81	mgO/L/hr
OUR - Nitrification	0.65	mgO/L/hr
Nit - Ammonia removal rate	0.19	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	0.19	mgN/L/hr
Nit - Nitrate production rate	0.03	mgN/L/hr
Denit - Nitrate removal rate	6.46	mgN/L/hr
Denit - Nitrite removal rate	3.32	mgN/L/hr
Denit - N2 production rate	6.86	mgN/L/hr
Off gas flow rate (dry)	2.50	ft3/min
Off gas Oxygen	0	%
Off gas Carbon dioxide	77.17	%
Off gas Ammonia	0.01	%
Off gas Hydrogen	6.24	%
Off gas Methane	0.13	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	9.19	mg/L
OTR	0	lb/hr
SOTR	0	lb/hr
OTE	100.00	%
SOTE	100.00	%
Air flow rate	0	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0	ft3/min (20C, 1 atm)
# of diffusers	456.00	

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Aerobic

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	3067.16	639850.82	
Total suspended solids	4051.09	845112.42	
Particulate COD	4483.57	935333.83	
Filtered COD	18.97	3957.57	
Total COD	4502.55	939291.40	
Soluble PO4-P	3.29	686.62	
Total P	90.06	18787.66	
Filtered TKN	2.72	568.02	
Particulate TKN	275.61	57495.30	
Total Kjeldahl Nitrogen	278.33	58063.32	
Filtered Carbonaceous BOD	1.00	208.52	
Total Carbonaceous BOD	1374.11	286658.16	
Nitrite + Nitrate	5.88	1225.61	
Total N	284.20	59288.93	

Total inorganic N	6.66	1388.86	
Alkalinity	3.95	373.73	mmol/L and kmol/d
pH	6.90		
Volatile fatty acids	0.01	1.93	
ISS precipitate	0	0.00	
ISS cellular	205.06	42778.20	
ISS Total	983.93	205261.60	
Ammonia N	0.78	163.25	
Nitrate N	5.61	1169.37	

Parameters	Value	Units
Hydraulic residence time	0.8	hours
Velocity gradient	183.31	1/s
VSS destruction	0.29	%
Total solids mass	29073.55	lb
Total readily biodegradable COD	1.38	mg/L
OUR - Total	49.15	mgO/L/hr
OUR - Carbonaceous	21.84	mgO/L/hr
OUR - Nitrification	27.31	mgO/L/hr
Nit - Ammonia removal rate	6.44	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	6.38	mgN/L/hr
Nit - Nitrate production rate	6.10	mgN/L/hr
Denit - Nitrate removal rate	0.16	mgN/L/hr
Denit - Nitrite removal rate	0.08	mgN/L/hr
Denit - N2 production rate	0.16	mgN/L/hr
Off gas flow rate (dry)	4773.23	ft3/min
Off gas Oxygen	19.49	%
Off gas Carbon dioxide	1.44	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.04	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	9.11	mg/L
OTR	347.10	lb/hr
SOTR	1053.77	lb/hr
OTE	6.92	%
SOTE	21.50	%
Air flow rate	4802.52	ft3/min (20C, 1 atm)
Air flow rate / diffuser	3.52	ft3/min (20C, 1 atm)
# of diffusers	1365.00	

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Post Anoxic			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	3068.91	384109.73	
Total suspended solids	4053.12	507295.01	
Particulate COD	4485.77	561446.00	
Filtered COD	19.24	2407.49	
Total COD	4505.01	563853.48	
Soluble PO4-P	3.16	396.11	
Total P	90.06	11271.82	
Filtered TKN	2.20	275.90	
Particulate TKN	276.02	34547.48	
Total Kjeldahl Nitrogen	278.23	34823.37	
Filtered Carbonaceous BOD	0.74	92.68	
Total Carbonaceous BOD	1374.49	172033.52	
Nitrite + Nitrate	0.41	51.00	
Total N	278.64	34874.37	
Total inorganic N	1.22	153.01	
Alkalinity	4.35	246.73	mmol/L and kmol/d
pH	6.92		
Volatile fatty acids	0.11	13.67	
ISS precipitate	0	0.00	
ISS cellular	205.35	25702.00	
ISS Total	984.21	123185.28	
Ammonia N	0.82	102.01	
Nitrate N	0.39	49.03	

Parameters	Value	Units
Hydraulic residence time	0.7	hours
Velocity gradient	71.58	1/s
VSS destruction	0	%
Total solids mass	14534.59	lb
Total readily biodegradable COD	1.00	mg/L
OUR - Total	2.90	mgO/L/hr
OUR - Carbonaceous	2.42	mgO/L/hr
OUR - Nitrification	0.48	mgO/L/hr
Nit - Ammonia removal rate	0.14	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	0.14	mgN/L/hr
Nit - Nitrate production rate	0.01	mgN/L/hr
Denit - Nitrate removal rate	7.60	mgN/L/hr
Denit - Nitrite removal rate	4.02	mgN/L/hr
Denit - N2 production rate	8.09	mgN/L/hr
Off gas flow rate (dry)	3.64	ft3/min

Off gas Oxygen	0	%
Off gas Carbon dioxide	72.31	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	4.96	%
Off gas Methane	0.04	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	9.19	mg/L
OTR	0	lb/hr
SOTR	0	lb/hr
OTE	100.00	%
SOTE	100.00	%
Air flow rate	0	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0	ft3/min (20C, 1 atm)
# of diffusers	1001.00	

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MBR

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	0	0	
Total suspended solids	0	0	
Particulate COD	0	0	
Filtered COD	18.81	784.71	
Total COD	18.81	784.71	
Soluble PO4-P	3.22	134.12	
Total P	3.22	134.12	
Filtered TKN	1.77	73.77	
Particulate TKN	0	0	
Total Kjeldahl Nitrogen	1.77	73.77	
Filtered Carbonaceous BOD	0.88	36.68	
Total Carbonaceous BOD	0.88	36.68	
Nitrite + Nitrate	0.96	40.15	
Total N	2.73	113.92	
Total inorganic N	1.05	43.70	
Alkalinity	4.25	80.46	mmol/L and kmol/d
pH	7.13		
Volatile fatty acids	0.01	0.23	
ISS precipitate	0	0	
ISS cellular	0	0	
ISS Total	0	0	
Ammonia N	0.09	3.55	
Nitrate N	0.95	39.44	

Parameters	Value	Units

Hydraulic residence time	0.3	hours
Velocity gradient	399.21	1/s
VSS destruction	100.00	%
Total solids mass	8417.07	lb
Total readily biodegradable COD	1.24	mg/L
OUR - Total	40.42	mgO/L/hr
OUR - Carbonaceous	31.09	mgO/L/hr
OUR - Nitrification	9.32	mgO/L/hr
Nit - Ammonia removal rate	2.18	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	2.15	mgN/L/hr
Nit - Nitrate production rate	2.15	mgN/L/hr
Denit - Nitrate removal rate	0.07	mgN/L/hr
Denit - Nitrite removal rate	0.02	mgN/L/hr
Denit - N2 production rate	0.06	mgN/L/hr
Off gas flow rate (dry)	5387.28	ft3/min
Off gas Oxygen	20.55	%
Off gas Carbon dioxide	0.56	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.03	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	9.55	mg/L
OTR	90.79	lb/hr
SOTR	481.37	lb/hr
OTE	1.61	%
SOTE	8.73	%
Air flow rate	5407.00	ft3/min (20C, 1 atm)
Air flow rate / diffuser	9.80	ft3/min (20C, 1 atm)
# of diffusers	552.00	
Mixed liquor flow	10.00	mgd
Membrane flux	11.78	gal/ft2/d (gfd)
# of cassettes	26.00	
Air flow rate / cassette	207.96	ft3/min (20C, 1 atm)

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Effluent

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	0.00	0.00	
Total suspended solids	0.00	0.00	
Particulate COD	0.00	0.00	
Filtered COD	18.81	784.71	
Total COD	18.81	784.71	
Soluble PO4-P	3.22	134.12	

Total P	3.22	134.12	
Filtered TKN	1.77	73.77	
Particulate TKN	0	0.00	
Total Kjeldahl Nitrogen	1.77	73.77	
Filtered Carbonaceous BOD	0.88	36.68	
Total Carbonaceous BOD	0.88	36.68	
Nitrite + Nitrate	0.96	40.15	
Total N	2.73	113.92	
Total inorganic N	1.05	43.70	
Alkalinity	4.25	80.46	mmol/L and kmol/d
pH	7.14		
Volatile fatty acids	0.01	0.23	
ISS precipitate	0	0.00	
ISS cellular	0.00	0.00	
ISS Total	0.00	0.00	
Ammonia N	0.09	3.55	
Nitrate N	0.95	39.44	

Parameters	Value	Units

Global Parameters

AOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9000	0.9000	1.0720
Substrate (NH4) half sat. [mgN/L]	0.7000	0.7000	1.0000
Byproduct NH4 logistic slope [-]	50.0000	50.0000	1.0000
Byproduct NH4 inflection point [mgN/L]	1.4000	1.4000	1.0000
AOB denite DO half sat. [mg/L]	0.1000	0.1000	1.0000
AOB denite HNO2 half sat. [mgN/L]	5.000E-6	5.000E-6	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiHNO2 [mmol/L]	0.0050	0.0050	1.0000

NOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.7000	0.7000	1.0600
Substrate (NO2) half sat. [mgN/L]	0.1000	0.1000	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiNH3 [mmol/L]	0.0750	0.0750	1.0000

ANAMMOX

Name	Default	Value	
Max. spec. growth rate [1/d]	0.1000	0.1000	1.1000
Substrate (NH4) half sat. [mgN/L]	2.0000	2.0000	1.0000
Substrate (NO2) half sat. [mgN/L]	1.0000	1.0000	1.0000
Aerobic decay rate [1/d]	0.0190	0.0190	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0095	0.0095	1.0290
Ki Nitrite [mgN/L]	1000.0000	1000.0000	1.0000
Nitrite sensitivity constant [L / (d mgN)]	0.0160	0.0160	1.0000

OHO

Name	Default	Value	
Max. spec. growth rate [1/d]	3.2000	3.2000	1.0290
Substrate half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Anoxic growth factor [-]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000

Aerobic decay rate [1/d]	0.6200	0.6200	1.0290
Anoxic decay rate [1/d]	0.2330	0.2330	1.0290
Anaerobic decay rate [1/d]	0.1310	0.1310	1.0290
Hydrolysis rate [1/d]	2.1000	2.1000	1.0290
Hydrolysis half sat. [-]	0.0600	0.0600	1.0000
Anoxic hydrolysis factor [-]	0.2800	0.2800	1.0000
Anaerobic hydrolysis factor (AS) [-]	0.0400	0.0400	1.0000
Anaerobic hydrolysis factor (AD) [-]	0.2000	0.5000	1.0000
Adsorption rate of colloids [L/(mgCOD d)]	0.1500	0.8000	1.0290
Ammonification rate [L/(mgN d)]	0.0400	0.0400	1.0290
Assimilative nitrate/nitrite reduction rate [1/d]	0.5000	0.5000	1.0000
Fermentation rate [1/d]	1.6000	3.2000	1.0290
Fermentation half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Fermentation growth factor (AS) [-]	0.2500	0.1250	1.0000
Endogenous products decay rate[1/d]	0	0	1.0000
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

Methylotrophs

Name	Default	Value	
Max. spec. growth rate [1/d]	1.3000	1.3000	1.0720
Methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.0400	0.0400	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0300	0.0300	1.0290
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

PAO

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9500	0.9500	1.0000
Max. spec. growth rate, P-limited [1/d]	0.4200	0.4200	1.0000
Substrate half sat. [mgCOD(PHB)/mgCOD(Zbp)]	0.1000	0.1000	1.0000
Substrate half sat., P-limited [mgCOD(PHB)/mgCOD(Zbp)]	0.0500	0.0500	1.0000
Magnesium half sat. [mgMg/L]	0.1000	0.1000	1.0000
Cation half sat. [mmol/L]	0.1000	0.1000	1.0000
Calcium half sat. [mgCa/L]	0.1000	0.1000	1.0000
Aerobic/anoxic decay rate [1/d]	0.1000	0.1000	1.0000
Aerobic/anoxic maintenance rate [1/d]	0	0	1.0000
Anaerobic decay rate [1/d]	0.0400	0.0400	1.0000
Anaerobic maintenance rate [1/d]	0	0	1.0000
Sequestration rate [1/d]	4.5000	6.0000	1.0000
Anoxic growth factor [-]	0.3300	0.3300	1.0000

Acetogens

Name	Default	Value	
Max. spec. growth rate [1/d]	0.2500	0.2500	1.0290
Substrate half sat. [mgCOD/L]	10.0000	10.0000	1.0000
Acetate inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Anaerobic decay rate [1/d]	0.0500	0.0500	1.0290
Aerobic/anoxic decay rate [1/d]	0.5200	0.5200	1.0290

Methanogens

Name	Default	Value	
Acetoclastic max. spec. growth rate [1/d]	0.3000	0.3000	1.0290
H2-utilizing max. spec. growth rate [1/d]	1.4000	1.4000	1.0290
Acetoclastic substrate half sat. [mgCOD/L]	100.0000	100.0000	1.0000
Acetoclastic methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
H2-utilizing CO2 half sat. [mmol/L]	0.1000	0.1000	1.0000
H2-utilizing substrate half sat. [mgCOD/L]	0.1000	0.1000	1.0000
H2-utilizing methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Acetoclastic propionic inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Acetoclastic anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
Acetoclastic aerobic/anoxic decay rate [1/d]	0.6000	0.6000	1.0290
H2-utilizing anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
H2-utilizing aerobic/anoxic decay rate [1/d]	2.8000	0.6000	1.0290

pH

Name	Default	Value
OHO low pH limit [-]	4.0000	4.0000
OHO high pH limit [-]	10.0000	10.0000
Methylotrophs low pH limit [-]	4.0000	4.0000
Methylotrophs high pH limit [-]	10.0000	10.0000
Autotrophs low pH limit [-]	5.5000	5.5000
Autotrophs high pH limit [-]	9.5000	9.5000
PAO low pH limit [-]	4.0000	4.0000
PAO high pH limit [-]	10.0000	10.0000
OHO low pH limit (anaerobic) [-]	5.5000	5.5000
OHO high pH limit (anaerobic) [-]	8.5000	8.5000
Propionic acetogens low pH limit [-]	4.0000	4.0000
Propionic acetogens high pH limit [-]	10.0000	10.0000

Acetoclastic methanogens low pH limit [-]	5.0000	5.0000
Acetoclastic methanogens high pH limit [-]	9.0000	9.0000
H2-utilizing methanogens low pH limit [-]	5.0000	5.0000
H2-utilizing methanogens high pH limit [-]	9.0000	9.0000

Switches

Name	Default	Value
Aerobic/anoxic DO half sat. [mgO2/L]	0.0500	0.0500
Anoxic/anaerobic NOx half sat. [mgN/L]	0.1500	0.1500
AOB DO half sat. [mgO2/L]	0.2500	0.2500
NOB DO half sat. [mgO2/L]	0.5000	0.5000
ANAMMOX DO half sat. [mgO2/L]	0.0100	0.0100
Anoxic NO3(->NO2) half sat. [mgN/L]	0.1000	0.1000
Anoxic NO3(->N2) half sat. [mgN/L]	0.0500	0.0500
Anoxic NO2(->N2) half sat. (mgN/L)	0.0100	0.0100
NH3 nutrient half sat. [mgN/L]	0.0050	1.000E-4
PolyP half sat. [mgP/mgCOD]	0.0100	0.0100
VFA sequestration half sat. [mgCOD/L]	5.0000	5.0000
P uptake half sat. [mgP/L]	0.1500	0.1500
P nutrient half sat. [mgP/L]	0.0010	0.0010
Autotroph CO2 half sat. [mmol/L]	0.1000	0.1000
H2 low/high half sat. [mgCOD/L]	1.0000	1.0000
Propionic acetogens H2 inhibition [mgCOD/L]	5.0000	5.0000
Synthesis anion/cation half sat. [meq/L]	0.0100	0.0100

Common

Name	Default	Value
Biomass volatile fraction (VSS/TSS)	0.9200	0.9200
Endogenous residue volatile fraction (VSS/TSS)	0.9200	0.9200
N in endogenous residue [mgN/mgCOD]	0.0700	0.0700
P in endogenous residue [mgP/mgCOD]	0.0220	0.0220
Endogenous residue COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Particulate substrate COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000
Particulate inert COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000

AOB

Name	Default	Value
Yield [mgCOD/mgN]	0.1500	0.1500
AOB denite NO2 fraction as TEA [-]	0.5000	0.5000
Byproduct NH4 fraction to N2O [-]	0.0025	0.0025
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

NOB

Name	Default	Value
Yield [mgCOD/mgN]	0.0900	0.0900
N in biomass [mgN/mgCOD]	0.0700	0.0700

P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

ANAMMOX

Name	Default	Value
Yield [mgCOD/mgN]	0.1140	0.1140
Nitrate production [mgN/mgBiomassCOD]	2.2800	2.2800
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

OHO

Name	Default	Value
Yield (aerobic) [-]	0.6660	0.6660
Yield (fermentation, low H2) [-]	0.1000	0.1000
Yield (fermentation, high H2) [-]	0.1000	0.1000
H2 yield (fermentation low H2) [-]	0.3500	0.3500
H2 yield (fermentation high H2) [-]	0	0
Propionate yield (fermentation, low H2) [-]	0	0
Propionate yield (fermentation, high H2) [-]	0.7000	0.7000
CO2 yield (fermentation, low H2) [-]	0.7000	0.7000
CO2 yield (fermentation, high H2) [-]	0	0
N in biomass [mgN/mgCOD]	0.0700	0.0700

P in biomass [mgP/mgCOD]	0.0220	0.0220
Endogenous fraction - aerobic [-]	0.0800	0.0800
Endogenous fraction - anoxic [-]	0.1030	0.1030
Endogenous fraction - anaerobic [-]	0.1840	0.1840
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield (anoxic) [-]	0.5400	0.5400
Yield propionic (aerobic) [-]	0.6400	0.6400
Yield propionic (anoxic) [-]	0.4600	0.4600
Yield acetic (aerobic) [-]	0.6000	0.6000
Yield acetic (anoxic) [-]	0.4300	0.4300
Yield methanol (aerobic) [-]	0.5000	0.5000
Adsorp. max. [-]	1.0000	1.0000
Max fraction to N2O at high FNA over nitrate [-]	0.0500	0.0500
Max fraction to N2O at high FNA over nitrite [-]	0.1000	0.1000

Methylotrophs

Name	Default	Value
Yield (anoxic) [-]	0.4000	0.4000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Max fraction to N2O at high FNA over nitrate [-]	0.1000	0.1000
Max fraction to N2O at high FNA over nitrite [-]	0.1500	0.1500

PAO

Name	Default	Value
Yield (aerobic) [-]	0.6390	0.6390
Yield (anoxic) [-]	0.5200	0.5200
Aerobic P/PHA uptake [mgP/mgCOD]	0.9300	0.9500
Anoxic P/PHA uptake [mgP/mgCOD]	0.3500	0.3500
Yield of PHA on sequestration [-]	0.8890	0.8890
N in biomass [mgN/mgCOD]	0.0700	0.0700
N in sol. inert [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous part. [-]	0.2500	0.2500
Inert fraction of endogenous sol. [-]	0.2000	0.2000
P/Ac release ratio [mgP/mgCOD]	0.5100	0.4900
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield of low PP [-]	0.9400	0.9400

Acetogens

Name	Default	Value
Yield [-]	0.1000	0.1000
H2 yield [-]	0.4000	0.4000
CO2 yield [-]	1.0000	1.0000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

Methanogens

Name	Default	Value
Acetoclastic yield [-]	0.1000	0.1000
Methanol acetoclastic yield [-]	0.1000	0.1000
H2-utilizing yield [-]	0.1000	0.1000
Methanol H2-utilizing yield [-]	0.1000	0.1000
N in acetoclastic biomass [mgN/mgCOD]	0.0700	0.0700
N in H2-utilizing biomass [mgN/mgCOD]	0.0700	0.0700
P in acetoclastic biomass [mgP/mgCOD]	0.0220	0.0220
P in H2-utilizing biomass [mgP/mgCOD]	0.0220	0.0220
Acetoclastic fraction to endog. residue [-]	0.0800	0.0800
H2-utilizing fraction to endog. residue [-]	0.0800	0.0800
Acetoclastic COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
H2-utilizing COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

General

Name	Default	Value
Molecular weight of other anions [mg/mmol]	35.5000	35.5000
Molecular weight of other cations [mg/mmol]	39.1000	39.1000
Mg to P mole ratio in polyphosphate [mmolMg/mmolP]	0.3000	0.3000
Cation to P mole ratio in polyphosphate [meq/mmolP]	0.1500	0.3000
Ca to P mole ratio in polyphosphate [mmolCa/mmolP]	0.0500	0.0500
Cation to P mole ratio in organic phosphate [meq/mmolP]	0.0100	0.0100
Bubble rise velocity (anaerobic digester) [cm/s]	23.9000	23.9000
Bubble Sauter mean diameter (anaerobic digester) [cm]	0.3500	0.3500
Anaerobic digester gas hold-up factor []	1.0000	1.0000

Tank head loss per metre of length (from flow) [m/m]	0.0025	0.0025

Mass transfer

Name	Default	Value	
Kl for H2 [m/d]	17.0000	17.0000	1.0240
Kl for CO2 [m/d]	10.0000	10.0000	1.0240
Kl for NH3 [m/d]	1.0000	1.0000	1.0240
Kl for CH4 [m/d]	8.0000	8.0000	1.0240
Kl for N2 [m/d]	15.0000	15.0000	1.0240
Kl for N2O [m/d]	8.0000	8.0000	1.0240
Kl for O2 [m/d]	13.0000	13.0000	1.0240

Henry's law constants

Name	Default	Value	
CO2 [M/atm]	0.0340	0.0340	2400.0000
O2 [M/atm]	0.0013	0.0013	1500.0000
N2 [M/atm]	6.500E-4	6.500E-4	1300.0000
N2O [M/atm]	0.0250	0.0250	2600.0000
NH3 [M/atm]	58.0000	58.0000	4100.0000
CH4 [M/atm]	0.0014	0.0014	1600.0000
H2 [M/atm]	7.800E-4	7.800E-4	500.0000

Physico-chemical rates

Name	Default	Value	
Struvite precipitation rate [1/d]	3.000E+10	3.000E+10	1.0240
Struvite redissolution rate [1/d]	3.000E+11	3.000E+11	1.0240
Struvite half sat. [mgTSS/L]	1.0000	1.0000	1.0000
HDP precipitation rate [L/(molP d)]	1.000E+8	1.000E+8	1.0000
HDP redissolution rate [L/(mol P d)]	1.000E+8	1.000E+8	1.0000
HAP precipitation rate [molHDP/(L d)]	5.000E-4	5.000E-4	1.0000

Physico-chemical constants

Name	Default	Value
Struvite solubility constant [mol/L]	6.918E-14	6.918E-14
HDP solubility product [mol/L]	2.750E-22	2.750E-22
HDP half sat. [mgTSS/L]	1.0000	1.0000
Equilibrium soluble PO4 with Al dosing at pH 7 [mgP/L]	0.0100	0.0100
Al to P ratio [molAl/molP]	0.8000	0.8000
Al(OH)3 solubility product [mol/L]	1.259E+9	1.259E+9
AlHPO4+ dissociation constant [mol/L]	7.943E-13	7.943E-13
Equilibrium soluble PO4 with Fe dosing at pH 7 [mgP/L]	0.0100	0.0100
Fe to P ratio [molFe/molP]	1.6000	1.6000
Fe(OH)3 solubility product [mol/L]	0.0500	0.0500
FeH2PO4++ dissociation constant [mol/L]	5.012E-22	5.012E-22

Aeration

Name	Default	Value
Alpha (surf) OR Alpha F (diff) [-]	0.5000	0.5000
Beta [-]	0.9500	0.9500
Surface pressure [kPa]	101.3250	101.3250
Fractional effective saturation depth (Fed) [-]	0.3250	0.3250
Supply gas CO2 content [vol. %]	0.0350	0.0350
Supply gas O2 [vol. %]	20.9500	20.9500
Off-gas CO2 [vol. %]	2.0000	2.0000
Off-gas O2 [vol. %]	18.8000	18.8000
Off-gas H2 [vol. %]	0	0
Off-gas NH3 [vol. %]	0	0
Off-gas CH4 [vol. %]	0	0
Surface turbulence factor [-]	2.0000	2.0000
Set point controller gain []	1.0000	1.0000

Modified Vesilind

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.387	0.387
Vesilind hindered zone settling parameter (K) [L/g]	0.370	0.370
Clarification switching function [mg/L]	100.000	100.000
Specified TSS conc.for height calc. [mg/L]	2500.000	2500.000
Maximum compactability constant [mg/L]	15000.000	15000.000

Double exponential

Name	Default	Value

Maximum Vesilind settling velocity (Vo) [ft/min]	0.934	0.934
Maximum (practical) settling velocity (Vo') [ft/min]	0.615	0.615
Hindered zone settling parameter (Kh) [L/g]	0.400	0.400
Flocculent zone settling parameter (Kf) [L/g]	2.500	2.500
Maximum non-settleable TSS [mg/L]	20.0000	20.0000
Non-settleable fraction [-]	0.0010	0.0010
Specified TSS conc. for height calc. [mg/L]	2500.0000	2500.0000

Emission factors

Name	Default	Value
Carbon dioxide equivalence of nitrous oxide	296.0000	296.0000
Carbon dioxide equivalence of methane	23.0000	23.0000

Biofilm general

Name	Default	Value	
Attachment rate [g / (m2 d)]	80.0000	80.0000	1.0000
Attachment TSS half sat. [mg/L]	100.0000	100.0000	1.0000
Detachment rate [g/(m3 d)]	8.000E+4	8.000E+4	1.0000
Solids movement factor []	10.0000	10.0000	1.0000
Diffusion neta []	0.8000	0.8000	1.0000
Thin film limit [mm]	0.5000	0.5000	1.0000
Thick film limit [mm]	3.0000	3.0000	1.0000
Assumed Film thickness for tank volume correction (temp independant) [mm]	0.7500	0.7500	1.0000
Film surface area to media area ratio - Max.[ ]	1.0000	1.0000	1.0000
Minimum biofilm conc. for streamer formation [gTSS/m2]	4.0000	4.0000	1.0000

Maximum biofilm concentrations [mg/L]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	5.000E+4	5.000E+4	1.0000
Methylotrophs	5.000E+4	5.000E+4	1.0000
Ammonia oxidizing biomass (AOB)	1.000E+5	1.000E+5	1.0000
Nitrite oxidizing biomass (NOB)	1.000E+5	1.000E+5	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E+4	5.000E+4	1.0000
Polyphosphate accumulating organisms (PAO)	5.000E+4	5.000E+4	1.0000
Propionic acetogens	5.000E+4	5.000E+4	1.0000
Methanogens - acetoclastic	5.000E+4	5.000E+4	1.0000
Methanogens - hydrogenotrophic	5.000E+4	5.000E+4	1.0000
Endogenous products	3.000E+4	3.000E+4	1.0000
Slowly bio. COD (part.)	5000.0000	5000.0000	1.0000
Slowly bio. COD (colloid.)	4000.0000	4000.0000	1.0000
Part. inert. COD	5000.0000	5000.0000	1.0000
Part. bio. org. N	0	0	1.0000
Part. bio. org. P	0	0	1.0000
Part. inert N	0	0	1.0000
Part. inert P	0	0	1.0000
Stored PHA	5000.0000	5000.0000	1.0000
Releasable stored polyP	1.150E+6	1.150E+6	1.0000
Fixed stored polyP	1.150E+6	1.150E+6	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000

Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.000E+10	1.000E+10	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	1.300E+6	1.300E+6	1.0000
Struvite	8.500E+5	8.500E+5	1.0000
Hydroxy-dicalcium-phosphate	1.150E+6	1.150E+6	1.0000
Hydroxy-apatite	1.600E+6	1.600E+6	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.000E+10	1.000E+10	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	5.000E+4	5.000E+4	1.0000
User defined 4	5.000E+4	5.000E+4	1.0000
Dissolved oxygen	0	0	1.0000

Effective diffusivities [m2/s]

Name	Default	Value

Ordinary heterotrophic organisms (OHO)	5.000E-14	5.000E-14	1.0290
Methylotrophs	5.000E-14	5.000E-14	1.0290
Ammonia oxidizing biomass (AOB)	5.000E-14	5.000E-14	1.0290
Nitrite oxidizing biomass (NOB)	5.000E-14	5.000E-14	1.0290
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E-14	5.000E-14	1.0290
Polyphosphate accumulating organisms (PAO)	5.000E-14	5.000E-14	1.0290
Propionic acetogens	5.000E-14	5.000E-14	1.0290
Methanogens - acetoclastic	5.000E-14	5.000E-14	1.0290
Methanogens - hydrogenotrophic	5.000E-14	5.000E-14	1.0290
Endogenous products	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (part.)	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (colloid.)	5.000E-12	5.000E-12	1.0290
Part. inert. COD	5.000E-14	5.000E-14	1.0290
Part. bio. org. N	5.000E-14	5.000E-14	1.0290
Part. bio. org. P	5.000E-14	5.000E-14	1.0290
Part. inert N	5.000E-14	5.000E-14	1.0290
Part. inert P	5.000E-14	5.000E-14	1.0290
Stored PHA	5.000E-14	5.000E-14	1.0290
Releasable stored polyP	5.000E-14	5.000E-14	1.0290
Fixed stored polyP	5.000E-14	5.000E-14	1.0290
Readily bio. COD (complex)	6.900E-10	6.900E-10	1.0290
Acetate	1.240E-9	1.240E-9	1.0290
Propionate	8.300E-10	8.300E-10	1.0290
Methanol	1.600E-9	1.600E-9	1.0290
Dissolved H2	5.850E-9	5.850E-9	1.0290
Dissolved methane	1.963E-9	1.963E-9	1.0290
Ammonia N	2.000E-9	2.000E-9	1.0290
Sol. bio. org. N	1.370E-9	1.370E-9	1.0290
Nitrous Oxide N	1.607E-9	1.607E-9	1.0290
Nitrite N	2.980E-9	2.980E-9	1.0290
Nitrate N	2.980E-9	2.980E-9	1.0290

Dissolved nitrogen gas	1.900E-9	1.900E-9	1.0290
PO4-P (Sol. & Me Complexed)	2.000E-9	2.000E-9	1.0290
Sol. inert COD	6.900E-10	6.900E-10	1.0290
Sol. inert TKN	6.850E-10	6.850E-10	1.0290
ISS Influent	5.000E-14	5.000E-14	1.0290
Struvite	5.000E-14	5.000E-14	1.0290
Hydroxy-dicalcium-phosphate	5.000E-14	5.000E-14	1.0290
Hydroxy-apatite	5.000E-14	5.000E-14	1.0290
Magnesium	7.200E-10	7.200E-10	1.0290
Calcium	7.200E-10	7.200E-10	1.0290
Metal	4.800E-10	4.800E-10	1.0290
Other Cations (strong bases)	1.440E-9	1.440E-9	1.0290
Other Anions (strong acids)	1.440E-9	1.440E-9	1.0290
Total CO2	1.960E-9	1.960E-9	1.0290
User defined 1	6.900E-10	6.900E-10	1.0290
User defined 2	6.900E-10	6.900E-10	1.0290
User defined 3	5.000E-14	5.000E-14	1.0290
User defined 4	5.000E-14	5.000E-14	1.0290
Dissolved oxygen	2.500E-9	2.500E-9	1.0290

EPS Strength coefficients [ ]

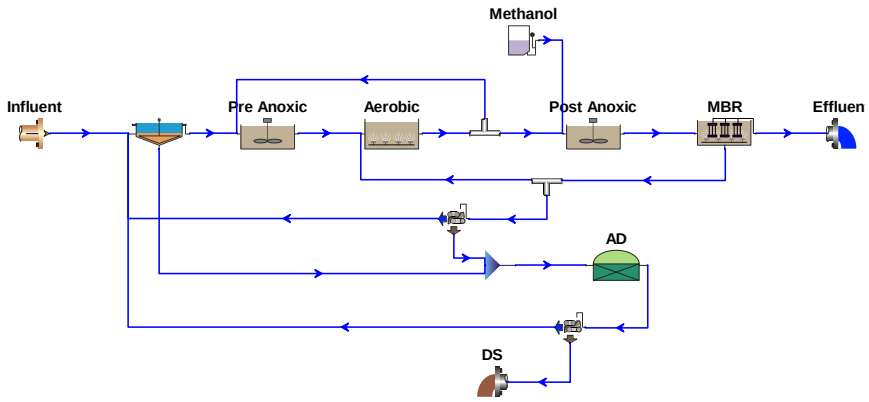
Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	1.0000	1.0000	1.0000
Methylotrophs	1.0000	1.0000	1.0000
Ammonia oxidizing biomass (AOB)	5.0000	1.0000	1.0000
Nitrite oxidizing biomass (NOB)	25.0000	1.0000	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	10.0000	1.0000	1.0000
Polyphosphate accumulating organisms (PAO)	1.0000	1.0000	1.0000

Propionic acetogens	1.0000	1.0000	1.0000
Methanogens - acetoclastic	1.0000	1.0000	1.0000
Methanogens - hydrogenotrophic	1.0000	1.0000	1.0000
Endogenous products	1.0000	1.0000	1.0000
Slowly bio. COD (part.)	1.0000	1.0000	1.0000
Slowly bio. COD (colloid.)	1.0000	1.0000	1.0000
Part. inert. COD	1.0000	1.0000	1.0000
Part. bio. org. N	1.0000	1.0000	1.0000
Part. bio. org. P	1.0000	1.0000	1.0000
Part. inert N	1.0000	1.0000	1.0000
Part. inert P	1.0000	1.0000	1.0000
Stored PHA	1.0000	1.0000	1.0000
Releasable stored polyP	1.0000	1.0000	1.0000
Fixed stored polyP	1.0000	1.0000	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.0000	1.0000	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	0.3300	0.3300	1.0000
Struvite	1.0000	1.0000	1.0000

Hydroxy-dicalcium-phosphate	1.0000	1.0000	1.0000
Hydroxy-apatite	1.0000	1.0000	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.0000	1.0000	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	1.0000	1.0000	1.0000
User defined 4	1.0000	1.0000	1.0000
Dissolved oxygen	0	0	1.0000

FAIRHAVEN, MA

Case Study No. 6
Bardenpho/MBR w/Anaerobic Digestion
Flow = 5.0 MGD @ 11^{0}C



Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	Head space volume
AD	0.6200	4144.0975	20.000	0.5

Operating data Average (flow/time weighted as required)

Element name	Pressure [psi]	pH
AD	14.9	-

Element name	Average Temperature
AD	35.0

Configuration information for all Bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Pre Anoxic	0.3112	3200.0000	13.000	Un-aerated
Post Anoxic	0.4297	4418.6568	13.000	Un-aerated

Aerobic	0.8600	9580.0000	12.000	1365

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
Pre Anoxic	0
Post Anoxic	0
Aerobic	2.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^0.25 + k2	k2 in C = k1(PC)^0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	% of tank area covered by diffusers [%]
Pre Anoxic	2.5656	0.0432	0.8200	0.4413	6.2900
Post Anoxic	2.5656	0.0432	0.8200	0.4413	10.0000
Aerobic	2.5656	0.0432	0.8200	0.4413	6.2900

Configuration information for all Membrane bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers	# of cassettes	Displaced volume / cassette [ft3/cassette]	Membrane area / cassette [ft2/cassette]	Total displaced volume [Mil. Gal]	Membrane surface area [ft2]
MBR	0.1777	1980.0000	12.000	552	26.00	59.682	16320.03	0.01	424320.78

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
MBR	Flow paced	200.00 %

Element name	Average Air flow rate [ft3/min (20C, 1 atm)]

MBR	5407.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^0.25 + k2	k2 in C = k1(PC)^0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	% of tank area covered by diffusers [%]
MBR	0.0500	0.3800	1.0500	0.5382	15.0000

Element name	Alpha (surf) OR Alpha F (diff) [-]	Beta [-]	Surface pressure [kPa]	Fractional effective saturation depth (Fed) [-]
MBR	0.7000	0.9500	101.3250	0.3000

Element name	Supply gas CO2 content [vol. %]	Supply gas O2 [vol. %]	Off-gas CO2 [vol. %]	Off-gas O2 [vol. %]	Off-gas H2 [vol. %]	Off-gas NH3 [vol. %]	Off-gas CH4 [vol. %]	Surface turbulence factor [-]
MBR	0.0350	20.9500	1.2000	19.9000	0	0	0	2.0000

Configuration information for all BOD Influent units

Operating data Average (flow/time weighted as required)

Element name	Influent
Flow	5
Total Carbonaceous BOD mgBOD/L	94.00
Volatile suspended solids mgVSS/L	66.00
Total suspended solids mgTSS/L	88.00
Total Kjeldahl Nitrogen mgN/L	17.00
Total P mgP/L	5.00
Nitrate N mgN/L	0
pH	7.00
Alkalinity mmol/L	6.00
Calcium mg/L	80.00

Magnesium mg/L	15.00
Dissolved oxygen mg/L	4.20

Element name	Influent
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.1600
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1500
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.6449
Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0500
Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.1300
Fna - Ammonia [gNH3-N/gTKN]	0.6600
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.5000
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0350
Fpo4 - Phosphate [gPO4-P/gTP]	0.5000
FupP - P:COD ratio for unbiodegradable part. COD [gP/gCOD]	0.0110
FZbh - OHO COD fraction [gCOD/g of total COD]	0.0200
FZbm - Methylotroph COD fraction [gCOD/g of total COD]	1.000E-4
FZaob - AOB COD fraction [gCOD/g of total COD]	1.000E-4
FZnob - NOB COD fraction [gCOD/g of total COD]	1.000E-4
FZamob - ANAMMOX COD fraction [gCOD/g of total COD]	1.000E-4
FZbp - PAO COD fraction [gCOD/g of total COD]	1.000E-4
FZbpa - Propionic acetogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbam - Acetoclastic methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbhm - H2-utilizing methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZe - Endogenous products COD fraction [gCOD/g of total COD]	0

Configuration information for all Methanol addition units

Operating data Average (flow/time weighted as required)

Element name	Methanol

Ordinary heterotrophic organisms (OHO) mgCOD/L	0
Methylotrophs mgCOD/L	0
Ammonia oxidizing biomass (AOB) mgCOD/L	0
Nitrite oxidizing biomass (NOB) mgCOD/L	0
Anaerobic ammonia oxidizers (ANAMMOX) mgCOD/L	0
Polyphosphate accumulating organisms (PAO) mgCOD/L	0
Propionic acetogens mgCOD/L	0
Methanogens - acetoclastic mgCOD/L	0
Methanogens - hydrogenotrophic mgCOD/L	0
Endogenous products mgCOD/L	0
Slowly bio. COD (part.) mgCOD/L	0
Slowly bio. COD (colloid.) mgCOD/L	0
Part. inert. COD mgCOD/L	0
Part. bio. org. N mgN/L	0
Part. bio. org. P mgP/L	0
Part. inert N mgN/L	0
Part. inert P mgP/L	0
Stored PHA mgCOD/L	0
Releasable stored polyP mgP/L	0
Fixed stored polyP mgP/L	0
Readily bio. COD (complex) mgCOD/L	0
Acetate mgCOD/L	0
Propionate mgCOD/L	0
Methanol mgCOD/L	1188000.00
Dissolved H2 mgCOD/L	0
Dissolved methane mg/L	0
Ammonia N mgN/L	0
Sol. bio. org. N mgN/L	0
Nitrous Oxide N mgN/L	0
Nitrite N mgN/L	0
Nitrate N mgN/L	0

Dissolved nitrogen gas mgN/L	0
PO4-P (Sol. & Me Complexed) mgP/L	0
Sol. inert COD mgCOD/L	0
Sol. inert TKN mgN/L	0
ISS Influent mgISS/L	0
Struvite mgISS/L	0
Hydroxy-dicalcium-phosphate mgISS/L	0
Hydroxy-apatite mgISS/L	0
Magnesium mg/L	0
Calcium mg/L	0
Metal mg/L	0
Other Cations (strong bases) meq/L	0
Other Anions (strong acids) meq/L	0
Total CO2 mmol/L	0
User defined 1 mg/L	0
User defined 2 mg/L	0
User defined 3 mgVSS/L	0
User defined 4 mgISS/L	0
Dissolved oxygen mg/L	0
Flow	0.000125

Configuration information for all Effluent units

Configuration information for all Ideal clarifier units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Ideal clarifier1	0.5460	6636.0000	11.000

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Ideal clarifier1	Flowrate [Under]	0.01

Element name	Average Temperature	Reactive	Percent removal	Blanket fraction
Ideal clarifier1	Uses global setting	No	50.00	0.50

Configuration information for all Dewatering unit units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Dewatering unit25	Flowrate [Under]	0.016
Dewatering unit29	Flowrate [Under]	0.0026

Element name	Percent removal
Dewatering unit25	90.00
Dewatering unit29	95.00

Configuration information for all Sludge units

Configuration information for all Splitter units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
	Flowrate [Side]	0.083
	Flow paced	200.00 %

BioWin Album

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Influent

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	66.00	2753.98	
Total suspended solids	88.24	3682.14	
Particulate COD	105.11	4385.84	
Filtered COD	81.57	3403.67	
Total COD	186.68	7789.51	
Soluble PO4-P	2.50	104.32	
Total P	5.00	208.64	
Filtered TKN	13.72	572.47	
Particulate TKN	3.28	136.89	
Total Kjeldahl Nitrogen	17.00	709.36	
Filtered Carbonaceous BOD	51.15	2134.44	
Total Carbonaceous BOD	94.00	3922.34	
Nitrite + Nitrate	0	0	
Total N	17.00	709.36	
Total inorganic N	11.22	468.18	
Alkalinity	6.00	113.56	mmol/L and kmol/d
pH	7.00		
Volatile fatty acids	4.48	186.95	
ISS precipitate	0	0	
ISS cellular	0.24	10.16	
ISS Total	22.24	928.15	
Ammonia N	11.22	468.18	
Nitrate N	0	0	

Parameters	Value	Units

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Elements	Total Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Nitrite N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]
Influent	94.00	88.24	11.22	0	0	17.00	17.00
Effluent	0.87	0.00	0.56	0.91	0.13	1.82	2.86

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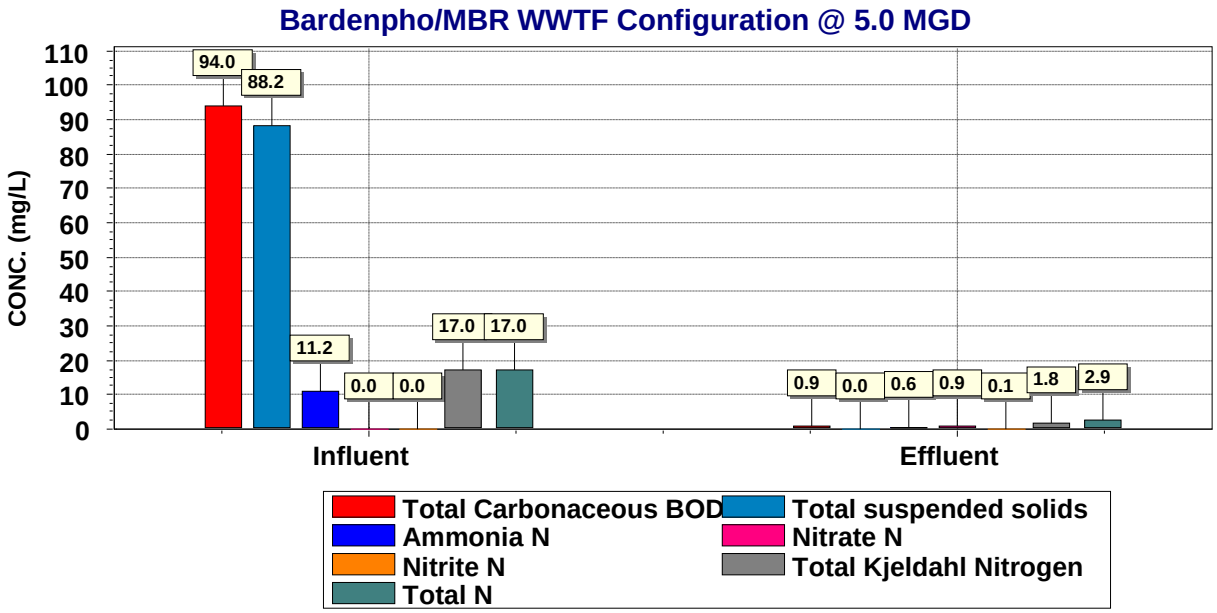

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Ideal clarifier1

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	35.33	1498.10	
Total suspended solids	47.62	2019.15	
Particulate COD	55.93	2371.42	
Filtered COD	80.83	3427.14	
Total COD	136.77	5798.56	

Soluble PO4-P	3.82	162.03	
Total P	5.13	217.51	
Filtered TKN	15.58	660.51	
Particulate TKN	1.86	78.96	
Total Kjeldahl Nitrogen	17.44	739.48	
Filtered Carbonaceous BOD	50.64	2147.17	
Total Carbonaceous BOD	72.76	3085.08	
Nitrite + Nitrate	0.01	0.58	
Total N	17.45	740.06	
Total inorganic N	13.12	556.15	
Alkalinity	6.09	117.11	mmol/L and kmol/d
pH	6.99		
Volatile fatty acids	4.93	208.95	
ISS precipitate	0	0.00	
ISS cellular	0.29	12.46	
ISS Total	12.29	521.05	
Ammonia N	13.10	555.58	
Nitrate N	0.01	0.51	

Parameters	Value	Units
Hydraulic residence time	2.57	hours
Percent removal	50.00	%
Height of specified concentration	5.50	ft
Total solids mass	55236.12	lb
Surface overflow rate	765.58	gal/(ft2 d)
Solids loading rate	0.61	lb/(ft2 d)

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Pre Anoxic

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	1094.74	137774.72	
Total suspended solids	1495.43	188202.96	
Particulate COD	1602.72	201705.07	
Filtered COD	14.61	1838.95	
Total COD	1617.33	203544.01	
Soluble PO4-P	3.87	487.11	
Total P	34.86	4386.94	
Filtered TKN	6.62	833.58	
Particulate TKN	97.35	12251.19	
Total Kjeldahl Nitrogen	103.97	13084.77	
Filtered Carbonaceous BOD	3.42	430.42	
Total Carbonaceous BOD	507.94	63925.09	
Nitrite + Nitrate	0.63	79.08	
Total N	104.60	13163.85	
Total inorganic N	5.71	718.85	
Alkalinity	5.49	313.43	mmol/L and kmol/d
pH	7.00		
Volatile fatty acids	0.47	59.49	
ISS precipitate	0	0.00	
ISS cellular	72.01	9062.43	
ISS Total	400.69	50428.23	
Ammonia N	5.08	639.77	
Nitrate N	0.46	57.81	

Parameters	Value	Units
Hydraulic residence time	0.5	hours
Velocity gradient	63.96	1/s
VSS destruction	0	%
Total solids mass	3883.64	lb

Total readily biodegradable COD	3.08	mg/L
OUR - Total	5.50	mgO/L/hr
OUR - Carbonaceous	4.70	mgO/L/hr
OUR - Nitrification	0.81	mgO/L/hr
Nit - Ammonia removal rate	0.23	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	0.23	mgN/L/hr
Nit - Nitrate production rate	0.06	mgN/L/hr
Denit - Nitrate removal rate	2.05	mgN/L/hr
Denit - Nitrite removal rate	1.29	mgN/L/hr
Denit - N2 production rate	2.52	mgN/L/hr
Off gas flow rate (dry)	2.10	ft3/min
Off gas Oxygen	0	%
Off gas Carbon dioxide	89.52	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	3.14	%
Off gas Methane	0.11	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	10.50	mg/L
OTR	0	lb/hr
SOTR	0	lb/hr
OTE	100.00	%
SOTE	100.00	%
Air flow rate	0	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0	ft3/min (20C, 1 atm)
# of diffusers	456.00	

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Aerobic

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes

Volatile suspended solids	1619.05	337754.60	
Total suspended solids	2216.63	462419.41	
Particulate COD	2367.19	493827.72	
Filtered COD	10.83	2258.52	
Total COD	2378.02	496086.24	
Soluble PO4-P	4.00	834.81	
Total P	49.96	10422.50	
Filtered TKN	2.75	574.24	
Particulate TKN	145.35	30321.11	
Total Kjeldahl Nitrogen	148.10	30895.34	
Filtered Carbonaceous BOD	1.00	208.90	
Total Carbonaceous BOD	739.39	154247.60	
Nitrite + Nitrate	2.65	553.61	
Total N	150.75	31448.95	
Total inorganic N	3.93	820.87	
Alkalinity	5.07	479.95	mmol/L and kmol/d
pH	7.01		
Volatile fatty acids	0.01	2.82	
ISS precipitate	0	0.00	
ISS cellular	108.01	22532.38	
ISS Total	597.59	124664.80	
Ammonia N	1.28	267.26	
Nitrate N	2.17	453.28	

Parameters	Value	Units
Hydraulic residence time	0.8	hours
Velocity gradient	106.92	1/s
VSS destruction	0.24	%
Total solids mass	15908.15	lb
Total readily biodegradable COD	1.36	mg/L

OUR - Total	20.37	mgO/L/hr
OUR - Carbonaceous	10.69	mgO/L/hr
OUR - Nitrification	9.68	mgO/L/hr
Nit - Ammonia removal rate	2.36	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	2.33	mgN/L/hr
Nit - Nitrate production rate	1.93	mgN/L/hr
Denit - Nitrate removal rate	0.07	mgN/L/hr
Denit - Nitrite removal rate	0.04	mgN/L/hr
Denit - N2 production rate	0.08	mgN/L/hr
Off gas flow rate (dry)	1480.88	ft3/min
Off gas Oxygen	19.19	%
Off gas Carbon dioxide	1.63	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.05	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	10.41	mg/L
OTR	136.02	lb/hr
SOTR	412.35	lb/hr
OTE	8.52	%
SOTE	26.42	%
Air flow rate	1529.46	ft3/min (20C, 1 atm)
Air flow rate / diffuser	1.12	ft3/min (20C, 1 atm)
# of diffusers	1365.00	

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Post Anoxic

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	1619.98	202757.34	

Total suspended solids	2217.71	277570.07	
Particulate COD	2368.37	296426.26	
Filtered COD	11.44	1432.35	
Total COD	2379.81	297858.61	
Soluble PO4-P	3.96	495.13	
Total P	49.96	6253.06	
Filtered TKN	2.49	311.71	
Particulate TKN	145.56	18218.17	
Total Kjeldahl Nitrogen	148.05	18529.88	
Filtered Carbonaceous BOD	1.20	150.60	
Total Carbonaceous BOD	739.96	92613.47	
Nitrite + Nitrate	0.34	42.33	
Total N	148.39	18572.21	
Total inorganic N	1.72	214.66	
Alkalinity	5.25	297.79	mmol/L and kmol/d
pH	7.02		
Volatile fatty acids	0.11	13.65	
ISS precipitate	0	0.00	
ISS cellular	108.16	13537.52	
ISS Total	597.73	74812.73	
Ammonia N	1.38	172.33	
Nitrate N	0.30	37.89	

Parameters	Value	Units
Hydraulic residence time	0.7	hours
Velocity gradient	64.03	1/s
VSS destruction	0	%
Total solids mass	7952.77	lb
Total readily biodegradable COD	1.59	mg/L
OUR - Total	2.90	mgO/L/hr

OUR - Carbonaceous	2.66	mgO/L/hr
OUR - Nitrification	0.24	mgO/L/hr
Nit - Ammonia removal rate	0.07	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	0.07	mgN/L/hr
Nit - Nitrate production rate	0.01	mgN/L/hr
Denit - Nitrate removal rate	2.73	mgN/L/hr
Denit - Nitrite removal rate	1.91	mgN/L/hr
Denit - N2 production rate	3.44	mgN/L/hr
Off gas flow rate (dry)	2.85	ft3/min
Off gas Oxygen	0	%
Off gas Carbon dioxide	82.62	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	3.61	%
Off gas Methane	0.04	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	10.50	mg/L
OTR	0	lb/hr
SOTR	0	lb/hr
OTE	100.00	%
SOTE	100.00	%
Air flow rate	0	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0	ft3/min (20C, 1 atm)
# of diffusers	1001.00	

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MBR			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	0	0	
Total suspended solids	0	0	

Particulate COD	0	0	
Filtered COD	10.61	442.50	
Total COD	10.61	442.50	
Soluble PO4-P	4.00	166.99	
Total P	4.00	166.99	
Filtered TKN	1.82	76.11	
Particulate TKN	0	0	
Total Kjeldahl Nitrogen	1.82	76.11	
Filtered Carbonaceous BOD	0.87	36.10	
Total Carbonaceous BOD	0.87	36.10	
Nitrite + Nitrate	1.04	43.25	
Total N	2.86	119.36	
Total inorganic N	1.60	66.71	
Alkalinity	5.14	97.17	mmol/L and kmol/d
pH	7.15		
Volatile fatty acids	0.01	0.40	
ISS precipitate	0	0	
ISS cellular	0	0	
ISS Total	0	0	
Ammonia N	0.56	23.46	
Nitrate N	0.91	37.99	

Parameters	Value	Units
Hydraulic residence time	0.3	hours
Velocity gradient	357.28	1/s
VSS destruction	100.00	%
Total solids mass	4606.61	lb
Total readily biodegradable COD	1.22	mg/L
OUR - Total	27.21	mgO/L/hr
OUR - Carbonaceous	16.06	mgO/L/hr

OUR - Nitrification	11.15	mgO/L/hr
Nit - Ammonia removal rate	2.69	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	2.66	mgN/L/hr
Nit - Nitrate production rate	2.31	mgN/L/hr
Denit - Nitrate removal rate	0.03	mgN/L/hr
Denit - Nitrite removal rate	0.01	mgN/L/hr
Denit - N2 production rate	0.03	mgN/L/hr
Off gas flow rate (dry)	5253.01	ft3/min
Off gas Oxygen	20.61	%
Off gas Carbon dioxide	0.49	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.02	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	10.91	mg/L
OTR	79.13	lb/hr
SOTR	481.37	lb/hr
OTE	1.40	%
SOTE	8.73	%
Air flow rate	5407.00	ft3/min (20C, 1 atm)
Air flow rate / diffuser	9.80	ft3/min (20C, 1 atm)
# of diffusers	552.00	
Mixed liquor flow	10.00	mgd
Membrane flux	11.78	gal/ft2/d (gfd)
# of cassettes	26.00	
Air flow rate / cassette	207.96	ft3/min (20C, 1 atm)

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Effluent

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	0.00	0.00	
Total suspended solids	0.00	0.00	
Particulate COD	0.00	0.00	
Filtered COD	10.61	442.50	
Total COD	10.61	442.50	
Soluble PO4-P	4.00	166.99	
Total P	4.00	166.99	
Filtered TKN	1.82	76.11	
Particulate TKN	0	0.00	
Total Kjeldahl Nitrogen	1.82	76.11	
Filtered Carbonaceous BOD	0.87	36.10	
Total Carbonaceous BOD	0.87	36.10	
Nitrite + Nitrate	1.04	43.25	
Total N	2.86	119.36	
Total inorganic N	1.60	66.71	
Alkalinity	5.14	97.16	mmol/L and kmol/d
pH	7.22		
Volatile fatty acids	0.01	0.40	
ISS precipitate	0	0.00	
ISS cellular	0.00	0.00	
ISS Total	0.00	0.00	
Ammonia N	0.56	23.46	
Nitrate N	0.91	37.99	

Parameters	Value	Units

Global Parameters

AOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9000	0.9000	1.0720
Substrate (NH4) half sat. [mgN/L]	0.7000	0.7000	1.0000
Byproduct NH4 logistic slope [-]	50.0000	50.0000	1.0000
Byproduct NH4 inflection point [mgN/L]	1.4000	1.4000	1.0000
AOB denite DO half sat. [mg/L]	0.1000	0.1000	1.0000
AOB denite HNO2 half sat. [mgN/L]	5.000E-6	5.000E-6	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiHNO2 [mmol/L]	0.0050	0.0050	1.0000

NOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.7000	0.7000	1.0600
Substrate (NO2) half sat. [mgN/L]	0.1000	0.1000	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiNH3 [mmol/L]	0.0750	0.0750	1.0000

ANAMMOX

Name	Default	Value

Max. spec. growth rate [1/d]	0.1000	0.1000	1.1000
Substrate (NH4) half sat. [mgN/L]	2.0000	2.0000	1.0000
Substrate (NO2) half sat. [mgN/L]	1.0000	1.0000	1.0000
Aerobic decay rate [1/d]	0.0190	0.0190	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0095	0.0095	1.0290
Ki Nitrite [mgN/L]	1000.0000	1000.0000	1.0000
Nitrite sensitivity constant [L / (d mgN)]	0.0160	0.0160	1.0000

OHO

Name	Default	Value	
Max. spec. growth rate [1/d]	3.2000	3.2000	1.0290
Substrate half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Anoxic growth factor [-]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.6200	0.6200	1.0290
Anoxic decay rate [1/d]	0.2330	0.2330	1.0290
Anaerobic decay rate [1/d]	0.1310	0.1310	1.0290
Hydrolysis rate [1/d]	2.1000	2.1000	1.0290
Hydrolysis half sat. [-]	0.0600	0.0600	1.0000
Anoxic hydrolysis factor [-]	0.2800	0.2800	1.0000
Anaerobic hydrolysis factor (AS) [-]	0.0400	0.0400	1.0000
Anaerobic hydrolysis factor (AD) [-]	0.2000	0.5000	1.0000
Adsorption rate of colloids [L/(mgCOD d)]	0.1500	0.8000	1.0290
Ammonification rate [L/(mgN d)]	0.0400	0.0400	1.0290
Assimilative nitrate/nitrite reduction rate [1/d]	0.5000	0.5000	1.0000
Fermentation rate [1/d]	1.6000	3.2000	1.0290
Fermentation half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Fermentation growth factor (AS) [-]	0.2500	0.1250	1.0000

Endogenous products decay rate[1/d]	0	0	1.0000
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

Methylotrophs

Name	Default	Value	
Max. spec. growth rate [1/d]	1.3000	1.3000	1.0720
Methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.0400	0.0400	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0300	0.0300	1.0290
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

PAO

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9500	0.9500	1.0000
Max. spec. growth rate, P-limited [1/d]	0.4200	0.4200	1.0000
Substrate half sat. [mgCOD(PHB)/mgCOD(Zbp)]	0.1000	0.1000	1.0000
Substrate half sat., P-limited [mgCOD(PHB)/mgCOD(Zbp)]	0.0500	0.0500	1.0000
Magnesium half sat. [mgMg/L]	0.1000	0.1000	1.0000
Cation half sat. [mmol/L]	0.1000	0.1000	1.0000
Calcium half sat. [mgCa/L]	0.1000	0.1000	1.0000
Aerobic/anoxic decay rate [1/d]	0.1000	0.1000	1.0000
Aerobic/anoxic maintenance rate [1/d]	0	0	1.0000
Anaerobic decay rate [1/d]	0.0400	0.0400	1.0000
Anaerobic maintenance rate [1/d]	0	0	1.0000

Sequestration rate [1/d]	4.5000	6.0000	1.0000
Anoxic growth factor [-]	0.3300	0.3300	1.0000

Acetogens

Name	Default	Value	
Max. spec. growth rate [1/d]	0.2500	0.2500	1.0290
Substrate half sat. [mgCOD/L]	10.0000	10.0000	1.0000
Acetate inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Anaerobic decay rate [1/d]	0.0500	0.0500	1.0290
Aerobic/anoxic decay rate [1/d]	0.5200	0.5200	1.0290

Methanogens

Name	Default	Value	
Acetoclastic max. spec. growth rate [1/d]	0.3000	0.3000	1.0290
H2-utilizing max. spec. growth rate [1/d]	1.4000	1.4000	1.0290
Acetoclastic substrate half sat. [mgCOD/L]	100.0000	100.0000	1.0000
Acetoclastic methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
H2-utilizing CO2 half sat. [mmol/L]	0.1000	0.1000	1.0000
H2-utilizing substrate half sat. [mgCOD/L]	0.1000	0.1000	1.0000
H2-utilizing methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Acetoclastic propionic inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Acetoclastic anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
Acetoclastic aerobic/anoxic decay rate [1/d]	0.6000	0.6000	1.0290
H2-utilizing anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
H2-utilizing aerobic/anoxic decay rate [1/d]	2.8000	0.6000	1.0290

pH

Name	Default	Value
OHO low pH limit [-]	4.0000	4.0000
OHO high pH limit [-]	10.0000	10.0000
Methylotrophs low pH limit [-]	4.0000	4.0000
Methylotrophs high pH limit [-]	10.0000	10.0000
Autotrophs low pH limit [-]	5.5000	5.5000
Autotrophs high pH limit [-]	9.5000	9.5000
PAO low pH limit [-]	4.0000	4.0000
PAO high pH limit [-]	10.0000	10.0000
OHO low pH limit (anaerobic) [-]	5.5000	5.5000
OHO high pH limit (anaerobic) [-]	8.5000	8.5000
Propionic acetogens low pH limit [-]	4.0000	4.0000
Propionic acetogens high pH limit [-]	10.0000	10.0000
Acetoclastic methanogens low pH limit [-]	5.0000	5.0000
Acetoclastic methanogens high pH limit [-]	9.0000	9.0000
H2-utilizing methanogens low pH limit [-]	5.0000	5.0000
H2-utilizing methanogens high pH limit [-]	9.0000	9.0000

Switches

Name	Default	Value
Aerobic/anoxic DO half sat. [mgO2/L]	0.0500	0.0500
Anoxic/anaerobic NOx half sat. [mgN/L]	0.1500	0.1500
AOB DO half sat. [mgO2/L]	0.2500	0.2500

NOB DO half sat. [mgO2/L]	0.5000	0.5000
ANAMMOX DO half sat. [mgO2/L]	0.0100	0.0100
Anoxic NO3(->NO2) half sat. [mgN/L]	0.1000	0.1000
Anoxic NO3(->N2) half sat. [mgN/L]	0.0500	0.0500
Anoxic NO2(->N2) half sat. (mgN/L)	0.0100	0.0100
NH3 nutrient half sat. [mgN/L]	0.0050	1.000E-4
PolyP half sat. [mgP/mgCOD]	0.0100	0.0100
VFA sequestration half sat. [mgCOD/L]	5.0000	5.0000
P uptake half sat. [mgP/L]	0.1500	0.1500
P nutrient half sat. [mgP/L]	0.0010	0.0010
Autotroph CO2 half sat. [mmol/L]	0.1000	0.1000
H2 low/high half sat. [mgCOD/L]	1.0000	1.0000
Propionic acetogens H2 inhibition [mgCOD/L]	5.0000	5.0000
Synthesis anion/cation half sat. [meq/L]	0.0100	0.0100

Common

Name	Default	Value
Biomass volatile fraction (VSS/TSS)	0.9200	0.9200
Endogenous residue volatile fraction (VSS/TSS)	0.9200	0.9200
N in endogenous residue [mgN/mgCOD]	0.0700	0.0700
P in endogenous residue [mgP/mgCOD]	0.0220	0.0220
Endogenous residue COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Particulate substrate COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000
Particulate inert COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000

AOB

Name	Default	Value
Yield [mgCOD/mgN]	0.1500	0.1500
AOB denite NO2 fraction as TEA [-]	0.5000	0.5000
Byproduct NH4 fraction to N2O [-]	0.0025	0.0025
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

NOB

Name	Default	Value
Yield [mgCOD/mgN]	0.0900	0.0900
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

ANAMMOX

Name	Default	Value
Yield [mgCOD/mgN]	0.1140	0.1140
Nitrate production [mgN/mgBiomassCOD]	2.2800	2.2800
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220

Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

OHO

Name	Default	Value
Yield (aerobic) [-]	0.6660	0.6660
Yield (fermentation, low H2) [-]	0.1000	0.1000
Yield (fermentation, high H2) [-]	0.1000	0.1000
H2 yield (fermentation low H2) [-]	0.3500	0.3500
H2 yield (fermentation high H2) [-]	0	0
Propionate yield (fermentation, low H2) [-]	0	0
Propionate yield (fermentation, high H2) [-]	0.7000	0.7000
CO2 yield (fermentation, low H2) [-]	0.7000	0.7000
CO2 yield (fermentation, high H2) [-]	0	0
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Endogenous fraction - aerobic [-]	0.0800	0.0800
Endogenous fraction - anoxic [-]	0.1030	0.1030
Endogenous fraction - anaerobic [-]	0.1840	0.1840
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield (anoxic) [-]	0.5400	0.5400
Yield propionic (aerobic) [-]	0.6400	0.6400
Yield propionic (anoxic) [-]	0.4600	0.4600
Yield acetic (aerobic) [-]	0.6000	0.6000
Yield acetic (anoxic) [-]	0.4300	0.4300
Yield methanol (aerobic) [-]	0.5000	0.5000
Adsorp. max. [-]	1.0000	1.0000
Max fraction to N2O at high FNA over nitrate [-]	0.0500	0.0500

Max fraction to N2O at high FNA over nitrite [-]	0.1000	0.1000

Methylotrophs

Name	Default	Value
Yield (anoxic) [-]	0.4000	0.4000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Max fraction to N2O at high FNA over nitrate [-]	0.1000	0.1000
Max fraction to N2O at high FNA over nitrite [-]	0.1500	0.1500

PAO

Name	Default	Value
Yield (aerobic) [-]	0.6390	0.6390
Yield (anoxic) [-]	0.5200	0.5200
Aerobic P/PHA uptake [mgP/mgCOD]	0.9300	0.9500
Anoxic P/PHA uptake [mgP/mgCOD]	0.3500	0.3500
Yield of PHA on sequestration [-]	0.8890	0.8890
N in biomass [mgN/mgCOD]	0.0700	0.0700
N in sol. inert [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous part. [-]	0.2500	0.2500
Inert fraction of endogenous sol. [-]	0.2000	0.2000
P/Ac release ratio [mgP/mgCOD]	0.5100	0.4900

COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield of low PP [-]	0.9400	0.9400

Acetogens

Name	Default	Value
Yield [-]	0.1000	0.1000
H2 yield [-]	0.4000	0.4000
CO2 yield [-]	1.0000	1.0000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

Methanogens

Name	Default	Value
Acetoclastic yield [-]	0.1000	0.1000
Methanol acetoclastic yield [-]	0.1000	0.1000
H2-utilizing yield [-]	0.1000	0.1000
Methanol H2-utilizing yield [-]	0.1000	0.1000
N in acetoclastic biomass [mgN/mgCOD]	0.0700	0.0700
N in H2-utilizing biomass [mgN/mgCOD]	0.0700	0.0700
P in acetoclastic biomass [mgP/mgCOD]	0.0220	0.0220
P in H2-utilizing biomass [mgP/mgCOD]	0.0220	0.0220
Acetoclastic fraction to endog. residue [-]	0.0800	0.0800
H2-utilizing fraction to endog. residue [-]	0.0800	0.0800

Acetoclastic COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
H2-utilizing COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

General

Name	Default	Value
Molecular weight of other anions [mg/mmol]	35.5000	35.5000
Molecular weight of other cations [mg/mmol]	39.1000	39.1000
Mg to P mole ratio in polyphosphate [mmolMg/mmolP]	0.3000	0.3000
Cation to P mole ratio in polyphosphate [meq/mmolP]	0.1500	0.3000
Ca to P mole ratio in polyphosphate [mmolCa/mmolP]	0.0500	0.0500
Cation to P mole ratio in organic phosphate [meq/mmolP]	0.0100	0.0100
Bubble rise velocity (anaerobic digester) [cm/s]	23.9000	23.9000
Bubble Sauter mean diameter (anaerobic digester) [cm]	0.3500	0.3500
Anaerobic digester gas hold-up factor []	1.0000	1.0000
Tank head loss per metre of length (from flow) [m/m]	0.0025	0.0025

Mass transfer

Name	Default	Value	
Kl for H2 [m/d]	17.0000	17.0000	1.0240
Kl for CO2 [m/d]	10.0000	10.0000	1.0240
Kl for NH3 [m/d]	1.0000	1.0000	1.0240
Kl for CH4 [m/d]	8.0000	8.0000	1.0240
Kl for N2 [m/d]	15.0000	15.0000	1.0240
Kl for N2O [m/d]	8.0000	8.0000	1.0240
Kl for O2 [m/d]	13.0000	13.0000	1.0240

Henry's law constants

Name	Default	Value	
CO2 [M/atm]	0.0340	0.0340	2400.0000
O2 [M/atm]	0.0013	0.0013	1500.0000
N2 [M/atm]	6.500E-4	6.500E-4	1300.0000
N2O [M/atm]	0.0250	0.0250	2600.0000
NH3 [M/atm]	58.0000	58.0000	4100.0000
CH4 [M/atm]	0.0014	0.0014	1600.0000
H2 [M/atm]	7.800E-4	7.800E-4	500.0000

Physico-chemical rates

Name	Default	Value	
Struvite precipitation rate [1/d]	3.000E+10	3.000E+10	1.0240
Struvite redissolution rate [1/d]	3.000E+11	3.000E+11	1.0240
Struvite half sat. [mgTSS/L]	1.0000	1.0000	1.0000
HDP precipitation rate [L/(molP d)]	1.000E+8	1.000E+8	1.0000
HDP redissolution rate [L/(mol P d)]	1.000E+8	1.000E+8	1.0000
HAP precipitation rate [molHDP/(L d)]	5.000E-4	5.000E-4	1.0000

Physico-chemical constants

Name	Default	Value

Struvite solubility constant [mol/L]	6.918E-14	6.918E-14
HDP solubility product [mol/L]	2.750E-22	2.750E-22
HDP half sat. [mgTSS/L]	1.0000	1.0000
Equilibrium soluble PO4 with Al dosing at pH 7 [mgP/L]	0.0100	0.0100
Al to P ratio [molAl/molP]	0.8000	0.8000
Al(OH)3 solubility product [mol/L]	1.259E+9	1.259E+9
AlHPO4+ dissociation constant [mol/L]	7.943E-13	7.943E-13
Equilibrium soluble PO4 with Fe dosing at pH 7 [mgP/L]	0.0100	0.0100
Fe to P ratio [molFe/molP]	1.6000	1.6000
Fe(OH)3 solubility product [mol/L]	0.0500	0.0500
FeH2PO4++ dissociation constant [mol/L]	5.012E-22	5.012E-22

Aeration

Name	Default	Value
Alpha (surf) OR Alpha F (diff) [-]	0.5000	0.5000
Beta [-]	0.9500	0.9500
Surface pressure [kPa]	101.3250	101.3250
Fractional effective saturation depth (Fed) [-]	0.3250	0.3250
Supply gas CO2 content [vol. %]	0.0350	0.0350
Supply gas O2 [vol. %]	20.9500	20.9500
Off-gas CO2 [vol. %]	2.0000	2.0000
Off-gas O2 [vol. %]	18.8000	18.8000
Off-gas H2 [vol. %]	0	0
Off-gas NH3 [vol. %]	0	0
Off-gas CH4 [vol. %]	0	0
Surface turbulence factor [-]	2.0000	2.0000
Set point controller gain []	1.0000	1.0000

Modified Vesilind

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.387	0.387
Vesilind hindered zone settling parameter (K) [L/g]	0.370	0.370
Clarification switching function [mg/L]	100.000	100.000
Specified TSS conc.for height calc. [mg/L]	2500.000	2500.000
Maximum compactability constant [mg/L]	15000.000	15000.000

Double exponential

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.934	0.934
Maximum (practical) settling velocity (Vo') [ft/min]	0.615	0.615
Hindered zone settling parameter (Kh) [L/g]	0.400	0.400
Flocculent zone settling parameter (Kf) [L/g]	2.500	2.500
Maximum non-settleable TSS [mg/L]	20.0000	20.0000
Non-settleable fraction [-]	0.0010	0.0010
Specified TSS conc. for height calc. [mg/L]	2500.0000	2500.0000

Emission factors

Name	Default	Value
Carbon dioxide equivalence of nitrous oxide	296.0000	296.0000
Carbon dioxide equivalence of methane	23.0000	23.0000

Biofilm general

Name	Default	Value	
Attachment rate [g / (m2 d)]	80.0000	80.0000	1.0000
Attachment TSS half sat. [mg/L]	100.0000	100.0000	1.0000
Detachment rate [g/(m3 d)]	8.000E+4	8.000E+4	1.0000
Solids movement factor []	10.0000	10.0000	1.0000
Diffusion neta []	0.8000	0.8000	1.0000
Thin film limit [mm]	0.5000	0.5000	1.0000
Thick film limit [mm]	3.0000	3.0000	1.0000
Assumed Film thickness for tank volume correction (temp independant) [mm]	0.7500	0.7500	1.0000
Film surface area to media area ratio - Max.[ ]	1.0000	1.0000	1.0000
Minimum biofilm conc. for streamer formation [gTSS/m2]	4.0000	4.0000	1.0000

Maximum biofilm concentrations [mg/L]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	5.000E+4	5.000E+4	1.0000
Methylotrophs	5.000E+4	5.000E+4	1.0000
Ammonia oxidizing biomass (AOB)	1.000E+5	1.000E+5	1.0000
Nitrite oxidizing biomass (NOB)	1.000E+5	1.000E+5	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E+4	5.000E+4	1.0000
Polyphosphate accumulating organisms (PAO)	5.000E+4	5.000E+4	1.0000
Propionic acetogens	5.000E+4	5.000E+4	1.0000
Methanogens - acetoclastic	5.000E+4	5.000E+4	1.0000
Methanogens - hydrogenotrophic	5.000E+4	5.000E+4	1.0000

Endogenous products	3.000E+4	3.000E+4	1.0000
Slowly bio. COD (part.)	5000.0000	5000.0000	1.0000
Slowly bio. COD (colloid.)	4000.0000	4000.0000	1.0000
Part. inert. COD	5000.0000	5000.0000	1.0000
Part. bio. org. N	0	0	1.0000
Part. bio. org. P	0	0	1.0000
Part. inert N	0	0	1.0000
Part. inert P	0	0	1.0000
Stored PHA	5000.0000	5000.0000	1.0000
Releasable stored polyP	1.150E+6	1.150E+6	1.0000
Fixed stored polyP	1.150E+6	1.150E+6	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.000E+10	1.000E+10	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	1.300E+6	1.300E+6	1.0000
Struvite	8.500E+5	8.500E+5	1.0000
Hydroxy-dicalcium-phosphate	1.150E+6	1.150E+6	1.0000
Hydroxy-apatite	1.600E+6	1.600E+6	1.0000
Magnesium	0	0	1.0000

Calcium	0	0	1.0000
Metal	1.000E+10	1.000E+10	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	5.000E+4	5.000E+4	1.0000
User defined 4	5.000E+4	5.000E+4	1.0000
Dissolved oxygen	0	0	1.0000

Effective diffusivities [m2/s]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	5.000E-14	5.000E-14	1.0290
Methylotrophs	5.000E-14	5.000E-14	1.0290
Ammonia oxidizing biomass (AOB)	5.000E-14	5.000E-14	1.0290
Nitrite oxidizing biomass (NOB)	5.000E-14	5.000E-14	1.0290
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E-14	5.000E-14	1.0290
Polyphosphate accumulating organisms (PAO)	5.000E-14	5.000E-14	1.0290
Propionic acetogens	5.000E-14	5.000E-14	1.0290
Methanogens - acetoclastic	5.000E-14	5.000E-14	1.0290
Methanogens - hydrogenotrophic	5.000E-14	5.000E-14	1.0290
Endogenous products	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (part.)	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (colloid.)	5.000E-12	5.000E-12	1.0290
Part. inert. COD	5.000E-14	5.000E-14	1.0290
Part. bio. org. N	5.000E-14	5.000E-14	1.0290
Part. bio. org. P	5.000E-14	5.000E-14	1.0290

Part. inert N	5.000E-14	5.000E-14	1.0290
Part. inert P	5.000E-14	5.000E-14	1.0290
Stored PHA	5.000E-14	5.000E-14	1.0290
Releasable stored polyP	5.000E-14	5.000E-14	1.0290
Fixed stored polyP	5.000E-14	5.000E-14	1.0290
Readily bio. COD (complex)	6.900E-10	6.900E-10	1.0290
Acetate	1.240E-9	1.240E-9	1.0290
Propionate	8.300E-10	8.300E-10	1.0290
Methanol	1.600E-9	1.600E-9	1.0290
Dissolved H2	5.850E-9	5.850E-9	1.0290
Dissolved methane	1.963E-9	1.963E-9	1.0290
Ammonia N	2.000E-9	2.000E-9	1.0290
Sol. bio. org. N	1.370E-9	1.370E-9	1.0290
Nitrous Oxide N	1.607E-9	1.607E-9	1.0290
Nitrite N	2.980E-9	2.980E-9	1.0290
Nitrate N	2.980E-9	2.980E-9	1.0290
Dissolved nitrogen gas	1.900E-9	1.900E-9	1.0290
PO4-P (Sol. & Me Complexed)	2.000E-9	2.000E-9	1.0290
Sol. inert COD	6.900E-10	6.900E-10	1.0290
Sol. inert TKN	6.850E-10	6.850E-10	1.0290
ISS Influent	5.000E-14	5.000E-14	1.0290
Struvite	5.000E-14	5.000E-14	1.0290
Hydroxy-dicalcium-phosphate	5.000E-14	5.000E-14	1.0290
Hydroxy-apatite	5.000E-14	5.000E-14	1.0290
Magnesium	7.200E-10	7.200E-10	1.0290
Calcium	7.200E-10	7.200E-10	1.0290
Metal	4.800E-10	4.800E-10	1.0290
Other Cations (strong bases)	1.440E-9	1.440E-9	1.0290
Other Anions (strong acids)	1.440E-9	1.440E-9	1.0290
Total CO2	1.960E-9	1.960E-9	1.0290
User defined 1	6.900E-10	6.900E-10	1.0290

User defined 2	6.900E-10	6.900E-10	1.0290
User defined 3	5.000E-14	5.000E-14	1.0290
User defined 4	5.000E-14	5.000E-14	1.0290
Dissolved oxygen	2.500E-9	2.500E-9	1.0290

EPS Strength coefficients [ ]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	1.0000	1.0000	1.0000
Methylotrophs	1.0000	1.0000	1.0000
Ammonia oxidizing biomass (AOB)	5.0000	1.0000	1.0000
Nitrite oxidizing biomass (NOB)	25.0000	1.0000	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	10.0000	1.0000	1.0000
Polyphosphate accumulating organisms (PAO)	1.0000	1.0000	1.0000
Propionic acetogens	1.0000	1.0000	1.0000
Methanogens - acetoclastic	1.0000	1.0000	1.0000
Methanogens - hydrogenotrophic	1.0000	1.0000	1.0000
Endogenous products	1.0000	1.0000	1.0000
Slowly bio. COD (part.)	1.0000	1.0000	1.0000
Slowly bio. COD (colloid.)	1.0000	1.0000	1.0000
Part. inert. COD	1.0000	1.0000	1.0000
Part. bio. org. N	1.0000	1.0000	1.0000
Part. bio. org. P	1.0000	1.0000	1.0000
Part. inert N	1.0000	1.0000	1.0000
Part. inert P	1.0000	1.0000	1.0000
Stored PHA	1.0000	1.0000	1.0000
Releasable stored polyP	1.0000	1.0000	1.0000
Fixed stored polyP	1.0000	1.0000	1.0000
Readily bio. COD (complex)	0	0	1.0000

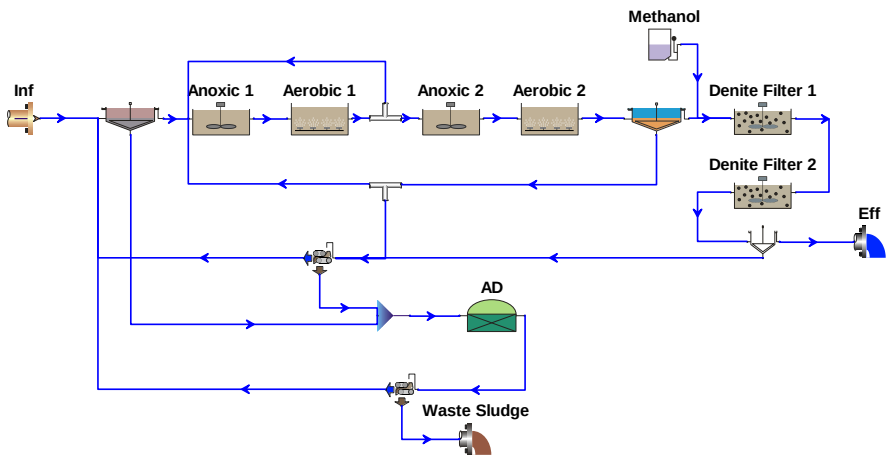
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.0000	1.0000	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	0.3300	0.3300	1.0000
Struvite	1.0000	1.0000	1.0000
Hydroxy-dicalcium-phosphate	1.0000	1.0000	1.0000
Hydroxy-apatite	1.0000	1.0000	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.0000	1.0000	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	1.0000	1.0000	1.0000
User defined 4	1.0000	1.0000	1.0000
Dissolved oxygen	0	0	1.0000

FAIRHAVEN, MA

Case Study No. 7

Bardenpho/Denite Filters w/Anaerobic Digestion

Flow = 5.0 MGD @ 18^{0}C



Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Primary Clarifier 1,2	0.5565	6636.0000	11.210

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Primary Clarifier 1,2	Flowrate [Under]	0.016

Element name	Percent removal	Blanket fraction
Primary Clarifier 1,2	60.00	0.85

Configuration information for all Anaerobic Digester units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	Head space volume
AD	0.6200	4144.0975	20.000	0.5

Operating data Average (flow/time weighted as required)

Element name	Pressure [psi]	pH
AD	14.9	-

Element name	Average Temperature
AD	35.0

Configuration information for all Bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Anoxic 1	0.1556	1600.0000	13.000	Un-aerated
Aerobic 1	0.4668	4800.0000	13.000	684
Anoxic 2	0.3112	3200.0000	13.000	Un-aerated
Aerobic 2	0.2379	3180.0000	10.000	721

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
Anoxic 1	0
Anoxic 2	0
Aerobic 2	2.0

Element name	Average Air flow rate [ft3/min (20C, 1 atm)]
Aerobic 1	2100.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^0.25 + k2	k2 in C = k1(PC)^0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	% of tank area covered by diffusers [%]
Anoxic 1	2.5656	0.0432	0.8200	0.4413	6.2900
Aerobic 1	2.5656	0.0432	0.8200	0.4413	6.2900
Anoxic 2	2.5656	0.0432	0.8200	0.4413	6.2900
Aerobic 2	2.5656	0.0432	0.8200	0.4413	10.0000

Element name	Alpha (surf) OR Alpha F (diff) [-]	Beta [-]	Surface pressure [kPa]	Fractional effective saturation depth (Fed) [-]
Aerobic 1	0.5000	0.9500	101.3250	0.3250

Element name	Supply gas CO2 content [vol. %]	Supply gas O2 [vol. %]	Off-gas CO2 [vol. %]	Off-gas O2 [vol. %]	Off-gas H2 [vol. %]	Off-gas NH3 [vol. %]	Off-gas CH4 [vol. %]	Surface turbulence factor [-]
Aerobic 1	0.0350	20.9500	2.0000	18.8000	0	0	0	2.0000

Configuration information for all BOD Influent units

Operating data Average (flow/time weighted as required)

Element name	Inf
Flow	5.00077666578962
Total Carbonaceous BOD mgBOD/L	180.00
Volatile suspended solids mgVSS/L	110.00
Total suspended solids mgTSS/L	145.00
Total Kjeldahl Nitrogen mgN/L	36.00
Total P mgP/L	5.00
Nitrate N mgN/L	0
pH	7.00
Alkalinity mmol/L	6.00
Calcium mg/L	80.00
Magnesium mg/L	15.00
Dissolved oxygen mg/L	1.10

Element name	Inf
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.1600
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1500
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.5634
Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0500
Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.1300
Fna - Ammonia [gNH3-N/gTKN]	0.6600
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.5000
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0350
Fpo4 - Phosphate [gPO4-P/gTP]	0.5000
FupP - P:COD ratio for unbiodegradable part. COD [gP/gCOD]	0.0110
FZbh - OHO COD fraction [gCOD/g of total COD]	1.000E-4
FZbm - Methylotroph COD fraction [gCOD/g of total COD]	1.000E-4
FZaob - AOB COD fraction [gCOD/g of total COD]	1.000E-4
FZnob - NOB COD fraction [gCOD/g of total COD]	1.000E-4
FZamob - ANAMMOX COD fraction [gCOD/g of total COD]	1.000E-4
FZbp - PAO COD fraction [gCOD/g of total COD]	1.000E-4
FZbpa - Propionic acetogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbam - Acetoclastic methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbhm - H2-utilizing methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZe - Endogenous products COD fraction [gCOD/g of total COD]	0

Configuration information for all Methanol addition units

Operating data Average (flow/time weighted as required)

Element name	Methanol
Ordinary heterotrophic organisms (OHO) mgCOD/L	0
Methylotrophs mgCOD/L	0
Ammonia oxidizing biomass (AOB) mgCOD/L	0
Nitrite oxidizing biomass (NOB) mgCOD/L	0
Anaerobic ammonia oxidizers (ANAMMOX) mgCOD/L	0
Polyphosphate accumulating organisms (PAO) mgCOD/L	0
Propionic acetogens mgCOD/L	0
Methanogens - acetoclastic mgCOD/L	0
Methanogens - hydrogenotrophic mgCOD/L	0
Endogenous products mgCOD/L	0
Slowly bio. COD (part.) mgCOD/L	0
Slowly bio. COD (colloid.) mgCOD/L	0
Part. inert. COD mgCOD/L	0
Part. bio. org. N mgN/L	0
Part. bio. org. P mgP/L	0
Part. inert N mgN/L	0
Part. inert P mgP/L	0
Stored PHA mgCOD/L	0
Releasable stored polyP mgP/L	0
Fixed stored polyP mgP/L	0
Readily bio. COD (complex) mgCOD/L	0
Acetate mgCOD/L	0
Propionate mgCOD/L	0
Methanol mgCOD/L	1188000.00
Dissolved H2 mgCOD/L	0
Dissolved methane mg/L	0
Ammonia N mgN/L	0
Sol. bio. org. N mgN/L	0
Nitrous Oxide N mgN/L	0
Nitrite N mgN/L	0
Nitrate N mgN/L	0
Dissolved nitrogen gas mgN/L	0
PO4-P (Sol. & Me Complexed) mgP/L	0
Sol. inert COD mgCOD/L	0
Sol. inert TKN mgN/L	0
ISS Influent mgISS/L	0
Struvite mgISS/L	0
Hydroxy-dicalcium-phosphate mgISS/L	0
Hydroxy-apatite mgISS/L	0

Magnesium mg/L	0
Calcium mg/L	0
Metal mg/L	0
Other Cations (strong bases) meq/L	0
Other Anions (strong acids) meq/L	0
Total CO2 mmol/L	0
User defined 1 mg/L	0
User defined 2 mg/L	0
User defined 3 mgVSS/L	0
User defined 4 mgISS/L	0
Dissolved oxygen mg/L	0
Flow	0.00015

Configuration information for all Effluent units

Configuration information for all Ideal clarifier units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Sec. Clarifier 1,2	0.8593	8836.0000	13.000

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Sec. Clarifier 1,2	Flow paced	200.00 %

Element name	Average Temperature	Reactive	Percent removal	Blanket fraction
Sec. Clarifier 1,2	Uses global setting	No	99.95	0.05

Configuration information for all Media Bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Denite Filter 1	0.0388	1728.0000	3.000	Un-aerated
Denite Filter 2	0.0388	1728.0000	3.000	Un-aerated

Element name	Specific area [ft2/ft3]	Specific volume [ft3/ft3]	% of reactor filled with media [%]
Denite Filter 1	250	0.5236	100.00

Denite Filter 2	250	0.5236	100.00

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint
Denite Filter 1	0
Denite Filter 2	0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^0.25 + k2	k2 in C = k1(PC)^0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	% of tank area covered by diffusers [%]
Denite Filter 1	2.5656	0.0432	0.8200	0.4413	10.0000
Denite Filter 2	2.5656	0.0432	0.8200	0.4413	10.0000

Configuration information for all Dewatering unit units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Dewatering unit3	Flowrate [Under]	0.01
Dewatering unit32	Flowrate [Under]	0.01

Element name	Percent removal
Dewatering unit3	90.00
Dewatering unit32	95.00

Configuration information for all Point clarifier units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Point clarifier30	Fraction	0.02

Element name	Percent removal
Point clarifier30	90.00

Configuration information for all Sludge units

Configuration information for all Splitter units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
	Flowrate [Side]	0.053
Splitter8	Flow paced	200.00 %

BioWin Album

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Elements	Total Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Nitrite N [mgN/L]	Total N [mgN/L]
Inf	180.00	145.03	23.76	0	0	36.00
Eff	11.88	1.19	0.43	0.00	0.02	1.98

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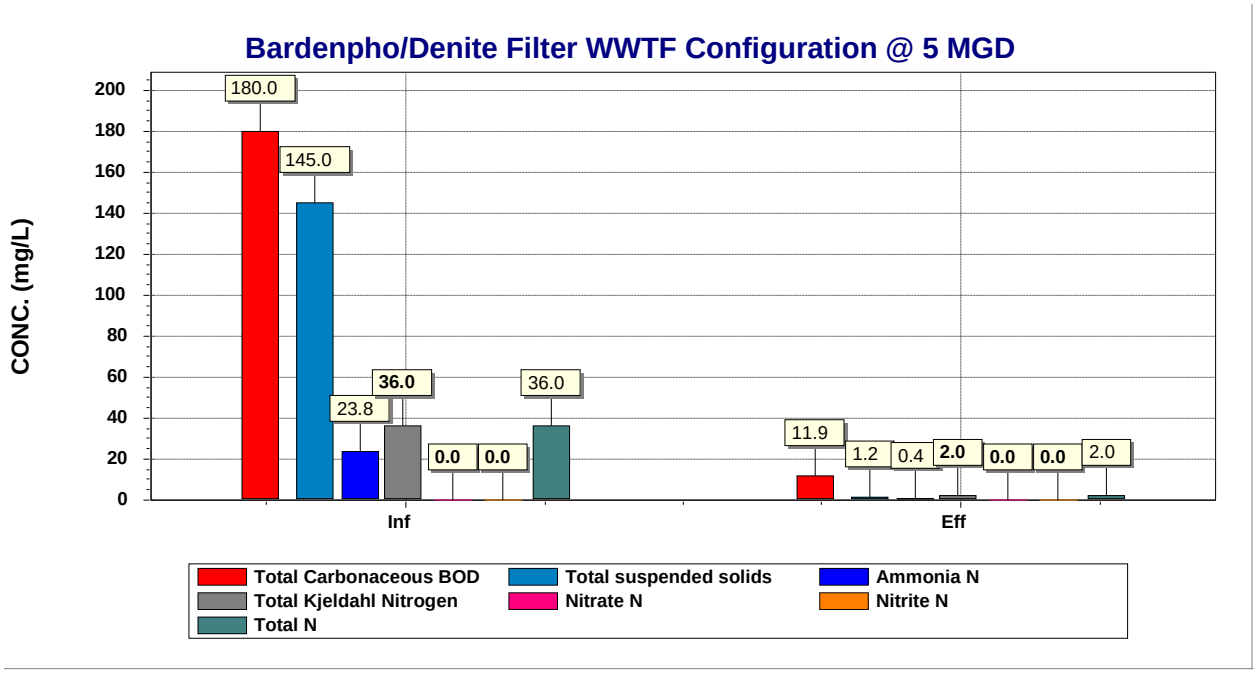

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Inf			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	110.00	4590.69	

Total suspended solids	145.03	6052.61	
Particulate COD	175.96	7343.43	
Filtered COD	174.41	7278.60	
Total COD	350.37	14622.03	
Soluble PO4-P	2.50	104.33	
Total P	5.00	208.67	
Filtered TKN	29.43	1228.30	
Particulate TKN	6.57	274.11	
Total Kjeldahl Nitrogen	36.00	1502.41	
Filtered Carbonaceous BOD	111.06	4634.87	
Total Carbonaceous BOD	180.00	7512.03	
Nitrite + Nitrate	0	0	
Total N	36.00	1502.41	
Total inorganic N	23.76	991.59	
Alkalinity	6.00	113.58	mmol/L and kmol/d
pH	7.00		
Volatile fatty acids	8.41	350.93	
ISS precipitate	0	0	
ISS cellular	0.03	1.25	
ISS Total	35.03	1461.93	
Ammonia N	23.76	991.59	
Nitrate N	0	0	
Parameters	Value	Units	

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Anoxic 1			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	3314.00	694064.70	
Total suspended solids	4409.64	923527.96	
Particulate COD	4852.83	1016347.13	
Filtered COD	26.47	5544.14	
Total COD	4879.30	1021891.27	
Soluble PO4-P	3.07	643.56	
Total P	96.40	20189.70	
Filtered TKN	9.41	1970.55	
Particulate TKN	295.05	61793.83	
Total Kjeldahl Nitrogen	304.46	63764.38	
Filtered Carbonaceous BOD	5.96	1248.13	
Total Carbonaceous BOD	1425.42	298530.96	
Nitrite + Nitrate	1.72	360.07	
Total N	306.18	64124.44	

Total inorganic N	9.09	1902.91	
Alkalinity	4.72	448.31	mmol/L and kmol/d
pH	6.95		
Volatile fatty acids	1.10	230.31	
ISS precipitate	0	0.00	
ISS cellular	218.72	45808.46	
ISS Total	1095.63	229463.26	
Ammonia N	7.37	1542.85	
Nitrate N	0.01	1.28	

Parameters	Value	Units
Hydraulic residence time	0.1	hours
Velocity gradient	76.35	1/s
VSS destruction	0	%
Total solids mass	5725.92	lb
Total readily biodegradable COD	6.44	mg/L
OUR - Total	7.21	mgO/L/hr
OUR - Carbonaceous	6.22	mgO/L/hr
OUR - Nitrification	0.99	mgO/L/hr
Nit - Ammonia removal rate	0.30	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	0.30	mgN/L/hr
Nit - Nitrate production rate	0.01	mgN/L/hr
Denit - Nitrate removal rate	1.31	mgN/L/hr
Denit - Nitrite removal rate	11.97	mgN/L/hr
Denit - N2 production rate	13.28	mgN/L/hr
Off gas flow rate (dry)	1.17	ft3/min
Off gas Oxygen	0	%
Off gas Carbon dioxide	81.05	%
Off gas Ammonia	0.01	%
Off gas Hydrogen	4.17	%
Off gas Methane	0.08	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	9.19	mg/L
OTR	0	lb/hr
SOTR	0	lb/hr
OTE	100.00	%
SOTE	100.00	%
Air flow rate	0	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0	ft3/min (20C, 1 atm)
# of diffusers	228.00	

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Aerobic 1			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	3310.05	693236.98	
Total suspended solids	4406.19	922805.50	
Particulate COD	4845.50	1014811.90	
Filtered COD	19.44	4072.18	
Total COD	4864.94	1018884.08	
Soluble PO4-P	2.99	625.76	
Total P	96.40	20189.70	
Filtered TKN	5.71	1195.97	
Particulate TKN	295.37	61859.64	
Total Kjeldahl Nitrogen	301.08	63055.61	
Filtered Carbonaceous BOD	1.26	264.36	
Total Carbonaceous BOD	1416.09	296577.79	
Nitrite + Nitrate	4.40	921.62	
Total N	305.48	63977.23	
Total inorganic N	8.25	1728.29	
Alkalinity	4.28	406.94	mmol/L and kmol/d
pH	6.89		
Volatile fatty acids	0.05	9.51	
ISS precipitate	0	0.00	
ISS cellular	219.23	45913.72	
ISS Total	1096.14	229568.52	
Ammonia N	3.85	806.66	
Nitrate N	0.03	5.69	

Parameters	Value	Units
Hydraulic residence time	0.4	hours
Velocity gradient	174.23	1/s
VSS destruction	0.12	%
Total solids mass	17164.32	lb
Total readily biodegradable COD	1.72	mg/L
OUR - Total	54.36	mgO/L/hr
OUR - Carbonaceous	29.05	mgO/L/hr
OUR - Nitrification	25.31	mgO/L/hr
Nit - Ammonia removal rate	7.66	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	7.58	mgN/L/hr
Nit - Nitrate production rate	0.46	mgN/L/hr
Denit - Nitrate removal rate	0.41	mgN/L/hr
Denit - Nitrite removal rate	1.16	mgN/L/hr
Denit - N2 production rate	1.57	mgN/L/hr
Off gas flow rate (dry)	2094.16	ft3/min

Off gas Oxygen	18.83	%
Off gas Carbon dioxide	2.18	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.08	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	9.19	mg/L
OTR	213.36	lb/hr
SOTR	516.08	lb/hr
OTE	9.73	%
SOTE	24.09	%
Air flow rate	2100.00	ft3/min (20C, 1 atm)
Air flow rate / diffuser	3.07	ft3/min (20C, 1 atm)
# of diffusers	684.00	

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Anoxic 2			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	3305.97	416443.69	
Total suspended solids	4401.93	554497.79	
Particulate COD	4839.32	609595.41	
Filtered COD	20.17	2540.59	
Total COD	4859.49	612136.00	
Soluble PO4-P	3.04	382.91	
Total P	96.40	12143.38	
Filtered TKN	5.82	733.74	
Particulate TKN	295.24	37189.92	
Total Kjeldahl Nitrogen	301.06	37923.66	
Filtered Carbonaceous BOD	1.30	163.28	
Total Carbonaceous BOD	1412.17	177887.36	
Nitrite + Nitrate	1.37	173.16	
Total N	302.43	38096.83	
Total inorganic N	5.86	738.30	
Alkalinity	4.54	259.55	mmol/L and kmol/d
pH	6.97		
Volatile fatty acids	0.34	43.02	
ISS precipitate	0	0.00	
ISS cellular	219.04	27592.33	
ISS Total	1095.95	138054.09	
Ammonia N	4.49	565.13	
Nitrate N	0.00	0.06	

Parameters	Value	Units
Hydraulic residence time	0.5	hours
Velocity gradient	72.66	1/s
VSS destruction	0.12	%
Total solids mass	11431.82	lb
Total readily biodegradable COD	1.82	mg/L
OUR - Total	0.38	mgO/L/hr
OUR - Carbonaceous	0.29	mgO/L/hr
OUR - Nitrification	0.09	mgO/L/hr
Nit - Ammonia removal rate	0.03	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	0.03	mgN/L/hr
Nit - Nitrate production rate	0.00	mgN/L/hr
Denit - Nitrate removal rate	0.06	mgN/L/hr
Denit - Nitrite removal rate	6.08	mgN/L/hr
Denit - N2 production rate	6.14	mgN/L/hr
Off gas flow rate (dry)	2.37	ft3/min
Off gas Oxygen	0	%
Off gas Carbon dioxide	74.90	%
Off gas Ammonia	0.01	%
Off gas Hydrogen	6.10	%
Off gas Methane	0.03	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	9.19	mg/L
OTR	0	lb/hr
SOTR	0	lb/hr
OTE	100.00	%
SOTE	100.00	%
Air flow rate	0	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0	ft3/min (20C, 1 atm)
# of diffusers	456.00	

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Aerobic 2			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	3299.68	415650.95	
Total suspended solids	4395.92	553740.68	
Particulate COD	4828.71	608258.00	
Filtered COD	19.04	2398.98	
Total COD	4847.75	610656.97	
Soluble PO4-P	3.05	384.22	
Total P	96.40	12143.38	
Filtered TKN	2.36	297.55	

Particulate TKN	295.23	37189.20	
Total Kjeldahl Nitrogen	297.59	37486.75	
Filtered Carbonaceous BOD	0.98	123.05	
Total Carbonaceous BOD	1405.44	177038.81	
Nitrite + Nitrate	4.76	599.81	
Total N	302.35	38086.56	
Total inorganic N	5.44	684.99	
Alkalinity	4.03	230.22	mmol/L and kmol/d
pH	6.91		
Volatile fatty acids	0.01	1.59	
ISS precipitate	0	0.00	
ISS cellular	219.33	27627.97	
ISS Total	1096.24	138089.73	
Ammonia N	0.68	85.18	
Nitrate N	0.47	59.64	

Parameters	Value	Units
Hydraulic residence time	0.4	hours
Velocity gradient	205.51	1/s
VSS destruction	0.19	%
Total solids mass	8726.81	lb
Total readily biodegradable COD	1.38	mg/L
OUR - Total	61.70	mgO/L/hr
OUR - Carbonaceous	30.22	mgO/L/hr
OUR - Nitrification	31.48	mgO/L/hr
Nit - Ammonia removal rate	9.27	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	9.17	mgN/L/hr
Nit - Nitrate production rate	1.36	mgN/L/hr
Denit - Nitrate removal rate	0.11	mgN/L/hr
Denit - Nitrite removal rate	0.11	mgN/L/hr
Denit - N2 production rate	0.21	mgN/L/hr
Off gas flow rate (dry)	2112.19	ft3/min
Off gas Oxygen	19.63	%
Off gas Carbon dioxide	1.35	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.07	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	8.95	mg/L
OTR	132.99	lb/hr
SOTR	405.77	lb/hr
OTE	6.01	%

SOTE	18.76	%
Air flow rate	2120.15	ft3/min (20C, 1 atm)
Air flow rate / diffuser	2.94	ft3/min (20C, 1 atm)
# of diffusers	721.00	

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Sec. Clarifier 1,2			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	4.89	207.83	
Total suspended solids	6.51	276.87	
Particulate COD	7.16	304.13	
Filtered COD	19.04	809.39	
Total COD	26.20	1113.52	
Soluble PO4-P	3.05	129.63	
Total P	3.19	135.51	
Filtered TKN	2.36	100.39	
Particulate TKN	0.44	18.59	
Total Kjeldahl Nitrogen	2.80	118.98	
Filtered Carbonaceous BOD	0.98	41.52	
Total Carbonaceous BOD	3.06	129.97	
Nitrite + Nitrate	4.76	202.37	
Total N	7.56	321.35	
Total inorganic N	5.44	231.11	
Alkalinity	4.03	77.68	mmol/L and kmol/d
pH	6.91		
Volatile fatty acids	0.01	0.54	
ISS precipitate	0	0.00	
ISS cellular	0.33	13.81	
ISS Total	1.62	69.04	
Ammonia N	0.68	28.74	
Nitrate N	0.47	20.12	

Parameters	Value	Units
Hydraulic residence time	1.37	hours
Percent removal	99.95	%
Height of specified concentration	0.65	ft
Total solids mass	2421.89	lb
Surface overflow rate	576.35	gal/(ft2 d)
Solids loading rate	62.67	lb/(ft2 d)

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Eff			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	0.98	40.99	
Total suspended solids	1.19	49.45	
Particulate COD	1.43	59.51	
Filtered COD	32.10	1337.17	
Total COD	33.53	1396.68	
Soluble PO4-P	2.90	120.75	
Total P	2.93	121.98	
Filtered TKN	1.87	77.97	
Particulate TKN	0.09	3.91	
Total Kjeldahl Nitrogen	1.97	81.88	
Filtered Carbonaceous BOD	11.30	470.83	
Total Carbonaceous BOD	11.88	494.92	
Nitrite + Nitrate	0.02	0.74	
Total N	1.98	82.62	
Total inorganic N	0.45	18.55	
Alkalinity	4.35	82.22	mmol/L and kmol/d
pH	6.99		
Volatile fatty acids	0.59	24.50	
ISS precipitate	0	0.00	
ISS cellular	0.07	2.94	
ISS Total	0.20	8.46	
Ammonia N	0.43	17.80	
Nitrate N	0.00	0.09	
Parameters	Value	Units	

Global Parameters

AOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9000	0.9000	1.0720
Substrate (NH4) half sat. [mgN/L]	0.7000	0.7000	1.0000
Byproduct NH4 logistic slope [-]	50.0000	50.0000	1.0000
Byproduct NH4 inflection point [mgN/L]	1.4000	1.4000	1.0000
AOB denite DO half sat. [mg/L]	0.1000	0.1000	1.0000
AOB denite HNO2 half sat. [mgN/L]	5.000E-6	5.000E-6	1.0000

Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiHNO2 [mmol/L]	0.0050	0.0050	1.0000

NOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.7000	0.7000	1.0600
Substrate (NO2) half sat. [mgN/L]	0.1000	0.1000	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiNH3 [mmol/L]	0.0750	0.0750	1.0000

ANAMMOX

Name	Default	Value	
Max. spec. growth rate [1/d]	0.1000	0.1000	1.1000
Substrate (NH4) half sat. [mgN/L]	2.0000	2.0000	1.0000
Substrate (NO2) half sat. [mgN/L]	1.0000	1.0000	1.0000
Aerobic decay rate [1/d]	0.0190	0.0190	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0095	0.0095	1.0290
Ki Nitrite [mgN/L]	1000.0000	1000.0000	1.0000
Nitrite sensitivity constant [L / (d mgN)]	0.0160	0.0160	1.0000

OHO

Name	Default	Value	
Max. spec. growth rate [1/d]	3.2000	3.2000	1.0290
Substrate half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Anoxic growth factor [-]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.6200	0.6200	1.0290

Anoxic decay rate [1/d]	0.2330	0.2330	1.0290
Anaerobic decay rate [1/d]	0.1310	0.1310	1.0290
Hydrolysis rate [1/d]	2.1000	2.1000	1.0290
Hydrolysis half sat. [-]	0.0600	0.0600	1.0000
Anoxic hydrolysis factor [-]	0.2800	0.2800	1.0000
Anaerobic hydrolysis factor (AS) [-]	0.0400	0.0400	1.0000
Anaerobic hydrolysis factor (AD) [-]	0.2000	0.5000	1.0000
Adsorption rate of colloids [L/(mgCOD d)]	0.1500	0.8000	1.0290
Ammonification rate [L/(mgN d)]	0.0400	0.0400	1.0290
Assimilative nitrate/nitrite reduction rate [1/d]	0.5000	0.5000	1.0000
Fermentation rate [1/d]	1.6000	3.2000	1.0290
Fermentation half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Fermentation growth factor (AS) [-]	0.2500	0.1250	1.0000
Endogenous products decay rate[1/d]	0	0	1.0000
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

Methylotrophs

Name	Default	Value	
Max. spec. growth rate [1/d]	1.3000	1.3000	1.0720
Methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.0400	0.0400	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0300	0.0300	1.0290
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

PAO

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9500	0.9500	1.0000
Max. spec. growth rate, P-limited [1/d]	0.4200	0.4200	1.0000
Substrate half sat. [mgCOD(PHB)/mgCOD(Zbp)]	0.1000	0.1000	1.0000
Substrate half sat., P-limited [mgCOD(PHB)/mgCOD(Zbp)]	0.0500	0.0500	1.0000
Magnesium half sat. [mgMg/L]	0.1000	0.1000	1.0000
Cation half sat. [mmol/L]	0.1000	0.1000	1.0000
Calcium half sat. [mgCa/L]	0.1000	0.1000	1.0000
Aerobic/anoxic decay rate [1/d]	0.1000	0.1000	1.0000
Aerobic/anoxic maintenance rate [1/d]	0	0	1.0000
Anaerobic decay rate [1/d]	0.0400	0.0400	1.0000
Anaerobic maintenance rate [1/d]	0	0	1.0000
Sequestration rate [1/d]	4.5000	6.0000	1.0000
Anoxic growth factor [-]	0.3300	0.3300	1.0000

Acetogens

Name	Default	Value	
Max. spec. growth rate [1/d]	0.2500	0.2500	1.0290
Substrate half sat. [mgCOD/L]	10.0000	10.0000	1.0000
Acetate inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Anaerobic decay rate [1/d]	0.0500	0.0500	1.0290
Aerobic/anoxic decay rate [1/d]	0.5200	0.5200	1.0290

Methanogens

Name	Default	Value	
Acetoclastic max. spec. growth rate [1/d]	0.3000	0.3000	1.0290
H2-utilizing max. spec. growth rate [1/d]	1.4000	1.4000	1.0290
Acetoclastic substrate half sat. [mgCOD/L]	100.0000	100.0000	1.0000
Acetoclastic methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
H2-utilizing CO2 half sat. [mmol/L]	0.1000	0.1000	1.0000
H2-utilizing substrate half sat. [mgCOD/L]	0.1000	0.1000	1.0000
H2-utilizing methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Acetoclastic propionic inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Acetoclastic anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
Acetoclastic aerobic/anoxic decay rate [1/d]	0.6000	0.6000	1.0290
H2-utilizing anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
H2-utilizing aerobic/anoxic decay rate [1/d]	2.8000	0.6000	1.0290

pH

Name	Default	Value
OHO low pH limit [-]	4.0000	4.0000
OHO high pH limit [-]	10.0000	10.0000
Methylotrophs low pH limit [-]	4.0000	4.0000
Methylotrophs high pH limit [-]	10.0000	10.0000
Autotrophs low pH limit [-]	5.5000	5.5000
Autotrophs high pH limit [-]	9.5000	9.5000
PAO low pH limit [-]	4.0000	4.0000
PAO high pH limit [-]	10.0000	10.0000
OHO low pH limit (anaerobic) [-]	5.5000	5.5000
OHO high pH limit (anaerobic) [-]	8.5000	8.5000
Propionic acetogens low pH limit [-]	4.0000	4.0000
Propionic acetogens high pH limit [-]	10.0000	10.0000

Acetoclastic methanogens low pH limit [-]	5.0000	5.0000
Acetoclastic methanogens high pH limit [-]	9.0000	9.0000
H2-utilizing methanogens low pH limit [-]	5.0000	5.0000
H2-utilizing methanogens high pH limit [-]	9.0000	9.0000

Switches

Name	Default	Value
Aerobic/anoxic DO half sat. [mgO2/L]	0.0500	0.0500
Anoxic/anaerobic NOx half sat. [mgN/L]	0.1500	0.1500
AOB DO half sat. [mgO2/L]	0.2500	0.2500
NOB DO half sat. [mgO2/L]	0.5000	0.5000
ANAMMOX DO half sat. [mgO2/L]	0.0100	0.0100
Anoxic NO3(->NO2) half sat. [mgN/L]	0.1000	0.1000
Anoxic NO3(->N2) half sat. [mgN/L]	0.0500	0.0500
Anoxic NO2(->N2) half sat. (mgN/L)	0.0100	0.0100
NH3 nutrient half sat. [mgN/L]	0.0050	1.000E-4
PolyP half sat. [mgP/mgCOD]	0.0100	0.0100
VFA sequestration half sat. [mgCOD/L]	5.0000	5.0000
P uptake half sat. [mgP/L]	0.1500	0.1500
P nutrient half sat. [mgP/L]	0.0010	0.0010
Autotroph CO2 half sat. [mmol/L]	0.1000	0.1000
H2 low/high half sat. [mgCOD/L]	1.0000	1.0000
Propionic acetogens H2 inhibition [mgCOD/L]	5.0000	5.0000
Synthesis anion/cation half sat. [meq/L]	0.0100	0.0100

Common

Name	Default	Value
Biomass volatile fraction (VSS/TSS)	0.9200	0.9200
Endogenous residue volatile fraction (VSS/TSS)	0.9200	0.9200
N in endogenous residue [mgN/mgCOD]	0.0700	0.0700
P in endogenous residue [mgP/mgCOD]	0.0220	0.0220
Endogenous residue COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Particulate substrate COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000
Particulate inert COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000

AOB

Name	Default	Value
Yield [mgCOD/mgN]	0.1500	0.1500
AOB denite NO2 fraction as TEA [-]	0.5000	0.5000
Byproduct NH4 fraction to N2O [-]	0.0025	0.0025
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

NOB

Name	Default	Value
Yield [mgCOD/mgN]	0.0900	0.0900
N in biomass [mgN/mgCOD]	0.0700	0.0700

P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

ANAMMOX

Name	Default	Value
Yield [mgCOD/mgN]	0.1140	0.1140
Nitrate production [mgN/mgBiomassCOD]	2.2800	2.2800
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

OHO

Name	Default	Value
Yield (aerobic) [-]	0.6660	0.6660
Yield (fermentation, low H2) [-]	0.1000	0.1000
Yield (fermentation, high H2) [-]	0.1000	0.1000
H2 yield (fermentation low H2) [-]	0.3500	0.3500
H2 yield (fermentation high H2) [-]	0	0
Propionate yield (fermentation, low H2) [-]	0	0
Propionate yield (fermentation, high H2) [-]	0.7000	0.7000
CO2 yield (fermentation, low H2) [-]	0.7000	0.7000
CO2 yield (fermentation, high H2) [-]	0	0
N in biomass [mgN/mgCOD]	0.0700	0.0700

P in biomass [mgP/mgCOD]	0.0220	0.0220
Endogenous fraction - aerobic [-]	0.0800	0.0800
Endogenous fraction - anoxic [-]	0.1030	0.1030
Endogenous fraction - anaerobic [-]	0.1840	0.1840
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield (anoxic) [-]	0.5400	0.5400
Yield propionic (aerobic) [-]	0.6400	0.6400
Yield propionic (anoxic) [-]	0.4600	0.4600
Yield acetic (aerobic) [-]	0.6000	0.6000
Yield acetic (anoxic) [-]	0.4300	0.4300
Yield methanol (aerobic) [-]	0.5000	0.5000
Adsorp. max. [-]	1.0000	1.0000
Max fraction to N2O at high FNA over nitrate [-]	0.0500	0.0500
Max fraction to N2O at high FNA over nitrite [-]	0.1000	0.1000

Methylotrophs

Name	Default	Value
Yield (anoxic) [-]	0.4000	0.4000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Max fraction to N2O at high FNA over nitrate [-]	0.1000	0.1000
Max fraction to N2O at high FNA over nitrite [-]	0.1500	0.1500

PAO

Name	Default	Value
Yield (aerobic) [-]	0.6390	0.6390
Yield (anoxic) [-]	0.5200	0.5200
Aerobic P/PHA uptake [mgP/mgCOD]	0.9300	0.9500
Anoxic P/PHA uptake [mgP/mgCOD]	0.3500	0.3500
Yield of PHA on sequestration [-]	0.8890	0.8890
N in biomass [mgN/mgCOD]	0.0700	0.0700
N in sol. inert [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous part. [-]	0.2500	0.2500
Inert fraction of endogenous sol. [-]	0.2000	0.2000
P/Ac release ratio [mgP/mgCOD]	0.5100	0.4900
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield of low PP [-]	0.9400	0.9400

Acetogens

Name	Default	Value
Yield [-]	0.1000	0.1000
H2 yield [-]	0.4000	0.4000
CO2 yield [-]	1.0000	1.0000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

Methanogens

Name	Default	Value
Acetoclastic yield [-]	0.1000	0.1000
Methanol acetoclastic yield [-]	0.1000	0.1000
H2-utilizing yield [-]	0.1000	0.1000
Methanol H2-utilizing yield [-]	0.1000	0.1000
N in acetoclastic biomass [mgN/mgCOD]	0.0700	0.0700
N in H2-utilizing biomass [mgN/mgCOD]	0.0700	0.0700
P in acetoclastic biomass [mgP/mgCOD]	0.0220	0.0220
P in H2-utilizing biomass [mgP/mgCOD]	0.0220	0.0220
Acetoclastic fraction to endog. residue [-]	0.0800	0.0800
H2-utilizing fraction to endog. residue [-]	0.0800	0.0800
Acetoclastic COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
H2-utilizing COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

General

Name	Default	Value
Molecular weight of other anions [mg/mmol]	35.5000	35.5000
Molecular weight of other cations [mg/mmol]	39.1000	39.1000
Mg to P mole ratio in polyphosphate [mmolMg/mmolP]	0.3000	0.3000
Cation to P mole ratio in polyphosphate [meq/mmolP]	0.1500	0.3000
Ca to P mole ratio in polyphosphate [mmolCa/mmolP]	0.0500	0.0500
Cation to P mole ratio in organic phosphate [meq/mmolP]	0.0100	0.0100
Bubble rise velocity (anaerobic digester) [cm/s]	23.9000	23.9000
Bubble Sauter mean diameter (anaerobic digester) [cm]	0.3500	0.3500
Anaerobic digester gas hold-up factor []	1.0000	1.0000

Tank head loss per metre of length (from flow) [m/m]	0.0025	0.0025

Mass transfer

Name	Default	Value	
Kl for H2 [m/d]	17.0000	17.0000	1.0240
Kl for CO2 [m/d]	10.0000	10.0000	1.0240
Kl for NH3 [m/d]	1.0000	1.0000	1.0240
Kl for CH4 [m/d]	8.0000	8.0000	1.0240
Kl for N2 [m/d]	15.0000	15.0000	1.0240
Kl for N2O [m/d]	8.0000	8.0000	1.0240
Kl for O2 [m/d]	13.0000	13.0000	1.0240

Henry's law constants

Name	Default	Value	
CO2 [M/atm]	0.0340	0.0340	2400.0000
O2 [M/atm]	0.0013	0.0013	1500.0000
N2 [M/atm]	6.500E-4	6.500E-4	1300.0000
N2O [M/atm]	0.0250	0.0250	2600.0000
NH3 [M/atm]	58.0000	58.0000	4100.0000
CH4 [M/atm]	0.0014	0.0014	1600.0000
H2 [M/atm]	7.800E-4	7.800E-4	500.0000

Physico-chemical rates

Name	Default	Value	
Struvite precipitation rate [1/d]	3.000E+10	3.000E+10	1.0240
Struvite redissolution rate [1/d]	3.000E+11	3.000E+11	1.0240
Struvite half sat. [mgTSS/L]	1.0000	1.0000	1.0000
HDP precipitation rate [L/(molP d)]	1.000E+8	1.000E+8	1.0000
HDP redissolution rate [L/(mol P d)]	1.000E+8	1.000E+8	1.0000
HAP precipitation rate [molHDP/(L d)]	5.000E-4	5.000E-4	1.0000

Physico-chemical constants

Name	Default	Value
Struvite solubility constant [mol/L]	6.918E-14	6.918E-14
HDP solubility product [mol/L]	2.750E-22	2.750E-22
HDP half sat. [mgTSS/L]	1.0000	1.0000
Equilibrium soluble PO4 with Al dosing at pH 7 [mgP/L]	0.0100	0.0100
Al to P ratio [molAl/molP]	0.8000	0.8000
Al(OH)3 solubility product [mol/L]	1.259E+9	1.259E+9
AlHPO4+ dissociation constant [mol/L]	7.943E-13	7.943E-13
Equilibrium soluble PO4 with Fe dosing at pH 7 [mgP/L]	0.0100	0.0100
Fe to P ratio [molFe/molP]	1.6000	1.6000
Fe(OH)3 solubility product [mol/L]	0.0500	0.0500
FeH2PO4++ dissociation constant [mol/L]	5.012E-22	5.012E-22

Aeration

Name	Default	Value
Alpha (surf) OR Alpha F (diff) [-]	0.5000	0.5000
Beta [-]	0.9500	0.9500
Surface pressure [kPa]	101.3250	101.3250
Fractional effective saturation depth (Fed) [-]	0.3250	0.3250
Supply gas CO2 content [vol. %]	0.0350	0.0350
Supply gas O2 [vol. %]	20.9500	20.9500
Off-gas CO2 [vol. %]	2.0000	2.0000
Off-gas O2 [vol. %]	18.8000	18.8000
Off-gas H2 [vol. %]	0	0
Off-gas NH3 [vol. %]	0	0
Off-gas CH4 [vol. %]	0	0
Surface turbulence factor [-]	2.0000	2.0000
Set point controller gain []	1.0000	1.0000

Modified Vesilind

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.387	0.387
Vesilind hindered zone settling parameter (K) [L/g]	0.370	0.370
Clarification switching function [mg/L]	100.000	100.000
Specified TSS conc.for height calc. [mg/L]	2500.000	2500.000
Maximum compactability constant [mg/L]	15000.000	15000.000

Double exponential

Name	Default	Value

Maximum Vesilind settling velocity (Vo) [ft/min]	0.934	0.934
Maximum (practical) settling velocity (Vo') [ft/min]	0.615	0.615
Hindered zone settling parameter (Kh) [L/g]	0.400	0.400
Flocculent zone settling parameter (Kf) [L/g]	2.500	2.500
Maximum non-settleable TSS [mg/L]	20.0000	20.0000
Non-settleable fraction [-]	0.0010	0.0010
Specified TSS conc. for height calc. [mg/L]	2500.0000	2500.0000

Emission factors

Name	Default	Value
Carbon dioxide equivalence of nitrous oxide	296.0000	296.0000
Carbon dioxide equivalence of methane	23.0000	23.0000

Biofilm general

Name	Default	Value	
Attachment rate [g / (m2 d)]	80.0000	80.0000	1.0000
Attachment TSS half sat. [mg/L]	100.0000	100.0000	1.0000
Detachment rate [g/(m3 d)]	8.000E+4	8.000E+4	1.0000
Solids movement factor []	10.0000	10.0000	1.0000
Diffusion neta []	0.8000	0.8000	1.0000
Thin film limit [mm]	0.5000	0.5000	1.0000
Thick film limit [mm]	3.0000	3.0000	1.0000
Assumed Film thickness for tank volume correction (temp independant) [mm]	0.7500	0.7500	1.0000
Film surface area to media area ratio - Max.[ ]	1.0000	1.0000	1.0000
Minimum biofilm conc. for streamer formation [gTSS/m2]	4.0000	4.0000	1.0000

Maximum biofilm concentrations [mg/L]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	5.000E+4	5.000E+4	1.0000
Methylotrophs	5.000E+4	5.000E+4	1.0000
Ammonia oxidizing biomass (AOB)	1.000E+5	1.000E+5	1.0000
Nitrite oxidizing biomass (NOB)	1.000E+5	1.000E+5	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E+4	5.000E+4	1.0000
Polyphosphate accumulating organisms (PAO)	5.000E+4	5.000E+4	1.0000
Propionic acetogens	5.000E+4	5.000E+4	1.0000
Methanogens - acetoclastic	5.000E+4	5.000E+4	1.0000
Methanogens - hydrogenotrophic	5.000E+4	5.000E+4	1.0000
Endogenous products	3.000E+4	3.000E+4	1.0000
Slowly bio. COD (part.)	5000.0000	5000.0000	1.0000
Slowly bio. COD (colloid.)	4000.0000	4000.0000	1.0000
Part. inert. COD	5000.0000	5000.0000	1.0000
Part. bio. org. N	0	0	1.0000
Part. bio. org. P	0	0	1.0000
Part. inert N	0	0	1.0000
Part. inert P	0	0	1.0000
Stored PHA	5000.0000	5000.0000	1.0000
Releasable stored polyP	1.150E+6	1.150E+6	1.0000
Fixed stored polyP	1.150E+6	1.150E+6	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000

Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.000E+10	1.000E+10	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	1.300E+6	1.300E+6	1.0000
Struvite	8.500E+5	8.500E+5	1.0000
Hydroxy-dicalcium-phosphate	1.150E+6	1.150E+6	1.0000
Hydroxy-apatite	1.600E+6	1.600E+6	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.000E+10	1.000E+10	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	5.000E+4	5.000E+4	1.0000
User defined 4	5.000E+4	5.000E+4	1.0000
Dissolved oxygen	0	0	1.0000

Effective diffusivities [m2/s]

Name	Default	Value

Ordinary heterotrophic organisms (OHO)	5.000E-14	5.000E-14	1.0290
Methylotrophs	5.000E-14	5.000E-14	1.0290
Ammonia oxidizing biomass (AOB)	5.000E-14	5.000E-14	1.0290
Nitrite oxidizing biomass (NOB)	5.000E-14	5.000E-14	1.0290
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E-14	5.000E-14	1.0290
Polyphosphate accumulating organisms (PAO)	5.000E-14	5.000E-14	1.0290
Propionic acetogens	5.000E-14	5.000E-14	1.0290
Methanogens - acetoclastic	5.000E-14	5.000E-14	1.0290
Methanogens - hydrogenotrophic	5.000E-14	5.000E-14	1.0290
Endogenous products	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (part.)	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (colloid.)	5.000E-12	5.000E-12	1.0290
Part. inert. COD	5.000E-14	5.000E-14	1.0290
Part. bio. org. N	5.000E-14	5.000E-14	1.0290
Part. bio. org. P	5.000E-14	5.000E-14	1.0290
Part. inert N	5.000E-14	5.000E-14	1.0290
Part. inert P	5.000E-14	5.000E-14	1.0290
Stored PHA	5.000E-14	5.000E-14	1.0290
Releasable stored polyP	5.000E-14	5.000E-14	1.0290
Fixed stored polyP	5.000E-14	5.000E-14	1.0290
Readily bio. COD (complex)	6.900E-10	6.900E-10	1.0290
Acetate	1.240E-9	1.240E-9	1.0290
Propionate	8.300E-10	8.300E-10	1.0290
Methanol	1.600E-9	1.600E-9	1.0290
Dissolved H2	5.850E-9	5.850E-9	1.0290
Dissolved methane	1.963E-9	1.963E-9	1.0290
Ammonia N	2.000E-9	2.000E-9	1.0290
Sol. bio. org. N	1.370E-9	1.370E-9	1.0290
Nitrous Oxide N	1.607E-9	1.607E-9	1.0290
Nitrite N	2.980E-9	2.980E-9	1.0290
Nitrate N	2.980E-9	2.980E-9	1.0290

Dissolved nitrogen gas	1.900E-9	1.900E-9	1.0290
PO4-P (Sol. & Me Complexed)	2.000E-9	2.000E-9	1.0290
Sol. inert COD	6.900E-10	6.900E-10	1.0290
Sol. inert TKN	6.850E-10	6.850E-10	1.0290
ISS Influent	5.000E-14	5.000E-14	1.0290
Struvite	5.000E-14	5.000E-14	1.0290
Hydroxy-dicalcium-phosphate	5.000E-14	5.000E-14	1.0290
Hydroxy-apatite	5.000E-14	5.000E-14	1.0290
Magnesium	7.200E-10	7.200E-10	1.0290
Calcium	7.200E-10	7.200E-10	1.0290
Metal	4.800E-10	4.800E-10	1.0290
Other Cations (strong bases)	1.440E-9	1.440E-9	1.0290
Other Anions (strong acids)	1.440E-9	1.440E-9	1.0290
Total CO2	1.960E-9	1.960E-9	1.0290
User defined 1	6.900E-10	6.900E-10	1.0290
User defined 2	6.900E-10	6.900E-10	1.0290
User defined 3	5.000E-14	5.000E-14	1.0290
User defined 4	5.000E-14	5.000E-14	1.0290
Dissolved oxygen	2.500E-9	2.500E-9	1.0290

EPS Strength coefficients [ ]

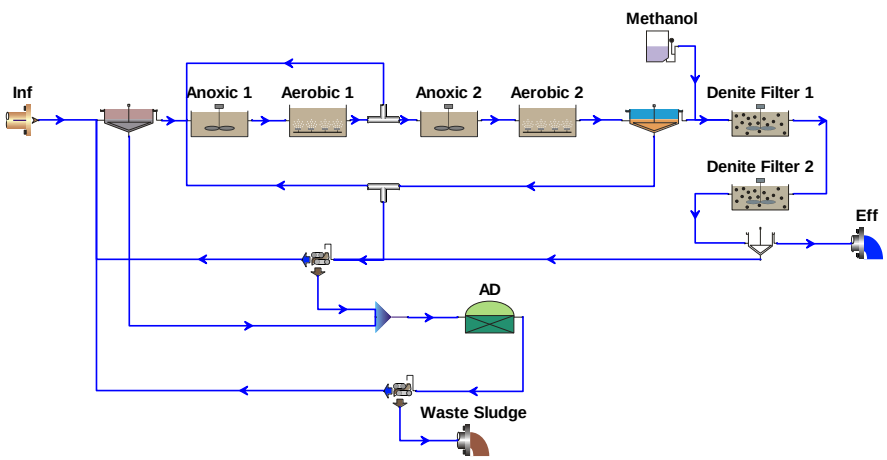
Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	1.0000	1.0000	1.0000
Methylotrophs	1.0000	1.0000	1.0000
Ammonia oxidizing biomass (AOB)	5.0000	1.0000	1.0000
Nitrite oxidizing biomass (NOB)	25.0000	1.0000	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	10.0000	1.0000	1.0000
Polyphosphate accumulating organisms (PAO)	1.0000	1.0000	1.0000

Propionic acetogens	1.0000	1.0000	1.0000
Methanogens - acetoclastic	1.0000	1.0000	1.0000
Methanogens - hydrogenotrophic	1.0000	1.0000	1.0000
Endogenous products	1.0000	1.0000	1.0000
Slowly bio. COD (part.)	1.0000	1.0000	1.0000
Slowly bio. COD (colloid.)	1.0000	1.0000	1.0000
Part. inert. COD	1.0000	1.0000	1.0000
Part. bio. org. N	1.0000	1.0000	1.0000
Part. bio. org. P	1.0000	1.0000	1.0000
Part. inert N	1.0000	1.0000	1.0000
Part. inert P	1.0000	1.0000	1.0000
Stored PHA	1.0000	1.0000	1.0000
Releasable stored polyP	1.0000	1.0000	1.0000
Fixed stored polyP	1.0000	1.0000	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.0000	1.0000	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	0.3300	0.3300	1.0000
Struvite	1.0000	1.0000	1.0000

Hydroxy-dicalcium-phosphate	1.0000	1.0000	1.0000
Hydroxy-apatite	1.0000	1.0000	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.0000	1.0000	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	1.0000	1.0000	1.0000
User defined 4	1.0000	1.0000	1.0000
Dissolved oxygen	0	0	1.0000

FAIRHAVEN, MA

Case Study No. 8
Bardenpho/Denite Filters w/Anaerobic Digestion
Flow = 5.0 MGD @ 11^{0}C



Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Primary Clarifier 1,2	0.5565	6636.0000	11.210

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Primary Clarifier 1,2	Flowrate [Under]	0.016

Element name	Percent removal	Blanket fraction
Primary Clarifier 1,2	60.00	0.85

Configuration information for all Anaerobic Digester units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	Head space volume
AD	0.6200	4144.0975	20.000	0.5

Operating data Average (flow/time weighted as required)

Element name	Pressure [psi]	pH
AD	14.9	-

Element name	Average Temperature
AD	35.0

Configuration information for all Bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Anoxic 1	0.1556	1600.0000	13.000	Un-aerated
Aerobic 1	0.4668	4800.0000	13.000	684
Anoxic 2	0.3112	3200.0000	13.000	Un-aerated
Aerobic 2	0.2379	3180.0000	10.000	721

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
Anoxic 1	0
Aerobic 1	2.0
Anoxic 2	0
Aerobic 2	2.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^0.25 + k2	k2 in C = k1(PC)^0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	% of tank area covered by diffusers [%]
Anoxic 1	2.5656	0.0432	0.8200	0.4413	6.2900
Aerobic 1	2.5656	0.0432	0.8200	0.4413	6.2900
Anoxic 2	2.5656	0.0432	0.8200	0.4413	6.2900
Aerobic 2	2.5656	0.0432	0.8200	0.4413	10.0000

Configuration information for all BOD Influent units

Operating data Average (flow/time weighted as required)

Element name	Inf
Flow	5
Total Carbonaceous BOD mgBOD/L	94.00

Volatile suspended solids mgVSS/L	66.00
Total suspended solids mgTSS/L	88.00
Total Kjeldahl Nitrogen mgN/L	17.00
Total P mgP/L	5.00
Nitrate N mgN/L	0
pH	7.00
Alkalinity mmol/L	6.00
Calcium mg/L	80.00
Magnesium mg/L	15.00
Dissolved oxygen mg/L	4.20

Element name	Inf
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.1600
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1500
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.6580
Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0500
Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.1300
Fna - Ammonia [gNH3-N/gTKN]	0.6600
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.5000
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0350
Fpo4 - Phosphate [gPO4-P/gTP]	0.5000
FupP - P:COD ratio for unbiodegradable part. COD [gP/gCOD]	0.0110
FZbh - OHO COD fraction [gCOD/g of total COD]	1.000E-4
FZbm - Methylotroph COD fraction [gCOD/g of total COD]	1.000E-4
FZaob - AOB COD fraction [gCOD/g of total COD]	1.000E-4
FZnob - NOB COD fraction [gCOD/g of total COD]	1.000E-4
FZamob - ANAMMOX COD fraction [gCOD/g of total COD]	1.000E-4
FZbp - PAO COD fraction [gCOD/g of total COD]	1.000E-4
FZbpa - Propionic acetogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbam - Acetoclastic methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbhm - H2-utilizing methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZe - Endogenous products COD fraction [gCOD/g of total COD]	0

Configuration information for all Methanol addition units

Operating data Average (flow/time weighted as required)

Element name	Methanol
Ordinary heterotrophic organisms (OHO) mgCOD/L	0
Methylotrophs mgCOD/L	0
Ammonia oxidizing biomass (AOB) mgCOD/L	0
Nitrite oxidizing biomass (NOB) mgCOD/L	0

Anaerobic ammonia oxidizers (ANAMMOX) mgCOD/L	0
Polyphosphate accumulating organisms (PAO) mgCOD/L	0
Propionic acetogens mgCOD/L	0
Methanogens - acetoclastic mgCOD/L	0
Methanogens - hydrogenotrophic mgCOD/L	0
Endogenous products mgCOD/L	0
Slowly bio. COD (part.) mgCOD/L	0
Slowly bio. COD (colloid.) mgCOD/L	0
Part. inert. COD mgCOD/L	0
Part. bio. org. N mgN/L	0
Part. bio. org. P mgP/L	0
Part. inert N mgN/L	0
Part. inert P mgP/L	0
Stored PHA mgCOD/L	0
Releasable stored polyP mgP/L	0
Fixed stored polyP mgP/L	0
Readily bio. COD (complex) mgCOD/L	0
Acetate mgCOD/L	0
Propionate mgCOD/L	0
Methanol mgCOD/L	1188000.00
Dissolved H2 mgCOD/L	0
Dissolved methane mg/L	0
Ammonia N mgN/L	0
Sol. bio. org. N mgN/L	0
Nitrous Oxide N mgN/L	0
Nitrite N mgN/L	0
Nitrate N mgN/L	0
Dissolved nitrogen gas mgN/L	0
PO4-P (Sol. & Me Complexed) mgP/L	0
Sol. inert COD mgCOD/L	0
Sol. inert TKN mgN/L	0
ISS Influent mgISS/L	0
Struvite mgISS/L	0
Hydroxy-dicalcium-phosphate mgISS/L	0
Hydroxy-apatite mgISS/L	0
Magnesium mg/L	0
Calcium mg/L	0
Metal mg/L	0
Other Cations (strong bases) meq/L	0
Other Anions (strong acids) meq/L	0
Total CO2 mmol/L	0
User defined 1 mg/L	0
User defined 2 mg/L	0
User defined 3 mgVSS/L	0

User defined 4 mgISS/L	0
Dissolved oxygen mg/L	0
Flow	3E-5

Configuration information for all Effluent units

Configuration information for all Ideal clarifier units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Sec. Clarifier 1,2	0.8593	8836.0000	13.000

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Sec. Clarifier 1,2	Flow paced	200.00 %

Element name	Average Temperature	Reactive	Percent removal	Blanket fraction
Sec. Clarifier 1,2	Uses global setting	No	99.95	0.05

Configuration information for all Media Bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Denite Filter 1	0.0388	1728.0000	3.000	Un-aerated
Denite Filter 2	0.0388	1728.0000	3.000	Un-aerated

Element name	Specific area [ft2/ft3]	Specific volume [ft3/ft3]	% of reactor filled with media [%]
Denite Filter 1	250	0.5236	100.00
Denite Filter 2	250	0.5236	100.00

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint
Denite Filter 1	0
Denite Filter 2	0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^0.25 + k2	k2 in C = k1(PC)^0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	% of tank area covered by diffusers [%]
Denite Filter 1	2.5656	0.0432	0.8200	0.4413	10.0000
Denite Filter 2	2.5656	0.0432	0.8200	0.4413	10.0000

Configuration information for all Dewatering unit units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Dewatering unit3	Flowrate [Under]	0.01
Dewatering unit32	Flowrate [Under]	0.01

Element name	Percent removal
Dewatering unit3	90.00
Dewatering unit32	95.00

Configuration information for all Point clarifier units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Point clarifier30	Fraction	0.02

Element name	Percent removal
Point clarifier30	90.00

Configuration information for all Sludge units

Configuration information for all Splitter units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
	Flowrate [Side]	0.053
Splitter8	Flow paced	200.00 %

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Elements	Total Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Total Kjeldahl Nitrogen [mgN/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Nitrite N [mgN/L]	Total N [mgN/L]
Inf	94.00	88.02	17.00	11.22	0	0	17.00
Eff	0.80	0.53	2.11	0.92	0.75	0.05	2.91

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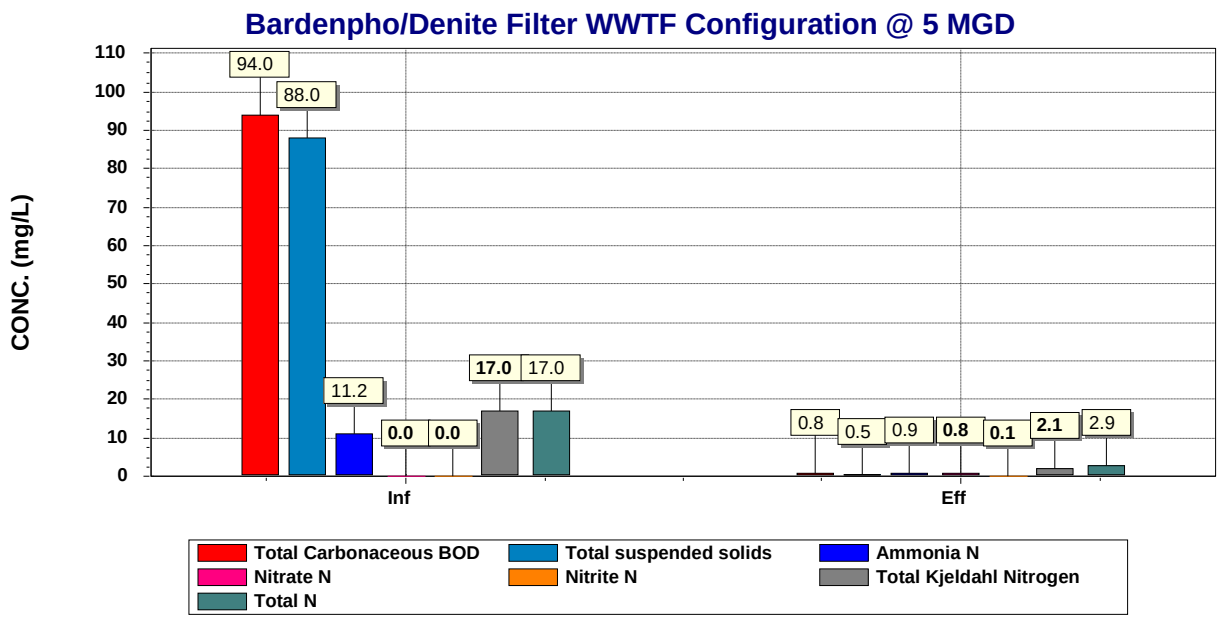

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Inf			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	66.00	2753.98	
Total suspended solids	88.02	3672.65	
Particulate COD	105.58	4405.48	
Filtered COD	81.43	3397.65	
Total COD	187.00	7803.13	
Soluble PO4-P	2.50	104.32	
Total P	5.00	208.64	
Filtered TKN	13.85	577.86	
Particulate TKN	3.15	131.50	

Total Kjeldahl Nitrogen	17.00	709.36	
Filtered Carbonaceous BOD	51.04	2129.71	
Total Carbonaceous BOD	94.00	3922.34	
Nitrite + Nitrate	0	0	
Total N	17.00	709.36	
Total inorganic N	11.22	468.18	
Alkalinity	6.00	113.56	mmol/L and kmol/d
pH	7.00		
Volatile fatty acids	4.49	187.28	
ISS precipitate	0	0	
ISS cellular	0.02	0.67	
ISS Total	22.02	918.66	
Ammonia N	11.22	468.18	
Nitrate N	0	0	

Parameters	Value	Units

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Anoxic 1			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	1743.70	365134.32	
Total suspended solids	2408.65	504375.19	
Particulate COD	2554.59	534934.39	
Filtered COD	14.02	2935.78	
Total COD	2568.61	537870.18	
Soluble PO4-P	3.58	748.81	
Total P	52.69	11033.96	
Filtered TKN	5.09	1066.58	
Particulate TKN	154.96	32448.79	
Total Kjeldahl Nitrogen	160.05	33515.37	
Filtered Carbonaceous BOD	3.11	651.25	
Total Carbonaceous BOD	783.04	163968.88	
Nitrite + Nitrate	1.20	250.48	
Total N	161.25	33765.84	
Total inorganic N	4.86	1017.49	
Alkalinity	5.36	508.94	mmol/L and kmol/d
pH	7.01		
Volatile fatty acids	0.42	88.78	
ISS precipitate	0	0.00	
ISS cellular	113.82	23834.99	
ISS Total	664.95	139240.87	
Ammonia N	3.66	767.01	

Nitrate N	0.91	191.01

Parameters	Value	Units
Hydraulic residence time	0.1	hours
Velocity gradient	68.30	1/s
VSS destruction	0	%
Total solids mass	3127.64	lb
Total readily biodegradable COD	2.75	mg/L
OUR - Total	0.00	mgO/L/hr
OUR - Carbonaceous	0.00	mgO/L/hr
OUR - Nitrification	0.00	mgO/L/hr
Nit - Ammonia removal rate	0.00	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	0.00	mgN/L/hr
Nit - Nitrate production rate	0.00	mgN/L/hr
Denit - Nitrate removal rate	5.96	mgN/L/hr
Denit - Nitrite removal rate	3.52	mgN/L/hr
Denit - N2 production rate	6.98	mgN/L/hr
Off gas flow rate (dry)	1.00	ft3/min
Off gas Oxygen	0	%
Off gas Carbon dioxide	88.83	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	2.05	%
Off gas Methane	0.05	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	10.50	mg/L
OTR	0	lb/hr
SOTR	0	lb/hr
OTE	100.00	%
SOTE	100.00	%
Air flow rate	0	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0	ft3/min (20C, 1 atm)
# of diffusers	228.00	

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Aerobic 1			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	1741.61	364695.81	
Total suspended solids	2406.78	503984.33	
Particulate COD	2550.77	534134.49	
Filtered COD	11.13	2330.00	
Total COD	2561.89	536464.49	

Soluble PO4-P	3.60	754.88	
Total P	52.69	11033.96	
Filtered TKN	3.30	691.79	
Particulate TKN	155.09	32476.52	
Total Kjeldahl Nitrogen	158.40	33168.30	
Filtered Carbonaceous BOD	1.20	252.11	
Total Carbonaceous BOD	778.73	163066.74	
Nitrite + Nitrate	2.80	587.10	
Total N	161.20	33755.40	
Total inorganic N	4.64	972.02	
Alkalinity	5.11	485.73	mmol/L and kmol/d
pH	7.00		
Volatile fatty acids	0.03	6.01	
ISS precipitate	0	0.00	
ISS cellular	114.05	23882.66	
ISS Total	665.17	139288.53	
Ammonia N	1.84	384.92	
Nitrate N	2.19	458.89	

Parameters	Value	Units
Hydraulic residence time	0.4	hours
Velocity gradient	139.40	1/s
VSS destruction	0.12	%
Total solids mass	9375.64	lb
Total readily biodegradable COD	1.58	mg/L
OUR - Total	30.35	mgO/L/hr
OUR - Carbonaceous	15.07	mgO/L/hr
OUR - Nitrification	15.28	mgO/L/hr
Nit - Ammonia removal rate	3.75	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	3.71	mgN/L/hr
Nit - Nitrate production rate	2.96	mgN/L/hr
Denit - Nitrate removal rate	0.10	mgN/L/hr
Denit - Nitrite removal rate	0.06	mgN/L/hr
Denit - N2 production rate	0.11	mgN/L/hr
Off gas flow rate (dry)	1539.83	ft3/min
Off gas Oxygen	19.23	%
Off gas Carbon dioxide	1.65	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.05	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	10.50	mg/L

OTR	135.68	lb/hr
SOTR	410.49	lb/hr
OTE	8.18	%
SOTE	25.33	%
Air flow rate	1588.50	ft3/min (20C, 1 atm)
Air flow rate / diffuser	2.32	ft3/min (20C, 1 atm)
# of diffusers	684.00	

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Anoxic 2			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	1740.26	219181.08	
Total suspended solids	2405.39	302953.09	
Particulate COD	2548.69	321000.50	
Filtered COD	10.27	1292.97	
Total COD	2558.95	322293.48	
Soluble PO4-P	3.63	457.03	
Total P	52.69	6636.53	
Filtered TKN	3.32	417.64	
Particulate TKN	155.08	19531.85	
Total Kjeldahl Nitrogen	158.40	19949.49	
Filtered Carbonaceous BOD	0.47	59.32	
Total Carbonaceous BOD	776.61	97811.47	
Nitrite + Nitrate	1.71	215.83	
Total N	160.11	20165.32	
Total inorganic N	3.92	493.83	
Alkalinity	5.22	298.06	mmol/L and kmol/d
pH	7.03		
Volatile fatty acids	0.04	4.61	
ISS precipitate	0	0.00	
ISS cellular	114.01	14359.52	
ISS Total	665.13	83772.00	
Ammonia N	2.21	278.00	
Nitrate N	1.27	159.53	

Parameters	Value	Units
Hydraulic residence time	0.5	hours
Velocity gradient	64.99	1/s
VSS destruction	0.08	%
Total solids mass	6246.81	lb
Total readily biodegradable COD	0.66	mg/L
OUR - Total	0.00	mgO/L/hr

OUR - Carbonaceous	0.00	mgO/L/hr
OUR - Nitrification	0.00	mgO/L/hr
Nit - Ammonia removal rate	0.00	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	0.00	mgN/L/hr
Nit - Nitrate production rate	0.00	mgN/L/hr
Denit - Nitrate removal rate	1.87	mgN/L/hr
Denit - Nitrite removal rate	1.11	mgN/L/hr
Denit - N2 production rate	2.20	mgN/L/hr
Off gas flow rate (dry)	1.93	ft3/min
Off gas Oxygen	0	%
Off gas Carbon dioxide	86.69	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	1.87	%
Off gas Methane	0.02	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	10.50	mg/L
OTR	0	lb/hr
SOTR	0	lb/hr
OTE	100.00	%
SOTE	100.00	%
Air flow rate	0	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0	ft3/min (20C, 1 atm)
# of diffusers	456.00	

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Aerobic 2			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	1737.03	218775.09	
Total suspended solids	2402.26	302558.54	
Particulate COD	2543.34	320327.39	
Filtered COD	10.73	1351.33	
Total COD	2554.07	321678.73	
Soluble PO4-P	3.68	464.11	
Total P	52.69	6636.53	
Filtered TKN	2.22	279.90	
Particulate TKN	155.06	19528.82	
Total Kjeldahl Nitrogen	157.28	19808.72	
Filtered Carbonaceous BOD	0.92	115.83	
Total Carbonaceous BOD	773.85	97464.96	
Nitrite + Nitrate	2.80	352.10	
Total N	160.07	20160.82	
Total inorganic N	3.74	471.56	

Alkalinity	5.05	288.42	mmol/L and kmol/d
pH	7.01		
Volatile fatty acids	0.00	0.43	
ISS precipitate	0	0.00	
ISS cellular	114.10	14370.97	
ISS Total	665.23	83783.45	
Ammonia N	0.95	119.46	
Nitrate N	2.32	291.79	

Parameters	Value	Units
Hydraulic residence time	0.4	hours
Velocity gradient	125.36	1/s
VSS destruction	0.19	%
Total solids mass	4768.99	lb
Total readily biodegradable COD	1.30	mg/L
OUR - Total	25.56	mgO/L/hr
OUR - Carbonaceous	12.87	mgO/L/hr
OUR - Nitrification	12.69	mgO/L/hr
Nit - Ammonia removal rate	2.99	mgN/L/hr
Nit - Nitrous oxide production rate	0	mgN/L/hr
Nit - Nitrite production rate	2.95	mgN/L/hr
Nit - Nitrate production rate	2.86	mgN/L/hr
Denit - Nitrate removal rate	0.08	mgN/L/hr
Denit - Nitrite removal rate	0.05	mgN/L/hr
Denit - N2 production rate	0.09	mgN/L/hr
Off gas flow rate (dry)	796.24	ft3/min
Off gas Oxygen	19.45	%
Off gas Carbon dioxide	1.35	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.05	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0	%
Actual DO sat. conc.	10.23	mg/L
OTR	61.25	lb/hr
SOTR	186.43	lb/hr
OTE	7.14	%
SOTE	22.25	%
Air flow rate	821.25	ft3/min (20C, 1 atm)
Air flow rate / diffuser	1.14	ft3/min (20C, 1 atm)
# of diffusers	721.00	

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Sec. Clarifier 1,2			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	2.57	109.39	
Total suspended solids	3.56	151.28	
Particulate COD	3.77	160.16	
Filtered COD	10.73	455.93	
Total COD	14.50	616.09	
Soluble PO4-P	3.68	156.59	
Total P	3.76	159.67	
Filtered TKN	2.22	94.43	
Particulate TKN	0.23	9.76	
Total Kjeldahl Nitrogen	2.45	104.20	
Filtered Carbonaceous BOD	0.92	39.08	
Total Carbonaceous BOD	2.07	87.76	
Nitrite + Nitrate	2.80	118.80	
Total N	5.25	222.99	
Total inorganic N	3.74	159.10	
Alkalinity	5.05	97.31	mmol/L and kmol/d
pH	7.01		
Volatile fatty acids	0.00	0.14	
ISS precipitate	0	0.00	
ISS cellular	0.17	7.19	
ISS Total	0.99	41.89	
Ammonia N	0.95	40.30	
Nitrate N	2.32	98.45	

Parameters	Value	Units
Hydraulic residence time	1.37	hours
Percent removal	99.95	%
Height of specified concentration	0.65	ft
Total solids mass	1323.50	lb
Surface overflow rate	576.26	gal/(ft2 d)
Solids loading rate	34.24	lb/(ft2 d)

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Eff			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	0.42	17.39	
Total suspended solids	0.53	22.12	
Particulate COD	0.61	25.21	
Filtered COD	10.33	429.99	
Total COD	10.93	455.20	

Soluble PO4-P	3.64	151.46	
Total P	3.65	151.97	
Filtered TKN	2.07	86.16	
Particulate TKN	0.04	1.63	
Total Kjeldahl Nitrogen	2.11	87.79	
Filtered Carbonaceous BOD	0.58	23.99	
Total Carbonaceous BOD	0.80	33.45	
Nitrite + Nitrate	0.80	33.44	
Total N	2.91	121.22	
Total inorganic N	1.72	71.71	
Alkalinity	5.19	98.04	mmol/L and kmol/d
pH	7.07		
Volatile fatty acids	0.05	2.20	
ISS precipitate	0	0.00	
ISS cellular	0.03	1.26	
ISS Total	0.11	4.73	
Ammonia N	0.92	38.27	
Nitrate N	0.75	31.24	
Parameters	Value	Units	

Global Parameters

AOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9000	0.9000	1.0720
Substrate (NH4) half sat. [mgN/L]	0.7000	0.7000	1.0000
Byproduct NH4 logistic slope [-]	50.0000	50.0000	1.0000
Byproduct NH4 inflection point [mgN/L]	1.4000	1.4000	1.0000
AOB denite DO half sat. [mg/L]	0.1000	0.1000	1.0000
AOB denite HNO2 half sat. [mgN/L]	5.000E-6	5.000E-6	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiHNO2 [mmol/L]	0.0050	0.0050	1.0000

NOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.7000	0.7000	1.0600
Substrate (NO2) half sat. [mgN/L]	0.1000	0.1000	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiNH3 [mmol/L]	0.0750	0.0750	1.0000

ANAMMOX

Name	Default	Value	
Max. spec. growth rate [1/d]	0.1000	0.1000	1.1000
Substrate (NH4) half sat. [mgN/L]	2.0000	2.0000	1.0000
Substrate (NO2) half sat. [mgN/L]	1.0000	1.0000	1.0000
Aerobic decay rate [1/d]	0.0190	0.0190	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0095	0.0095	1.0290
Ki Nitrite [mgN/L]	1000.0000	1000.0000	1.0000
Nitrite sensitivity constant [L / (d mgN)]	0.0160	0.0160	1.0000

OHO

Name	Default	Value	
Max. spec. growth rate [1/d]	3.2000	3.2000	1.0290

Substrate half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Anoxic growth factor [-]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.6200	0.6200	1.0290
Anoxic decay rate [1/d]	0.2330	0.2330	1.0290
Anaerobic decay rate [1/d]	0.1310	0.1310	1.0290
Hydrolysis rate [1/d]	2.1000	2.1000	1.0290
Hydrolysis half sat. [-]	0.0600	0.0600	1.0000
Anoxic hydrolysis factor [-]	0.2800	0.2800	1.0000
Anaerobic hydrolysis factor (AS) [-]	0.0400	0.0400	1.0000
Anaerobic hydrolysis factor (AD) [-]	0.2000	0.5000	1.0000
Adsorption rate of colloids [L/(mgCOD d)]	0.1500	0.8000	1.0290
Ammonification rate [L/(mgN d)]	0.0400	0.0400	1.0290
Assimilative nitrate/nitrite reduction rate [1/d]	0.5000	0.5000	1.0000
Fermentation rate [1/d]	1.6000	3.2000	1.0290
Fermentation half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Fermentation growth factor (AS) [-]	0.2500	0.1250	1.0000
Endogenous products decay rate[1/d]	0	0	1.0000
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

Methylotrophs

Name	Default	Value	
Max. spec. growth rate [1/d]	1.3000	1.3000	1.0720
Methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.0400	0.0400	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0300	0.0300	1.0290
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

PAO

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9500	0.9500	1.0000
Max. spec. growth rate, P-limited [1/d]	0.4200	0.4200	1.0000
Substrate half sat. [mgCOD(PHB)/mgCOD(Zbp)]	0.1000	0.1000	1.0000
Substrate half sat., P-limited [mgCOD(PHB)/mgCOD(Zbp)]	0.0500	0.0500	1.0000
Magnesium half sat. [mgMg/L]	0.1000	0.1000	1.0000
Cation half sat. [mmol/L]	0.1000	0.1000	1.0000
Calcium half sat. [mgCa/L]	0.1000	0.1000	1.0000
Aerobic/anoxic decay rate [1/d]	0.1000	0.1000	1.0000
Aerobic/anoxic maintenance rate [1/d]	0	0	1.0000
Anaerobic decay rate [1/d]	0.0400	0.0400	1.0000
Anaerobic maintenance rate [1/d]	0	0	1.0000
Sequestration rate [1/d]	4.5000	6.0000	1.0000
Anoxic growth factor [-]	0.3300	0.3300	1.0000

Acetogens

Name	Default	Value	
Max. spec. growth rate [1/d]	0.2500	0.2500	1.0290
Substrate half sat. [mgCOD/L]	10.0000	10.0000	1.0000
Acetate inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Anaerobic decay rate [1/d]	0.0500	0.0500	1.0290
Aerobic/anoxic decay rate [1/d]	0.5200	0.5200	1.0290

Methanogens

Name	Default	Value	
Acetoclastic max. spec. growth rate [1/d]	0.3000	0.3000	1.0290
H2-utilizing max. spec. growth rate [1/d]	1.4000	1.4000	1.0290
Acetoclastic substrate half sat. [mgCOD/L]	100.0000	100.0000	1.0000
Acetoclastic methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
H2-utilizing CO2 half sat. [mmol/L]	0.1000	0.1000	1.0000
H2-utilizing substrate half sat. [mgCOD/L]	0.1000	0.1000	1.0000
H2-utilizing methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Acetoclastic propionic inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Acetoclastic anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
Acetoclastic aerobic/anoxic decay rate [1/d]	0.6000	0.6000	1.0290
H2-utilizing anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
H2-utilizing aerobic/anoxic decay rate [1/d]	2.8000	0.6000	1.0290

pH

Name	Default	Value
OHO low pH limit [-]	4.0000	4.0000
OHO high pH limit [-]	10.0000	10.0000
Methylotrophs low pH limit [-]	4.0000	4.0000
Methylotrophs high pH limit [-]	10.0000	10.0000
Autotrophs low pH limit [-]	5.5000	5.5000
Autotrophs high pH limit [-]	9.5000	9.5000
PAO low pH limit [-]	4.0000	4.0000
PAO high pH limit [-]	10.0000	10.0000

OHO low pH limit (anaerobic) [-]	5.5000	5.5000
OHO high pH limit (anaerobic) [-]	8.5000	8.5000
Propionic acetogens low pH limit [-]	4.0000	4.0000
Propionic acetogens high pH limit [-]	10.0000	10.0000
Acetoclastic methanogens low pH limit [-]	5.0000	5.0000
Acetoclastic methanogens high pH limit [-]	9.0000	9.0000
H2-utilizing methanogens low pH limit [-]	5.0000	5.0000
H2-utilizing methanogens high pH limit [-]	9.0000	9.0000

Switches

Name	Default	Value
Aerobic/anoxic DO half sat. [mgO2/L]	0.0500	0.0500
Anoxic/anaerobic NOx half sat. [mgN/L]	0.1500	0.1500
AOB DO half sat. [mgO2/L]	0.2500	0.2500
NOB DO half sat. [mgO2/L]	0.5000	0.5000
ANAMMOX DO half sat. [mgO2/L]	0.0100	0.0100
Anoxic NO3(->NO2) half sat. [mgN/L]	0.1000	0.1000
Anoxic NO3(->N2) half sat. [mgN/L]	0.0500	0.0500
Anoxic NO2(->N2) half sat. (mgN/L)	0.0100	0.0100
NH3 nutrient half sat. [mgN/L]	0.0050	1.000E-4
PolyP half sat. [mgP/mgCOD]	0.0100	0.0100
VFA sequestration half sat. [mgCOD/L]	5.0000	5.0000
P uptake half sat. [mgP/L]	0.1500	0.1500
P nutrient half sat. [mgP/L]	0.0010	0.0010
Autotroph CO2 half sat. [mmol/L]	0.1000	0.1000
H2 low/high half sat. [mgCOD/L]	1.0000	1.0000
Propionic acetogens H2 inhibition [mgCOD/L]	5.0000	5.0000
Synthesis anion/cation half sat. [meq/L]	0.0100	0.0100

Common

Name	Default	Value
Biomass volatile fraction (VSS/TSS)	0.9200	0.9200
Endogenous residue volatile fraction (VSS/TSS)	0.9200	0.9200
N in endogenous residue [mgN/mgCOD]	0.0700	0.0700
P in endogenous residue [mgP/mgCOD]	0.0220	0.0220
Endogenous residue COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Particulate substrate COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000
Particulate inert COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000

AOB

Name	Default	Value
Yield [mgCOD/mgN]	0.1500	0.1500
AOB denite NO2 fraction as TEA [-]	0.5000	0.5000
Byproduct NH4 fraction to N2O [-]	0.0025	0.0025
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

NOB

Name	Default	Value
Yield [mgCOD/mgN]	0.0900	0.0900
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

ANAMMOX

Name	Default	Value
Yield [mgCOD/mgN]	0.1140	0.1140
Nitrate production [mgN/mgBiomassCOD]	2.2800	2.2800
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

OHO

Name	Default	Value
Yield (aerobic) [-]	0.6660	0.6660
Yield (fermentation, low H2) [-]	0.1000	0.1000
Yield (fermentation, high H2) [-]	0.1000	0.1000
H2 yield (fermentation low H2) [-]	0.3500	0.3500
H2 yield (fermentation high H2) [-]	0	0
Propionate yield (fermentation, low H2) [-]	0	0
Propionate yield (fermentation, high H2) [-]	0.7000	0.7000

CO2 yield (fermentation, low H2) [-]	0.7000	0.7000
CO2 yield (fermentation, high H2) [-]	0	0
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Endogenous fraction - aerobic [-]	0.0800	0.0800
Endogenous fraction - anoxic [-]	0.1030	0.1030
Endogenous fraction - anaerobic [-]	0.1840	0.1840
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield (anoxic) [-]	0.5400	0.5400
Yield propionic (aerobic) [-]	0.6400	0.6400
Yield propionic (anoxic) [-]	0.4600	0.4600
Yield acetic (aerobic) [-]	0.6000	0.6000
Yield acetic (anoxic) [-]	0.4300	0.4300
Yield methanol (aerobic) [-]	0.5000	0.5000
Adsorp. max. [-]	1.0000	1.0000
Max fraction to N2O at high FNA over nitrate [-]	0.0500	0.0500
Max fraction to N2O at high FNA over nitrite [-]	0.1000	0.1000

Methylotrophs

Name	Default	Value
Yield (anoxic) [-]	0.4000	0.4000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Max fraction to N2O at high FNA over nitrate [-]	0.1000	0.1000
Max fraction to N2O at high FNA over nitrite [-]	0.1500	0.1500

PAO

Name	Default	Value
Yield (aerobic) [-]	0.6390	0.6390
Yield (anoxic) [-]	0.5200	0.5200
Aerobic P/PHA uptake [mgP/mgCOD]	0.9300	0.9500
Anoxic P/PHA uptake [mgP/mgCOD]	0.3500	0.3500
Yield of PHA on sequestration [-]	0.8890	0.8890
N in biomass [mgN/mgCOD]	0.0700	0.0700
N in sol. inert [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous part. [-]	0.2500	0.2500
Inert fraction of endogenous sol. [-]	0.2000	0.2000
P/Ac release ratio [mgP/mgCOD]	0.5100	0.4900
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield of low PP [-]	0.9400	0.9400

Acetogens

Name	Default	Value
Yield [-]	0.1000	0.1000
H2 yield [-]	0.4000	0.4000
CO2 yield [-]	1.0000	1.0000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

Methanogens

Name	Default	Value
Acetoclastic yield [-]	0.1000	0.1000
Methanol acetoclastic yield [-]	0.1000	0.1000
H2-utilizing yield [-]	0.1000	0.1000
Methanol H2-utilizing yield [-]	0.1000	0.1000
N in acetoclastic biomass [mgN/mgCOD]	0.0700	0.0700
N in H2-utilizing biomass [mgN/mgCOD]	0.0700	0.0700
P in acetoclastic biomass [mgP/mgCOD]	0.0220	0.0220
P in H2-utilizing biomass [mgP/mgCOD]	0.0220	0.0220
Acetoclastic fraction to endog. residue [-]	0.0800	0.0800
H2-utilizing fraction to endog. residue [-]	0.0800	0.0800
Acetoclastic COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
H2-utilizing COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

General

Name	Default	Value
Molecular weight of other anions [mg/mmol]	35.5000	35.5000
Molecular weight of other cations [mg/mmol]	39.1000	39.1000
Mg to P mole ratio in polyphosphate [mmolMg/mmolP]	0.3000	0.3000
Cation to P mole ratio in polyphosphate [meq/mmolP]	0.1500	0.3000
Ca to P mole ratio in polyphosphate [mmolCa/mmolP]	0.0500	0.0500
Cation to P mole ratio in organic phosphate [meq/mmolP]	0.0100	0.0100
Bubble rise velocity (anaerobic digester) [cm/s]	23.9000	23.9000

Bubble Sauter mean diameter (anaerobic digester) [cm]	0.3500	0.3500
Anaerobic digester gas hold-up factor []	1.0000	1.0000
Tank head loss per metre of length (from flow) [m/m]	0.0025	0.0025

Mass transfer

Name	Default	Value	
Kl for H2 [m/d]	17.0000	17.0000	1.0240
Kl for CO2 [m/d]	10.0000	10.0000	1.0240
Kl for NH3 [m/d]	1.0000	1.0000	1.0240
Kl for CH4 [m/d]	8.0000	8.0000	1.0240
Kl for N2 [m/d]	15.0000	15.0000	1.0240
Kl for N2O [m/d]	8.0000	8.0000	1.0240
Kl for O2 [m/d]	13.0000	13.0000	1.0240

Henry's law constants

Name	Default	Value	
CO2 [M/atm]	0.0340	0.0340	2400.0000
O2 [M/atm]	0.0013	0.0013	1500.0000
N2 [M/atm]	6.500E-4	6.500E-4	1300.0000
N2O [M/atm]	0.0250	0.0250	2600.0000
NH3 [M/atm]	58.0000	58.0000	4100.0000
CH4 [M/atm]	0.0014	0.0014	1600.0000
H2 [M/atm]	7.800E-4	7.800E-4	500.0000

Physico-chemical rates

Name	Default	Value	
Struvite precipitation rate [1/d]	3.000E+10	3.000E+10	1.0240
Struvite redissolution rate [1/d]	3.000E+11	3.000E+11	1.0240
Struvite half sat. [mgTSS/L]	1.0000	1.0000	1.0000
HDP precipitation rate [L/(molP d)]	1.000E+8	1.000E+8	1.0000
HDP redissolution rate [L/(mol P d)]	1.000E+8	1.000E+8	1.0000
HAP precipitation rate [molHDP/(L d)]	5.000E-4	5.000E-4	1.0000

Physico-chemical constants

Name	Default	Value
Struvite solubility constant [mol/L]	6.918E-14	6.918E-14
HDP solubility product [mol/L]	2.750E-22	2.750E-22
HDP half sat. [mgTSS/L]	1.0000	1.0000
Equilibrium soluble PO4 with Al dosing at pH 7 [mgP/L]	0.0100	0.0100
Al to P ratio [molAl/molP]	0.8000	0.8000
Al(OH)3 solubility product [mol/L]	1.259E+9	1.259E+9
AlHPO4+ dissociation constant [mol/L]	7.943E-13	7.943E-13
Equilibrium soluble PO4 with Fe dosing at pH 7 [mgP/L]	0.0100	0.0100
Fe to P ratio [molFe/molP]	1.6000	1.6000
Fe(OH)3 solubility product [mol/L]	0.0500	0.0500
FeH2PO4++ dissociation constant [mol/L]	5.012E-22	5.012E-22

Aeration

Name	Default	Value
Alpha (surf) OR Alpha F (diff) [-]	0.5000	0.5000
Beta [-]	0.9500	0.9500
Surface pressure [kPa]	101.3250	101.3250
Fractional effective saturation depth (Fed) [-]	0.3250	0.3250
Supply gas CO2 content [vol. %]	0.0350	0.0350
Supply gas O2 [vol. %]	20.9500	20.9500
Off-gas CO2 [vol. %]	2.0000	2.0000
Off-gas O2 [vol. %]	18.8000	18.8000
Off-gas H2 [vol. %]	0	0
Off-gas NH3 [vol. %]	0	0
Off-gas CH4 [vol. %]	0	0
Surface turbulence factor [-]	2.0000	2.0000
Set point controller gain []	1.0000	1.0000

Modified Vesilind

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.387	0.387
Vesilind hindered zone settling parameter (K) [L/g]	0.370	0.370
Clarification switching function [mg/L]	100.000	100.000
Specified TSS conc.for height calc. [mg/L]	2500.000	2500.000
Maximum compactability constant [mg/L]	15000.000	15000.000

Double exponential

Name	Default	Value

Maximum Vesilind settling velocity (Vo) [ft/min]	0.934	0.934
Maximum (practical) settling velocity (Vo') [ft/min]	0.615	0.615
Hindered zone settling parameter (Kh) [L/g]	0.400	0.400
Flocculent zone settling parameter (Kf) [L/g]	2.500	2.500
Maximum non-settleable TSS [mg/L]	20.0000	20.0000
Non-settleable fraction [-]	0.0010	0.0010
Specified TSS conc. for height calc. [mg/L]	2500.0000	2500.0000

Emission factors

Name	Default	Value
Carbon dioxide equivalence of nitrous oxide	296.0000	296.0000
Carbon dioxide equivalence of methane	23.0000	23.0000

Biofilm general

Name	Default	Value	
Attachment rate [g / (m2 d)]	80.0000	80.0000	1.0000
Attachment TSS half sat. [mg/L]	100.0000	100.0000	1.0000
Detachment rate [g/(m3 d)]	8.000E+4	8.000E+4	1.0000
Solids movement factor []	10.0000	10.0000	1.0000
Diffusion neta []	0.8000	0.8000	1.0000
Thin film limit [mm]	0.5000	0.5000	1.0000
Thick film limit [mm]	3.0000	3.0000	1.0000
Assumed Film thickness for tank volume correction (temp independant) [mm]	0.7500	0.7500	1.0000
Film surface area to media area ratio - Max.[ ]	1.0000	1.0000	1.0000
Minimum biofilm conc. for streamer formation [gTSS/m2]	4.0000	4.0000	1.0000

Maximum biofilm concentrations [mg/L]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	5.000E+4	5.000E+4	1.0000
Methylotrophs	5.000E+4	5.000E+4	1.0000
Ammonia oxidizing biomass (AOB)	1.000E+5	1.000E+5	1.0000
Nitrite oxidizing biomass (NOB)	1.000E+5	1.000E+5	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E+4	5.000E+4	1.0000
Polyphosphate accumulating organisms (PAO)	5.000E+4	5.000E+4	1.0000
Propionic acetogens	5.000E+4	5.000E+4	1.0000
Methanogens - acetoclastic	5.000E+4	5.000E+4	1.0000
Methanogens - hydrogenotrophic	5.000E+4	5.000E+4	1.0000
Endogenous products	3.000E+4	3.000E+4	1.0000
Slowly bio. COD (part.)	5000.0000	5000.0000	1.0000
Slowly bio. COD (colloid.)	4000.0000	4000.0000	1.0000
Part. inert. COD	5000.0000	5000.0000	1.0000
Part. bio. org. N	0	0	1.0000
Part. bio. org. P	0	0	1.0000
Part. inert N	0	0	1.0000
Part. inert P	0	0	1.0000
Stored PHA	5000.0000	5000.0000	1.0000
Releasable stored polyP	1.150E+6	1.150E+6	1.0000
Fixed stored polyP	1.150E+6	1.150E+6	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000

Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.000E+10	1.000E+10	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	1.300E+6	1.300E+6	1.0000
Struvite	8.500E+5	8.500E+5	1.0000
Hydroxy-dicalcium-phosphate	1.150E+6	1.150E+6	1.0000
Hydroxy-apatite	1.600E+6	1.600E+6	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.000E+10	1.000E+10	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	5.000E+4	5.000E+4	1.0000
User defined 4	5.000E+4	5.000E+4	1.0000
Dissolved oxygen	0	0	1.0000

Effective diffusivities [m2/s]

Name	Default	Value

Ordinary heterotrophic organisms (OHO)	5.000E-14	5.000E-14	1.0290
Methylotrophs	5.000E-14	5.000E-14	1.0290
Ammonia oxidizing biomass (AOB)	5.000E-14	5.000E-14	1.0290
Nitrite oxidizing biomass (NOB)	5.000E-14	5.000E-14	1.0290
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E-14	5.000E-14	1.0290
Polyphosphate accumulating organisms (PAO)	5.000E-14	5.000E-14	1.0290
Propionic acetogens	5.000E-14	5.000E-14	1.0290
Methanogens - acetoclastic	5.000E-14	5.000E-14	1.0290
Methanogens - hydrogenotrophic	5.000E-14	5.000E-14	1.0290
Endogenous products	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (part.)	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (colloid.)	5.000E-12	5.000E-12	1.0290
Part. inert. COD	5.000E-14	5.000E-14	1.0290
Part. bio. org. N	5.000E-14	5.000E-14	1.0290
Part. bio. org. P	5.000E-14	5.000E-14	1.0290
Part. inert N	5.000E-14	5.000E-14	1.0290
Part. inert P	5.000E-14	5.000E-14	1.0290
Stored PHA	5.000E-14	5.000E-14	1.0290
Releasable stored polyP	5.000E-14	5.000E-14	1.0290
Fixed stored polyP	5.000E-14	5.000E-14	1.0290
Readily bio. COD (complex)	6.900E-10	6.900E-10	1.0290
Acetate	1.240E-9	1.240E-9	1.0290
Propionate	8.300E-10	8.300E-10	1.0290
Methanol	1.600E-9	1.600E-9	1.0290
Dissolved H2	5.850E-9	5.850E-9	1.0290
Dissolved methane	1.963E-9	1.963E-9	1.0290
Ammonia N	2.000E-9	2.000E-9	1.0290
Sol. bio. org. N	1.370E-9	1.370E-9	1.0290
Nitrous Oxide N	1.607E-9	1.607E-9	1.0290
Nitrite N	2.980E-9	2.980E-9	1.0290
Nitrate N	2.980E-9	2.980E-9	1.0290

Dissolved nitrogen gas	1.900E-9	1.900E-9	1.0290
PO4-P (Sol. & Me Complexed)	2.000E-9	2.000E-9	1.0290
Sol. inert COD	6.900E-10	6.900E-10	1.0290
Sol. inert TKN	6.850E-10	6.850E-10	1.0290
ISS Influent	5.000E-14	5.000E-14	1.0290
Struvite	5.000E-14	5.000E-14	1.0290
Hydroxy-dicalcium-phosphate	5.000E-14	5.000E-14	1.0290
Hydroxy-apatite	5.000E-14	5.000E-14	1.0290
Magnesium	7.200E-10	7.200E-10	1.0290
Calcium	7.200E-10	7.200E-10	1.0290
Metal	4.800E-10	4.800E-10	1.0290
Other Cations (strong bases)	1.440E-9	1.440E-9	1.0290
Other Anions (strong acids)	1.440E-9	1.440E-9	1.0290
Total CO2	1.960E-9	1.960E-9	1.0290
User defined 1	6.900E-10	6.900E-10	1.0290
User defined 2	6.900E-10	6.900E-10	1.0290
User defined 3	5.000E-14	5.000E-14	1.0290
User defined 4	5.000E-14	5.000E-14	1.0290
Dissolved oxygen	2.500E-9	2.500E-9	1.0290

EPS Strength coefficients [ ]

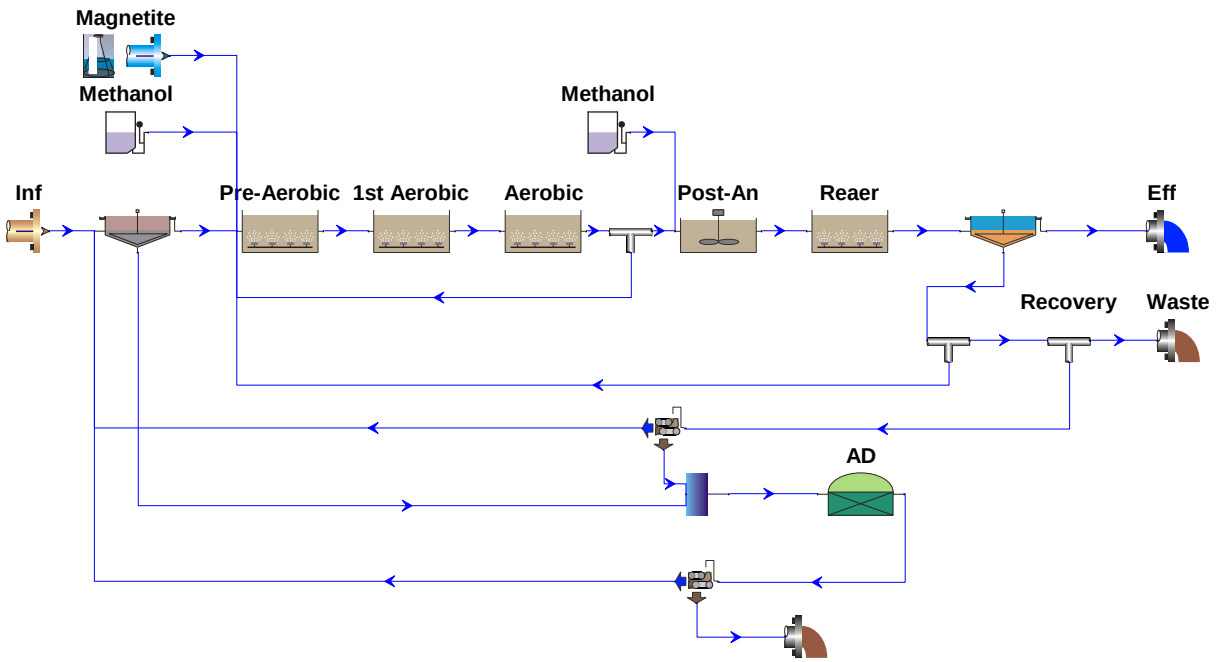
Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	1.0000	1.0000	1.0000
Methylotrophs	1.0000	1.0000	1.0000
Ammonia oxidizing biomass (AOB)	5.0000	1.0000	1.0000
Nitrite oxidizing biomass (NOB)	25.0000	1.0000	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	10.0000	1.0000	1.0000
Polyphosphate accumulating organisms (PAO)	1.0000	1.0000	1.0000

Propionic acetogens	1.0000	1.0000	1.0000
Methanogens - acetoclastic	1.0000	1.0000	1.0000
Methanogens - hydrogenotrophic	1.0000	1.0000	1.0000
Endogenous products	1.0000	1.0000	1.0000
Slowly bio. COD (part.)	1.0000	1.0000	1.0000
Slowly bio. COD (colloid.)	1.0000	1.0000	1.0000
Part. inert. COD	1.0000	1.0000	1.0000
Part. bio. org. N	1.0000	1.0000	1.0000
Part. bio. org. P	1.0000	1.0000	1.0000
Part. inert N	1.0000	1.0000	1.0000
Part. inert P	1.0000	1.0000	1.0000
Stored PHA	1.0000	1.0000	1.0000
Releasable stored polyP	1.0000	1.0000	1.0000
Fixed stored polyP	1.0000	1.0000	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.0000	1.0000	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	0.3300	0.3300	1.0000
Struvite	1.0000	1.0000	1.0000

Hydroxy-dicalcium-phosphate	1.0000	1.0000	1.0000
Hydroxy-apatite	1.0000	1.0000	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.0000	1.0000	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	1.0000	1.0000	1.0000
User defined 4	1.0000	1.0000	1.0000
Dissolved oxygen	0	0	1.0000

FAIRHAVEN, MA

Case Study No. 9
Biomag w/Anaerobic Digestion
Flow = 5.0 MGD @ 18^{0}C



Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Activated primary settling tank12	0.5565	6636.0000	11.210

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Activated primary settling tank12	Flowrate [Under]	0.016

Element name	Percent removal	Blanket fraction
Activated primary settling tank12	60.00	0.85

Configuration information for all Anaerobic Digester units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	Head space volume
AD	0.6200	4144.0975	20.000	0.5

Operating data Average (flow/time weighted as required)

Element name	Pressure [psi]	pH
AD	14.9	-

Element name	Average Temperature
AD	35.0

Configuration information for all Bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Pre-Aerobic	0.3112	3200.0000	13.000	725
1st Aerobic	0.3112	3200.0000	13.000	725
Aerobic	0.3112	3200.0000	13.000	725
Post-An	0.1683	2250.0000	10.000	Un-aerated
Reaer	0.0696	930.0000	10.000	211

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
1st Aerobic	0.3
Aerobic	2.0
Post-An	0

Element name	Average Air flow rate [ft3/min (20C, 1 atm)]
Pre-Aerobic	400.0
Reaer	300.0

Local biological parameters

Element name	Max. spec. growth rate [1/d]	Substrate (NH4) half sat. [mgN/L]	Byproduct NH4 logistic slope [-]	Byproduct NH4 inflection point [mgN/L]	AOB denite DO half sat. [mg/L]	AOB denite HNO2 half sat. [mgN/L]	Aerobic decay rate [1/d]	Anoxic/anaerobic decay rate [1/d]	KiHNO2 [mmol/L]
Pre-Aerobic	0.9000	0.7000	50.0000	1.4000	0.1000	5.000E-6	0.1700	0.0800	0.0050
1st Aerobic	0.9000	0.7000	50.0000	1.4000	0.1000	5.000E-6	0.1700	0.0800	0.0050
Aerobic	0.9000	0.7000	50.0000	1.4000	0.1000	5.000E-6	0.1700	0.0800	0.0050
Reaer	0.9000	0.7000	50.0000	1.4000	0.1000	5.000E-6	0.1700	0.0800	0.0050

Element name	Max. spec. growth rate [1/d]	Substrate (NO2) half sat. [mgN/L]	Aerobic decay rate [1/d]	Anoxic/anaerobic decay rate [1/d]	KiNH3 [mmol/L]
Pre-Aerobic	0.7000	0.1000	0.1700	0.0800	0.0750
1st Aerobic	0.7000	0.1000	0.1700	0.0800	0.0750
Aerobic	0.7000	0.1000	0.1700	0.0800	0.0750
Reaer	0.7000	0.1000	0.1700	0.0800	0.0750

Element name	Max. spec. growth rate [1/d]	Substrate (NH4) half sat. [mgN/L]	Substrate (NO2) half sat. [mgN/L]	Aerobic decay rate [1/d]	Anoxic/anaerobic decay rate [1/d]	Ki Nitrite [mgN/L]	Nitrite sensitivity constant [L / (d mgN)]
Pre-Aerobic	0.1000	2.0000	1.0000	0.0190	0.0095	1000.0000	0.0160
1st Aerobic	0.1000	2.0000	1.0000	0.0190	0.0095	1000.0000	0.0160
Aerobic	0.1000	2.0000	1.0000	0.0190	0.0095	1000.0000	0.0160
Reaer	0.1000	2.0000	1.0000	0.0190	0.0095	1000.0000	0.0160

Element name	Max. spec. growth rate	Substrate half sat.	Anoxic growth	Denite N2 producers	Aerobic decay rate	Anoxic decay rate	Anaerobic decay rate	Hydrolysis rate [1/d]	Hydrolysis half sat. [-]	Anoxic hydrolysis	Anaerobic hydrolysis	Anaerobic hydrolysis	Adsorption rate of	Ammonification rate	Assimilative nitrate/nitrite	Fermentation rate [1/d]	Fermentation half sat.	Fermentation growth	Endogenous products	Free nitrous acid inhibition
Pre-Aerobic	3.2	5.0	0.5	0.5	0.62	0.233	0.131	2.1	0.06	0.28	0.04	0.2	0.15	0.04	0.5	1.6	5.0	0.25	0	1.000E-7
1st Aerobic	3.2	5.0	0.5	0.5	0.62	0.233	0.131	2.1	0.060	0.280	0.040	0.200	0.150	0.040	0.5	1.6	5.0	0.25	0	1.000E-7
Aerobic	3.2	5.0	0.5	0.5	0.620	0.233	0.131	2.100	0.060	0.280	0.040	0.200	0.150	0.040	0.5	1.6	5.0	0.25	0	1.000E-7
Reaer	3.2	5.0	0.5	0.5	0.620	0.233	0.131	2.1	0.060	0.280	0.040	0.2	0.150	0.040	0.5	1.6	5.0	0.25	0	1.000E-7

Element name	Max. spec. growth rate [1/d]	Max. spec. growth rate, P-limited [1/d]	Substrate half sat. [mgCOD(PHB)/mgCOD(Zbp)]	Substrate half sat., P-limited [mgCOD(PHB)/mgC	Magnesium half sat. [mgMg/L]	Cation half sat. [mmol/L]	Calcium half sat. [mgCa/L]	Aerobic/anoxic decay rate [1/d]	Aerobic/anoxic maintenance rate [1/d]	Anaerobic decay rate [1/d]	Anaerobic maintenance rate [1/d]	Sequestration rate [1/d]	Anoxic growth factor [-]
Pre-Aerobic	0.950	0.420	0.100	0.050	0.100	0.100	0.100	0.100	0	0.040	0	4.500	0.330
1st Aerobic	0.950	0.420	0.100	0.050	0.100	0.100	0.100	0.100	0	0.040	0	4.500	0.330
Aerobic	0.950	0.420	0.100	0.050	0.100	0.100	0.100	0.100	0	0.040	0	4.500	0.330
Reaer	0.950	0.420	0.100	0.050	0.100	0.100	0.100	0.100	0	0.040	0	4.500	0.330

Element name	Max. spec. growth rate [1/d]	Methanol half sat. [mgCOD/L]	Denite N2 producers (NO3 or NO2) [-]	Aerobic decay rate [1/d]	Anoxic/anaerobic decay rate [1/d]	Free nitrous acid inhibition [mmol/L]
Pre-Aerobic	1.3000	0.5000	0.5000	0.0400	0.0300	1.000E-7
1st Aerobic	1.3000	0.5000	0.5000	0.0400	0.0300	1.000E-7
Aerobic	1.3000	0.5000	0.5000	0.0400	0.0300	1.000E-7
Reaer	1.3000	0.5000	0.5000	0.0400	0.0300	1.000E-7

Element name	Max. spec. growth	Substrate half sat.	Acetate inhibition	Anaerobic decay	Aerobic/anoxic

	rate [1/d]	[mgCOD/L]	[mgCOD/L]	rate [1/d]	decay rate [1/d]
Pre-Aerobic	0.2500	10.0000	10000.0000	0.0500	0.5200
1st Aerobic	0.2500	10.0000	10000.0000	0.0500	0.5200
Aerobic	0.2500	10.0000	10000.0000	0.0500	0.5200
Reaer	0.2500	10.0000	10000.0000	0.0500	0.5200

Element name	Acetoclastic max. spec. growth rate	H2-utilizing max. spec. growth rate	Acetoclastic substrate half sat.	Acetoclastic methanol half sat.	H2-utilizing CO2 half sat.	H2-utilizing substrate half sat.	H2-utilizing methanol half sat.	Acetoclastic propionic inhibition	Acetoclastic anaerobic decay rate	Acetoclastic aerobic/anoxic decay	H2-utilizing anaerobic decay rate	H2-utilizing aerobic/anoxic decay
Pre-Aerobic	0.3000	1.4000	100.00	0.5000	0.1000	0.1000	0.5000	10000	0.1300	0.6000	0.1300	2.8000
1st Aerobic	0.3000	1.4000	100.0	0.5000	0.1000	0.1000	0.5000	1.0000	0.1300	0.6000	0.1300	2.8000
Aerobic	0.3000	1.4000	100.00	0.5000	0.1000	0.1000	0.5000	10000.	0.1300	0.6000	0.1300	2.8000
Reaer	0.3000	1.4000	100.00	0.5000	0.1000	0.1000	0.5000	10000.	0.1300	0.6000	0.1300	2.8000

Element name	OHO low pH limit [-]	OHO high pH limit [-]	Methylotrophs low pH	Methylotrophs high pH	Autotrophs low pH limit	Autotrophs high pH limit	PAO low pH limit [-]	PAO high pH limit [-]	OHO low pH limit	OHO high pH limit	Propionic acetogens	Propionic acetogens	Acetoclastic methanogen	Acetoclastic methanogen	H2-utilizing methanogen	H2-utilizing methanogen
Pre-Aerobic	4.0000	10.0000	4.0000	10.0000	5.5000	9.5000	4.0000	10.0000	5.5000	8.5000	4.0000	10.0000	5.0000	9.0000	5.0000	9.0000
1st Aerobic	4.0000	10.0000	4.0000	10.0000	5.5000	9.5000	4.0000	10.0000	5.5000	8.5000	4.0000	10.0000	5.0000	9.0000	5.0000	9.0000
Aerobic	4.0000	10.0000	4.0000	10.0000	5.5000	9.5000	4.0000	10.0000	5.5000	8.5000	4.0000	10.0000	5.0000	9.0000	5.0000	9.0000
Reaer	4.0000	10.0000	4.0000	10.0000	5.5000	9.5000	4.0000	10.0000	5.5000	8.5000	4.0000	10.0000	5.0000	9.0000	5.0000	9.0000

Element name	Aerobic/anoxic DO half	Anoxic/anaerobic NOx	AOB DO half sat.	NOB DO half sat.	ANAMMOX DO half sat.	Anoxic NO3(-	Anoxic NO3(->N2)	Anoxic NO2(->N2)	NH3 nutrient half sat.	PolyP half sat.	VFA sequestratio	P uptake half sat.	P nutrient half sat.	Autotroph CO2 half	H2 low/high half sat.	Propionic acetogens	Synthesis anion/cation
Pre-Aerobic	0.0500	0.1500	0.2500	0.5000	0.0100	0.1000	0.0500	0.0100	0.0050	0.0100	5.0000	0.1500	0.0010	0.1000	1.0000	5.0000	0.0100
1st	0.05	0.15	0.25	0.50	0.01	0.10	0.05	0.01	0.00	0.01	5.00	0.15	0.00	0.10	1.00	5.00	0.01

Aerobic	00	00	00	00	00	00	00	00	50	00	00	00	10	00	00	00	00
Aerobic	0.0500	0.1500	0.2500	0.5000	0.0100	0.1000	0.0500	0.0100	0.0050	0.0100	5.0000	0.1500	0.0010	0.1000	1.0000	5.0000	0.0100
Reaer	0.0500	0.1500	0.2500	0.5000	0.0100	0.1000	0.0500	0.0100	0.0050	0.0100	5.0000	0.1500	0.0010	0.1000	1.0000	5.0000	0.0100

Aeration equipment parameters

Element name	k1 in C = k1(PC)^0.25 + k2	k2 in C = k1(PC)^0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	% of tank area covered by diffusers [%]
Pre-Aerobic	2.400E-4	1.2600	1.0000	0.4413	10.0000
1st Aerobic	2.400E-4	1.2600	1.0000	0.4413	10.0000
Aerobic	2.400E-4	1.2600	1.0000	0.4413	10.0000
Post-An	2.5656	0.0432	0.8200	0.4413	10.0000
Reaer	2.5656	0.0432	0.8200	0.4413	10.0000

Element name	Alpha (surf) OR Alpha F (diff) [-]	Beta [-]	Surface pressure [kPa]	Fractional effective saturation depth (Fed) [-]
Pre-Aerobic	0.7500	0.9500	101.3250	0.3250
1st Aerobic	0.7500	0.9500	101.3250	0.3250
Aerobic	0.7500	0.9500	101.3250	0.3250
Reaer	0.8500	0.9500	101.3250	0.3250

Element name	Supply gas CO2 content [vol. %]	Supply gas O2 [vol. %]	Off-gas CO2 [vol. %]	Off-gas O2 [vol. %]	Off-gas H2 [vol. %]	Off-gas NH3 [vol. %]	Off-gas CH4 [vol. %]	Surface turbulence factor [-]
Pre-Aerobic	0.0350	20.9500	2.0000	18.8000	0	0	0	2.0000
1st Aerobic	0.0350	20.9500	2.0000	18.8000	0	0	0	2.0000
Aerobic	0.0350	20.9500	2.0000	18.8000	0	0	0	2.0000
Reaer	0.0350	20.9500	2.0000	18.8000	0	0	0	2.0000

Configuration information for all BOD Influent units

Operating data Average (flow/time weighted as required)

Element name	Inf
Flow	5.00077666578962
Total Carbonaceous BOD mgBOD/L	180.00
Volatile suspended solids mgVSS/L	110.00
Total suspended solids mgTSS/L	145.00

Total Kjeldahl Nitrogen mgN/L	36.00
Total P mgP/L	5.00
Nitrate N mgN/L	0
pH	7.00
Alkalinity mmol/L	6.00
Calcium mg/L	80.00
Magnesium mg/L	15.00
Dissolved oxygen mg/L	1.10

Element name	Inf
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.2700
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1470
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.7850
Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0670
Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.0400
Fna - Ammonia [gNH3-N/gTKN]	0.7140
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.2500
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0350
Fpo4 - Phosphate [gPO4-P/gTP]	0.6670
FupP - P:COD ratio for unbiodegradable part. COD [gP/gCOD]	0.0110
FZbh - OHO COD fraction [gCOD/g of total COD]	0.0100
FZbm - Methylotroph COD fraction [gCOD/g of total COD]	1.000E-4
FZaob - AOB COD fraction [gCOD/g of total COD]	1.000E-4
FZnob - NOB COD fraction [gCOD/g of total COD]	1.000E-4
FZamob - ANAMMOX COD fraction [gCOD/g of total COD]	1.000E-4
FZbp - PAO COD fraction [gCOD/g of total COD]	1.000E-4
FZbpa - Propionic acetogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbam - Acetoclastic methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbhm - H2-utilizing methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZe - Endogenous products COD fraction [gCOD/g of total COD]	0

Configuration information for all Methanol addition units

Operating data Average (flow/time weighted as required)

Element name	Methanol	Methanol
Ordinary heterotrophic organisms (OHO) mgCOD/L	0	0
Methylotrophs mgCOD/L	0	0
Ammonia oxidizing biomass (AOB) mgCOD/L	0	0
Nitrite oxidizing biomass (NOB) mgCOD/L	0	0
Anaerobic ammonia oxidizers (ANAMMOX) mgCOD/L	0	0
Polyphosphate accumulating organisms (PAO) mgCOD/L	0	0

Propionic acetogens mgCOD/L	0	0
Methanogens - acetoclastic mgCOD/L	0	0
Methanogens - hydrogenotrophic mgCOD/L	0	0
Endogenous products mgCOD/L	0	0
Slowly bio. COD (part.) mgCOD/L	0	0
Slowly bio. COD (colloid.) mgCOD/L	0	0
Part. inert. COD mgCOD/L	0	0
Part. bio. org. N mgN/L	0	0
Part. bio. org. P mgP/L	0	0
Part. inert N mgN/L	0	0
Part. inert P mgP/L	0	0
Stored PHA mgCOD/L	0	0
Releasable stored polyP mgP/L	0	0
Fixed stored polyP mgP/L	0	0
Readily bio. COD (complex) mgCOD/L	0	0
Acetate mgCOD/L	0	0
Propionate mgCOD/L	0	0
Methanol mgCOD/L	1188000.00	1188000.00
Dissolved H2 mgCOD/L	0	0
Dissolved methane mg/L	0	0
Ammonia N mgN/L	0	0
Sol. bio. org. N mgN/L	0	0
Nitrous Oxide N mgN/L	0	0
Nitrite N mgN/L	0	0
Nitrate N mgN/L	0	0
Dissolved nitrogen gas mgN/L	0	0
PO4-P (Sol. & Me Complexed) mgP/L	0	0
Sol. inert COD mgCOD/L	0	0
Sol. inert TKN mgN/L	0	0
ISS Influent mgISS/L	0	0
Struvite mgISS/L	0	0
Hydroxy-dicalcium-phosphate mgISS/L	0	0
Hydroxy-apatite mgISS/L	0	0
Magnesium mg/L	0	0
Calcium mg/L	0	0
Metal mg/L	0	0
Other Cations (strong bases) meq/L	0	0
Other Anions (strong acids) meq/L	0	0
Total CO2 mmol/L	0	0
User defined 1 mg/L	0	0
User defined 2 mg/L	0	0
User defined 3 mgVSS/L	0	0
User defined 4 mgISS/L	0	0
Dissolved oxygen mg/L	0	0

Flow	0.00012	0.00012

Configuration information for all Effluent units

Configuration information for all Ideal clarifier units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Ideal clarifier6	0.8593	8836.0000	13.000

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Ideal clarifier6	Flow paced	50.00 %

Element name	Average Temperature	Reactive	Percent removal	Blanket fraction
Ideal clarifier6	Uses global setting	No	99.95	0.05

Configuration information for all Metal addition units

Operating data Average (flow/time weighted as required)

Element name	Magnetite
Ordinary heterotrophic organisms (OHO) mgCOD/L	0
Methylotrophs mgCOD/L	0
Ammonia oxidizing biomass (AOB) mgCOD/L	0
Nitrite oxidizing biomass (NOB) mgCOD/L	0
Anaerobic ammonia oxidizers (ANAMMOX) mgCOD/L	0
Polyphosphate accumulating organisms (PAO) mgCOD/L	0
Propionic acetogens mgCOD/L	0
Methanogens - acetoclastic mgCOD/L	0
Methanogens - hydrogenotrophic mgCOD/L	0
Endogenous products mgCOD/L	0
Slowly bio. COD (part.) mgCOD/L	0
Slowly bio. COD (colloid.) mgCOD/L	0
Part. inert. COD mgCOD/L	0
Part. bio. org. N mgN/L	0
Part. bio. org. P mgP/L	0
Part. inert N mgN/L	0
Part. inert P mgP/L	0

Stored PHA mgCOD/L	0
Releasable stored polyP mgP/L	0
Fixed stored polyP mgP/L	0
Readily bio. COD (complex) mgCOD/L	0
Acetate mgCOD/L	0
Propionate mgCOD/L	0
Methanol mgCOD/L	0
Dissolved H2 mgCOD/L	0
Dissolved methane mg/L	0
Ammonia N mgN/L	0
Sol. bio. org. N mgN/L	0
Nitrous Oxide N mgN/L	0
Nitrite N mgN/L	0
Nitrate N mgN/L	0
Dissolved nitrogen gas mgN/L	0
PO4-P (Sol. & Me Complexed) mgP/L	0
Sol. inert COD mgCOD/L	0
Sol. inert TKN mgN/L	0
ISS Influent mgISS/L	0
Struvite mgISS/L	0
Hydroxy-dicalcium-phosphate mgISS/L	0
Hydroxy-apatite mgISS/L	0
Magnesium mg/L	0
Calcium mg/L	0
Metal mg/L	150000.00
Other Cations (strong bases) meq/L	5.00
Other Anions (strong acids) meq/L	8077.12
Total CO2 mmol/L	7.00
User defined 1 mg/L	0
User defined 2 mg/L	0
User defined 3 mgVSS/L	0
User defined 4 mgISS/L	0
Dissolved oxygen mg/L	0
Flow	5E-5

Configuration information for all Dewatering unit units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Thickening	Flowrate [Under]	0.01
Dewatering	Flowrate [Under]	0.01

Element name	Percent removal
Thickening	90.00
Dewatering	95.00

Configuration information for all Sludge units

Configuration information for all Splitter units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
	Flowrate [Main]	0.018
	Flow paced	400.00 %
Recovery	Flowrate [Main]	0.001

BioWin Album

Album page - Page 1

Inf			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	110.00	4590.69	
Total suspended solids	145.23	6060.90	
Particulate COD	175.55	7326.22	
Filtered COD	154.80	6460.33	
Total COD	330.35	13786.55	
Soluble PO4-P	3.34	139.18	
Total P	5.00	208.67	
Filtered TKN	33.07	1380.20	
Particulate TKN	2.93	122.20	
Total Kjeldahl Nitrogen	36.00	1502.41	
Filtered Carbonaceous BOD	94.09	3926.58	
Total Carbonaceous BOD	180.00	7512.03	
Nitrite + Nitrate	0	0	
Total N	36.00	1502.41	
Total inorganic N	25.70	1072.72	
Alkalinity	6.00	113.58	mmol/L and kmol/d
pH	7.00		
Volatile fatty acids	13.11	547.19	
ISS precipitate	0	0	

ISS cellular	0.23	9.54
ISS Total	35.23	1470.21
Ammonia N	25.70	1072.72
Nitrate N	0	0

Parameters	Value	Units

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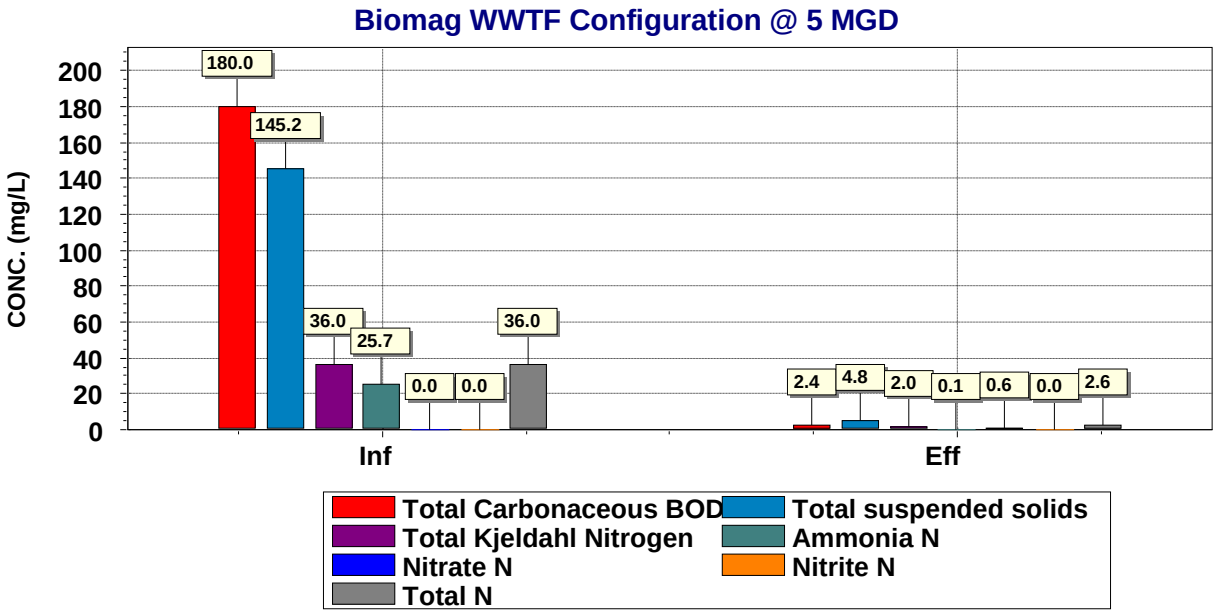

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Pre-Aerobic			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	4346.44	997263.90	
Total suspended solids	6395.09	1467314.88	
Particulate COD	6245.92	1433088.65	
Filtered COD	26.45	6068.27	
Total COD	6272.37	1439156.91	
Soluble PO4-P	2.50	572.57	
Total P	181.02	41534.90	
Filtered TKN	6.69	1535.01	
Particulate TKN	416.42	95545.50	
Total Kjeldahl Nitrogen	423.11	97080.51	
Filtered Carbonaceous BOD	2.87	657.40	
Total Carbonaceous BOD	2054.16	471315.08	

Nitrite + Nitrate	1.41	323.98	
Total N	424.52	97404.50	
Total inorganic N	6.03	1384.13	
Alkalinity	7.70	801.00	mmol/L and kmol/d
pH	6.91		
Volatile fatty acids	0.23	51.74	
ISS precipitate	384.20	88151.98	
ISS cellular	342.47	78576.95	
ISS Total	2048.65	470050.98	
Ammonia N	4.62	1060.15	
Nitrate N	1.25	286.38	

Parameters	Value	Units
Hydraulic residence time	0.3	hours
Velocity gradient	112.68	1/s
VSS destruction	0	%
Total solids mass	16608.07	lb
Total readily biodegradable COD	2.22	mg/L
OUR - Total	25.98	mgO/L/hr
OUR - Carbonaceous	18.53	mgO/L/hr
OUR - Nitrification	7.45	mgO/L/hr
Nit - Ammonia removal rate	2.12	mgN/L/hr
Nit - Nitrous oxide production rate	0.05	mgN/L/hr
Nit - Nitrite production rate	0.00	mgN/L/hr
Nit - Nitrate production rate	0.57	mgN/L/hr
Denit - Nitrate removal rate	10.44	mgN/L/hr
Denit - Nitrite removal rate	6.38	mgN/L/hr
Denit - N2 production rate	11.98	mgN/L/hr
Off gas flow rate (dry)	403.71	ft3/min
Off gas Oxygen	18.19	%
Off gas Carbon dioxide	3.04	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.22	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0.00	%
Actual DO sat. conc.	9.19	mg/L
OTR	49.06	lb/hr
SOTR	77.74	lb/hr
OTE	11.75	%
SOTE	19.05	%
Air flow rate	400.00	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0.55	ft3/min (20C, 1 atm)
# of diffusers	725.00	

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1st Aerobic			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	4343.64	996622.32	
Total suspended solids	6392.35	1466684.72	
Particulate COD	6241.32	1432033.74	
Filtered COD	23.80	5461.34	
Total COD	6265.13	1437495.08	
Soluble PO4-P	2.52	577.81	
Total P	181.02	41534.90	
Filtered TKN	4.01	918.94	
Particulate TKN	416.41	95543.07	
Total Kjeldahl Nitrogen	420.42	96462.01	
Filtered Carbonaceous BOD	1.12	256.98	
Total Carbonaceous BOD	2049.33	470207.03	
Nitrite + Nitrate	3.75	859.99	
Total N	424.16	97322.00	
Total inorganic N	5.85	1341.78	
Alkalinity	7.35	765.16	mmol/L and kmol/d
pH	6.88		
Volatile fatty acids	0.01	3.02	
ISS precipitate	384.19	88149.53	
ISS cellular	342.53	78590.82	
ISS Total	2048.70	470062.40	
Ammonia N	2.10	481.79	
Nitrate N	2.63	604.16	

Parameters	Value	Units
Hydraulic residence time	0.3	hours
Velocity gradient	175.14	1/s
VSS destruction	0.06	%
Total solids mass	16600.94	lb
Total readily biodegradable COD	1.17	mg/L
OUR - Total	63.45	mgO/L/hr
OUR - Carbonaceous	24.54	mgO/L/hr
OUR - Nitrification	38.91	mgO/L/hr
Nit - Ammonia removal rate	10.04	mgN/L/hr
Nit - Nitrous oxide production rate	0.12	mgN/L/hr
Nit - Nitrite production rate	0.00	mgN/L/hr
Nit - Nitrate production rate	6.12	mgN/L/hr
Denit - Nitrate removal rate	1.02	mgN/L/hr

Denit - Nitrite removal rate	0.62	mgN/L/hr
Denit - N2 production rate	1.20	mgN/L/hr
Off gas flow rate (dry)	1402.56	ft3/min
Off gas Oxygen	18.49	%
Off gas Carbon dioxide	2.51	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.06	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0.00	%
Actual DO sat. conc.	9.19	mg/L
OTR	167.38	lb/hr
SOTR	273.35	lb/hr
OTE	11.40	%
SOTE	19.05	%
Air flow rate	1406.51	ft3/min (20C, 1 atm)
Air flow rate / diffuser	1.94	ft3/min (20C, 1 atm)
# of diffusers	725.00	

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Aerobic			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	4339.48	995667.73	
Total suspended solids	6388.20	1465733.23	
Particulate COD	6234.64	1430500.21	
Filtered COD	23.39	5367.78	
Total COD	6258.04	1435867.99	
Soluble PO4-P	2.56	588.35	
Total P	181.02	41534.90	
Filtered TKN	2.21	507.83	
Particulate TKN	416.32	95522.45	
Total Kjeldahl Nitrogen	418.53	96030.28	
Filtered Carbonaceous BOD	0.88	200.99	
Total Carbonaceous BOD	2044.83	469174.45	
Nitrite + Nitrate	5.58	1279.35	
Total N	424.11	97309.63	
Total inorganic N	5.91	1356.43	
Alkalinity	7.10	738.78	mmol/L and kmol/d
pH	6.88		
Volatile fatty acids	0.00	0.20	
ISS precipitate	384.19	88149.48	
ISS cellular	342.54	78593.97	
ISS Total	2048.72	470065.50	
Ammonia N	0.34	77.08	

Nitrate N	5.33	1221.82

Parameters	Value	Units
Hydraulic residence time	0.3	hours
Velocity gradient	194.32	1/s
VSS destruction	0.10	%
Total solids mass	16590.17	lb
Total readily biodegradable COD	1.15	mg/L
OUR - Total	60.57	mgO/L/hr
OUR - Carbonaceous	26.91	mgO/L/hr
OUR - Nitrification	33.67	mgO/L/hr
Nit - Ammonia removal rate	7.10	mgN/L/hr
Nit - Nitrous oxide production rate	0.00	mgN/L/hr
Nit - Nitrite production rate	7.03	mgN/L/hr
Nit - Nitrate production rate	10.11	mgN/L/hr
Denit - Nitrate removal rate	0.19	mgN/L/hr
Denit - Nitrite removal rate	0.10	mgN/L/hr
Denit - N2 production rate	0.19	mgN/L/hr
Off gas flow rate (dry)	1791.51	ft3/min
Off gas Oxygen	19.01	%
Off gas Carbon dioxide	1.93	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.01	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0.00	%
Actual DO sat. conc.	9.19	mg/L
OTR	173.57	lb/hr
SOTR	350.43	lb/hr
OTE	9.22	%
SOTE	19.05	%
Air flow rate	1803.13	ft3/min (20C, 1 atm)
Air flow rate / diffuser	2.49	ft3/min (20C, 1 atm)
# of diffusers	725.00	

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Post-An			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	4340.86	271351.10	
Total suspended solids	6389.71	399426.66	
Particulate COD	6236.52	389850.46	
Filtered COD	23.73	1483.20	
Total COD	6260.25	391333.66	

Soluble PO4-P	2.47	154.13	
Total P	181.02	11315.80	
Filtered TKN	1.79	112.19	
Particulate TKN	416.66	26045.59	
Total Kjeldahl Nitrogen	418.45	26157.78	
Filtered Carbonaceous BOD	0.60	37.49	
Total Carbonaceous BOD	2044.86	127825.95	
Nitrite + Nitrate	0.31	19.56	
Total N	418.76	26177.34	
Total inorganic N	0.78	49.02	
Alkalinity	7.48	212.01	mmol/L and kmol/d
pH	6.89		
Volatile fatty acids	0.11	6.93	
ISS precipitate	384.19	24015.94	
ISS cellular	342.70	21422.32	
ISS Total	2048.85	128075.55	
Ammonia N	0.47	29.46	
Nitrate N	0.30	18.74	

Parameters	Value	Units
Hydraulic residence time	0.5	hours
Velocity gradient	71.85	1/s
VSS destruction	0	%
Total solids mass	8975.18	lb
Total readily biodegradable COD	0.80	mg/L
OUR - Total	3.70	mgO/L/hr
OUR - Carbonaceous	2.99	mgO/L/hr
OUR - Nitrification	0.70	mgO/L/hr
Nit - Ammonia removal rate	0.21	mgN/L/hr
Nit - Nitrous oxide production rate	0.00	mgN/L/hr
Nit - Nitrite production rate	0.21	mgN/L/hr
Nit - Nitrate production rate	0.02	mgN/L/hr
Denit - Nitrate removal rate	9.32	mgN/L/hr
Denit - Nitrite removal rate	4.83	mgN/L/hr
Denit - N2 production rate	9.90	mgN/L/hr
Off gas flow rate (dry)	1.86	ft3/min
Off gas Oxygen	0	%
Off gas Carbon dioxide	72.84	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	5.17	%
Off gas Methane	0.01	%
Off gas Nitrous oxide	0.02	%
Actual DO sat. conc.	8.95	mg/L

OTR	0	lb/hr
SOTR	0	lb/hr
OTE	100.00	%
SOTE	100.00	%
Air flow rate	0	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0	ft3/min (20C, 1 atm)
# of diffusers	510.00	

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Reaer			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	4336.67	271088.84	
Total suspended solids	6385.47	399161.03	
Particulate COD	6229.95	389439.46	
Filtered COD	23.50	1468.92	
Total COD	6253.45	390908.39	
Soluble PO4-P	2.53	158.44	
Total P	181.02	11315.80	
Filtered TKN	1.65	102.89	
Particulate TKN	416.47	26033.97	
Total Kjeldahl Nitrogen	418.12	26136.86	
Filtered Carbonaceous BOD	0.82	51.21	
Total Carbonaceous BOD	2040.97	127582.79	
Nitrite + Nitrate	0.63	39.23	
Total N	418.74	26176.09	
Total inorganic N	0.69	43.41	
Alkalinity	7.43	210.70	mmol/L and kmol/d
pH	6.94		
Volatile fatty acids	0.01	0.49	
ISS precipitate	384.20	24016.71	
ISS cellular	342.63	21418.19	
ISS Total	2048.80	128072.19	
Ammonia N	0.07	4.17	
Nitrate N	0.61	38.40	

Parameters	Value	Units
Hydraulic residence time	0.2	hours
Velocity gradient	151.72	1/s
VSS destruction	0.10	%
Total solids mass	3707.27	lb
Total readily biodegradable COD	1.16	mg/L
OUR - Total	34.51	mgO/L/hr

OUR - Carbonaceous	26.20	mgO/L/hr
OUR - Nitrification	8.31	mgO/L/hr
Nit - Ammonia removal rate	2.01	mgN/L/hr
Nit - Nitrous oxide production rate	0.00	mgN/L/hr
Nit - Nitrite production rate	1.99	mgN/L/hr
Nit - Nitrate production rate	1.71	mgN/L/hr
Denit - Nitrate removal rate	0.10	mgN/L/hr
Denit - Nitrite removal rate	0.03	mgN/L/hr
Denit - N2 production rate	0.09	mgN/L/hr
Off gas flow rate (dry)	301.39	ft3/min
Off gas Oxygen	18.80	%
Off gas Carbon dioxide	2.15	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.20	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0.00	%
Actual DO sat. conc.	8.95	mg/L
OTR	28.96	lb/hr
SOTR	65.43	lb/hr
OTE	9.25	%
SOTE	21.38	%
Air flow rate	300.00	ft3/min (20C, 1 atm)
Air flow rate / diffuser	1.42	ft3/min (20C, 1 atm)
# of diffusers	211.00	

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Ideal clarifier6			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	3.25	135.54	
Total suspended solids	4.80	199.71	
Particulate COD	4.68	194.72	
Filtered COD	23.50	978.58	
Total COD	28.17	1173.30	
Soluble PO4-P	2.53	105.55	
Total P	2.67	111.15	
Filtered TKN	1.65	68.54	
Particulate TKN	0.31	13.02	
Total Kjeldahl Nitrogen	1.96	81.56	
Filtered Carbonaceous BOD	0.82	34.11	
Total Carbonaceous BOD	2.35	97.88	
Nitrite + Nitrate	0.63	26.14	
Total N	2.59	107.70	
Total inorganic N	0.69	28.92	

Alkalinity	4.13	78.00	mmol/L and kmol/d
pH	6.94		
Volatile fatty acids	0.01	0.33	
ISS precipitate	0.29	12.14	
ISS cellular	0.26	10.71	
ISS Total	1.54	64.17	
Ammonia N	0.07	2.78	
Nitrate N	0.61	25.58	

Parameters	Value	Units
Hydraulic residence time	2.75	hours
Percent removal	99.95	%
Height of specified concentration	0.65	ft
Total solids mass	6887.93	lb
Surface overflow rate	564.74	gal/(ft2 d)
Solids loading rate	45.17	lb/(ft2 d)

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EFF			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	3.25	135.54	
Total suspended solids	4.80	199.71	
Particulate COD	4.68	194.72	
Filtered COD	23.50	978.58	
Total COD	28.17	1173.30	
Soluble PO4-P	2.53	105.55	
Total P	2.67	111.15	
Filtered TKN	1.65	68.54	
Particulate TKN	0.31	13.02	
Total Kjeldahl Nitrogen	1.96	81.56	
Filtered Carbonaceous BOD	0.82	34.11	
Total Carbonaceous BOD	2.35	97.88	
Nitrite + Nitrate	0.63	26.14	
Total N	2.59	107.70	
Total inorganic N	0.69	28.92	
Alkalinity	4.13	78.00	mmol/L and kmol/d
pH	6.94		
Volatile fatty acids	0.01	0.33	
ISS precipitate	0.29	12.14	
ISS cellular	0.26	10.71	
ISS Total	1.54	64.17	
Ammonia N	0.07	2.78	

Nitrate N	0.61	25.58

Parameters	Value	Units

Global Parameters

AOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9000	0.9000	1.0720
Substrate (NH4) half sat. [mgN/L]	0.7000	0.7000	1.0000
Byproduct NH4 logistic slope [-]	50.0000	50.0000	1.0000
Byproduct NH4 inflection point [mgN/L]	1.4000	1.4000	1.0000
AOB denite DO half sat. [mg/L]	0.1000	0.1000	1.0000
AOB denite HNO2 half sat. [mgN/L]	5.000E-6	5.000E-6	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiHNO2 [mmol/L]	0.0050	0.0050	1.0000

NOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.7000	0.7000	1.0600
Substrate (NO2) half sat. [mgN/L]	0.1000	0.1000	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiNH3 [mmol/L]	0.0750	0.0750	1.0000

ANAMMOX

Name	Default	Value	
Max. spec. growth rate [1/d]	0.1000	0.1000	1.1000
Substrate (NH4) half sat. [mgN/L]	2.0000	2.0000	1.0000
Substrate (NO2) half sat. [mgN/L]	1.0000	1.0000	1.0000
Aerobic decay rate [1/d]	0.0190	0.0190	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0095	0.0095	1.0290
Ki Nitrite [mgN/L]	1000.0000	1000.0000	1.0000
Nitrite sensitivity constant [L / (d mgN)]	0.0160	0.0160	1.0000

OHO

Name	Default	Value	
Max. spec. growth rate [1/d]	3.2000	3.2000	1.0290
Substrate half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Anoxic growth factor [-]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.6200	0.6200	1.0290
Anoxic decay rate [1/d]	0.2330	0.2330	1.0290
Anaerobic decay rate [1/d]	0.1310	0.1310	1.0290
Hydrolysis rate [1/d]	2.1000	2.1000	1.0290
Hydrolysis half sat. [-]	0.0600	0.0600	1.0000
Anoxic hydrolysis factor [-]	0.2800	0.2800	1.0000
Anaerobic hydrolysis factor (AS) [-]	0.0400	0.0400	1.0000
Anaerobic hydrolysis factor (AD) [-]	0.2000	0.2000	1.0000
Adsorption rate of colloids [L/(mgCOD d)]	0.1500	0.1500	1.0290
Ammonification rate [L/(mgN d)]	0.0400	0.0400	1.0290
Assimilative nitrate/nitrite reduction rate [1/d]	0.5000	0.5000	1.0000
Fermentation rate [1/d]	1.6000	1.6000	1.0290
Fermentation half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Fermentation growth factor (AS) [-]	0.2500	0.2500	1.0000
Endogenous products decay rate[1/d]	0	0	1.0000
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

Methylotrophs

Name	Default	Value	
Max. spec. growth rate [1/d]	1.3000	1.3000	1.0720
Methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.0400	0.0400	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0300	0.0300	1.0000
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

PAO

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9500	0.9500	1.0000
Max. spec. growth rate, P-limited [1/d]	0.4200	0.4200	1.0000
Substrate half sat. [mgCOD(PHB)/mgCOD(Zbp)]	0.1000	0.1000	1.0000
Substrate half sat., P-limited [mgCOD(PHB)/mgCOD(Zbp)]	0.0500	0.0500	1.0000
Magnesium half sat. [mgMg/L]	0.1000	0.1000	1.0000
Cation half sat. [mmol/L]	0.1000	0.1000	1.0000
Calcium half sat. [mgCa/L]	0.1000	0.1000	1.0000
Aerobic/anoxic decay rate [1/d]	0.1000	0.1000	1.0000

Aerobic/anoxic maintenance rate [1/d]	0	0	1.0000
Anaerobic decay rate [1/d]	0.0400	0.0400	1.0000
Anaerobic maintenance rate [1/d]	0	0	1.0000
Sequestration rate [1/d]	4.5000	4.5000	1.0000
Anoxic growth factor [-]	0.3300	0.3300	1.0000

Acetogens

Name	Default	Value	
Max. spec. growth rate [1/d]	0.2500	0.2500	1.0290
Substrate half sat. [mgCOD/L]	10.0000	10.0000	1.0000
Acetate inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Anaerobic decay rate [1/d]	0.0500	0.0500	1.0290
Aerobic/anoxic decay rate [1/d]	0.5200	0.5200	1.0290

Methanogens

Name	Default	Value	
Acetoclastic max. spec. growth rate [1/d]	0.3000	0.3000	1.0290
H2-utilizing max. spec. growth rate [1/d]	1.4000	1.4000	1.0290
Acetoclastic substrate half sat. [mgCOD/L]	100.0000	100.0000	1.0000
Acetoclastic methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
H2-utilizing CO2 half sat. [mmol/L]	0.1000	0.1000	1.0000
H2-utilizing substrate half sat. [mgCOD/L]	0.1000	0.1000	1.0000
H2-utilizing methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Acetoclastic propionic inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Acetoclastic anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
Acetoclastic aerobic/anoxic decay rate [1/d]	0.6000	0.6000	1.0290
H2-utilizing anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
H2-utilizing aerobic/anoxic decay rate [1/d]	2.8000	2.8000	1.0290

pH

Name	Default	Value
OHO low pH limit [-]	4.0000	4.0000
OHO high pH limit [-]	10.0000	10.0000
Methylotrophs low pH limit [-]	4.0000	4.0000
Methylotrophs high pH limit [-]	10.0000	10.0000
Autotrophs low pH limit [-]	5.5000	5.5000
Autotrophs high pH limit [-]	9.5000	9.5000
PAO low pH limit [-]	4.0000	4.0000
PAO high pH limit [-]	10.0000	10.0000

OHO low pH limit (anaerobic) [-]	5.5000	5.5000
OHO high pH limit (anaerobic) [-]	8.5000	8.5000
Propionic acetogens low pH limit [-]	4.0000	4.0000
Propionic acetogens high pH limit [-]	10.0000	10.0000
Acetoclastic methanogens low pH limit [-]	5.0000	5.0000
Acetoclastic methanogens high pH limit [-]	9.0000	9.0000
H2-utilizing methanogens low pH limit [-]	5.0000	5.0000
H2-utilizing methanogens high pH limit [-]	9.0000	9.0000

Switches

Name	Default	Value
Aerobic/anoxic DO half sat. [mgO2/L]	0.0500	0.0500
Anoxic/anaerobic NOx half sat. [mgN/L]	0.1500	0.1500
AOB DO half sat. [mgO2/L]	0.2500	0.2500
NOB DO half sat. [mgO2/L]	0.5000	0.5000
ANAMMOX DO half sat. [mgO2/L]	0.0100	0.0100
Anoxic NO3(->NO2) half sat. [mgN/L]	0.1000	0.1000
Anoxic NO3(->N2) half sat. [mgN/L]	0.0500	0.0500
Anoxic NO2(->N2) half sat. (mgN/L)	0.0100	0.0100
NH3 nutrient half sat. [mgN/L]	0.0050	0.0050
PolyP half sat. [mgP/mgCOD]	0.0100	0.0100
VFA sequestration half sat. [mgCOD/L]	5.0000	5.0000
P uptake half sat. [mgP/L]	0.1500	0.1500
P nutrient half sat. [mgP/L]	0.0010	0.0010
Autotroph CO2 half sat. [mmol/L]	0.1000	0.1000
H2 low/high half sat. [mgCOD/L]	1.0000	1.0000
Propionic acetogens H2 inhibition [mgCOD/L]	5.0000	5.0000
Synthesis anion/cation half sat. [meq/L]	0.0100	0.0100

Common

Name	Default	Value
Biomass volatile fraction (VSS/TSS)	0.9200	0.9200
Endogenous residue volatile fraction (VSS/TSS)	0.9200	0.9200
N in endogenous residue [mgN/mgCOD]	0.0700	0.0700
P in endogenous residue [mgP/mgCOD]	0.0220	0.0220
Endogenous residue COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Particulate substrate COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000
Particulate inert COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000

AOB

Name	Default	Value
Yield [mgCOD/mgN]	0.1500	0.1500
AOB denite NO2 fraction as TEA [-]	0.5000	0.5000
Byproduct NH4 fraction to N2O [-]	0.0025	0.0025
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

NOB

Name	Default	Value
Yield [mgCOD/mgN]	0.0900	0.0900
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

ANAMMOX

Name	Default	Value
Yield [mgCOD/mgN]	0.1140	0.1140
Nitrate production [mgN/mgBiomassCOD]	2.2800	2.2800
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

OHO

Name	Default	Value
Yield (aerobic) [-]	0.6660	0.6660
Yield (fermentation, low H2) [-]	0.1000	0.1000
Yield (fermentation, high H2) [-]	0.1000	0.1000
H2 yield (fermentation low H2) [-]	0.3500	0.3500
H2 yield (fermentation high H2) [-]	0	0
Propionate yield (fermentation, low H2) [-]	0	0
Propionate yield (fermentation, high H2) [-]	0.7000	0.7000
CO2 yield (fermentation, low H2) [-]	0.7000	0.7000
CO2 yield (fermentation, high H2) [-]	0	0
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220

Endogenous fraction - aerobic [-]	0.0800	0.0800
Endogenous fraction - anoxic [-]	0.1030	0.1030
Endogenous fraction - anaerobic [-]	0.1840	0.1840
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield (anoxic) [-]	0.5400	0.5400
Yield propionic (aerobic) [-]	0.6400	0.6400
Yield propionic (anoxic) [-]	0.4600	0.4600
Yield acetic (aerobic) [-]	0.6000	0.6000
Yield acetic (anoxic) [-]	0.4300	0.4300
Yield methanol (aerobic) [-]	0.5000	0.5000
Adsorp. max. [-]	1.0000	1.0000
Max fraction to N2O at high FNA over nitrate [-]	0.0500	0.0500
Max fraction to N2O at high FNA over nitrite [-]	0.1000	0.1000

Methylotrophs

Name	Default	Value
Yield (anoxic) [-]	0.4000	0.4000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Max fraction to N2O at high FNA over nitrate [-]	0.1000	0.1000
Max fraction to N2O at high FNA over nitrite [-]	0.1500	0.1500

PAO

Name	Default	Value
Yield (aerobic) [-]	0.6390	0.6390
Yield (anoxic) [-]	0.5200	0.5200
Aerobic P/PHA uptake [mgP/mgCOD]	0.9300	0.9300
Anoxic P/PHA uptake [mgP/mgCOD]	0.3500	0.3500
Yield of PHA on sequestration [-]	0.8890	0.8890
N in biomass [mgN/mgCOD]	0.0700	0.0700
N in sol. inert [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous part. [-]	0.2500	0.2500
Inert fraction of endogenous sol. [-]	0.2000	0.2000
P/Ac release ratio [mgP/mgCOD]	0.5100	0.5100
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield of low PP [-]	0.9400	0.9400

Acetogens

Name	Default	Value
Yield [-]	0.1000	0.1000
H2 yield [-]	0.4000	0.4000
CO2 yield [-]	1.0000	1.0000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

Methanogens

Name	Default	Value
Acetoclastic yield [-]	0.1000	0.1000
Methanol acetoclastic yield [-]	0.1000	0.1000
H2-utilizing yield [-]	0.1000	0.1000
Methanol H2-utilizing yield [-]	0.1000	0.1000
N in acetoclastic biomass [mgN/mgCOD]	0.0700	0.0700
N in H2-utilizing biomass [mgN/mgCOD]	0.0700	0.0700
P in acetoclastic biomass [mgP/mgCOD]	0.0220	0.0220
P in H2-utilizing biomass [mgP/mgCOD]	0.0220	0.0220
Acetoclastic fraction to endog. residue [-]	0.0800	0.0800
H2-utilizing fraction to endog. residue [-]	0.0800	0.0800
Acetoclastic COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
H2-utilizing COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

General

Name	Default	Value
Molecular weight of other anions [mg/mmol]	35.5000	35.5000
Molecular weight of other cations [mg/mmol]	39.1000	39.1000
Mg to P mole ratio in polyphosphate [mmolMg/mmolP]	0.3000	0.3000
Cation to P mole ratio in polyphosphate [meq/mmolP]	0.1500	0.1500
Ca to P mole ratio in polyphosphate [mmolCa/mmolP]	0.0500	0.0500
Cation to P mole ratio in organic phosphate [meq/mmolP]	0.0100	0.0100
Bubble rise velocity (anaerobic digester) [cm/s]	23.9000	23.9000
Bubble Sauter mean diameter (anaerobic digester) [cm]	0.3500	0.3500
Anaerobic digester gas hold-up factor []	1.0000	1.0000
Tank head loss per metre of length (from flow) [m/m]	0.0025	0.0025

Mass transfer

Name	Default	Value	
Kl for H2 [m/d]	17.0000	17.0000	1.0240
Kl for CO2 [m/d]	10.0000	10.0000	1.0240
Kl for NH3 [m/d]	1.0000	1.0000	1.0240
Kl for CH4 [m/d]	8.0000	8.0000	1.0240
Kl for N2 [m/d]	15.0000	15.0000	1.0240
Kl for N2O [m/d]	8.0000	8.0000	1.0240
Kl for O2 [m/d]	13.0000	13.0000	1.0240

Henry's law constants

Name	Default	Value	
CO2 [M/atm]	0.0340	0.0340	2400.0000
O2 [M/atm]	0.0013	0.0013	1500.0000
N2 [M/atm]	6.500E-4	6.500E-4	1300.0000
N2O [M/atm]	0.0250	0.0250	2600.0000
NH3 [M/atm]	58.0000	58.0000	4100.0000
CH4 [M/atm]	0.0014	0.0014	1600.0000
H2 [M/atm]	7.800E-4	7.800E-4	500.0000

Physico-chemical rates

Name	Default	Value	
Struvite precipitation rate [1/d]	3.000E+10	3.000E+10	1.0240
Struvite redissolution rate [1/d]	3.000E+11	3.000E+11	1.0240
Struvite half sat. [mgTSS/L]	1.0000	1.0000	1.0000
HDP precipitation rate [L/(molP d)]	1.000E+8	1.000E+8	1.0000
HDP redissolution rate [L/(mol P d)]	1.000E+8	1.000E+8	1.0000
HAP precipitation rate [molHDP/(L d)]	5.000E-4	5.000E-4	1.0000

Physico-chemical constants

Name	Default	Value
Struvite solubility constant [mol/L]	6.918E-14	6.918E-14
HDP solubility product [mol/L]	2.750E-22	2.750E-22
HDP half sat. [mgTSS/L]	1.0000	1.0000
Equilibrium soluble PO4 with Al dosing at pH 7 [mgP/L]	0.0100	0.0100
Al to P ratio [molAl/molP]	0.8000	0.8000
Al(OH)3 solubility product [mol/L]	1.259E+9	1.259E+9
AlHPO4+ dissociation constant [mol/L]	7.943E-13	7.943E-13
Equilibrium soluble PO4 with Fe dosing at pH 7 [mgP/L]	0.0100	0.0100
Fe to P ratio [molFe/molP]	1.6000	1.6000

Fe(OH)3 solubility product [mol/L]	0.0500	0.0500
FeH2PO4++ dissociation constant [mol/L]	5.012E-22	5.012E-22

Aeration

Name	Default	Value
Alpha (surf) OR Alpha F (diff) [-]	0.5000	0.5000
Beta [-]	0.9500	0.9500
Surface pressure [kPa]	101.3250	101.3250
Fractional effective saturation depth (Fed) [-]	0.3250	0.3250
Supply gas CO2 content [vol. %]	0.0350	0.0350
Supply gas O2 [vol. %]	20.9500	20.9500
Off-gas CO2 [vol. %]	2.0000	2.0000
Off-gas O2 [vol. %]	18.8000	18.8000
Off-gas H2 [vol. %]	0	0
Off-gas NH3 [vol. %]	0	0
Off-gas CH4 [vol. %]	0	0
Surface turbulence factor [-]	2.0000	2.0000
Set point controller gain []	1.0000	1.0000

Modified Vesilind

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.387	0.387
Vesilind hindered zone settling parameter (K) [L/g]	0.370	0.370
Clarification switching function [mg/L]	100.000	100.000
Specified TSS conc.for height calc. [mg/L]	2500.000	2500.000
Maximum compactability constant [mg/L]	15000.000	15000.000

Double exponential

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.934	0.934
Maximum (practical) settling velocity (Vo') [ft/min]	0.615	0.615
Hindered zone settling parameter (Kh) [L/g]	0.400	0.400
Flocculent zone settling parameter (Kf) [L/g]	2.500	2.500
Maximum non-settleable TSS [mg/L]	20.0000	20.0000
Non-settleable fraction [-]	0.0010	0.0010
Specified TSS conc. for height calc. [mg/L]	2500.0000	2500.0000

Emission factors

Name	Default	Value
Carbon dioxide equivalence of nitrous oxide	296.0000	296.0000
Carbon dioxide equivalence of methane	23.0000	23.0000

Biofilm general

Name	Default	Value	
Attachment rate [g / (m2 d)]	80.0000	80.0000	1.0000
Attachment TSS half sat. [mg/L]	100.0000	100.0000	1.0000
Detachment rate [g/(m3 d)]	8.000E+4	8.000E+4	1.0000
Solids movement factor []	10.0000	10.0000	1.0000
Diffusion neta []	0.8000	0.8000	1.0000
Thin film limit [mm]	0.5000	0.5000	1.0000
Thick film limit [mm]	3.0000	3.0000	1.0000
Assumed Film thickness for tank volume correction (temp independant) [mm]	0.7500	0.7500	1.0000
Film surface area to media area ratio - Max.[ ]	1.0000	1.0000	1.0000
Minimum biofilm conc. for streamer formation [gTSS/m2]	4.0000	4.0000	1.0000

Maximum biofilm concentrations [mg/L]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	5.000E+4	5.000E+4	1.0000
Methylotrophs	5.000E+4	5.000E+4	1.0000
Ammonia oxidizing biomass (AOB)	1.000E+5	1.000E+5	1.0000
Nitrite oxidizing biomass (NOB)	1.000E+5	1.000E+5	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E+4	5.000E+4	1.0000
Polyphosphate accumulating organisms (PAO)	5.000E+4	5.000E+4	1.0000
Propionic acetogens	5.000E+4	5.000E+4	1.0000
Methanogens - acetoclastic	5.000E+4	5.000E+4	1.0000
Methanogens - hydrogenotrophic	5.000E+4	5.000E+4	1.0000
Endogenous products	3.000E+4	3.000E+4	1.0000
Slowly bio. COD (part.)	5000.0000	5000.0000	1.0000
Slowly bio. COD (colloid.)	4000.0000	4000.0000	1.0000
Part. inert. COD	5000.0000	5000.0000	1.0000
Part. bio. org. N	0	0	1.0000
Part. bio. org. P	0	0	1.0000
Part. inert N	0	0	1.0000
Part. inert P	0	0	1.0000
Stored PHA	5000.0000	5000.0000	1.0000
Releasable stored polyP	1.150E+6	1.150E+6	1.0000
Fixed stored polyP	1.150E+6	1.150E+6	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000

Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.000E+10	1.000E+10	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	1.300E+6	1.300E+6	1.0000
Struvite	8.500E+5	8.500E+5	1.0000
Hydroxy-dicalcium-phosphate	1.150E+6	1.150E+6	1.0000
Hydroxy-apatite	1.600E+6	1.600E+6	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.000E+10	1.000E+10	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	5.000E+4	5.000E+4	1.0000
User defined 4	5.000E+4	5.000E+4	1.0000
Dissolved oxygen	0	0	1.0000

Effective diffusivities [m2/s]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	5.000E-14	5.000E-14	1.0290
Methylotrophs	5.000E-14	5.000E-14	1.0290
Ammonia oxidizing biomass (AOB)	5.000E-14	5.000E-14	1.0290
Nitrite oxidizing biomass (NOB)	5.000E-14	5.000E-14	1.0290
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E-14	5.000E-14	1.0290
Polyphosphate accumulating organisms (PAO)	5.000E-14	5.000E-14	1.0290
Propionic acetogens	5.000E-14	5.000E-14	1.0290
Methanogens - acetoclastic	5.000E-14	5.000E-14	1.0290
Methanogens - hydrogenotrophic	5.000E-14	5.000E-14	1.0290
Endogenous products	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (part.)	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (colloid.)	5.000E-12	5.000E-12	1.0290

Part. inert. COD	5.000E-14	5.000E-14	1.0290
Part. bio. org. N	5.000E-14	5.000E-14	1.0290
Part. bio. org. P	5.000E-14	5.000E-14	1.0290
Part. inert N	5.000E-14	5.000E-14	1.0290
Part. inert P	5.000E-14	5.000E-14	1.0290
Stored PHA	5.000E-14	5.000E-14	1.0290
Releasable stored polyP	5.000E-14	5.000E-14	1.0290
Fixed stored polyP	5.000E-14	5.000E-14	1.0290
Readily bio. COD (complex)	6.900E-10	6.900E-10	1.0290
Acetate	1.240E-9	1.240E-9	1.0290
Propionate	8.300E-10	8.300E-10	1.0290
Methanol	1.600E-9	1.600E-9	1.0290
Dissolved H2	5.850E-9	5.850E-9	1.0290
Dissolved methane	1.963E-9	1.963E-9	1.0290
Ammonia N	2.000E-9	2.000E-9	1.0290
Sol. bio. org. N	1.370E-9	1.370E-9	1.0290
Nitrous Oxide N	1.607E-9	1.607E-9	1.0290
Nitrite N	2.980E-9	2.980E-9	1.0290
Nitrate N	2.980E-9	2.980E-9	1.0290
Dissolved nitrogen gas	1.900E-9	1.900E-9	1.0290
PO4-P (Sol. & Me Complexed)	2.000E-9	2.000E-9	1.0290
Sol. inert COD	6.900E-10	6.900E-10	1.0290
Sol. inert TKN	6.850E-10	6.850E-10	1.0290
ISS Influent	5.000E-14	5.000E-14	1.0290
Struvite	5.000E-14	5.000E-14	1.0290
Hydroxy-dicalcium-phosphate	5.000E-14	5.000E-14	1.0290
Hydroxy-apatite	5.000E-14	5.000E-14	1.0290
Magnesium	7.200E-10	7.200E-10	1.0290
Calcium	7.200E-10	7.200E-10	1.0290
Metal	4.800E-10	4.800E-10	1.0290
Other Cations (strong bases)	1.440E-9	1.440E-9	1.0290
Other Anions (strong acids)	1.440E-9	1.440E-9	1.0290
Total CO2	1.960E-9	1.960E-9	1.0290
User defined 1	6.900E-10	6.900E-10	1.0290
User defined 2	6.900E-10	6.900E-10	1.0290
User defined 3	5.000E-14	5.000E-14	1.0290
User defined 4	5.000E-14	5.000E-14	1.0290
Dissolved oxygen	2.500E-9	2.500E-9	1.0290

EPS Strength coefficients [ ]

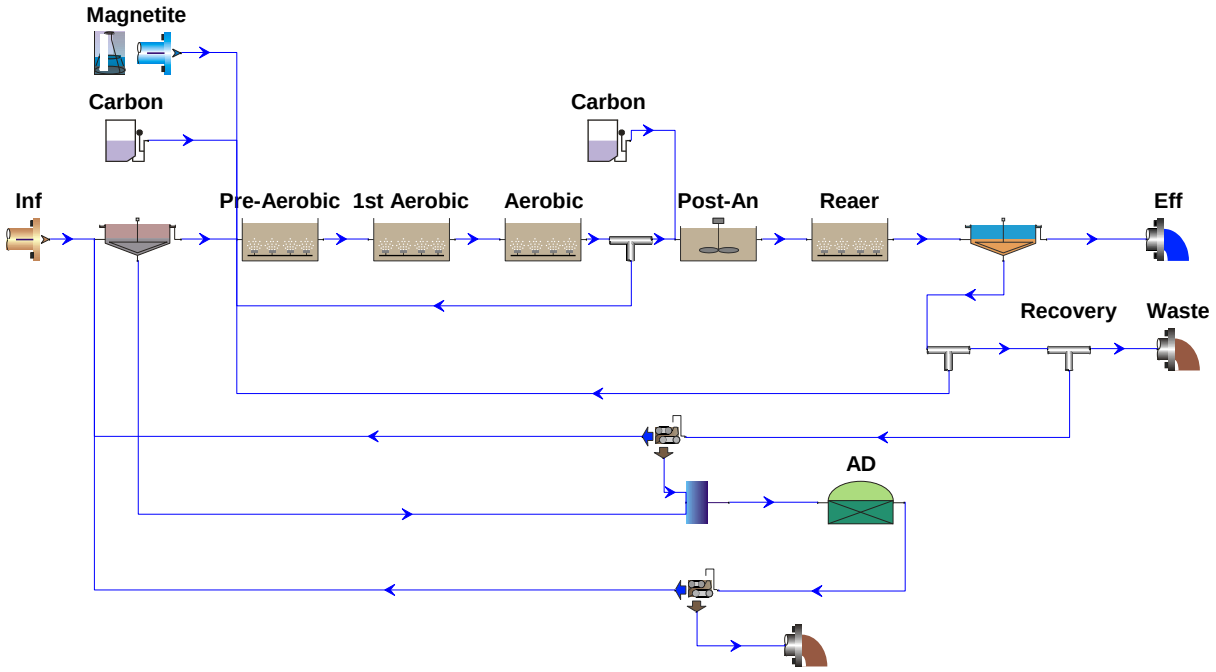
Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	1.0000	1.0000	1.0000
Methylotrophs	1.0000	1.0000	1.0000

Ammonia oxidizing biomass (AOB)	5.0000	5.0000	1.0000
Nitrite oxidizing biomass (NOB)	25.0000	25.0000	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	10.0000	10.0000	1.0000
Polyphosphate accumulating organisms (PAO)	1.0000	1.0000	1.0000
Propionic acetogens	1.0000	1.0000	1.0000
Methanogens - acetoclastic	1.0000	1.0000	1.0000
Methanogens - hydrogenotrophic	1.0000	1.0000	1.0000
Endogenous products	1.0000	1.0000	1.0000
Slowly bio. COD (part.)	1.0000	1.0000	1.0000
Slowly bio. COD (colloid.)	1.0000	1.0000	1.0000
Part. inert. COD	1.0000	1.0000	1.0000
Part. bio. org. N	1.0000	1.0000	1.0000
Part. bio. org. P	1.0000	1.0000	1.0000
Part. inert N	1.0000	1.0000	1.0000
Part. inert P	1.0000	1.0000	1.0000
Stored PHA	1.0000	1.0000	1.0000
Releasable stored polyP	1.0000	1.0000	1.0000
Fixed stored polyP	1.0000	1.0000	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.0000	1.0000	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	0.3300	0.3300	1.0000
Struvite	1.0000	1.0000	1.0000
Hydroxy-dicalcium-phosphate	1.0000	1.0000	1.0000
Hydroxy-apatite	1.0000	1.0000	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.0000	1.0000	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000

User defined 2	0	0	1.0000
User defined 3	1.0000	1.0000	1.0000
User defined 4	1.0000	1.0000	1.0000
Dissolved oxygen	0	0	1.0000

FAIRHAVEN, MA

Case Study No. 10
Biomag w/Anaerobic Digestion
Flow = 5.0 MGD @ 11^{0}C



Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Activated primary settling tank12	0.5565	6636.0000	11.210

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Activated primary settling tank12	Flowrate [Under]	0.016

Element name	Percent removal	Blanket fraction
Activated primary settling tank12	60.00	0.85

Configuration information for all Anaerobic Digester units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	Head space volume
AD	0.6200	4144.0975	20.000	0.5

Operating data Average (flow/time weighted as required)

Element name	Pressure [psi]	pH
AD	14.9	-

Element name	Average Temperature
AD	35.0

Configuration information for all Bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Pre-Aerobic	0.3112	3200.0000	13.000	725
1st Aerobic	0.3112	3200.0000	13.000	725
Aerobic	0.3112	3200.0000	13.000	725
Post-An	0.1683	2250.0000	10.000	Un-aerated
Reaer	0.0696	930.0000	10.000	211

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
1st Aerobic	0.3
Aerobic	2.0
Post-An	0

Element name	Average Air flow rate [ft3/min (20C, 1 atm)]
Pre-Aerobic	400.0
Reaer	300.0

Local biological parameters

Element name	Max. spec. growth rate [1/d]	Substrate (NH4) half sat. [mgN/L]	Byproduct NH4 logistic slope [-]	Byproduct NH4 inflection point [mgN/L]	AOB denite DO half sat. [mg/L]	AOB denite HNO2 half sat. [mgN/L]	Aerobic decay rate [1/d]	Anoxic/anaerobic decay rate [1/d]	KiHNO2 [mmol/L]
Pre-Aerobic	0.9000	0.7000	50.0000	1.4000	0.1000	5.000E-6	0.1700	0.0800	0.0050
1st Aerobic	0.9000	0.7000	50.0000	1.4000	0.1000	5.000E-6	0.1700	0.0800	0.0050
Aerobic	0.9000	0.7000	50.0000	1.4000	0.1000	5.000E-6	0.1700	0.0800	0.0050
Reaer	0.9000	0.7000	50.0000	1.4000	0.1000	5.000E-6	0.1700	0.0800	0.0050

Element name	Max. spec. growth rate [1/d]	Substrate (NO2) half sat. [mgN/L]	Aerobic decay rate [1/d]	Anoxic/anaerobic decay rate [1/d]	KiNH3 [mmol/L]
Pre-Aerobic	0.7000	0.1000	0.1700	0.0800	0.0750
1st Aerobic	0.7000	0.1000	0.1700	0.0800	0.0750
Aerobic	0.7000	0.1000	0.1700	0.0800	0.0750
Reaer	0.7000	0.1000	0.1700	0.0800	0.0750

Element name	Max. spec. growth rate [1/d]	Substrate (NH4) half sat. [mgN/L]	Substrate (NO2) half sat. [mgN/L]	Aerobic decay rate [1/d]	Anoxic/anaerobic decay rate [1/d]	Ki Nitrite [mgN/L]	Nitrite sensitivity constant [L / (d mgN)]
Pre-Aerobic	0.1000	2.0000	1.0000	0.0190	0.0095	1000.0000	0.0160
1st Aerobic	0.1000	2.0000	1.0000	0.0190	0.0095	1000.0000	0.0160
Aerobic	0.1000	2.0000	1.0000	0.0190	0.0095	1000.0000	0.0160
Reaer	0.1000	2.0000	1.0000	0.0190	0.0095	1000.0000	0.0160

Element name	Max. spec. growth rate [1/d]	Methanol half sat. [mgCOD/L]	Denite N2 producers (NO3 or NO2) [-]	Aerobic decay rate [1/d]	Anoxic/anaerobic decay rate [1/d]	Free nitrous acid inhibition [mmol/L]
Pre-Aerobic	1.3000	0.5000	0.5000	0.0400	0.0300	1.000E-7
1st Aerobic	1.3000	0.5000	0.5000	0.0400	0.0300	1.000E-7
Aerobic	1.3000	0.5000	0.5000	0.0400	0.0300	1.000E-7
Reaer	1.3000	0.5000	0.5000	0.0400	0.0300	1.000E-7

Element name	Max. spec. growth rate [1/d]	Substrate half sat. [mgCOD/L]	Acetate inhibition [mgCOD/L]	Anaerobic decay rate [1/d]	Aerobic/anoxic decay rate [1/d]
Pre-Aerobic	0.2500	10.0000	10000.0000	0.0500	0.5200
1st Aerobic	0.2500	10.0000	10000.0000	0.0500	0.5200
Aerobic	0.2500	10.0000	10000.0000	0.0500	0.5200
Reaer	0.2500	10.0000	10000.0000	0.0500	0.5200

Aeration equipment parameters

Element name	k1 in C = k1(PC)^0.25 + k2	k2 in C = k1(PC)^0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	% of tank area covered by diffusers [%]
Pre-Aerobic	2.400E-4	1.2600	1.0000	0.4413	10.0000
1st Aerobic	2.400E-4	1.2600	1.0000	0.4413	10.0000
Aerobic	2.400E-4	1.2600	1.0000	0.4413	10.0000
Post-An	2.5656	0.0432	0.8200	0.4413	10.0000
Reaer	2.5656	0.0432	0.8200	0.4413	10.0000

Element name	Alpha (surf) OR Alpha F (diff) [-]	Beta [-]	Surface pressure [kPa]	Fractional effective saturation depth (Fed) [-]
Pre-Aerobic	0.7500	0.9500	101.3250	0.3250
1st Aerobic	0.7500	0.9500	101.3250	0.3250
Aerobic	0.7500	0.9500	101.3250	0.3250
Reaer	0.8500	0.9500	101.3250	0.3250

Element name	Supply gas CO2 content [vol. %]	Supply gas O2 [vol. %]	Off-gas CO2 [vol. %]	Off-gas O2 [vol. %]	Off-gas H2 [vol. %]	Off-gas NH3 [vol. %]	Off-gas CH4 [vol. %]	Surface turbulence factor [-]
Pre-Aerobic	0.0350	20.9500	2.0000	18.8000	0	0	0	2.0000
1st Aerobic	0.0350	20.9500	2.0000	18.8000	0	0	0	2.0000
Aerobic	0.0350	20.9500	2.0000	18.8000	0	0	0	2.0000
Reaer	0.0350	20.9500	2.0000	18.8000	0	0	0	2.0000

Configuration information for all BOD Influent units

Operating data Average (flow/time weighted as required)

Element name	Inf
Flow	5.00077666578962
Total Carbonaceous BOD mgBOD/L	94.00
Volatile suspended solids mgVSS/L	66.00
Total suspended solids mgTSS/L	88.00
Total Kjeldahl Nitrogen mgN/L	17.00
Total P mgP/L	5.00
Nitrate N mgN/L	0
pH	7.00
Alkalinity mmol/L	6.00
Calcium mg/L	80.00
Magnesium mg/L	15.00
Dissolved oxygen mg/L	4.20

Element name	Inf
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.2700
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1470
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.8931

Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0670
Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.0400
Fna - Ammonia [gNH3-N/gTKN]	0.7140
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.2500
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0350
Fpo4 - Phosphate [gPO4-P/gTP]	0.6670
FupP - P:COD ratio for unbiodegradable part. COD [gP/gCOD]	0.0110
FZbh - OHO COD fraction [gCOD/g of total COD]	0.0100
FZbm - Methylotroph COD fraction [gCOD/g of total COD]	1.000E-4
FZaob - AOB COD fraction [gCOD/g of total COD]	1.000E-4
FZnob - NOB COD fraction [gCOD/g of total COD]	1.000E-4
FZamob - ANAMMOX COD fraction [gCOD/g of total COD]	1.000E-4
FZbp - PAO COD fraction [gCOD/g of total COD]	1.000E-4
FZbpa - Propionic acetogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbam - Acetoclastic methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbhm - H2-utilizing methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZe - Endogenous products COD fraction [gCOD/g of total COD]	0

Configuration information for all Methanol addition units

Operating data Average (flow/time weighted as required)

Element name	Carbon	Carbon
Ordinary heterotrophic organisms (OHO) mgCOD/L	0	0
Methylotrophs mgCOD/L	0	0
Ammonia oxidizing biomass (AOB) mgCOD/L	0	0
Nitrite oxidizing biomass (NOB) mgCOD/L	0	0
Anaerobic ammonia oxidizers (ANAMMOX) mgCOD/L	0	0
Polyphosphate accumulating organisms (PAO) mgCOD/L	0	0
Propionic acetogens mgCOD/L	0	0
Methanogens - acetoclastic mgCOD/L	0	0

Methanogens - hydrogenotrophic mgCOD/L	0	0
Endogenous products mgCOD/L	0	0
Slowly bio. COD (part.) mgCOD/L	0	0
Slowly bio. COD (colloid.) mgCOD/L	0	0
Part. inert. COD mgCOD/L	0	0
Part. bio. org. N mgN/L	0	0
Part. bio. org. P mgP/L	0	0
Part. inert N mgN/L	0	0
Part. inert P mgP/L	0	0
Stored PHA mgCOD/L	0	0
Releasable stored polyP mgP/L	0	0
Fixed stored polyP mgP/L	0	0
Readily bio. COD (complex) mgCOD/L	0	0
Acetate mgCOD/L	0	0
Propionate mgCOD/L	0	0
Methanol mgCOD/L	1188000.00	1188000.00
Dissolved H2 mgCOD/L	0	0
Dissolved methane mg/L	0	0
Ammonia N mgN/L	0	0
Sol. bio. org. N mgN/L	0	0
Nitrous Oxide N mgN/L	0	0
Nitrite N mgN/L	0	0
Nitrate N mgN/L	0	0
Dissolved nitrogen gas mgN/L	0	0
PO4-P (Sol. & Me Complexed) mgP/L	0	0
Sol. inert COD mgCOD/L	0	0
Sol. inert TKN mgN/L	0	0
ISS Influent mgISS/L	0	0
Struvite mgISS/L	0	0
Hydroxy-dicalcium-phosphate mgISS/L	0	0
Hydroxy-apatite mgISS/L	0	0

Magnesium mg/L	0	0
Calcium mg/L	0	0
Metal mg/L	0	0
Other Cations (strong bases) meq/L	0	0
Other Anions (strong acids) meq/L	0	0
Total CO2 mmol/L	0	0
User defined 1 mg/L	0	0
User defined 2 mg/L	0	0
User defined 3 mgVSS/L	0	0
User defined 4 mgISS/L	0	0
Dissolved oxygen mg/L	0	0
Flow	0.0001	0.0001

Configuration information for all Effluent units

Configuration information for all Ideal clarifier units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Ideal clarifier6	0.8593	8836.0000	13.000

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Ideal clarifier6	Flow paced	50.00 %

Element name	Average Temperature	Reactive	Percent removal	Blanket fraction
Ideal clarifier6	Uses global setting	No	99.95	0.05

Configuration information for all Metal addition units

Operating data Average (flow/time weighted as required)

Element name	Magnetite
Ordinary heterotrophic organisms (OHO) mgCOD/L	0
Methylotrophs mgCOD/L	0
Ammonia oxidizing biomass (AOB) mgCOD/L	0
Nitrite oxidizing biomass (NOB) mgCOD/L	0
Anaerobic ammonia oxidizers (ANAMMOX) mgCOD/L	0
Polyphosphate accumulating organisms (PAO) mgCOD/L	0
Propionic acetogens mgCOD/L	0
Methanogens - acetoclastic mgCOD/L	0
Methanogens - hydrogenotrophic mgCOD/L	0
Endogenous products mgCOD/L	0
Slowly bio. COD (part.) mgCOD/L	0
Slowly bio. COD (colloid.) mgCOD/L	0
Part. inert. COD mgCOD/L	0
Part. bio. org. N mgN/L	0
Part. bio. org. P mgP/L	0
Part. inert N mgN/L	0
Part. inert P mgP/L	0
Stored PHA mgCOD/L	0
Releasable stored polyP mgP/L	0
Fixed stored polyP mgP/L	0
Readily bio. COD (complex) mgCOD/L	0
Acetate mgCOD/L	0
Propionate mgCOD/L	0
Methanol mgCOD/L	0
Dissolved H2 mgCOD/L	0
Dissolved methane mg/L	0
Ammonia N mgN/L	0
Sol. bio. org. N mgN/L	0
Nitrous Oxide N mgN/L	0
Nitrite N mgN/L	0

Nitrate N mgN/L	0
Dissolved nitrogen gas mgN/L	0
PO4-P (Sol. & Me Complexed) mgP/L	0
Sol. inert COD mgCOD/L	0
Sol. inert TKN mgN/L	0
ISS Influent mgISS/L	0
Struvite mgISS/L	0
Hydroxy-dicalcium-phosphate mgISS/L	0
Hydroxy-apatite mgISS/L	0
Magnesium mg/L	0
Calcium mg/L	0
Metal mg/L	150000.00
Other Cations (strong bases) meq/L	5.00
Other Anions (strong acids) meq/L	8077.12
Total CO2 mmol/L	7.00
User defined 1 mg/L	0
User defined 2 mg/L	0
User defined 3 mgVSS/L	0
User defined 4 mgISS/L	0
Dissolved oxygen mg/L	0
Flow	0.0001

Configuration information for all Dewatering unit units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Thickening	Flowrate [Under]	0.01
Dewatering	Flowrate [Under]	0.01

Element name	Percent removal

Thickening	90.00
Dewatering	95.00

Configuration information for all Sludge units

Configuration information for all Splitter units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
	Flowrate [Main]	0.018
	Flow paced	400.00 %
Recovery	Flowrate [Main]	0.001

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Inf

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	66.00	2754.41	
Total suspended solids	88.12	3677.64	
Particulate COD	105.36	4396.98	
Filtered COD	70.96	2961.43	
Total COD	176.32	7358.42	
Soluble PO4-P	3.34	139.18	
Total P	5.00	208.67	
Filtered TKN	15.58	650.39	
Particulate TKN	1.42	59.08	
Total Kjeldahl Nitrogen	17.00	709.47	
Filtered Carbonaceous BOD	41.98	1752.00	
Total Carbonaceous BOD	94.00	3922.95	
Nitrite + Nitrate	0	0	

Total N	17.00	709.47	
Total inorganic N	12.14	506.56	
Alkalinity	6.00	113.58	mmol/L and kmol/d
pH	7.00		
Volatile fatty acids	7.00	292.06	
ISS precipitate	0	0	
ISS cellular	0.12	5.09	
ISS Total	22.12	923.23	
Ammonia N	12.14	506.56	
Nitrate N	0	0	
Parameters	Value	Units	

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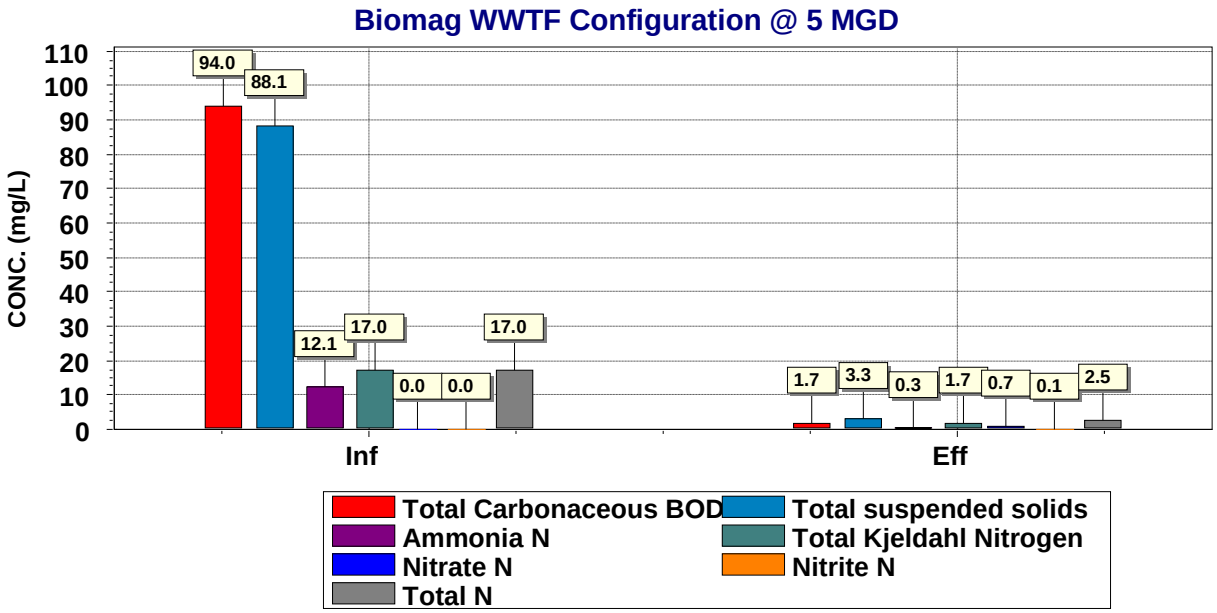

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Pre-Aerobic			
Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	2573.01	590361.02	
Total suspended solids	4380.93	1005177.59	
Particulate COD	3693.29	847404.58	
Filtered COD	14.90	3418.95	
Total COD	3708.19	850823.53	
Soluble PO4-P	2.58	591.86	
Total P	176.01	40384.52	
Filtered TKN	3.88	889.23	
Particulate TKN	247.65	56822.10	
Total Kjeldahl Nitrogen	251.53	57711.33	
Filtered Carbonaceous BOD	2.16	495.32	
Total Carbonaceous BOD	1268.12	290963.25	
Nitrite + Nitrate	2.41	553.78	
Total N	253.94	58265.12	
Total inorganic N	4.70	1079.21	
Alkalinity	11.42	1188.50	mmol/L and kmol/d
pH	6.96		
Volatile fatty acids	0.15	33.91	
ISS precipitate	772.24	177185.93	
ISS cellular	204.72	46971.62	
ISS Total	1807.92	414816.57	
Ammonia N	2.29	525.43	
Nitrate N	1.81	415.22	

Parameters	Value	Units

Hydraulic residence time	0.3	hours
Velocity gradient	100.83	1/s
VSS destruction	0	%
Total solids mass	11377.28	lb
Total readily biodegradable COD	2.26	mg/L
OUR - Total	27.38	mgO/L/hr
OUR - Carbonaceous	21.19	mgO/L/hr
OUR - Nitrification	6.19	mgO/L/hr
Nit - Ammonia removal rate	1.66	mgN/L/hr
Nit - Nitrous oxide production rate	0.05	mgN/L/hr
Nit - Nitrite production rate	0.00	mgN/L/hr
Nit - Nitrate production rate	0.78	mgN/L/hr
Denit - Nitrate removal rate	2.65	mgN/L/hr
Denit - Nitrite removal rate	1.84	mgN/L/hr
Denit - N2 production rate	3.34	mgN/L/hr
Off gas flow rate (dry)	391.27	ft3/min
Off gas Oxygen	18.42	%
Off gas Carbon dioxide	3.09	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.05	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0.00	%
Actual DO sat. conc.	10.50	mg/L
OTR	47.13	lb/hr
SOTR	77.74	lb/hr
OTE	11.29	%
SOTE	19.05	%
Air flow rate	400.00	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0.55	ft3/min (20C, 1 atm)
# of diffusers	725.00	

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1st Aerobic

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	2571.64	590047.99	
Total suspended solids	4379.57	1004867.46	
Particulate COD	3691.09	846898.00	
Filtered COD	13.24	3038.60	
Total COD	3704.33	849936.60	
Soluble PO4-P	2.61	599.23	
Total P	176.01	40384.52	
Filtered TKN	3.15	721.67	
Particulate TKN	247.64	56818.54	
Total Kjeldahl Nitrogen	250.78	57540.22	
Filtered Carbonaceous BOD	0.98	225.38	
Total Carbonaceous BOD	1265.42	290343.67	
Nitrite + Nitrate	2.98	683.02	
Total N	253.76	58223.24	
Total inorganic N	4.63	1061.33	
Alkalinity	11.34	1179.83	mmol/L and kmol/d
pH	6.96		
Volatile fatty acids	0.02	3.48	
ISS precipitate	772.24	177186.02	
ISS cellular	204.73	46974.43	
ISS Total	1807.93	414819.47	
Ammonia N	1.65	378.30	
Nitrate N	2.13	489.35	

Parameters	Value	Units
Hydraulic residence time	0.3	hours
Velocity gradient	110.85	1/s

VSS destruction	0.05	%
Total solids mass	11373.77	lb
Total readily biodegradable COD	1.12	mg/L
OUR - Total	23.70	mgO/L/hr
OUR - Carbonaceous	12.86	mgO/L/hr
OUR - Nitrification	10.84	mgO/L/hr
Nit - Ammonia removal rate	2.79	mgN/L/hr
Nit - Nitrous oxide production rate	0.03	mgN/L/hr
Nit - Nitrite production rate	0.00	mgN/L/hr
Nit - Nitrate production rate	1.73	mgN/L/hr
Denit - Nitrate removal rate	0.54	mgN/L/hr
Denit - Nitrite removal rate	0.33	mgN/L/hr
Denit - N2 production rate	0.64	mgN/L/hr
Off gas flow rate (dry)	533.89	ft3/min
Off gas Oxygen	18.54	%
Off gas Carbon dioxide	2.68	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.03	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0.00	%
Actual DO sat. conc.	10.50	mg/L
OTR	63.39	lb/hr
SOTR	106.55	lb/hr
OTE	11.08	%
SOTE	19.05	%
Air flow rate	548.25	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0.76	ft3/min (20C, 1 atm)
# of diffusers	725.00	

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Aerobic

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	2569.57	589573.71	
Total suspended solids	4377.48	1004388.17	
Particulate COD	3687.83	846150.53	
Filtered COD	12.96	2974.27	
Total COD	3700.79	849124.80	
Soluble PO4-P	2.66	610.27	
Total P	176.01	40384.52	
Filtered TKN	2.29	524.47	
Particulate TKN	247.57	56802.74	
Total Kjeldahl Nitrogen	249.85	57327.21	
Filtered Carbonaceous BOD	0.80	183.70	
Total Carbonaceous BOD	1263.12	289815.40	
Nitrite + Nitrate	3.88	889.67	
Total N	253.73	58216.88	
Total inorganic N	4.69	1075.79	
Alkalinity	11.22	1167.24	mmol/L and kmol/d
pH	6.97		
Volatile fatty acids	0.00	0.36	
ISS precipitate	772.24	177186.46	
ISS cellular	204.71	46968.98	
ISS Total	1807.91	414814.46	
Ammonia N	0.81	186.11	
Nitrate N	3.10	712.02	

Parameters	Value	Units
Hydraulic residence time	0.3	hours
Velocity gradient	133.65	1/s

VSS destruction	0.08	%
Total solids mass	11368.34	lb
Total readily biodegradable COD	1.04	mg/L
OUR - Total	28.54	mgO/L/hr
OUR - Carbonaceous	13.41	mgO/L/hr
OUR - Nitrification	15.13	mgO/L/hr
Nit - Ammonia removal rate	3.48	mgN/L/hr
Nit - Nitrous oxide production rate	0.00	mgN/L/hr
Nit - Nitrite production rate	3.44	mgN/L/hr
Nit - Nitrate production rate	3.66	mgN/L/hr
Denit - Nitrate removal rate	0.09	mgN/L/hr
Denit - Nitrite removal rate	0.05	mgN/L/hr
Denit - N2 production rate	0.10	mgN/L/hr
Off gas flow rate (dry)	909.87	ft3/min
Off gas Oxygen	19.00	%
Off gas Carbon dioxide	2.01	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.01	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0.00	%
Actual DO sat. conc.	10.50	mg/L
OTR	90.37	lb/hr
SOTR	182.27	lb/hr
OTE	9.23	%
SOTE	19.05	%
Air flow rate	937.88	ft3/min (20C, 1 atm)
Air flow rate / diffuser	1.29	ft3/min (20C, 1 atm)
# of diffusers	725.00	

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Post-An

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	2572.04	160780.74	
Total suspended solids	4380.14	273806.69	
Particulate COD	3691.35	230749.71	
Filtered COD	13.86	866.66	
Total COD	3705.21	231616.38	
Soluble PO4-P	2.57	160.56	
Total P	176.01	11002.42	
Filtered TKN	1.92	119.98	
Particulate TKN	247.90	15496.27	
Total Kjeldahl Nitrogen	249.82	15616.25	
Filtered Carbonaceous BOD	1.18	73.79	
Total Carbonaceous BOD	1265.05	79079.53	
Nitrite + Nitrate	0.29	17.96	
Total N	250.10	15634.21	
Total inorganic N	1.16	72.44	
Alkalinity	11.47	325.22	mmol/L and kmol/d
pH	6.98		
Volatile fatty acids	0.10	5.95	
ISS precipitate	772.24	48273.19	
ISS cellular	204.91	12809.32	
ISS Total	1808.10	113025.95	
Ammonia N	0.87	54.48	
Nitrate N	0.26	16.34	

Parameters	Value	Units
Hydraulic residence time	0.5	hours
Velocity gradient	64.27	1/s

VSS destruction	0	%
Total solids mass	6152.47	lb
Total readily biodegradable COD	1.54	mg/L
OUR - Total	3.70	mgO/L/hr
OUR - Carbonaceous	3.41	mgO/L/hr
OUR - Nitrification	0.29	mgO/L/hr
Nit - Ammonia removal rate	0.09	mgN/L/hr
Nit - Nitrous oxide production rate	0.00	mgN/L/hr
Nit - Nitrite production rate	0.08	mgN/L/hr
Nit - Nitrate production rate	0.01	mgN/L/hr
Denit - Nitrate removal rate	5.28	mgN/L/hr
Denit - Nitrite removal rate	3.76	mgN/L/hr
Denit - N2 production rate	6.71	mgN/L/hr
Off gas flow rate (dry)	1.58	ft3/min
Off gas Oxygen	0	%
Off gas Carbon dioxide	79.87	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	3.20	%
Off gas Methane	0.01	%
Off gas Nitrous oxide	0.02	%
Actual DO sat. conc.	10.23	mg/L
OTR	0	lb/hr
SOTR	0	lb/hr
OTE	100.00	%
SOTE	100.00	%
Air flow rate	0	ft3/min (20C, 1 atm)
Air flow rate / diffuser	0	ft3/min (20C, 1 atm)
# of diffusers	510.00	

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Reaer

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	2570.29	160671.39	
Total suspended solids	4378.37	273696.25	
Particulate COD	3688.60	230577.92	
Filtered COD	12.98	811.47	
Total COD	3701.58	231389.39	
Soluble PO4-P	2.61	163.11	
Total P	176.01	11002.42	
Filtered TKN	1.51	94.53	
Particulate TKN	247.82	15491.70	
Total Kjeldahl Nitrogen	249.34	15586.22	
Filtered Carbonaceous BOD	0.74	46.14	
Total Carbonaceous BOD	1262.82	78940.35	
Nitrite + Nitrate	0.76	47.26	
Total N	250.09	15633.49	
Total inorganic N	1.09	68.16	
Alkalinity	11.40	323.27	mmol/L and kmol/d
pH	7.02		
Volatile fatty acids	0.01	0.61	
ISS precipitate	772.24	48273.60	
ISS cellular	204.89	12807.80	
ISS Total	1808.08	113024.85	
Ammonia N	0.33	20.90	
Nitrate N	0.68	42.71	

Parameters	Value	Units
Hydraulic residence time	0.2	hours
Velocity gradient	135.77	1/s

VSS destruction	0.07	%
Total solids mass	2542.00	lb
Total readily biodegradable COD	1.03	mg/L
OUR - Total	24.10	mgO/L/hr
OUR - Carbonaceous	14.78	mgO/L/hr
OUR - Nitrification	9.32	mgO/L/hr
Nit - Ammonia removal rate	2.24	mgN/L/hr
Nit - Nitrous oxide production rate	0.00	mgN/L/hr
Nit - Nitrite production rate	2.22	mgN/L/hr
Nit - Nitrate production rate	1.95	mgN/L/hr
Denit - Nitrate removal rate	0.05	mgN/L/hr
Denit - Nitrite removal rate	0.03	mgN/L/hr
Denit - N2 production rate	0.05	mgN/L/hr
Off gas flow rate (dry)	292.74	ft3/min
Off gas Oxygen	19.11	%
Off gas Carbon dioxide	1.75	%
Off gas Ammonia	0.00	%
Off gas Hydrogen	0.13	%
Off gas Methane	0.00	%
Off gas Nitrous oxide	0.00	%
Actual DO sat. conc.	10.23	mg/L
OTR	25.60	lb/hr
SOTR	65.43	lb/hr
OTE	8.18	%
SOTE	21.38	%
Air flow rate	300.00	ft3/min (20C, 1 atm)
Air flow rate / diffuser	1.42	ft3/min (20C, 1 atm)
# of diffusers	211.00	

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Ideal clarifier6

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	1.93	80.34	
Total suspended solids	3.30	137.37	
Particulate COD	2.77	115.29	
Filtered COD	12.98	540.59	
Total COD	15.75	655.88	
Soluble PO4-P	2.61	108.66	
Total P	2.74	114.15	
Filtered TKN	1.51	62.97	
Particulate TKN	0.19	7.75	
Total Kjeldahl Nitrogen	1.70	70.72	
Filtered Carbonaceous BOD	0.74	30.73	
Total Carbonaceous BOD	1.69	70.18	
Nitrite + Nitrate	0.76	31.49	
Total N	2.45	102.20	
Total inorganic N	1.09	45.41	
Alkalinity	5.00	94.52	mmol/L and kmol/d
pH	7.02		
Volatile fatty acids	0.01	0.41	
ISS precipitate	0.59	24.66	
ISS cellular	0.15	6.40	
ISS Total	1.37	57.03	
Ammonia N	0.33	13.92	
Nitrate N	0.68	28.46	

Parameters	Value	Units
Hydraulic residence time	2.75	hours
Percent removal	99.95	%

Height of specified concentration	0.65	ft
Total solids mass	4722.97	lb
Surface overflow rate	564.74	gal/(ft2 d)
Solids loading rate	30.98	lb/(ft2 d)

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SE

Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes
Volatile suspended solids	1.93	80.34	
Total suspended solids	3.30	137.37	
Particulate COD	2.77	115.29	
Filtered COD	12.98	540.59	
Total COD	15.75	655.88	
Soluble PO4-P	2.61	108.66	
Total P	2.74	114.15	
Filtered TKN	1.51	62.97	
Particulate TKN	0.19	7.75	
Total Kjeldahl Nitrogen	1.70	70.72	
Filtered Carbonaceous BOD	0.74	30.73	
Total Carbonaceous BOD	1.69	70.18	
Nitrite + Nitrate	0.76	31.49	
Total N	2.45	102.20	
Total inorganic N	1.09	45.41	
Alkalinity	5.00	94.52	mmol/L and kmol/d
pH	7.02		
Volatile fatty acids	0.01	0.41	
ISS precipitate	0.59	24.66	
ISS cellular	0.15	6.40	
ISS Total	1.37	57.03	
Ammonia N	0.33	13.92	

Nitrate N	0.68	28.46

Parameters	Value	Units

Global Parameters

AOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9000	0.9000	1.0720
Substrate (NH4) half sat. [mgN/L]	0.7000	0.7000	1.0000
Byproduct NH4 logistic slope [-]	50.0000	50.0000	1.0000
Byproduct NH4 inflection point [mgN/L]	1.4000	1.4000	1.0000
AOB denite DO half sat. [mg/L]	0.1000	0.1000	1.0000
AOB denite HNO2 half sat. [mgN/L]	5.000E-6	5.000E-6	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiHNO2 [mmol/L]	0.0050	0.0050	1.0000

NOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.7000	0.7000	1.0600
Substrate (NO2) half sat. [mgN/L]	0.1000	0.1000	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiNH3 [mmol/L]	0.0750	0.0750	1.0000

ANAMMOX

Name	Default	Value

Max. spec. growth rate [1/d]	0.1000	0.1000	1.1000
Substrate (NH4) half sat. [mgN/L]	2.0000	2.0000	1.0000
Substrate (NO2) half sat. [mgN/L]	1.0000	1.0000	1.0000
Aerobic decay rate [1/d]	0.0190	0.0190	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0095	0.0095	1.0290
Ki Nitrite [mgN/L]	1000.0000	1000.0000	1.0000
Nitrite sensitivity constant [L / (d mgN)]	0.0160	0.0160	1.0000

OHO

Name	Default	Value	
Max. spec. growth rate [1/d]	3.2000	3.2000	1.0290
Substrate half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Anoxic growth factor [-]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.6200	0.6200	1.0290
Anoxic decay rate [1/d]	0.2330	0.2330	1.0290
Anaerobic decay rate [1/d]	0.1310	0.1310	1.0290
Hydrolysis rate [1/d]	2.1000	2.1000	1.0290
Hydrolysis half sat. [-]	0.0600	0.0600	1.0000
Anoxic hydrolysis factor [-]	0.2800	0.2800	1.0000
Anaerobic hydrolysis factor (AS) [-]	0.0400	0.0400	1.0000
Anaerobic hydrolysis factor (AD) [-]	0.2000	0.2000	1.0000
Adsorption rate of colloids [L/(mgCOD d)]	0.1500	0.1500	1.0290
Ammonification rate [L/(mgN d)]	0.0400	0.0400	1.0290
Assimilative nitrate/nitrite reduction rate [1/d]	0.5000	0.5000	1.0000
Fermentation rate [1/d]	1.6000	1.6000	1.0290
Fermentation half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Fermentation growth factor (AS) [-]	0.2500	0.2500	1.0000
Endogenous products decay rate[1/d]	0	0	1.0000
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

Methylotrophs

Name	Default	Value	
Max. spec. growth rate [1/d]	1.3000	1.3000	1.0720
Methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.0400	0.0400	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0300	0.0300	1.0000
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

PAO

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9500	0.9500	1.0000
Max. spec. growth rate, P-limited [1/d]	0.4200	0.4200	1.0000
Substrate half sat. [mgCOD(PHB)/mgCOD(Zbp)]	0.1000	0.1000	1.0000
Substrate half sat., P-limited [mgCOD(PHB)/mgCOD(Zbp)]	0.0500	0.0500	1.0000
Magnesium half sat. [mgMg/L]	0.1000	0.1000	1.0000
Cation half sat. [mmol/L]	0.1000	0.1000	1.0000
Calcium half sat. [mgCa/L]	0.1000	0.1000	1.0000
Aerobic/anoxic decay rate [1/d]	0.1000	0.1000	1.0000
Aerobic/anoxic maintenance rate [1/d]	0	0	1.0000
Anaerobic decay rate [1/d]	0.0400	0.0400	1.0000
Anaerobic maintenance rate [1/d]	0	0	1.0000
Sequestration rate [1/d]	4.5000	4.5000	1.0000
Anoxic growth factor [-]	0.3300	0.3300	1.0000

Acetogens

Name	Default	Value	
Max. spec. growth rate [1/d]	0.2500	0.2500	1.0290
Substrate half sat. [mgCOD/L]	10.0000	10.0000	1.0000

Acetate inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Anaerobic decay rate [1/d]	0.0500	0.0500	1.0290
Aerobic/anoxic decay rate [1/d]	0.5200	0.5200	1.0290

Methanogens

Name	Default	Value	
Acetoclastic max. spec. growth rate [1/d]	0.3000	0.3000	1.0290
H2-utilizing max. spec. growth rate [1/d]	1.4000	1.4000	1.0290
Acetoclastic substrate half sat. [mgCOD/L]	100.0000	100.0000	1.0000
Acetoclastic methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
H2-utilizing CO2 half sat. [mmol/L]	0.1000	0.1000	1.0000
H2-utilizing substrate half sat. [mgCOD/L]	0.1000	0.1000	1.0000
H2-utilizing methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Acetoclastic propionic inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Acetoclastic anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
Acetoclastic aerobic/anoxic decay rate [1/d]	0.6000	0.6000	1.0290
H2-utilizing anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
H2-utilizing aerobic/anoxic decay rate [1/d]	2.8000	2.8000	1.0290

pH

Name	Default	Value
OHO low pH limit [-]	4.0000	4.0000
OHO high pH limit [-]	10.0000	10.0000
Methylotrophs low pH limit [-]	4.0000	4.0000
Methylotrophs high pH limit [-]	10.0000	10.0000
Autotrophs low pH limit [-]	5.5000	5.5000
Autotrophs high pH limit [-]	9.5000	9.5000
PAO low pH limit [-]	4.0000	4.0000
PAO high pH limit [-]	10.0000	10.0000

OHO low pH limit (anaerobic) [-]	5.5000	5.5000
OHO high pH limit (anaerobic) [-]	8.5000	8.5000
Propionic acetogens low pH limit [-]	4.0000	4.0000
Propionic acetogens high pH limit [-]	10.0000	10.0000
Acetoclastic methanogens low pH limit [-]	5.0000	5.0000
Acetoclastic methanogens high pH limit [-]	9.0000	9.0000
H2-utilizing methanogens low pH limit [-]	5.0000	5.0000
H2-utilizing methanogens high pH limit [-]	9.0000	9.0000

Switches

Name	Default	Value
Aerobic/anoxic DO half sat. [mgO2/L]	0.0500	0.0500
Anoxic/anaerobic NOx half sat. [mgN/L]	0.1500	0.1500
AOB DO half sat. [mgO2/L]	0.2500	0.2500
NOB DO half sat. [mgO2/L]	0.5000	0.5000
ANAMMOX DO half sat. [mgO2/L]	0.0100	0.0100
Anoxic NO3(->NO2) half sat. [mgN/L]	0.1000	0.1000
Anoxic NO3(->N2) half sat. [mgN/L]	0.0500	0.0500
Anoxic NO2(->N2) half sat. (mgN/L)	0.0100	0.0100
NH3 nutrient half sat. [mgN/L]	0.0050	0.0050
PolyP half sat. [mgP/mgCOD]	0.0100	0.0100
VFA sequestration half sat. [mgCOD/L]	5.0000	5.0000
P uptake half sat. [mgP/L]	0.1500	0.1500
P nutrient half sat. [mgP/L]	0.0010	0.0010
Autotroph CO2 half sat. [mmol/L]	0.1000	0.1000
H2 low/high half sat. [mgCOD/L]	1.0000	1.0000
Propionic acetogens H2 inhibition [mgCOD/L]	5.0000	5.0000
Synthesis anion/cation half sat. [meq/L]	0.0100	0.0100

Common

Name	Default	Value
Biomass volatile fraction (VSS/TSS)	0.9200	0.9200
Endogenous residue volatile fraction (VSS/TSS)	0.9200	0.9200
N in endogenous residue [mgN/mgCOD]	0.0700	0.0700
P in endogenous residue [mgP/mgCOD]	0.0220	0.0220
Endogenous residue COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Particulate substrate COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000
Particulate inert COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000

AOB

Name	Default	Value
Yield [mgCOD/mgN]	0.1500	0.1500
AOB denite NO2 fraction as TEA [-]	0.5000	0.5000
Byproduct NH4 fraction to N2O [-]	0.0025	0.0025
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

NOB

Name	Default	Value
Yield [mgCOD/mgN]	0.0900	0.0900
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

ANAMMOX

Name	Default	Value
Yield [mgCOD/mgN]	0.1140	0.1140
Nitrate production [mgN/mgBiomassCOD]	2.2800	2.2800
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

OHO

Name	Default	Value
Yield (aerobic) [-]	0.6660	0.6660
Yield (fermentation, low H2) [-]	0.1000	0.1000
Yield (fermentation, high H2) [-]	0.1000	0.1000
H2 yield (fermentation low H2) [-]	0.3500	0.3500
H2 yield (fermentation high H2) [-]	0	0
Propionate yield (fermentation, low H2) [-]	0	0
Propionate yield (fermentation, high H2) [-]	0.7000	0.7000
CO2 yield (fermentation, low H2) [-]	0.7000	0.7000
CO2 yield (fermentation, high H2) [-]	0	0
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Endogenous fraction - aerobic [-]	0.0800	0.0800
Endogenous fraction - anoxic [-]	0.1030	0.1030
Endogenous fraction - anaerobic [-]	0.1840	0.1840
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield (anoxic) [-]	0.5400	0.5400
Yield propionic (aerobic) [-]	0.6400	0.6400
Yield propionic (anoxic) [-]	0.4600	0.4600
Yield acetic (aerobic) [-]	0.6000	0.6000

Yield acetic (anoxic) [-]	0.4300	0.4300
Yield methanol (aerobic) [-]	0.5000	0.5000
Adsorp. max. [-]	1.0000	1.0000
Max fraction to N2O at high FNA over nitrate [-]	0.0500	0.0500
Max fraction to N2O at high FNA over nitrite [-]	0.1000	0.1000

Methylotrophs

Name	Default	Value
Yield (anoxic) [-]	0.4000	0.4000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Max fraction to N2O at high FNA over nitrate [-]	0.1000	0.1000
Max fraction to N2O at high FNA over nitrite [-]	0.1500	0.1500

PAO

Name	Default	Value
Yield (aerobic) [-]	0.6390	0.6390
Yield (anoxic) [-]	0.5200	0.5200
Aerobic P/PHA uptake [mgP/mgCOD]	0.9300	0.9300
Anoxic P/PHA uptake [mgP/mgCOD]	0.3500	0.3500
Yield of PHA on sequestration [-]	0.8890	0.8890
N in biomass [mgN/mgCOD]	0.0700	0.0700
N in sol. inert [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous part. [-]	0.2500	0.2500
Inert fraction of endogenous sol. [-]	0.2000	0.2000
P/Ac release ratio [mgP/mgCOD]	0.5100	0.5100

COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield of low PP [-]	0.9400	0.9400

Acetogens

Name	Default	Value
Yield [-]	0.1000	0.1000
H2 yield [-]	0.4000	0.4000
CO2 yield [-]	1.0000	1.0000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

Methanogens

Name	Default	Value
Acetoclastic yield [-]	0.1000	0.1000
Methanol acetoclastic yield [-]	0.1000	0.1000
H2-utilizing yield [-]	0.1000	0.1000
Methanol H2-utilizing yield [-]	0.1000	0.1000
N in acetoclastic biomass [mgN/mgCOD]	0.0700	0.0700
N in H2-utilizing biomass [mgN/mgCOD]	0.0700	0.0700
P in acetoclastic biomass [mgP/mgCOD]	0.0220	0.0220
P in H2-utilizing biomass [mgP/mgCOD]	0.0220	0.0220
Acetoclastic fraction to endog. residue [-]	0.0800	0.0800
H2-utilizing fraction to endog. residue [-]	0.0800	0.0800
Acetoclastic COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
H2-utilizing COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

General

Name	Default	Value
Molecular weight of other anions [mg/mmol]	35.5000	35.5000
Molecular weight of other cations [mg/mmol]	39.1000	39.1000
Mg to P mole ratio in polyphosphate [mmolMg/mmolP]	0.3000	0.3000
Cation to P mole ratio in polyphosphate [meq/mmolP]	0.1500	0.1500
Ca to P mole ratio in polyphosphate [mmolCa/mmolP]	0.0500	0.0500
Cation to P mole ratio in organic phosphate [meq/mmolP]	0.0100	0.0100
Bubble rise velocity (anaerobic digester) [cm/s]	23.9000	23.9000
Bubble Sauter mean diameter (anaerobic digester) [cm]	0.3500	0.3500
Anaerobic digester gas hold-up factor []	1.0000	1.0000
Tank head loss per metre of length (from flow) [m/m]	0.0025	0.0025

Mass transfer

Name	Default	Value	
Kl for H2 [m/d]	17.0000	17.0000	1.0240
Kl for CO2 [m/d]	10.0000	10.0000	1.0240
Kl for NH3 [m/d]	1.0000	1.0000	1.0240
Kl for CH4 [m/d]	8.0000	8.0000	1.0240
Kl for N2 [m/d]	15.0000	15.0000	1.0240
Kl for N2O [m/d]	8.0000	8.0000	1.0240
Kl for O2 [m/d]	13.0000	13.0000	1.0240

Henry's law constants

Name	Default	Value	
CO2 [M/atm]	0.0340	0.0340	2400.0000
O2 [M/atm]	0.0013	0.0013	1500.0000
N2 [M/atm]	6.500E-4	6.500E-4	1300.0000
N2O [M/atm]	0.0250	0.0250	2600.0000

NH3 [M/atm]	58.0000	58.0000	4100.0000
CH4 [M/atm]	0.0014	0.0014	1600.0000
H2 [M/atm]	7.800E-4	7.800E-4	500.0000

Physico-chemical rates

Name	Default	Value	
Struvite precipitation rate [1/d]	3.000E+10	3.000E+10	1.0240
Struvite redissolution rate [1/d]	3.000E+11	3.000E+11	1.0240
Struvite half sat. [mgTSS/L]	1.0000	1.0000	1.0000
HDP precipitation rate [L/(molP d)]	1.000E+8	1.000E+8	1.0000
HDP redissolution rate [L/(mol P d)]	1.000E+8	1.000E+8	1.0000
HAP precipitation rate [molHDP/(L d)]	5.000E-4	5.000E-4	1.0000

Physico-chemical constants

Name	Default	Value
Struvite solubility constant [mol/L]	6.918E-14	6.918E-14
HDP solubility product [mol/L]	2.750E-22	2.750E-22
HDP half sat. [mgTSS/L]	1.0000	1.0000
Equilibrium soluble PO4 with Al dosing at pH 7 [mgP/L]	0.0100	0.0100
Al to P ratio [molAl/molP]	0.8000	0.8000
Al(OH)3 solubility product [mol/L]	1.259E+9	1.259E+9
AlHPO4+ dissociation constant [mol/L]	7.943E-13	7.943E-13
Equilibrium soluble PO4 with Fe dosing at pH 7 [mgP/L]	0.0100	0.0100
Fe to P ratio [molFe/molP]	1.6000	1.6000
Fe(OH)3 solubility product [mol/L]	0.0500	0.0500
FeH2PO4++ dissociation constant [mol/L]	5.012E-22	5.012E-22

Aeration

Name	Default	Value

Alpha (surf) OR Alpha F (diff) [-]	0.5000	0.5000
Beta [-]	0.9500	0.9500
Surface pressure [kPa]	101.3250	101.3250
Fractional effective saturation depth (Fed) [-]	0.3250	0.3250
Supply gas CO2 content [vol. %]	0.0350	0.0350
Supply gas O2 [vol. %]	20.9500	20.9500
Off-gas CO2 [vol. %]	2.0000	2.0000
Off-gas O2 [vol. %]	18.8000	18.8000
Off-gas H2 [vol. %]	0	0
Off-gas NH3 [vol. %]	0	0
Off-gas CH4 [vol. %]	0	0
Surface turbulence factor [-]	2.0000	2.0000
Set point controller gain []	1.0000	1.0000

Modified Vesilind

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.387	0.387
Vesilind hindered zone settling parameter (K) [L/g]	0.370	0.370
Clarification switching function [mg/L]	100.000	100.000
Specified TSS conc.for height calc. [mg/L]	2500.000	2500.000
Maximum compactability constant [mg/L]	15000.000	15000.000

Double exponential

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.934	0.934
Maximum (practical) settling velocity (Vo') [ft/min]	0.615	0.615
Hindered zone settling parameter (Kh) [L/g]	0.400	0.400
Flocculent zone settling parameter (Kf) [L/g]	2.500	2.500
Maximum non-settleable TSS [mg/L]	20.0000	20.0000
Non-settleable fraction [-]	0.0010	0.0010

Specified TSS conc. for height calc. [mg/L]	2500.0000	2500.0000

Emission factors

Name	Default	Value
Carbon dioxide equivalence of nitrous oxide	296.0000	296.0000
Carbon dioxide equivalence of methane	23.0000	23.0000

Biofilm general

Name	Default	Value	
Attachment rate [g / (m2 d)]	80.0000	80.0000	1.0000
Attachment TSS half sat. [mg/L]	100.0000	100.0000	1.0000
Detachment rate [g/(m3 d)]	8.000E+4	8.000E+4	1.0000
Solids movement factor []	10.0000	10.0000	1.0000
Diffusion neta []	0.8000	0.8000	1.0000
Thin film limit [mm]	0.5000	0.5000	1.0000
Thick film limit [mm]	3.0000	3.0000	1.0000
Assumed Film thickness for tank volume correction (temp independant) [mm]	0.7500	0.7500	1.0000
Film surface area to media area ratio - Max.[ ]	1.0000	1.0000	1.0000
Minimum biofilm conc. for streamer formation [gTSS/m2]	4.0000	4.0000	1.0000

Maximum biofilm concentrations [mg/L]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	5.000E+4	5.000E+4	1.0000
Methylotrophs	5.000E+4	5.000E+4	1.0000
Ammonia oxidizing biomass (AOB)	1.000E+5	1.000E+5	1.0000
Nitrite oxidizing biomass (NOB)	1.000E+5	1.000E+5	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E+4	5.000E+4	1.0000
Polyphosphate accumulating organisms (PAO)	5.000E+4	5.000E+4	1.0000
Propionic acetogens	5.000E+4	5.000E+4	1.0000

Methanogens - acetoclastic	5.000E+4	5.000E+4	1.0000
Methanogens - hydrogenotrophic	5.000E+4	5.000E+4	1.0000
Endogenous products	3.000E+4	3.000E+4	1.0000
Slowly bio. COD (part.)	5000.0000	5000.0000	1.0000
Slowly bio. COD (colloid.)	4000.0000	4000.0000	1.0000
Part. inert. COD	5000.0000	5000.0000	1.0000
Part. bio. org. N	0	0	1.0000
Part. bio. org. P	0	0	1.0000
Part. inert N	0	0	1.0000
Part. inert P	0	0	1.0000
Stored PHA	5000.0000	5000.0000	1.0000
Releasable stored polyP	1.150E+6	1.150E+6	1.0000
Fixed stored polyP	1.150E+6	1.150E+6	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.000E+10	1.000E+10	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	1.300E+6	1.300E+6	1.0000
Struvite	8.500E+5	8.500E+5	1.0000
Hydroxy-dicalcium-phosphate	1.150E+6	1.150E+6	1.0000

Hydroxy-apatite	1.600E+6	1.600E+6	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.000E+10	1.000E+10	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	5.000E+4	5.000E+4	1.0000
User defined 4	5.000E+4	5.000E+4	1.0000
Dissolved oxygen	0	0	1.0000

Effective diffusivities [m2/s]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	5.000E-14	5.000E-14	1.0290
Methylotrophs	5.000E-14	5.000E-14	1.0290
Ammonia oxidizing biomass (AOB)	5.000E-14	5.000E-14	1.0290
Nitrite oxidizing biomass (NOB)	5.000E-14	5.000E-14	1.0290
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E-14	5.000E-14	1.0290
Polyphosphate accumulating organisms (PAO)	5.000E-14	5.000E-14	1.0290
Propionic acetogens	5.000E-14	5.000E-14	1.0290
Methanogens - acetoclastic	5.000E-14	5.000E-14	1.0290
Methanogens - hydrogenotrophic	5.000E-14	5.000E-14	1.0290
Endogenous products	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (part.)	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (colloid.)	5.000E-12	5.000E-12	1.0290
Part. inert. COD	5.000E-14	5.000E-14	1.0290
Part. bio. org. N	5.000E-14	5.000E-14	1.0290
Part. bio. org. P	5.000E-14	5.000E-14	1.0290

Part. inert N	5.000E-14	5.000E-14	1.0290
Part. inert P	5.000E-14	5.000E-14	1.0290
Stored PHA	5.000E-14	5.000E-14	1.0290
Releasable stored polyP	5.000E-14	5.000E-14	1.0290
Fixed stored polyP	5.000E-14	5.000E-14	1.0290
Readily bio. COD (complex)	6.900E-10	6.900E-10	1.0290
Acetate	1.240E-9	1.240E-9	1.0290
Propionate	8.300E-10	8.300E-10	1.0290
Methanol	1.600E-9	1.600E-9	1.0290
Dissolved H2	5.850E-9	5.850E-9	1.0290
Dissolved methane	1.963E-9	1.963E-9	1.0290
Ammonia N	2.000E-9	2.000E-9	1.0290
Sol. bio. org. N	1.370E-9	1.370E-9	1.0290
Nitrous Oxide N	1.607E-9	1.607E-9	1.0290
Nitrite N	2.980E-9	2.980E-9	1.0290
Nitrate N	2.980E-9	2.980E-9	1.0290
Dissolved nitrogen gas	1.900E-9	1.900E-9	1.0290
PO4-P (Sol. & Me Complexed)	2.000E-9	2.000E-9	1.0290
Sol. inert COD	6.900E-10	6.900E-10	1.0290
Sol. inert TKN	6.850E-10	6.850E-10	1.0290
ISS Influent	5.000E-14	5.000E-14	1.0290
Struvite	5.000E-14	5.000E-14	1.0290
Hydroxy-dicalcium-phosphate	5.000E-14	5.000E-14	1.0290
Hydroxy-apatite	5.000E-14	5.000E-14	1.0290
Magnesium	7.200E-10	7.200E-10	1.0290
Calcium	7.200E-10	7.200E-10	1.0290
Metal	4.800E-10	4.800E-10	1.0290
Other Cations (strong bases)	1.440E-9	1.440E-9	1.0290
Other Anions (strong acids)	1.440E-9	1.440E-9	1.0290
Total CO2	1.960E-9	1.960E-9	1.0290
User defined 1	6.900E-10	6.900E-10	1.0290

User defined 2	6.900E-10	6.900E-10	1.0290
User defined 3	5.000E-14	5.000E-14	1.0290
User defined 4	5.000E-14	5.000E-14	1.0290
Dissolved oxygen	2.500E-9	2.500E-9	1.0290

EPS Strength coefficients [ ]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	1.0000	1.0000	1.0000
Methylotrophs	1.0000	1.0000	1.0000
Ammonia oxidizing biomass (AOB)	5.0000	5.0000	1.0000
Nitrite oxidizing biomass (NOB)	25.0000	25.0000	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	10.0000	10.0000	1.0000
Polyphosphate accumulating organisms (PAO)	1.0000	1.0000	1.0000
Propionic acetogens	1.0000	1.0000	1.0000
Methanogens - acetoclastic	1.0000	1.0000	1.0000
Methanogens - hydrogenotrophic	1.0000	1.0000	1.0000
Endogenous products	1.0000	1.0000	1.0000
Slowly bio. COD (part.)	1.0000	1.0000	1.0000
Slowly bio. COD (colloid.)	1.0000	1.0000	1.0000
Part. inert. COD	1.0000	1.0000	1.0000
Part. bio. org. N	1.0000	1.0000	1.0000
Part. bio. org. P	1.0000	1.0000	1.0000
Part. inert N	1.0000	1.0000	1.0000
Part. inert P	1.0000	1.0000	1.0000
Stored PHA	1.0000	1.0000	1.0000
Releasable stored polyP	1.0000	1.0000	1.0000
Fixed stored polyP	1.0000	1.0000	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000

Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.0000	1.0000	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	0.3300	0.3300	1.0000
Struvite	1.0000	1.0000	1.0000
Hydroxy-dicalcium-phosphate	1.0000	1.0000	1.0000
Hydroxy-apatite	1.0000	1.0000	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.0000	1.0000	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	1.0000	1.0000	1.0000
User defined 4	1.0000	1.0000	1.0000
Dissolved oxygen	0	0	1.0000

APPENDIX C

DETAILED COST ESTIMATES FOR

MAIN WPCF NITROGEN REDUCTION ALTERNATIVES

JOB #: JF-066
DATE: May 2014
LOCATION: Fairhaven WWTP
CCI = 9795.92 (MAY 2014)
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BIOMAG
COST SUMMARY TABLE

CSI. SECTION	DESCRIPTION	TOTAL DIRECT COST
DIVISION 2	SITE CONSTRUCTION	$279,171
DIVISION 3	CONCRETE	$149,933
DIVISION 4	MASONRY*	$46,639
DIVISION 5	METALS*	$27,674
DIVISION 7	THERMAL AND MOISTURE PROTECTION*	$21,113
DIVISION 7	ROOFING*	$26,295
DIVISION 8	DOORS AND WINDOWS*	$24,673
DIVISION 9	FINISHES*	$25,000
DIVISION 11	EQUIPMENT	$3,133,163
DIVISION 13	SPECIAL CONSTRUCTION	$75,000
DIVISION 15	PIPING	$50,000
DIVISION 15	HVAC-PLUMBING*	$105,000
DIVISION 16	ELECTRICAL*	$795,000
	SUBTOTAL	**$4,758,661**

* Requires Filed Sub-Bid

GENERAL CONTRACTOR DIRECT COST	$	4,758,661
GENERAL CONDITIONS, INCLUDING MOBIL/DEMOBIL @ 15%	$	713,799
SUBTOTAL	$	5,472,460
CONTRACTOR OVERHEAD & PROFIT @ 15%	$	820,869
SUBTOTAL	$	6,293,329
CONTRACTOR PROFIT ON SUBCONTRACTORS @ 5%	$	61,605
SUBTOTAL	$	6,354,934
BONDS & INSURANCE @ 3%	$	190,648
SUBTOTAL	$	6,545,582
CONSTRUCTION CONTINGENCIES @ 30%	$	1,963,675
GENERAL CONTRACTOR TOTAL COST	$	8,509,257
ENGINEERING @ 15%	$	1,276,388
TOTAL COST	**$**	**9,785,645**

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BIOMAG COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MANHOURS		MATERIAL		LABOR		EQUIPMENT		TOTAL DIRECT COST
				MHR/ UNIT	TOTAL MH	UNIT COST	TOTAL MATL	WAGE RATE	TOTAL LABOR	UNIT RATE	TOTAL EQUIP	
	DIVISION 2 - SITE CONSTRUCTION											
02050	DEMOLITION	1	LS									$10,000
02100	EARTHWORK - SITE RESTORATION	1	LS	75.00	75	$0	$0	$80	$6,000	9.38	$7,500	$13,500
02140	DEWATERING	1	LS				$0		$0		$0	$7,500
02200	EARTH EXCAVATION	356	CY	0.19	66		$0	$80	$5,291	8.27	$6,613	$11,904
02615	EXTERIOR PROCESS PIPING	500	LF	0.50	250	$35	$17,500	$80	$20,000	$7.00	$3,500	$41,000
02615	EXTERIOR PROCESS PIPING - EXCAVATION/BACKFILL	593	CY	0.19	113		$0	$80	$9,007	14.07	$11,259	$20,267
02736	WASTEWATER FLOW HANDLING	1	LS				$0					$25,000
	TANK MODIFICATIONS	1	LS									$50,000
02600	MISCELLANEOUS SITEWORK	1	LS									$100,000
	SUBTOTAL						**$ 17,500**		**40,298**		**$28,873**	**$279,171**

Note:

* - Removal of existing aerators and coring of penetrations

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BIOMAG COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MANHOURS		MATERIAL		LABOR		EQUIPMENT		TOTAL DIRECT COST
				MHR/UNIT	TOTAL MH	UNIT COST	TOTAL MATL	WAGE RATE	TOTAL LABOR	UNIT RATE	TOTAL EQUIPMENT	
	DIVISION 3 - CONCRETE											
03300	CONCRETE SLAB	56	CY	4.5	250	$ 220.00	$12,222	$ 80.00	$20,000			$32,222
03300	CONCRETE FOOTINGS	27	CY	5	133	$ 220.00	$5,867	$ 80.00	$10,667			$16,533
03300	CONCRETE WALLS	24	CY	5.5	130	$ 220.00	$5,215	$ 80.00	$10,430			$15,644
03300	CONCRETE COLUMNS	10	CY	7.5	75	$ 220.00	$2,200	$ 80.00	$6,000	$200	$2,000	$10,200
03300	CONCRETE BEAMS	10	CY	8.5	85	$ 220.00	$2,200	$ 80.00	$6,800	$200	$2,000	$11,000
03300	CONCRETE ROOF	28	CY	7.5	208	$ 220.00	$6,111	$ 80.00	$16,667	$200	$5,556	$28,333
03890	SPECIAL COATINGS	1	LS			$ 20,000.00	$20,000	$ 12,000.00	$12,000	$4,000	$4,000	$36,000
	SUBTOTAL						**$53,815**		**$82,563**		**$13,556**	**$149,933**

* Includes installation.

JOB #: JF-066
DATE: May 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BIOMAG COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MANHOURS		MATERIAL		LABOR		EQUIPMENT		TOTAL DIRECT COST
				MHR/ UNIT	TOTAL MH	UNIT COST	TOTAL MATL	WAGE RATE	TOTAL LABOR	UNIT RATE	TOTAL EQUIP	
	DIVISION 4 - MASONRY											
04200	4" BRICK VENEER	1,920	SF	0.06	115	$ 3.80	$ 7,296.00	$ 85.00	$ 9,792.00		$ -	$ 17,100.00
04200	8" CMU	1,920	SF	0.09	175	$ 5.75	$ 11,040.00	$ 85.00	$ 14,851.20			$ 25,891.20
04200	6" CMU	320	SF	0.08	26	$ 4.60	$ 1,472.00	$ 85.00	$ 2,176.00			$ 3,648.00
	SUBTOTAL						**$ 19,808**		**$ 26,819**		**$ -**	**$ 46,639**

Notes:

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BIOMAG COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MANHOURS		MATERIAL		LABOR		TOTAL DIRECT COST
				MHR/ UNIT	TOTAL MH	UNIT COST	TOTAL MATL	WAGE RATE	TOTAL LABOR	
	DIVISION 5 - MISCELLANEOUS METALS									
	ANCHOR BOLTS, BRACKETS, FASTENERS	250	EA	$ 0.32	80	$ 0.18	$ 45.00	$ 80.00	$6,400	$6,445
	LINTLES	8	EA	$ 0.17	1	$ 10.00	$ 80.00	$ 80.00	$109	$189
	PIPE SUPPORTS	30	LS	$ 1.00	30	$ 350.00	$ 10,500.00	$ 80.00	$2,400	$12,900
	GRATING, STAIRWAYS, LADDERS, PLATFORMS, HANDRAILINGS, ETC.	1	LS	$ 8.00	8	$ 7,500.00	$ 7,500.00	$ 80.00	$640	$8,140
	SUBTOTAL				**119**		**$ 18,125**		**$9,549**	**$27,674**

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BIOMAG COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MANHOURS		MATERIAL		LABOR		EQUIPMENT		TOTAL DIRECT COST
				MHR/ UNIT	TOTAL MH	UNIT COST	TOTAL MATL	WAGE RATE	TOTAL LABOR	UNIT RATE	TOTAL EQUIP	
	DIVISION 7 - THERMAL AND MOISTURE PROTECTION											
07200	BUILDING INSULATION	1,920	SF	0.02	46	$ 1.73	$3,322	$ 85.00	$3,917		$ -	$7,238
07420	METAL WALL PANELS	250	SF	0.24	60	$ 24.00	$6,000	$ 85.00	$5,100		$ -	$11,100
07900	JOINT SEALANTS	250	LF	0.06	15	$ 6.00	$1,500	$ 85.00	$1,275		$ -	$2,775
	SUBTOTAL						**$10,822**		**$10,292**		**$ -**	**$21,113**

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BIOMAG COST ESTIMATE

CCI INDEX:

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MANHOURS		MATERIAL		LABOR		EQUIPMENT		TOTAL DIRECT COST
				MHR/ UNIT	TOTAL MH	UNIT COST	TOTAL MATL	WAGE RATE	TOTAL LABOR	UNIT RATE	TOTAL EQUIP	
	DIVISION 7 - ROOFING											
07300	EPDM Roof System	1,500	SF	0.10	147	$ 9.20	$ 13,800.00	$ 85.00	$ 12,495.00		$ -	$ 26,295.00
	SUBTOTAL						**$ 13,800**		**$ 12,495**		**$ -**	**$ 26,295**

Notes:

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BIOMAG COST ESTIMATE

CCI INDEX:

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MANHOURS		MATERIAL		LABOR		EQUIPMENT		TOTAL DIRECT COST
				MHR/ UNIT	TOTAL MH	UNIT COST	TOTAL MATL	WAGE RATE	TOTAL LABOR	UNIT RATE	TOTAL EQUIP	
	DIVISION 8 - DOORS AND WINDOWS											
08116	FRP DOORS	2	EA	4.80	10	$ 1,990.00	$ 3,980.00	$ 85.00	$ 816.00		$ -	$ 4,796.00
08411	ANODIZED FINISH	5	EA	18.35	92	$ 600.00	$ 3,000.00	$ 85.00	$ 7,797.90		$ -	$ 10,797.90
08800	GLAZING	70	SF	0.56	39	$ 24.00	$ 1,680.00	$ 85.00	$ 3,355.80		$ -	$ 5,035.80
08620	UNIT SKYLIGHT	66	SF	0.16	10	$ 48.00	$ 3,168.00	$ 85.00	$ 875.16		$ -	$ 4,043.16
	SUBTOTAL						**$ 11,828**		**$ 12,845**		**$ -**	**$ 24,673**

Notes:

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BIOMAG COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MATERIAL		TOTAL LABOR	TOTAL DIRECT COST
				UNIT COST	TOTAL MATL		
	DIVISION 9 - FINISHES						
09900	PAINTING	1	LS	$ 25,000.00	$ 25,000.00	$ -	$ 25,000.00
	SUBTOTAL				**$ 25,000**	**$ -**	**$ 25,000**

JOB #: JF-066
DATE: MARCH 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BIOMAG COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MATERIAL		TOTAL LABOR	TOTAL DIRECT COST
				UNIT COST	TOTAL MATL		
	DIVISION 11 - EQUIPMENT						
	BIOMAG	1	LS	$2,336,000	$2,336,000	$0	$2,336,000
	INSTALLATION (5%)	1	LS			$116,800	$116,800
	BLOWERS	3	EA	$51,000	$153,000	$7,650	$160,650
	DIFFUSERS	225	EA	$150	$33,750	$5,063	$38,813
	MIXERS	6	EA	$18,000	$108,000	$5,400	$113,400
	PUMPS	6	EA	$45,000	$270,000	$13,500	$283,500
	CHEMICAL FEED SYSTEM	2	EA	$15,000	$30,000	$1,500	$31,500
	METHANOL STORAGE	2	EA	$25,000	$50,000	$2,500	$52,500
	SUBTOTAL				**$ 2,980,750.00**	**$ 152,412.50**	**$3,133,163**

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BIOMAG COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MATERIAL		TOTAL LABOR	TOTAL DIRECT COST
				UNIT COST	TOTAL MATL		
	DIVISION 13 - SPECIAL CONSTRUCTION						
		1	LS	$ -	$ -	$ -	$75,000
	SUBTOTAL				**$ -**	**$ -**	**$75,000**

* Includes installation

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BIOMAG COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MATERIAL		TOTAL LABOR	TOTAL DIRECT COST
				UNIT COST	TOTAL MATL		
	DIVISION 15 - PIPING						
15060	PIPING, VALVES AND GATES - PIPE SUPPORT	20	EA	$2,000	$40,000	$10,000	$50,000
	SUBTOTAL				**$40,000**	**$10,000**	**$50,000**

Notes:

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BIOMAG COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MATERIAL		TOTAL LABOR	TOTAL DIRECT COST
				UNIT COST	TOTAL MATL		
	DIVISION 15 - HVAC/PLUMBING						
15060	HVAC	1	LS		$ -	$ -	$30,000
	PLUMBING	1	LS		$ -	$ -	$75,000
	SUBTOTAL				**$ -**	**$ -**	**$105,000**

Notes:

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BIOMAG COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MATERIAL		TOTAL LABOR	TOTAL DIRECT COST
				UNIT COST	TOTAL MATL		
	DIVISION 16 (Electrical)						
16013	WIRING, CONDUITS, CONNECTIONS*	1	LS	$250,000	$250,000	$125,000	$375,000
	LIGHTING	1	LS	$60,000	$60,000	$30,000	$90,000
	FIRE ALARM	1	LS	$30,000	$30,000	$15,000	$45,000
	SCADA SYSTEM	1	LS	$50,000	$50,000	$25,000	$75,000
	VFD	6	EA	$15,000	$90,000	$45,000	$135,000
	POWER PANELS	1	LS	$50,000	$50,000	$25,000	$75,000
	SUBTOTAL				**$530,000**	**$265,000**	**$795,000**

Notes:

* Includes Installation

JOB #: JF-066
DATE: May 2014
LOCATION: Fairhaven WWTP
CCI = 9795.92 (MAY 2014)
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BARDENPHO
COST SUMMARY TABLE

CSI. SECTION	DESCRIPTION	TOTAL DIRECT COST
DIVISION 2	SITE CONSTRUCTION	$267,267
DIVISION 5	METALS*	$16,767
DIVISION 9	FINISHES*	$15,000
DIVISION 11	EQUIPMENT	$561,750
DIVISION 13	SPECIAL CONSTRUCTION	$35,000
DIVISION 15	PIPING	$37,500
DIVISION 16	ELECTRICAL*	$435,000
	SUBTOTAL	**$1,368,284**

* Requires Filed Sub-Bid

GENERAL CONTRACTOR DIRECT COST	$	1,368,284
GENERAL CONDITIONS, INCLUDING MOBIL/DEMOBIL @ 15%	$	205,243
SUBTOTAL	$	1,573,526
CONTRACTOR OVERHEAD & PROFIT @ 15%	$	236,029
SUBTOTAL	$	1,809,555
CONTRACTOR PROFIT ON SUBCONTRACTORS @ 5%	$	26,839
SUBTOTAL	$	1,836,394
BONDS & INSURANCE @ 3%	$	55,092
SUBTOTAL	$	1,891,486
CONSTRUCTION CONTINGENCIES @ 30%	$	567,446
GENERAL CONTRACTOR TOTAL COST	$	2,458,932
ENGINEERING @ 15%	$	368,840
TOTAL COST	**$**	**2,827,772**

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BARDENPHO COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MANHOURS		MATERIAL		LABOR		EQUIPMENT		TOTAL DIRECT COST
				MHR/ UNIT	TOTAL MH	UNIT COST	TOTAL MATL	WAGE RATE	TOTAL LABOR	UNIT RATE	TOTAL EQUIP	
	DIVISION 2 - SITE CONSTRUCTION											
02050	DEMOLITION	1	LS									$10,000
02100	EARTHWORK - SITE RESTORATION	1	LS	75.00	75	$0	$0	$80	$6,000	9.38	$7,500	$13,500
02140	DEWATERING	1	LS				$0		$0		$0	$7,500
02615	EXTERIOR PROCESS PIPING	500	LF	0.50	250	$35	$17,500	$80	$20,000	$7.00	$3,500	$41,000
02615	EXTERIOR PROCESS PIPING - EXCAVATION/BACKFILL	593	CY	0.19	113		$0	$80	$9,007	14.07	$11,259	$20,267
02736	WASTEWATER FLOW HANDLING	1	LS				$0					$25,000
	TANK MODIFICATIONS	1	LS									$50,000
02600	MISCELLANEOUS SITEWORK	1	LS									$100,000
	SUBTOTAL						**$ 17,500**		**35,007**		**$22,259**	**$267,267**

Note:

* - Removal of existing aerators and coring of penetrations

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BARDENPHO COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MANHOURS		MATERIAL		LABOR		TOTAL DIRECT COST
				MHR/ UNIT	TOTAL MH	UNIT COST	TOTAL MATL	WAGE RATE	TOTAL LABOR	
	DIVISION 5 - MISCELLANEOUS METALS									
	ANCHOR BOLTS, BRACKETS, FASTENERS	150	EA	$ 0.32	48	$ 0.18	$ 27.00	$ 80.00	$3,840	$3,867
	PIPE SUPPORTS	30	LS	$ 1.00	30	$ 350.00	$ 10,500.00	$ 80.00	$2,400	$12,900
	SUBTOTAL				**78**		**$ 10,527**		**$6,240**	**$16,767**

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BARDENPHO COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MATERIAL		TOTAL LABOR	TOTAL DIRECT COST
				UNIT COST	TOTAL MATL		
	DIVISION 9 - FINISHES						
09900	PAINTING	1	LS	$ 15,000.00	$ 15,000.00	$ -	$ 15,000.00
	SUBTOTAL				**$ 15,000**	**$ -**	**$ 15,000**

JOB #: JF-066
DATE: MARCH 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BARDENPHO COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MATERIAL		TOTAL LABOR	TOTAL DIRECT COST
				UNIT COST	TOTAL MATL		
	DIVISION 11 - EQUIPMENT						
	BLOWERS	3	EA	$51,000	$153,000	$7,650	$160,650
	MIXERS	4	EA	$18,000	$72,000	$3,600	$75,600
	PUMPS	6	EA	$45,000	$270,000	$13,500	$283,500
	CHEMICAL FEED SYSTEM	1	EA	$15,000	$15,000	$750	$15,750
	METHANOL STORAGE	1	EA	$25,000	$25,000	$1,250	$26,250
	SUBTOTAL				**$0**	**$0**	**$561,750**

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BARDENPHO COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MATERIAL		TOTAL LABOR	TOTAL DIRECT COST
				UNIT COST	TOTAL MATL		
	DIVISION 13 - SPECIAL CONSTRUCTION						
		1	LS	$ -	$ -	$ -	$35,000
	SUBTOTAL				**$ -**	**$ -**	**$35,000**

* Includes installation

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BARDENPHO COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MATERIAL		TOTAL LABOR	TOTAL DIRECT COST
				UNIT COST	TOTAL MATL		
	DIVISION 15 - PIPING						
15060	PIPING, VALVES AND GATES - PIPE SUPPORT	15	EA	$2,000	$30,000	$7,500	$37,500
	SUBTOTAL				**$30,000**	**$7,500**	**$37,500**

Notes:

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

BARDENPHO COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MATERIAL		TOTAL LABOR	TOTAL DIRECT COST
				UNIT COST	TOTAL MATL		
	DIVISION 16 (Electrical)						
16013	WIRING, CONDUITS, CONNECTIONS*	1	LS	$100,000	$100,000	$50,000	$150,000
	SCADA SYSTEM	1	LS	$50,000	$50,000	$25,000	$75,000
	VFD	6	EA	$15,000	$90,000	$45,000	$135,000
	POWER PANELS	1	LS	$50,000	$50,000	$25,000	$75,000
	SUBTOTAL				**$290,000**	**$145,000**	**$435,000**

Notes:

* Includes Installation

JOB #: JF-066
DATE: May 2014
LOCATION: Fairhaven WWTP
CCI = 9795.92 (MAY 2014)
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

DENITRIFICATION FILTER
COST SUMMARY TABLE

CSI. SECTION	DESCRIPTION	TOTAL DIRECT COST
DIVISION 2	SITE CONSTRUCTION	$472,978
DIVISION 3	CONCRETE	$445,643
DIVISION 4	MASONRY*	$78,078
DIVISION 5	METALS*	$52,130
DIVISION 7	THERMAL AND MOISTURE PROTECTION*	$34,234
DIVISION 7	ROOFING*	$33,552
DIVISION 8	DOORS AND WINDOWS*	$49,346
DIVISION 9	FINISHES*	$50,000
DIVISION 11	EQUIPMENT	$2,292,623
DIVISION 13	SPECIAL CONSTRUCTION	$100,000
DIVISION 15	PIPING	$90,000
DIVISION 15	HVAC-PLUMBING*	$168,000
DIVISION 16	ELECTRICAL*	$1,249,500
	SUBTOTAL	**$5,116,082**

* Requires Filed Sub-Bid

GENERAL CONTRACTOR DIRECT COST	$	5,116,082
GENERAL CONDITIONS, INCLUDING MOBIL/DEMOBIL @ 15%	$	767,412
SUBTOTAL	$	5,883,495
CONTRACTOR OVERHEAD & PROFIT @ 15%	$	882,524
SUBTOTAL	$	6,766,019
CONTRACTOR PROFIT ON SUBCONTRACTORS @ 5%	$	98,603
SUBTOTAL	$	6,864,622
BONDS & INSURANCE @ 3%	$	205,939
SUBTOTAL	$	7,070,561
CONSTRUCTION CONTINGENCIES @ 30%	$	2,121,168
GENERAL CONTRACTOR TOTAL COST	$	9,191,729
ENGINEERING @ 15%	$	1,378,759
TOTAL COST	**$**	**10,570,489**

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

DENITRIFICATION FILTER COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MANHOURS		MATERIAL		LABOR		EQUIPMENT		TOTAL DIRECT COST
				MHR/ UNIT	TOTAL MH	UNIT COST	TOTAL MATL	WAGE RATE	TOTAL LABOR	UNIT RATE	TOTAL EQUIP	
	DIVISION 2 - SITE CONSTRUCTION											
02050	DEMOLITION	1	LS									$10,000
02100	EARTHWORK - SITE RESTORATION	1	LS	75.00	75	$0	$0	$80	$6,000	9.38	$7,500	$13,500
02140	DEWATERING	1	LS				$0		$0		$0	$7,500
02200	EARTH EXCAVATION	2,287	CY	0.19	425		$0	$80	$34,026	53.17	$42,532	$76,558
02615	EXTERIOR PROCESS PIPING	1,350	LF	0.50	675	$35	$47,250	$80	$54,000	$7.00	$9,450	$110,700
02615	EXTERIOR PROCESS PIPING - EXCAVATION/BACKFILL	1,600	CY	0.19	304		$0	$80	$24,320	38.00	$30,400	$54,720
02736	WASTEWATER FLOW HANDLING	1	LS				$0					$25,000
	TANK MODIFICATIONS	1	LS									$50,000
02600	MISCELLANEOUS SITEWORK	1	LS									$125,000
	SUBTOTAL						**$ 47,250**		**118,346**		**$89,882**	**$472,978**

Note:

* - Removal of existing aerators and coring of penetrations

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

DENITRIFICATION FILTER COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MANHOURS		MATERIAL		LABOR		EQUIPMENT		TOTAL DIRECT COST
				MHR/UNIT	TOTAL MH	UNIT COST	TOTAL MATL	WAGE RATE	TOTAL LABOR	UNIT RATE	TOTAL EQUIPMENT	
	DIVISION 3 - CONCRETE											
03300	CONCRETE SLAB	258	CY	4.5	1161	$ 220.00	$56,760	$ 80.00	$92,880			$149,640
03300	CONCRETE WALLS	267	CY	5.5	1469	$ 220.00	$58,764	$ 80.00	$117,529			$176,293
03300	CONCRETE CHANNELS	20	CY	7.5	148	$ 220.00	$4,335	$ 80.00	$11,822			$16,157
03300	CONCRETE COLUMNS	14	CY	7.5	105	$ 220.00	$3,080	$ 80.00	$8,400	$200	$2,800	$14,280
03300	CONCRETE BEAMS	14	CY	8.5	119	$ 220.00	$3,080	$ 80.00	$9,520	$200	$2,800	$15,400
03300	CONCRETE ROOF	37	CY	7.5	278	$ 220.00	$8,169	$ 80.00	$22,278	$200	$7,426	$37,872
03890	SPECIAL COATINGS	1	LS			$ 20,000.00	$20,000	$ 12,000.00	$12,000	$4,000	$4,000	$36,000
	SUBTOTAL						**$154,188**		**$274,429**		**$17,026**	**$445,643**

* Includes installation.

JOB #: JF-066
DATE: May 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

DENITRIFICATION FILTER COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MANHOURS		MATERIAL		LABOR		EQUIPMENT		TOTAL DIRECT COST
				MHR/ UNIT	TOTAL MH	UNIT COST	TOTAL MATL	WAGE RATE	TOTAL LABOR	UNIT RATE	TOTAL EQUIP	
	DIVISION 4 - MASONRY											
04200	4" BRICK VENEER	3,216	SF	0.06	193	$ 3.80	$ 12,220.80	$ 85.00	$ 16,401.60		$ -	$ 28,600.00
04200	8" CMU	3,216	SF	0.09	293	$ 5.75	$ 18,492.00	$ 85.00	$ 24,875.76			$ 43,367.76
04200	6" CMU	536	SF	0.08	43	$ 4.60	$ 2,465.60	$ 85.00	$ 3,644.80			$ 6,110.40
	SUBTOTAL						**$ 33,178**		**$ 44,922**		**$ -**	**$ 78,078**

Notes:

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

DENITRIFICATION FILTER COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MANHOURS		MATERIAL		LABOR		TOTAL DIRECT COST
				MHR/ UNIT	TOTAL MH	UNIT COST	TOTAL MATL	WAGE RATE	TOTAL LABOR	
	DIVISION 5 - MISCELLANEOUS METALS									
	ANCHOR BOLTS, BRACKETS, FASTENERS	400	EA	$ 0.32	128	$ 0.18	$ 72.00	$ 80.00	$10,240	$10,312
	LINTLES	16	EA	$ 0.17	3	$ 10.00	$ 160.00	$ 80.00	$218	$378
	PIPE SUPPORTS	60	LS	$ 1.00	60	$ 350.00	$ 21,000.00	$ 80.00	$4,800	$25,800
	GRATING, STAIRWAYS, LADDERS, PLATFORMS, HANDRAILINGS, ETC.	2	LS	$ 8.00	16	$ 7,500.00	$ 15,000.00	$ 80.00	$640	$15,640
	SUBTOTAL				**207**		**$ 36,232**		**$15,898**	**$52,130**

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

DENITRIFICATION FILTER COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MANHOURS		MATERIAL		LABOR		EQUIPMENT		TOTAL DIRECT COST
				MHR/ UNIT	TOTAL MH	UNIT COST	TOTAL MATL	WAGE RATE	TOTAL LABOR	UNIT RATE	TOTAL EQUIP	
	DIVISION 7 - THERMAL AND MOISTURE PROTECTION											
07200	BUILDING INSULATION	3,192	SF	0.02	77	$ 1.73	$5,522	$ 85.00	$6,512		$ -	$12,034
07420	METAL WALL PANELS	400	SF	0.24	96	$ 24.00	$9,600	$ 85.00	$8,160		$ -	$17,760
07900	JOINT SEALANTS	400	LF	0.06	24	$ 6.00	$2,400	$ 85.00	$2,040		$ -	$4,440
	SUBTOTAL						**$17,522**		**$16,712**		**$ -**	**$34,234**

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

DENITRIFICATION FILTER COST ESTIMATE

CCI INDEX:

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MANHOURS		MATERIAL		LABOR		EQUIPMENT		TOTAL DIRECT COST
				MHR/ UNIT	TOTAL MH	UNIT COST	TOTAL MATL	WAGE RATE	TOTAL LABOR	UNIT RATE	TOTAL EQUIP	
	DIVISION 7 - ROOFING											
07300	EPDM Roof System	1,914	SF	0.10	188	$ 9.20	$ 17,608.80	$ 85.00	$ 15,943.62		$ -	$ 33,552.42
	SUBTOTAL						**$ 17,609**		**$ 15,944**		**$ -**	**$ 33,552**

Notes:

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

DENITRIFICATION FILTER COST ESTIMATE

CCI INDEX:

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MANHOURS		MATERIAL		LABOR		EQUIPMENT		TOTAL DIRECT COST
				MHR/ UNIT	TOTAL MH	UNIT COST	TOTAL MATL	WAGE RATE	TOTAL LABOR	UNIT RATE	TOTAL EQUIP	
	DIVISION 8 - DOORS AND WINDOWS											
08116	FRP DOORS	4	EA	4.80	19	$ 1,990.00	$ 7,960.00	$ 85.00	$ 1,632.00		$ -	$ 9,592.00
08411	ANODIZED FINISH	10	EA	18.35	183	$ 600.00	$ 6,000.00	$ 85.00	$ 15,595.80		$ -	$ 21,595.80
08800	GLAZING	140	SF	0.56	79	$ 24.00	$ 3,360.00	$ 85.00	$ 6,711.60		$ -	$ 10,071.60
08620	UNIT SKYLIGHT	132	SF	0.16	21	$ 48.00	$ 6,336.00	$ 85.00	$ 1,750.32		$ -	$ 8,086.32
	SUBTOTAL						**$ 23,656**		**$ 25,690**		**$ -**	**$ 49,346**

Notes:

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

DENITRIFICATION FILTER COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MATERIAL		TOTAL LABOR	TOTAL DIRECT COST
				UNIT COST	TOTAL MATL		
	DIVISION 9 - FINISHES						
09900	PAINTING	2	LS	$ 25,000.00	$ 50,000.00	$ -	$ 50,000.00
	SUBTOTAL				**$ 50,000**	**$ -**	**$ 50,000**

JOB #: JF-066
DATE: MARCH 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

DENITRIFICATION FILTER COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MATERIAL		TOTAL LABOR	TOTAL DIRECT COST
				UNIT COST	TOTAL MATL		
	DIVISION 11 - EQUIPMENT						
	LEOPOLD ELIMINITE FILTER SYSTEM RETROFIT	1	LS	$1,395,000	$1,395,000	$0	$1,395,000
	INSTALLATION (5%)	1	LS			$69,750	$69,750
	BLOWERS	3	EA	$51,000	$153,000	$7,650	$160,650
	MIXERS	4	EA	$18,000	$72,000	$3,600	$75,600
	DIFFUSERS	721	EA	$150	$108,150	$16,223	$124,373
	PUMPS	9	EA	$45,000	$405,000	$20,250	$425,250
	CHEMICAL FEED SYSTEM	1	EA	$15,000	$15,000	$750	$15,750
	METHANOL STORAGE	1	EA	$25,000	$25,000	$1,250	$26,250
	SUBTOTAL				**$2,173,150**	**$119,473**	**$2,292,623**

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

DENITRIFICATION FILTER COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MATERIAL		TOTAL LABOR	TOTAL DIRECT COST
				UNIT COST	TOTAL MATL		
	DIVISION 13 - SPECIAL CONSTRUCTION						
		1	LS	$ -	$ -	$ -	$100,000
	SUBTOTAL				**$ -**	**$ -**	**$100,000**

* Includes installation

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

DENITRIFICATION FILTER COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MATERIAL		TOTAL LABOR	TOTAL DIRECT COST
				UNIT COST	TOTAL MATL		
	DIVISION 15 -PIPING						
15060	PIPING, VALVES AND GATES - PIPE SUPPORT	36	EA	$2,000	$72,000	$18,000	$90,000
	SUBTOTAL				**$72,000**	**$18,000**	**$90,000**

Notes:

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

DENITRIFICATION FILTER COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MATERIAL		TOTAL LABOR	TOTAL DIRECT COST
				UNIT COST	TOTAL MATL		
	DIVISION 15 - HVAC/PLUMBING						
15060	HVAC	1	LS		$ -	$ -	$48,000
	PLUMBING	1	LS		$ -	$ -	$120,000
	SUBTOTAL				**$ -**	**$ -**	**$168,000**

Notes:

JOB #: JF-066
DATE: March 2014
LOCATION: Fairhaven WWTP
PREPARED BY: PDD

CLIENT: Fairhaven, MA
PROJECT NAME:

DENITRIFICATION FILTER COST ESTIMATE

SPEC. SECTION	DESCRIPTION	QUANTITY	UNITS	MATERIAL		TOTAL LABOR	TOTAL DIRECT COST
				UNIT COST	TOTAL MATL		
	DIVISION 16 (Electrical)						
16013	WIRING, CONDUITS, CONNECTIONS*	2	LS	$160,000	$320,000	$160,000	$480,000
	LIGHTING	2	LS	$40,000	$80,000	$40,000	$120,000
	FIRE ALARM	2	LS	$24,000	$48,000	$24,000	$72,000
	SCADA SYSTEM	1	LS	$50,000	$50,000	$25,000	$75,000
	VFD	9	EA	$15,000	$135,000	$67,500	$202,500
	POWER PANELS	2	LS	$50,000	$100,000	$50,000	$150,000
	EMERGENCY GENERATOR	1	LS	$100,000	$100,000	$50,000	$150,000
	SUBTOTAL				**$833,000**	**$416,500**	**$1,249,500**

Notes:

* Includes Installation

FAIRHAVEN, MA - WWTP

OPTION NO. 3
Bardenpho w/Anaerobic Digestion
Flow = 5.0 MGD @ 18 deg. C

Kilowatts/hour =	0.75
Dollars/Kilowatt =	0.1276

Annual Operation and Maintenance Cost

	HP	Hrs/week	Hrs/year	Cost/year
Mixer in Anoxic Tank 1	16.64	168	8736	$13,912
Aeration Tank Blowers - Aerobic Tank 1	210	168	8736	$175,567
Intermediate Return Pumps	26.98	168	8736	$22,556
Mixer in Anoxic Tank 2	16.64	168	8736	$13,912
Aeration Tank Blowers - Aerobic Tank 2	110.00	169	8788	$92,511
Return Sludge Pumps	161.88	168	8736	$135,333
Deduct for Existing Aeration Tank Blowers	-120	168	8736	($100,324)
Total Power Cost				**$353,467**

Sludge Disposal

Transpertation Cost	$245	per load
Disposal Cost	$320	per Dry Ton
(Estimated Sludge Production from Biowin)		
30,000 gpd	3840	lbs/day

Assume 30,000 gal tanker = 1 load per day

Sludge Disposal Cc	$859	per day

Current Annual Operation & Maintenance Costs

Labor	$29,667
Power	$353,467
Chemical	$0
Sludge Disposal	$313,681
Total O&M Costs	**$696,815**

20 YEAR PRESENT WORTH @ 4.5% Interest **$9,064,164**

FAIRHAVEN, MA - WWTP

OPTION NO. 5
Bardenpho w/MBR & Anaerobic Digestion
Flow = 5.0 MGD @ 18 deg. C

Kilowatts/hour = 0.75
Dollars/Kilowatt = 0.1276

Annual Operation and Maintenance Cost

	HP	Hrs/week	Hrs/year	Kw-Hr/Day	Cost/year
Mixer in Anoxic Tank 1	16.64	168	8736		$13,912
Aeration Tank Blowers	260	168	8736		$217,369
Intermediate Return Pumps	26.98	168	8736		$22,556
Mixer in Anoxic Tank 2	23	168	8736		$19,229
Return Sludge Pumps	161.88	168	8736		$135,333
MBR, kw-hr/day	290.00	169	8788		$243,893
Deduct for Existing Aeration Tank Blowers	-120	168	8736		($100,324)
Total Power Cost					**$551,968**

Sludge Disposal

Transpertation Cost $245 per load
Disposal Cost $320 per Dry Ton
(Estimated Sludge Production from Biowin)
30,000 gpd 4497 lbs/day

Assume 30,000 gal tanker = 1 load per day

Sludge Disposal Co $965 per day

Current Annual Operation & Maintenance Costs

Labor		$59,334
Power		$551,968
Chemical	250	$159,688
Sludge Disposal		$352,050
Total O&M Costs		**$1,123,039**

20 YEAR PRESENT WORTH @ 4.5% Interest **$14,608,490**

FAIRHAVEN, MA - WWTP

OPTION NO. 7

Bardenpho w/Denite Filters & Anaerobic Digestion

Flow = 5.0 MGD @ 18 deg. C

Kilowatts/hour =	0.75
Dollars/Kilowatt =	0.1276

Annual Operation and Maintenance Cost

	HP	Hrs/week	Hrs/year	Kw-Hr/Day	Cost/year
Mixer in Anoxic Tank 1	8.32	168	8736		$6,956
Aerbic Tank No. 1 Blowers	120	168	8736		$100,324
Intermediate Return Pumps	26.98	168	8736		$22,556
Mixer in Anoxic Tank 2	16.64	168	8736		$13,912
Aerbic Tank No. 2 Blowers	110	168	8736		$91,964
Return Sludge Pumps	161.88	168	8736		$135,333
Denite Filter	145.00	14	728		$10,102
Deduct for Existing Aeration Tank Blowers	-120	168	8736		($100,324)
Effluent Pumps	20	168	8736		$16,721
Total Power Cost					**$297,543**

Sludge Disposal

Transpertation Cos	$245	per load
Disposal Cost	$320	per Dry Ton
(Estimated Sludge Production from Biowin)		
30,000 gpd	4139	lbs/day

Assume 30,000 gal tanker = 1 load per day

Sludge Disposal Cc	$907	per day

Current Annual Operation & Maintenance Costs

Labor		$104,284
Power		$297,543
Chemical	150	$95,813
Sludge Disposal		$331,143
Total O&M Costs		**$828,782**

20 YEAR PRESENT WORTH @ 4.5% Interest **$10,780,797**

APPENDIX D

CONDITIONS SURVEY DATABASE

UPDATED FOR SYSTEMS 01 AND 03 AT MAIN WPCF

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Headworks Structure - Concrete	X			Tough to see (snow)	1	Exterior	S/A			
Headworks – Aluminum Grating/Covers	X			In good condition per town	1	Exterior	S/A			
Influent Channels (Exterior) – North Side		[X]		[FST to check influent channel capacity for screens]	1	Exterior	S/A			
North Entrance Walkway (Concrete w/ Aluminum Handrails)	X			Icy	1	Exterior	S/A			
North Covered Entranceway (Aluminum Panels) Some Water Ponding (Icy)			X	Sloped glass cover leaking @ glass & at wall flashing. Minor brick spalling.	1	Exterior	S/A	$31,500		$31,500
South Entrance Walkway (Concrete w/ Aluminum Handrails)	X			Icy	1	Exterior	S/A			
South Covered Entranceway (Aluminum Panels)			X		1	Exterior	S/A	$16,000		$16,000
Exterior Brick Walls	X			Good to very good condition. Several cracked spalling bricks.	1	Exterior	S/A	$3,400		$3,400
North Elevation	X			(Handful) of cracked bricks.	1	Exterior	S/A			
South Elevation	X				1	Exterior	S/A			
East Elevation	X				1	Exterior	S/A			
West Elevation	X				1	Exterior	S/A			
Main Roof			[X]	No roofs inspected due to snow, except for leak at chimney. (Boiler flue) no leaks reported. [Roof leaks at upper Electrical Room] {Membrane exposed, no stone in large area over Electrical Room.}	1	Exterior	S/A	$110,000		$110,000
Loading Area Roof					1	Exterior	S/A	$19,500		$19,500
Stairway #1A Roof					1	Exterior	S/A	$10,000		$10,000
Skylights					1	Exterior	S/A			
GRIT & SCREENINGS ROOM (1/203)					1	Rm 203	S/A			
Columns	X			Caulking/sealant cracked, replace at all joints at columns.	1	Rm 203	S/A			
Floor (Concrete)			X	Concrete slab over influent channels should be replaced; some rebar visible. [Town inquires about making open channels at this location?]	1	Rm 203	S/A	$3,000	$3,000	
Walls (8" CMU)	X			Dirty.	1	Rm 203	S/A			
Ceiling (Concrete)	X				1	Rm 203	S/A			
Door 122		X Door	X Hdw.	Hardware in tough shape. Door marginal. Replace door frame and hardware. Scheduled for replacement in 2015 (Contract 29).	1	Rm 203	S/A	$3,600	$3,600	

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Door 123			X	Frame rusted. Hardware in tough shape. Scheduled for replacement in 2015 (Contract 29).	1	Rm 203	S/A	$3,600	$3,600	
Door 124			X	Hardware gone. Replace door frame. Scheduled for replacement in 2015 (Contract 29).	1	Rm 203	S/A		$3,600	
Windows			X	Corroding hardware, rusting. Replace. No screens. Scheduled for replacement in 2015 (Contract 29).	1	Rm 203	S/A	$3,700	$3,700	
Vision Panel		X		Frame rusted/pitted.	1	Rm 203	S/A			
Concrete Channels				Cleaned and coated at bar screens in 2009. Remainder not accessible for inspection	1	Rm 203	S/A	$3,000	$3,000	
Concrete Curbs	X				1	Rm 203	S/A			
Aluminum Grating & Handrails	X	X		Dirty. Fitting joint opened. Grating o.k. (Floor plate).	1	Rm 203	S/A	$2,500		$2,500
Preservation/Painting	X	X		Clean and paint. Paint in good condition.	1	Rm 203	S/A	$500		$500
ELECTRICAL ROOM (1/201)				Leak around chimney.	1	Rm 201	S/A			
Columns	X			Sealant at joints cracked.	1	Rm 201	S/A			
Floor (Concrete)	X			Coating in good condition.	1	Rm 201	S/A			
Walls (8” CMU)	X			Very good condition.	1	Rm 201	S/A			
Ceiling (Concrete)	X			Very good condition.	1	Rm 201	S/A			
Door 125		X		Dirty. Hardware o.k. (intact). Scheduled for replacement in 2015 (Contract 29).	1	Rm 201	S/A	$3,600	$3,600	
Windows	X			No screens on any windows. Scheduled for replacement in 2015 (Contract 29).	1	Rm 201	S/A	$22,700	$22,700	
Preservation/Painting	X			A little dirty. Not immediate need of paint.	1	Rm 201	S/A			
UPPER SCUM ROOM (1/202)					1	Rm 202	S/A			
Columns	X			Typical comment regarding sealant	1	Rm 202	S/A			
Floor (Concrete)	X			Very good condition	1	Rm 202	S/A			
Walls (8” CMU)	X			Very good condition	1	Rm 202	S/A			
Ceiling (Concrete)	X			Very good condition	1	Rm 202	S/A			
Door 121		X Hdw.	X Door	Does not close freely, hardware marginal. Scheduled for replacement in 2015 (Contract 29).	1	Rm 202	S/A	$3,600	$3,600	
Windows		X		Frame rusting a little, locks pitted. No screens. Scheduled for replacement in 2015 (Contract 29).	1	Rm 202	S/A	$13,600	$13,600	
Equipment Curb	X			Very good condition	1	Rm 202	S/A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Preservation/Painting	X			Very good condition. Painting not immediately required.	1	Rm 202	S/A			
LOWER SCUM ROOM (1/102)				Minor hairline cracks extend from door 45° at corners.	1	Rm 102	S/A			
Columns				N/A	1	Rm 102	S/A			
Floor (Concrete)	X	X		Coating peeling, marginal condition.	1	Rm 102	S/A			
Walls (Concrete & 8" CMU)	X CMU			Concrete parged? Dirty, paint not peeling.	1	Rm 102	S/A			
Ceiling (Concrete)	X			Very good condition.	1	Rm 102	S/A			
Door 102			X	Door binds. Lintel rusting. Scheduled for replacement in 2015 (Contract 29).	1	Rm 102	S/A	$3,600	$3,600	
Door 103			X	Closer rusting. Door binds. [Hole in door.] Scheduled for replacement in 2015 (Contract 29).	1	Rm 102	S/A	$3,600	$3,600	
Windows/Louver Side Light		X		Minor hairline cracks in wall at window opening. Scheduled for replacement in 2015 (Contract 29).	1	Rm 102	S/A		$1,000	
Equipment Pad (Concrete)				N/A	1	Rm 102	S/A			
Preservation/Painting		X		Needs painting. Floor & wall paint are peeling.	1	Rm 102	S/A	$5,400		$5,400
BOILER ROOM (1/101)					1	Rm 101	S/A			
Floor (Concrete)	X			Very good condition.	1	Rm 101	S/A			
Walls (Concrete & 8" CMU)	X			Very good condition.	1	Rm 101	S/A			
Ceiling (Concrete)	X			Very good condition.	1	Rm 101	S/A			
Door 101			X	Binds somewhat. Scheduled for replacement in 2015 (Contract 29).	1	Rm 101	S/A	$3,600	$3,600	
Preservation/Painting Paint Walls		X		Paint peeling off concrete walls approx. 30 S.F.	1	Rm 101	S/A	$2,100		$2,100
STAIRWAY #1A				Skylight shows no signs of leaks.	1	Stair 1A	S/A			
Floors (Concrete)	X				1	Stair 1A	S/A			
Walls (Concrete & 8" CMU)	X			1 crack at opening to exterior. Rake out & repoint.	1	Stair 1A	S/A			
Ceiling (Concrete)	X				1	Stair 1A	S/A			
Stairs (Concrete)	X				1	Stair 1A	S/A			
Handrails (Metal)	X				1	Stair 1A	S/A			
Preservation/Painting	X			A little dirty. Not in need of immediate attention.	1	Stair 1A	S/A			
STAIRWAY #1B				Icy/snow accumulation on stair treads and platforms.	1	Stair 1B	S/A			
Columns	X			Very good condition. Sealant cracking.	1	Stair 1B	S/A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Floor (Concrete)	X			Very good condition.	1	Stair 1B	S/A			
Walls (Concrete & 8" CMU)	X			Very good condition.	1	Stair 1B	S/A			
Ceiling (Concrete)	X				1	Stair 1B	S/A			
Stairs (Concrete)	X			Very good condition. Icy	1	Stair 1B	S/A			
Handrails (Aluminum)	X			Dirty	1	Stair 1B	S/A			
Preservation/Painting		X		Could be painted. Paint not peeling.	1	Stair 1B	S/A	$3,400		$3,400
LOADING AREA (1/103)					1	Rm 103	S/A			
Floor (Concrete)			[X]	Grid Steel exposed and rusting. Slab is scheduled for replacement in 2015 (Contract 29).	1	Rm 103	S/A	$13,400	$13,400	
Walls (Concrete)	X			Some cracks.	1	Rm 103	S/A			
Ceiling (Concrete)	X			Some cracks.	1	Rm 103	S/A			
Door 104	X			Operates well but guides are rusting a little. Scheduled for replacement in 2015 (Contract 29).	1	Rm 103	S/A	$3,600	$3,600	
Door 105		X		Typical exterior door comments. Scheduled for replacement in 2015 (Contract 29).	1	Rm 103	S/A	$3,600	$3,600	
Door 106		X		Binds a little. Scheduled for replacement in 2015 (Contract 29).	1	Rm 103	S/A	$3,600	$3,600	
Preservation/Painting				Nothing is painted.	1	Rm 103	S/A			
Exterior Entrance Slab (Concrete)			X	Grid steel rusting and separating from slab. Slab is scheduled for replacement in 2015 (Contract 29).	1	Rm 103	S/A	$6,100	$6,100	
Drainage Grate	X				1	Rm 103	S/A			
LOADING PLATFORM (1/204)					1	Rm 204	S/A			
Columns				N/A	1	Rm 204	S/A			
Floor (Concrete)	X			Very good condition.	1	Rm 204	S/A			
Walls (Face Brick)	X			Very good condition.	1	Rm 204	S/A			
Ceiling (Concrete)	X			Very good.	1	Rm 204	S/A			
Screenings & Grit Hopper Walls (Concrete)	X			Provide safety chains across hopper.	1	Rm 204	S/A			
Steel Hopper		X		Rusting. Install plastic/FRP insert. Scheduled for replacement in 2015 (Contract 29).	1	Rm 204	S/A	$13,300	$13,300	
Handrails (Aluminum)	X				1	Rm 204	S/A			
RETAINING WALL #1	X				1	Rm 204	S/A			
RETAINING WALL #2	X				1	Rm 204	S/A			
RETAINING WALL #3	X				1	Rm 204	S/A			
RETAINING WALL #4	X				1	Rm 204	S/A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
EFFLUENT CHANNELS (EXTERIOR – SOUTH SIDE)					1	Exterior	S/A			
Walls/Walkways (Concrete)	X				1	Exterior	S/A			
Aluminum Gratings		{X}		{Town cut grating to install new level sensor and this presents a tripping hazard (safety issue).}	1	Exterior	S/A			$2,500
Aluminum Handrails	X				1	Exterior	S/A			
PARSHALL FLUMES					1	FE-121A & FE-122A	S/A			
Parshall Flume FE-121A		[X]		Formed concrete channels okay. [1" wide separation where Parshall flume seal/seam meets concrete.] Scheduled for replacement in 2015 (Contract 29).	1	FE-121A	S/A	$6,600	$6,600	
Parshall Flume FE-122A	X			Formed concrete channels okay. Scheduled for replacement in 2015 (Contract 29).	1	FE-122A	S/A			
STORMWATER OVERFLOW/DIVERSION CHAMBER					1		S/A			
Walls (Concrete)	X				1	FE Diversion	S/A			
Aluminum Gratings	X				1	FE Diversion	S/A			
Aluminum Handrails	X				1	FE Diversion	S/A			
Aluminum Stairs	X			Wide joints at railing couplings.	1	FE Diversion	S/A			
PRIMARY SETTLING TANK INFLUENT DISTRIBUTION BOX					1		S/A			
Walls (Concrete)		{X}		Cracked corner near flume	1	PST Distr.	S/A			$1,000
Aluminum Grating	X				1	PST Distr.	S/A			
Aluminum Handrails	X				1	PST Distr.	S/A			
HEADWORKS/INFLUENT CHANNELS					1		PM			
24" DI Influent Pipes	X				1	PT Influent	PM			
6" DI Septage Influent Force Main	X				1	PT Influent	PM			
2" PVC Chlorine Solution w/ Diffuser	X			Pipe & diffuser intact; chlorinators and chlorine solution piping abandoned at chlorination bldg. during UV disinfection upgrade in 2003-2004.	1	PT Influent	PM			
2" Chlorine Solution Ball Valve	X			Pipe & diffuser intact; chlorinators and chlorine solution piping abandoned at chlorination bldg. during UV disinfection upgrade in 2003-2004.	1	PT Influent	PM			
Raw Influent WW Auto Sampler (SP-1201)	X				1	PT Influent	PM			
Type "A" Stop Gates (Aluminum) & Guides					1	PT Influent	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
East Channel				Channel degritted and cleaned about one month ago; access to channel via grating and/or diamond plate requested by Town.	1	PT Influent	PM			
STP-101	X				1	PT Influent	PM	$2,500		$2,500
STP-102	X				1	PT Influent	PM	$2,500		$2,500
STP-105			X	Stop gate out but sticks in frame guides.	1	PT Influent	PM	$2,500		$2,500
STP-107			X	Stop gate corroded and "frozen" in place.	1	PT Influent	PM	$2,500		$2,500
West Channel				Channel degritted and cleaned about one month ago; access to channel via grating and/or diamond plate requested by Town.	1	PT Influent	PM			
STP-103	X				1	PT Influent	PM	$2,500		$2,500
STP-106			X	Stop gate out but sticks in frame guides.	1	PT Influent	PM	$2,500		$2,500
STP-109			X	Stop gate in place and corroded – stuck in place. Gate handle broken. Floor slab cracked at gate openings.	1	PT Influent	PM	$2,500		$2,500
Bypass Channel					1	PT Influent	PM			
STP-104	X				1	PT Influent	PM	$2,500		$2,500
STP-108	X				1	PT Influent	PM	$2,500		$2,500
STP-110			X	Stop gate out – broken concrete at gate guide and underside of floor slab.	1	PT Influent	PM	$2,500		$2,500
STP-111			X	Stop gate in place and corroded – stuck in place.	1	PT Influent	PM	$2,500		$2,500
GRIT & SCREENINGS ROOM (1/203)				Date of Inspection: 12/21/04 & 12/28/04	1	Rm 203	PM			
Mechanically-Cleaned Bar Screen S-101	X			Replaced in 2009	1	S-101	PM			
Bar Rack	X				1	S-101	PM			
Rake Mechanism	X				1	S-101	PM			
Wiper Assembly/Discharge Chute	X				1	S-101	PM			
Motor M-101 (1.5 hp)	X				1	S-101	PM			
Mechanically-Cleaned Bar Screen S-102	X			Replaced in 2009	1	S-102	PM			
Bar Rack	X				1	S-102	PM			
Rake Mechanism	X				1	S-102	PM			
Wiper Assembly/Discharge Chute	X				1	S-102	PM			
Motor M-102 (1.5 hp)	X				1	S-102	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Manual Bar Screen w/ Aluminum Cover	X				1	S-102	PM			
Grit Collector S-111			X	~~Overall grit collector performance satisfactory – some clogging problems (witnessed operation). [marginal] Add aeration.~~ Complete replacement scheduled for 2015 (Contract 29).	1	S-111	PM	$270,000	$270,000	
Grit Channel				Inspect	1	S-111	PM		IA	
Grit Bucket/Chain Mechanism			X	~~Replaced chains, buckets, rails, sprockets, gears, etc. in Summer 2003. Replace housing/covers with stainless steel covers.~~ Complete replacement scheduled for 2015 (Contract 29).	1	S-111	PM	$14,700	IA	
Drive Motor M-111 (3/4 hp)			X	Complete replacement scheduled for 2015 (Contract 29)	1	S-111	PM		IA	
¾" Solenoid-Operated Grit Wash System			X	~~Some corroded valve handles. [marginal]~~ Complete replacement scheduled for 2015 (Contract 29).	1	S-111	PM	$800	IA	
Preservation/Painting				~~Recently scraped and repainted grit collector housings; however, housings have thin spots in metal and some deterioration from corrosion. [unsatisfactory]~~	1	S-111	PM			
Grit Collector S-112			X	~~Overall grit collector performance satisfactory – some clogging problems (witnessed operation). [marginal]~~ Complete replacement scheduled for 2015 (Contract 29).	1	S-112	PM	$270,000	$270,000	
Grit Channel			X	Inspect	1	S-112	PM		IA	
Grit Bucket/Chain Mechanism			X	~~Replaced chains, buckets, rails, sprockets, gears, etc. in Summer 2003. Replace housing/covers with stainless steel covers.~~ Complete replacement scheduled for 2015 (Contract 29).	1	S-112	PM	$14,700	IA	
Drive Motor M-112 (3/4 hp)			X	Complete replacement scheduled for 2015 (Contract 29).	1	S-112	PM		IA	
¾" Solenoid-Operated Grit Wash System			X	~~Some corroded valve handles.~~ Complete replacement scheduled for 2015 (Contract 29).	1	S-112	PM		IA	

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Preservation/Painting				~~Recently scraped and repainted grit collector housings; however, housings have thin spots in metal and some deterioration from corrosion. [unsatisfactory]~~	1	S-112	PM			
Grit Dewatering Screw S-113			X	Complete replacement scheduled for 2015 (Contract 29)	1	S-113	PM	$60,000	$60,000	
Grit Screw			X	~~Some broken PVC valves on draining piping – need to be replaced.~~ Complete replacement scheduled for 2015 (Contract 29).	1	S-113	PM		IA	
Drive Motor M-113			X	Complete replacement scheduled for 2015 (Contract 29)	1	S-113	PM		IA	
¾" Solenoid-Operated Grit Wash System			X	~~Some corroded valve handles~~. Complete replacement scheduled for 2015 (Contract 29).	1	S-113	PM		IA	
Preservation/Painting				~~Scraped and repainted housing recently.~~	1	S-113	PM			
6" Channel Drain System (6" Mud Valves)					1	S-113	PM			
MV-1			X	Mud valve "frozen" and shafts corroded; require replacement.	1	S-113	PM	$1,640		$1,640
MV-2			X	Mud valve "frozen" and shafts corroded; require replacement.	1	S-113	PM	$1,640		$1,640
MV-3			X	Mud valve "frozen" and shafts corroded; require replacement.	1	S-113	PM	$1,640		$1,640
MV-4			X	Mud valve "frozen" and shafts corroded; require replacement.	1	S-113	PM	$1,640		$1,640
MV-5			X	Mud valve "frozen" and shafts corroded; require replacement.	1	S-113	PM	$1,640		$1,640
Type "B" Stop Gates (Aluminum) @ Parshall Flumes					1	S-113	PM			
STP-112	X			Gate guides okay; channels recently cleaned (one year ago).	1	S-113	PM	$1,900		$1,900
STP-113	X			Gate guides okay; channels recently cleaned (one year ago).	1	S-113	PM	$1,900		$1,900
Plastic Wheeled Containers for Screenings/Grit Removal	X			One of four containers broken – piece missing.	1	S-113	PM			
Upper & Lower Scum Rooms				Date of Inspection; 12/21/04 & 12/28/04.	1	Rm 102 & 202	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Scum Concentrator T-241	X			Overall performance satisfactory (witnessed operation). Not used; scum pumped to digester. Replace scum concentrator and piping	1	T-241	PM	$272,300		$272,300
Scum Concentrator Tank*		X		Hopper has thin metal in several areas; covers are rusted and corroded and need replacing. [still marginal] Town inquires whether an insert can be installed at scum hopper.	1	Rm 102	PM			
Scum Collector Drive M-241 (3/4 hp)		X		Drive motor recently repaired but [still marginal]; chains and flights/squeegees, need replacing.	1	M-241	PM			
Concentrated Scum Pump P-251	X			Spare pump/motor are available.	1	P-251	PM			
Concentrated Scum Pump Motor M-251 (3 hp)	X			Spare pump/motor are available. Pump and base painted a year ago; needs touchup paint.	1	M-251	PM			
6” DI Scum Influent Pipe	X				1	Rm 102 & 202	PM			
6” Scum Influent Plug Valve SC-2	X				1	SC-2	PM			
12” Concentrated Scum Discharge Knife Gate SC-22	X				1	SC-22	PM			
6” Concentrated Scum Discharge Force Main	X			Some rusting bolts/pipe supports.	1	Rm 102 & 202	PM			
6” 3-Way Ball Valve SC-23 (Grit & Screenings Room)			X	Valve painted orange – valve appears to be "frozen" and not operable. Operator lever/valve support rusted.	1	SC-23	PM	$6,900		$6,900
6” DI Concentrator Drain	X				1	Rm 102 & 202	PM			
6” DI Drain Plug Valves SD-1	X				1	SD-1	PM			
Scum Storage Tank Heater Controller		X		Low level probe for scum concentrator pump control in scum hopper replaced – still not working.	1	Rm 102 & 202	PM			
Scum Concentrator Control Panel	X			Town remote wired control to Upper Scum Room for pull on/push off pump start.	1	Rm 102 & 202	PM			
6” DI Effluent (To 6” Process Drain)	X				1	Rm 102 & 202	PM			
4” DI Vent From Scum Concentrator	X				1	Rm 102 & 202	PM			
2” Vents (For Process Drains)	X				1	Rm 102 & 202	PM			
Loading Area (1/103 & 1/204)					1	Rm 103 & 204	PM			
Loading Chute (Galvanized Steel)			X	Heavy deterioration/corrosion of metal at bottom of hopper; loose paint on FRP odor piping. Scheduled for replacement in 2015 (Contract 29).	1	Rm 103 & 204	PM	$15,000	$15,000	

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
6" DI Floor Grate/Drain	X				1	Rm 103 & 204	PM			
3" DI Floor Drains	X				1	Rm 103 & 204	PM			
Parshall Flumes					1	Exterior	PM			
FE-121A Transducer & Transmitter		[X]		[Hangers should be stainless steel.]	1	Exterior	PM			
FE-122A Transducer & Transmitter		[X]		[Hangers should be stainless steel.]	1	Exterior	PM			
48"x24" Motor-Operated Alum. Overflow Weir Gate G-123 (1/2 hp) w/ Pressure Transducer	X				1	Exterior	PM			
Weir Gate G-123 Position Transmitter	X			Support needs painting.	1	Exterior	PM			
72"x36" Handwheel-Operated Alum. Weir Gates @ Primary Settling Tank Influent Distribution Box			X	Replace with all stainless steel construction w/ motor operator w/ manual override.	1	Exterior	PM			
WG-1	X			Scheduled for replacement in 2015 (Contract 29).	1	Exterior	PM	$30,500	$30,500	
WG-2	X			Scheduled for replacement in 2015 (Contract 29).	1	Exterior	PM	$30,500	$30,500	
16" DI Flow Equalization Return Force Main w/ 24" PVC Stilling Well Sleeve	X				1	Exterior	PM			
8" DI Process Waste Return Force Main	X				1	Exterior	PM			
18" DI Overflow (To Flow Equalization)	X				1	Exterior	PM			
24" DI Influent to Primary Settling Tank T-201	X				1	Exterior	PM			
24" DI Influent to Primary Settling Tank T-202	X				1	Exterior	PM			
Preservation/Painting		X		Transmitter support for weir gate G-123 needs painting due to presence of rusting; FRP odor control piping throughout grit & screenings building has rusting hangers which require repainting. [Confirmed that WWTP staff will replace these supports.]	1	Exterior	PM			
GRIT & SCREENINGS ROOM (1/203)					1	Rm 203	HV			
Unit Heater UH-1 (North Side) w/ Thermostat			X	UH is rusted. Scheduled for replacement in 2015 (Contract 29).	1	Rm 203	HV	$4,000	$4,000	
Unit Heater UH-1 (South Side) w/ Thermostat			X	UH is rusted. Scheduled for replacement in 2015 (Contract 29).	1	Rm 203	HV	$4,000	$4,000	
Combination Louver L-1 (64"x48" Fixed w/ M.O. XP Damper)			X	Damper is rusted every so often and requires spraying/cleaning. Scheduled for replacement in 2015 (Contract 29).	1	Rm 203	HV	$6,700	$6,700	

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Roof Ventilator RV-3 (w/ Prefab Curb & Auto Backdraft)			X	Fan and damper get rusted every so often and requires spraying/cleaning. {RV-3: Fan is off but the damper stays open.} Scheduled for replacement in 2015 (Contract 29).	1	Rm 203	HV	$4,700	$4,700	
8" FRP Odor Control Piping	X			Piping is in good condition, but not being used (see comments to OC unit).	1	Rm 203	HV			
Preservation/Painting	X				1	Rm 203	HV			
UPPER SCUM CONCENTRATOR ROOM (1/202)					1	Rm 202	HV			
Unit Heater UH-3 (North Side) w/ Thermostat			X	Fan motor requires replacement. Scheduled for replacement in 2015 (Contract 29).	1	Rm 202	HV	$4,000	$4,000	
Unit Heater UH-3 (South Side) w/ Thermostat			X	Scheduled for replacement in 2015 (Contract 29).	1	Rm 202	HV	$4,000	$4,000	
Combination Louver L-4 (24"x32" Fixed w/ M.O. Damper)	X				1	Rm 202	HV			
Roof Ventilator RV-1 (w/ Prefab Curb & Auto Backdraft)			X	{Working but noisy.} Scheduled for replacement in 2015 (Contract 29).	1	Rm 202	HV			
8" FRP Odor Control Piping	X			Piping is in good condition, but not being used (see comments to OC unit).	1	Rm 202	HV			
Preservation/Painting	X				1	Rm 202	HV			
LOWER SCUM CONCENTRATOR ROOM (1/102)					1	Rm 102	HV			
Unit Heater UH-6 (North Side) w/ Thermostat			X	UH is rusted. Scheduled for replacement in 2015 (Contract 29).	1	Rm 102	HV	$4,000	$4,000	
Unit Heater UH-6 (South Side) w/ Thermostat			X	UH is rusted, fins require repair. Scheduled for replacement in 2015 (Contract 29).	1	Rm 102	HV	$4,000	$4,000	
Combination Louver L-5 (24"x24" Fixed w/ M.O. Damper)	X				1	Rm 102	HV			
Exhaust Fan EF-1 (w/ Prefab Curb & Auto Backdraft)			X	{Working but noisy.} Scheduled for replacement in 2015 (Contract 29).	1	Rm 102	HV		$4,700	
Preservation/Painting	X			Room sweats. A dehumidifier may be needed to take care of sweating. Install dehumidifier.	1	Rm 102	HV	$6,700		$6,700
BOILER ROOM (1/101)					1	Rm 101	HV			
Unit Heater UH-4 w/ Thermostat	X				1	Rm 101	HV			
Unit Heater UH-5 w/ Thermostat	X				1	Rm 101	HV			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Gas Boiler (Hot Water) w/ 10" Metal Flue, Barometric Damper & 15 Gal. Expansion Tank	X			Relief valve discharges water. Circulator and burner motor were replaced within last 5 years. Boiler seems to be working fine although unit has exceed typical service life.	1	Rm 101	HV			
Circulator Pump C-1 (Inline 1/12 hp)	X				1	Rm 101	HV			
Circulator Pump C-2 (Inline ¾ hp)	X				1	Rm 101	HV			
Fixed 16"x16" Louver L-3	X				1	Rm 101	HV			
Preservation/Painting	X				1	Rm 101	HV			
ELECTRICAL ROOM (1/201)					1	Rm 201	HV			
Unit Heater UH-2 w/ Thermostat	X				1	Rm 201	HV			
Combination Fixed/M.O. 24"x24" Louver L-2 (w/ R.A. Thermostat)	X				1	Rm 201	HV			
Roof Ventilator RV-2 (w/ Prefab Curb & Auto Backdraft)	X				1	Rm 201	HV			
Preservation/Painting	X				1	Rm 201	HV			
LOADING AREA					1	Rm 103	HV			
Unit Heater UH-7 w/ Thermostat			X	UH is rusted. Scheduled for replacement in 2015 (Contract 29).	1	Rm 103	HV	$4,000	$4,000	
Activated Carbon Odor Control System A-131			X	Odor Control unit has not been used for years.	1	Rm 103	HV			X
4' Diameter FRP Adsorber Tank w/ Weather Cap	X			Tank appears to be in good condition, but OC unit has not been used.	1	Rm 103	HV			
Exhaust Fan EF-2 (FRP w/ Cover & Belt Guard)				Can't determine, if the fan is operable, since the OC unit has not been used.	1	Rm 103	HV			
8" FRP Influent Pipe w/ Transition	X			Tank appears to be in good condition, but OC unit has not been used.	1	Rm 103	HV			
GRIT & SCREENINGS ROOM (1/203)					1	Rm 203	P			
¾" to 1-1/4" Heating Supply & Return Piping (w/ Insulation)	X				1	Rm 203	P			
3" & 4" Roof Drain Piping	X				1	Rm 203	P			
2" & ¾" Plant Water Piping w/ Valved Feed to Equipment	X				1	Rm 203	P			
¾" Hose Bibbs	X				1	Rm 203	P			
2" Valves for Wash Down	X				1	Rm 203	P			
Preservation/Painting		X		Drain piping requires painting	1	Rm 203	P			$700
UPPER SCUM CONCENTRATOR ROOM (1/202)					1	Rm 202	P			
¾" to 1-1/4" Heating Supply & Return Piping (w/ Insulation)	X				1	Rm 202	P			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
3" Roof Drain Piping	X				1	Rm 202	P			
3" & 4" Vents Thru Roof	X				1	Rm 202	P			
1" Plant Water Piping w/ Valves	X				1	Rm 202	P			
Preservation/Painting		X		Drain piping requires painting	1	Rm 202	P			$1,000
LOWER SCUM CONCENTRATOR ROOM (1/102)					1	Rm 102	P			
¾" to 1-1/4" Heating Supply & Return Piping (w/ Insulation)	X				1	Rm 102	P			
3" Floor Drains w/ C.O.	X				1	Rm 102	P			
2" Floor Drain Vents Thru Roof	X				1	Rm 102	P			
4" Vents Thru Roof	X				1	Rm 102	P			
¾" Hose Bibbs	X				1	Rm 102	P			
Preservation/Painting		X		Drain piping requires painting	1	Rm 102	P			$700
BOILER ROOM (1/101)					1	Rm 101	P			
¾" to 1-1/2" Heating Supply & Return Piping (w/ Insulation)	X				1	Rm 101	P			
3" Floor Drain	X				1	Rm 101	P			
¾" Natural Gas Supply	X				1	Rm 101	P			
1" Water Main	X				1	Rm 101	P			
¾" City Water DP	X				1	Rm 101	P			
¾" Water Meter	X				1	Rm 101	P			
¾" Reduced Pressure Backflow Preventer	X				1	Rm 101	P			
¾" Gas Vent	X				1	Rm 101	P			
Preservation/Painting	X				1	Rm 101	P			
ELECTRICAL ROOM (1/201)					1	Rm 201	P			
¾" Heating Supply & Return Piping (w/ Insulation)	X				1	Rm 201	P			
Preservation/Painting	X				1	Rm 201	P			
LOADING AREA					1	Rm 103	P			
3"Roof Drain	X				1	Rm 103	P			
¾" Hose Bibb		X		Outside HB freeze (HB does not have a drainable feature), Replace	1	Rm 103	P	$800		$800
Fire Extinguishers (Grit & Screenings Rm; Upper & Lower Scum Rms; Boiler Rm.)	X				1	Rm 103	P			
GRIT & SCREENINGS ROOM (1/203)					1	Rm 203	E/I			
Conduits & Wiring			[X]	Explosionproof fittings corroded [unsatisfactory]	1	Rm 203	E/I	$400	$400	
Receptacles			X	None [unsatisfactory]	1	Rm 203	E/I			$500

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Unit Heaters thermal motor switches			[X]	corroded	1	Rm 203	E/I	$900	$900	
Bar Screen Motor M-101	X			New unit installed in 2009	1	Rm 203	E/I			
Remote-Off-Local PB Station	X				1	Rm 203	E/I			
Bar Screen Motor M-102	X			New unit installed in 2009	1	Rm 203	E/I			
Remote-Off-Local PB Station	X				1	Rm 203	E/I			
Grit Collector Motor M-111 Start-Stop PB and disconnect switch			[X]	Pushbuttons randomly stick (Ray), bolts corroded [unsatisfactory]	1	Rm 203	E/I	$700	$700	
Grit Collector Motor M-112 Start-Stop PB and disconnect switch			[X]	Pushbuttons randomly stick (Ray), bolts corroded [unsatisfactory]	1	Rm 203	E/I	$700	$700	
Grit Dewatering Screw Motor M-113 Start-Stop PB and disconnect switch			[X]	Pushbuttons randomly stick (Ray), bolts corroded [unsatisfactory]	1	Rm 203	E/I	$700	$700	
Concentrated Scum Pump Motor M-251 Start-Stop PB and disconnect switch			[X]	Pushbuttons randomly stick (Ray), bolts corroded [unsatisfactory]	1	Rm 203	E/I	$700	$700	
Lighting Fixtures/Switches	X		[X]	Lighting (S), Switches corroded ([U])	1	Rm 203	E/I	$900	$900	
Handset/Speaker	X			Handset recently replaced	1	Rm 203	E/I			
Level Switch LS-103 and conduit/J-Boxes	X				1	Rm 203	E/I			
Level Switch LS-104 and conduit/J-Boxes	X				1	Rm 203	E/I			
Preservation/Painting		X		Some paint on conduits chipped/corroded	1	Rm 203	E/I	$200		$200
ELECTRICAL ROOM (1/201)					1	Rm 201	E/I			
Conduits & Wiring	X				1	Rm 201	E/I			
Receptacles	X				1	Rm 201	E/I			
MCC No.4 (277/480V, 30A, 4W)	X			ATS has been replaced	1	Rm 201	E/I			
30KVA Transformer	X				1	Rm 201	E/I			
Receptacle Panel RP4	X				1	Rm 201	E/I			
Bar Screen Control Panel	X				1	Rm 201	E/I			
Timer for Septage Pumps					1	Rm 201	E/I			
Time Switch (Strlgt. Control) Tork		[X]		Timeclock replaced with Intermatic digital [Town to replace with photocell contactor]	1	Rm 201	E/I			X
Unit Heaters thermal motor switches	X				1	Rm 201	E/I			
Lighting Fixtures/Switches	X				1	Rm 201	E/I			
Handset/Speaker	X				1	Rm 201	E/I			
Instrumentation Panel IP-04	X				1	Rm 201	E/I			
Preservation/Painting	X				1	Rm 201	E/I			
UPPER SCUM ROOM (1/202)					1	Rm 202	E/I			
Conduits & Wiring	X				1	Rm 202	E/I			
Receptacles	X				1	Rm 202	E/I			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Unit Heaters thermal motor switches	X				1	Rm 202	E/I			
Scum Concentrator				Per WWTP, unit operation satisfactory.	1	Rm 202	E/I			
Zero Speed Switch	X				1	Rm 202	E/I			
Tach Generator		[X]		[When runs at slow speed it chatters – commutator problem (FST electrical to review)]	1	Rm 202	E/I			X
High Level Probe	X				1	Rm 202	E/I			
Emergency Stop Button	X				1	Rm 202	E/I			
Lighting Fixtures/Switches	X				1	Rm 202	E/I			
Handset/Speaker	X			Speaker only (no handset)	1	Rm 202	E/I			
Preservation/Painting	X				1	Rm 202	E/I			
LOWER SCUM ROOM (1/102)					1	Rm 102	E/I			
Conduits & Wiring	X			Minor chipping of paint on conduits	1	Rm 102	E/I			
Unit Heaters thermal motor switches			[X]	Corrosion on bottom of unit heater [Needs to be replaced.]	1	Rm 102	E/I		IA	
Receptacles	X				1	Rm 102	E/I			
Scum Concentrator Control Panel	X				1	Rm 102	E/I			
Low Level Probe			X	Does not work and isn't used (Ray) [Replace per (Ray)]	1	Rm 102	E/I			X
Heater Element/Control					1	Rm 102	E/I			
Lighting Fixtures/Switches	X				1	Rm 102	E/I			
Handset/Speaker	X			Speaker only (no handset)	1	Rm 102	E/I			
Preservation/Painting	X				1	Rm 102	E/I			
BOILER ROOM (1/101)					1	Rm 101	E/I			
Conduits & Wiring	X			Wireway – minor corrosion	1	Rm 101	E/I			
Receptacles	X				1	Rm 101	E/I			
Unit Heaters thermal motor switches	X				1	Rm 101	E/I			
Boiler Emergency Shutoff Switch	X				1	Rm 101	E/I			
Lighting Fixtures/Switches	X				1	Rm 101	E/I			
Preservation/Painting	X				1	Rm 101	E/I			
LOADING AREA (1/103)					1	Rm 103	E/I			
Conduits & Wiring	X				1	Rm 103	E/I			
Receptacles	X				1	Rm 103	E/I			
Unit Heater thermal motor switch			[X]	Corroded [Replace per Town.]	1	Rm 103	E/I		IA	
Door Operator PB & Safety Switch	X				1	Rm 103	E/I			
Lighting Fixtures/Switches			[X]	Switches - minor corrosion [unsatisfactory]	1	Rm 103	E/I		$1,200	
Preservation/Painting		X			1	Rm 103	E/I			
LOADING AREA (1/204)					1	Rm 204	E/I			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Conduits & Wiring				Concealed	1	Rm 204	E/I			
Lighting Fixtures/Switches			[X]	[Replace per Town.]	1	Rm 204	E/I		$800	
Handset/Speaker	X				1	Rm 204	E/I			
Preservation/Painting				N/A	1	Rm 204	E/I			
STAIRWAY #1A					1	Stair 1A	E/I			
Conduits & Wiring				Concealed	1	Stair 1A	E/I			
Lighting Fixtures & Switches	X				1	Stair 1A	E/I			
Preservation/Painting				N/A	1	Stair 1A	E/I			
STAIRWAY #1B					1	Stair 1B	E/I			
Conduits & Wiring				Concealed	1	Stair 1B	E/I			
Lighting Fixtures & Switches	X				1	Stair 1B	E/I			
Preservation/Painting				N/A	1	Stair 1B	E/I			
Parshall Flumes					1	FE-121A & FE-122A	E/I			
Conduits & Wiring	X				1	FE-121A & FE-122A	E/I			
Flow Element FE-121			[X]	[Needs stainless steel bracket.] {FE-121 replaced week of 3/10/08.}	1	FE-121A	E/I	$0		X
Liquid Level Indicator FIT-121	X				1	FE-121A	E/I			
Flow Element FE-122			[X]	[Needs stainless steel bracket.] {FE-122 replaced week of 3/10/08.}	1	FE-122A	E/I	$0		X
Liquid Level Indicator FIT-122			[X]	[Needs stainless steel bracket.]	1	FE-122A	E/I			X
Preservation/Painting	X				1	FE-121A & FE-122A	E/I			
Overflow Weir Gate				Gates recently repaired by Ray	1	FE-121A & FE-122A	E/I			
Conduit & Wiring	X				1	FE-121A & FE-122A	E/I			
Level Element LE-123			[X]	[Needs stainless steel bracket.]	1	LE-123	E/I			X
Level Indicator LIT-123			[X]	[Needs stainless steel bracket.]	1	LIT-123	E/I			X
Reversing Starter 4x w/ Limit & Torque Switches, L.O.R Selector Switch	X			Per WWTP staff, weir gate operation okay.	1	FE-121A & FE-122A	E/I			
30A, SP, 600V 4x SS Disconnect Switch	X				1	FE-121A & FE-122A	E/I			
Weir Position Indicator ZT-123	X				1	ZT-123	E/I			
Preservation/Painting		X		Some rusting of supports.	1	FE-121A & FE-122A	E/I			X
Activated Carbon Odor Control System					1	FE-121A & FE-122A	E/I			
Conduit & Wiring	X				1	FE-121A & FE-122A	E/I			
30A,3P,600V NEMA 4x Disconnect	X				1	FE-121A & FE-122A	E/I			
NEMA 4x PB Control Station	X				1	FE-121A & FE-122A	E/I			
Preservation/Painting				Not inspected.	1	FE-121A & FE-122A	E/I			
Exterior Flood Lights	X				1	FE-121A & FE-122A	E/I			
									$853,100	$537,100

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
AERATION TANKS					3		S/A			
Aeration Tank Influent Distribution Chamber					3	Aeration Tank IDC	S/A			
Walls (Concrete)	X			Visible walls ok; some walls not visible.	3	Aeration Tank IDC	S/A			
Channels (Concrete)	X				3	Aeration Tank IDC	S/A			
Concrete Fill				Chamber full.	3	Aeration Tank IDC	S/A			
Aluminum Grating & Handrails		[X]		Wide joints at rail couplings. Variation in finish appearance. [marginal]	3	Aeration Tank IDC	S/A			
Access Aluminum Stairs	X				3	Aeration Tank IDC	S/A			
Preservation/Painting				N/A	3	Aeration Tank IDC	S/A			
Aeration Tank T- 301A					3	T-301A	S/A			
Walls (Concrete)	X			Concrete rehab'd in Contract 26.	3	T-301A	S/A			
Bottom (Concrete)	X				3	T-301A	S/A			
Center Walkway, Platform & Column Supports (Concrete)			X	Cracks at the platform supporting anchors. Loose concrete removed in Contract 26.	3	T-301A	S/A			
Center Walkway Aluminum Handrails & Diamond Plate Cover		[X]		Finished Safety chains all rusted (galvanized steel).somewhat pitted in railings. [marginal]	3	T-301A	S/A			
Influent Distribution Channel (Inside Tank)	X			Visible walls ok; chamber filled with wastewater & entire channel not visible.	3	T-301A	S/A			
Influent Distribution Channel Aluminum Walkway Grating & Handrails		[X]		Grating not visible. For Tanks 301 A, B, 302 A,B, and 303 A, B., all grating, checkered plate railings and safety chains are in satisfactory condition. Safety chains are badly rusted and could be replaced. Aluminum finish varies. Some railings' finish is more pitted than others. [marginal]	3	T-301A	S/A			
Preservation/Painting				N/A	3	T-301A	S/A			
Aeration Tank T- 301B					3	T-301B	S/A			
Walls (Concrete)	X			Concrete rehab'd in Contract 26.	3	T-301B	S/A			
Bottom (Concrete)	X				3	T-301B	S/A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Center Walkway, Platform & Column Supports (Concrete)	X			Cracks at the platform supporting anchors. Repair scheduled in 2013. Walkway removed in Contract 26.	3	T-301B	S/A			
Center Walkway Aluminum Handrails & Diamond Plate Cover	X			Walkway removed in Contract 26.	3	T-301B	S/A			
Influent Distribution Channel (Inside Tank)	X				3	T-301B	S/A			
Influent Distribution Channel Aluminum Walkway Grating & Handrails	X			See Sheet 1 comments.	3	T-301B	S/A			
Preservation/Painting				N/A	3	T-302A	S/A			
Aeration Tank T- 302A					3	T-302A	S/A			
Walls (Concrete)	X			Concrete rehab'd in Contract 26.	3	T-302A	S/A			
Bottom (Concrete)	X				3	T-302A	S/A			
Center Walkway, Platform & Column Supports (Concrete)			X	Cracks under center platform. Loose concrete removed in Contract 26.	3	T-302A	S/A			
Center Walkway Aluminum Handrails & Diamond Plate Cover	X			See Sheet 1 comments.	3	T-302A	S/A			
Aluminum Walkway Grating & Handrails	X				3	T-302A	S/A			
Preservation/Painting				N/A	3	T-302A	S/A			
Aeration Tank T- 302B				Ladder at effluent distribution chamber is satisfactory.	3	T-302B	S/A			
Walls (Concrete)	X			Concrete rehab'd in Contract 26.	3	T-302B	S/A			
Bottom (Concrete)	X				3	T-302B	S/A			
Center Walkway, Platform & Column Supports (Concrete)	X			Cracks under center platform. Walkway removed in Contract 26.	3	T-302B	S/A			
Center Walkway Aluminum Handrails & Diamond Plate Cover	X			Walkway removed in Contract 26.	3	T-302B	S/A			
Influent Distribution Channel Aluminum Walkway Grating & Handrails	X				3	T-302B	S/A			
Preservation/Painting				N/A	3	T-302B	S/A			
Aeration Tank T- 303A					3	T-303A	S/A			
Walls (Concrete)	X			Concrete rehab'd in Contract 26.	3	T-303A	S/A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Bottom (Concrete)	X				3	T-303A	S/A			
Center Walkway, Platform & Column Supports (Concrete)			X	Cracks under center platform. Loose concrete removed in Contract 26.	3	T-303A	S/A			
Center Walkway Aluminum Handrails & Diamond Plate Cover	X			See Sheet 1 comments.	3	T-303A	S/A			
Influent Distribution Channel (Inside Tank)					3	T-303A	S/A			
Influent Distribution Channel Aluminum Walkway Grating & Handrails	X			See Sheet 1 comments.	3	T-303A	S/A			
Preservation/Painting				N/A	3	T-303A	S/A			
Aeration Tank T- 303B					3	T-303B	S/A			
Walls (Concrete)	X			Cracks at top of the South wall, next to the ladder. Concrete rehab'd in Contract 26.	3	T-303B	S/A			
Bottom (Concrete)	X				3	T-303B	S/A			
Center Walkway, Platform & Column Supports (Concrete)	X			Cracks under center platform. Walkway removed in Contract 26.	3	T-303B	S/A			
Center Walkway Aluminum Handrails & Diamond Plate Cover	X			Walkway removed in Contract 26.	3	T-303B	S/A			
Influent Distribution Channel (Inside Tank)					3	T-303B	S/A			
Influent Distribution Channel Aluminum Walkway Grating & Handrails	X				3	T-303B	S/A			
Preservation/Painting				N/A	3	T-303B	S/A			
Aeration Tank Center Channel					3	Aeration Tank CC	S/A			
Walls (Concrete)	X				3	Aeration Tank CC	S/A			
Channels (Concrete)	X				3	Aeration Tank CC	S/A			
Aluminum Grating & Handrails	X				3	Aeration Tank CC	S/A			
Access Aluminum Stairs	X				3	Aeration Tank CC	S/A			
Preservation/Painting				N/A	3	Aeration Tank CC	S/A			
Aeration Tank Effluent Channel					3	Aeration Tank EC	S/A			
Walls (Concrete)	X				3	Aeration Tank EC	S/A			
Channels & Gate Platforms (Concrete)	X				3	Aeration Tank EC	S/A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Aluminum Grating & Handrails	X				3	Aeration Tank EC	S/A			
Access Aluminum Stairs	X				3	Aeration Tank EC	S/A			
Preservation/Painting				N/A	3	Aeration Tank EC	S/A			
Aeration Tank Effluent Distribution Chamber					3	Aeration Tank EDC	S/A			
Walls (Concrete)	X				3	Aeration Tank EDC	S/A			
Channels (Concrete)	X				3	Aeration Tank EDC	S/A			
Concrete Fill				Not visible.	3	Aeration Tank EDC	S/A			
Aluminum Grating & Handrails	X				3	Aeration Tank EDC	S/A			
Access Aluminum Ladder	X				3	Aeration Tank EDC	S/A			
Access Aluminum Stairs	X				3	Aeration Tank EDC	S/A			
Preservation/Painting				N/A	3	Aeration Tank EDC	S/A			
BLOWER BUILDING					3	Blower Building	S/A			
Exterior Foundation Walls (Concrete)	[X]			Snow covered. [satisfactory]	3	Blower Building	S/A			
Exterior Brick Walls	X			Somewhat snow covered. Sealant at control joints opening a bit. Lintels need to be painted. (galvanized steel lintels).	3	Blower Building	S/A	$2,800		$2,800
North Elevation					3	Blower Building	S/A			
South Elevation	X				3	Blower Building	S/A			
East Elevation	X				3	Blower Building	S/A			
West Elevation	X				3	Blower Building	S/A			
Loading Dock (North Side)					3	Blower Building	S/A			
Walls (Concrete)					3	Blower Building	S/A			
Top Slab (Concrete)	X				3	Blower Building	S/A			
Armor Angle	X			Not completely visible. Appears ok.	3	Blower Building	S/A			
Aluminum Handrails		X		Missing return rail at bottom of stair.	3	Blower Building	S/A	$1,500		$1,500
Galvanized Steel Safety Chain		X		Rusting.	3	Blower Building	S/A			
Concrete Access Stairs		[X]		Not visible, snow covered. No reported problems. [Skid plates need replacement; also broken concrete.]	3	Blower Building	S/A			
Roof (FSR EPDM w/ Ballast)				Roof not inspected. Snow covered.	3	Blower Building	S/A			
First Floor – Operating Platform A (3/101)					3	Rm 101	S/A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Floor (Concrete)	X Conc.	X Coating		Coating a little worn. No cracks.	3	Rm 101	S/A	$3,500		$3,500
Floor Beams (Concrete)	X				3	Rm 101	S/A			
Walls (8" CMU)	X			Very good condition.	3	Rm 101	S/A			
Steel Columns	X			Very good condition.	3	Rm 101	S/A			
Ceiling (Metal Decking) (Acoustical Deck)	X				3	Rm 101	S/A			
Door 304	X			Operates o.k. Minor rusting on door and frame.	3	Rm 101	S/A			
Door 306	X			Operates o.k. No threshold weatherstripping. Minor rusting on door and frame. No screens.	3	Rm 101	S/A			
Windows	X				3	Rm 101	S/A			
4' Sq. Aluminum Access Hatch	X				3	Rm 101	S/A			
Aluminum Handrail	X	[X]		[Safety chain required.]	3	Rm 101	S/A			
Preservation/Painting	X			A little dirty. Painting not immediately required. Minor maintenance painting required.	3	Rm 101	S/A			
Crane	X			{Crane has a platform for changing light bulbs. Platform has no security chains.}	3	Rm 101	S/A			
First Floor – Electrical Control Room (3/102)					3	Rm 102	S/A			
Floor (Concrete)	X Conc.	X Coating		Coating a little worn.	3	Rm 102	S/A			
Walls (8" CMU)	X			Very good condition.	3	Rm 102	S/A			
Steel Columns				N/A	3	Rm 102	S/A			
Ceiling (Metal Decking) (Acoustical Deck)(Acoustical Deck)	X Decking	X Coating		Paint peeling at one corner at visual panel. Paint ceiling.	3	Rm 102	S/A	$900		$900
Door 305	X			Very good condition.	3	Rm 102	S/A			
Windows			X	Very good condition. No screens. {Remote window operators need replacing. Need different type of operator.}	3	Rm 102	S/A	$1,800	$1,800	
Vision Panel	X			Very good condition.	3	Rm 102	S/A			
Preservation/Painting	X			Very good condition. No need to paint except spot at ceiling.	3	Rm 102	S/A			
First Floor – Operating Platform B (3/103)					3	Rm 103	S/A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Floor (Concrete)	X	X Coating		Coating a little worn.	3	Rm 103	S/A			
Floor Beams (Concrete)	X				3	Rm 103	S/A			
Walls (8” CMU)	X				3	Rm 103	S/A			
Steel Columns				N/A	3	Rm 103	S/A			
Ceiling (Metal Decking)	X			Some water staining around flue penetration.	3	Rm 103	S/A			
Door 303	X			Very good condition. Paint lintel.	3	Rm 103	S/A			
Metal Ladder		[X]		No safety chains. [marginal]	3	Rm 103	S/A			
Aluminum Handrail	X			No kick plate or curb at edge of slab.	3	Rm 103	S/A			
Concrete Curb For Duct Opening	X				3	Rm 103	S/A			
Preservation/Painting	X			No painting immediately required.	3	Rm 103	S/A			
Basement - Pump Room (3/001)					3	Rm 001	S/A			
Floor (Concrete)	X			Some hairline cracking. Uncoated.	3	Rm 001	S/A			
Walls (Concrete & 8” CMU)	X			CMU in very good condition. Some cracks in concrete.	3	Rm 001	S/A			
Concrete Columns				N/A	3	Rm 001	S/A			
Ceiling (Concrete)	X			Very good condition.	3	Rm 001	S/A			
Door 301			X	Closes but doesn’t latch tightly. Kicked out at bottom. Replace door, frame & hardware.	3	Rm 001	S/A	$4,400	$4,400	
2.5’ x 3’ Sump Pump Pit	X				3	Rm 001	S/A			
Trench Drain w/ CI Grate		[X]		[Pitted concrete on bottom – needs skim coat added.]	3	Rm 001	S/A			
Preservation/Painting	X			Paint underside of hatch in ceiling.	3	Rm 001	S/A			
Basement – Blower Room (3/002)					3	Rm 002	S/A			
Floor (Concrete)	X			Some cracks. Coating o.k.	3	Rm 002	S/A			
Walls (Concrete)	X			Some minor hairline cracks under windows with efflorescence stains.	3	Rm 002	S/A			
Concrete Columns				N/A	3	Rm 002	S/A			
Ceiling (Metal Decking & Concrete)	X				3	Rm 002	S/A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Windows	X Window		X Oper.	Operators don't work at all. No screens.	3	Rm 002	S/A	$24,800		$24,800
Steel Stairs, Grating & Handrails	X			Minor rusting on treads.	3	Rm 002	S/A			
Equipment Concrete Pads	X				3	Rm 002	S/A			
Preservation/Painting		X		Needs to be painted (not peeling).	3	Rm 002	S/A	$5,600		$5,600
Basement – Boiler Room (3/003)					3	Rm 003	S/A			
Floor (Concrete)	X			Some cracks. Uncoated.	3	Rm 003	S/A			
Floor Beams (Concrete)				N/A	3	Rm 003	S/A			
Walls (8" CMU & Concrete)	X			Cracked sealant at concrete columns.	3	Rm 003	S/A			
Ceiling (Concrete)	X			Very good condition. Painted.	3	Rm 003	S/A			
Door 302	X			Tied off in open position. Did not test for operability.	3	Rm 003	S/A			
Boiler Concrete Pad	X			No cracks.	3	Rm 003	S/A			
Preservation/Painting	X			Not in immediate need of painting.	3	Rm 003	S/A			
FINAL SETTLING TANKS					3		S/A			
Final Settling Tank T- 331 (45' Dia.)				Conduct full inspection of T-331	3	T-331	S/A			
Tank Walls (Concrete)	X				3	T-331	S/A			
Weir (Wall)	X				3	T-331	S/A			
Tank Bottom (Grout Topping)				Not visible due to standing water.	3	T-331	S/A	$11,100		$11,100
Sludge Pit				Not visible due to standing water.	3	T-331	S/A			
Effluent Channel/Launder	X			Visible concrete ok.	3	T-331	S/A			
Walkway Support Beams	X				3	T-331	S/A			
Walkway Aluminum Grating & Handrails	X			Grating barely visible. Typical to aeration tank.	3	T-331	S/A			
Access Stairs (Conc. w/ Alum. Handrails)	X Railings				3	T-331	S/A			
Preservation/Painting		X		Paint support beams.	3	T-331	S/A	$3,800		$3,800
Final Settling Tank T- 332 (45' Dia.)				Conduct full inspection of T-332	3	T-332	S/A			
Tank Walls (Concrete)	X				3	T-332	S/A			
Weir (Wall)	X				3	T-332	S/A			
Tank Bottom (Grout Topping)				Not visible due to standing water.	3	T-332	S/A	$11,100		$11,100
Effluent Channel/Launder				Visible concrete ok.	3	T-332	S/A			
Sludge Pit				Not visible due to standing water.	3	T-332	S/A			
Walkway Support Beams	X				3	T-332	S/A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Walkway Aluminum Grating & Handrails	X			Grating not visible.	3	T-332	S/A			
Access Stairs (Conc. w/ Alum. Handrails)	X				3	T-332	S/A			
Preservation/Painting		X		Paint support beam.	3	T-332	S/A	$3,800		$3,800
Final Settling Tank T- 333 (75' Dia.)				Tank presently on line. Inspect when offline.	3	T-333	S/A			
Tank Walls (Concrete)	X				3	T-333	S/A			
Weir (Wall)	X				3	T-333	S/A			
Tank Bottom (Grout Topping)			[X]	Not visible due to tank full. [Grout topping on bottom of tank is delaminated and needs replacement.]	3	T-333	S/A	$30,700	$30,700	
Sludge Pit	[X]			Not visible due to tank full. [satisfactory]	3	T-333	S/A			
Effluent Channel/Launder	X			Coating applied under UV contract during 2003/2004.	3	T-333	S/A			
Walkway Support Beams	X				3	T-333	S/A			
Walkway Aluminum Grating & Handrails	X				3	T-333	S/A			
Access Aluminum Stairs	X				3	T-333	S/A			
Preservation/Painting		X		Paint support beam.	3	T-333	S/A			
Final Settling Tank T- 334 (75' Dia.)				Tank presently on line. Inspect when offline.	3	T-334	S/A			
Tank Walls (Concrete)	X				3	T-334	S/A			
Weir (Wall)	X				3	T-334	S/A			
Tank Bottom (Grout Topping)			X	Not visible due to tank full. [Grout topping on bottom of tank is delaminated and needs replacement.]	3	T-334	S/A	$30,700	$30,700	
Sludge Pit	[X]			Not visible due to tank full. [satisfactory]	3	T-334	S/A			
Effluent Channel/Launder	X			Coating applied under UV contract during 2003/2004.	3	T-334	S/A			
Walkway Support Beams	X				3	T-334	S/A			
Walkway Aluminum Grating & Handrails	X				3	T-334	S/A			
Access Aluminum Stairs	X				3	T-334	S/A			
Preservation/Painting		X		Paint support beam.	3	T-335	S/A	$3,800	$3,800	
Secondary Scum Well T- 335					3	T-335	S/A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Precast Concrete Manhole	X			Per WWTP staff, condition okay.	3	T-335	S/A			
Aluminum Access Cover		[X]		Per WWTP staff, condition okay. [Town wants to reconfigure cover?]	3	T-335	S/A			
Aeration Tank Influent Distribution Chamber				Date of Inspection: 1/4/05.	3	Aeration Tank IDC	PM			
24" DI Influent Pipe From PST T-201	X				3	Aeration Tank IDC	PM			
24" DI Influent Pipe From PST T-202	X				3	Aeration Tank IDC	PM			
16" DI Flow Equalization Return FM	X				3	Aeration Tank IDC	PM			
24" DI Flow Equalization Gravity Overflow	X				3	Aeration Tank IDC	PM			
8" DI RAS Pipes	X				3	Aeration Tank IDC	PM			
12" DI RAS Pipes	X			Visible rusting at bottom of 90° elbow on 12" RAS pipe on west side of aeration tanks.	3	Aeration Tank IDC	PM			
RAS Valves (In Yard @ Aeration Tanks)					3	Aeration Tank Yard	PM			
RS-44 (8")			X	Replace	3	Aeration Tank Yard	PM	$8,800	$8,800	
RS-45 (8")			X	Replace	3	Aeration Tank Yard	PM	$8,800	$8,800	
RS-46 (8")			X	Replace	3	Aeration Tank Yard	PM	$8,800	$8,800	
RS-47 (10")			X	Replace	3	Aeration Tank Yard	PM	$10,500	$10,500	
RS-48 (8")			X	Replace	3	Aeration Tank Yard	PM	$8,800	$8,800	
RS-49 (12")			X	Replace	3	Aeration Tank Yard	PM	$12,800	$12,800	
RS-50 (12")			X	Replace	3	Aeration Tank Yard	PM	$12,800	$12,800	
RS-51 (12")			X	Replace	3	Aeration Tank Yard	PM	$12,800	$12,800	
RS-52 (12")			X	Replace	3	Aeration Tank Yard	PM	$12,800	$12,800	
RS-60 (8")			X	Replace	3	Aeration Tank Yard	PM	$8,800	$8,800	
RS-61 (10")			X	Replace	3	Aeration Tank Yard	PM	$10,500	$10,500	
RS-62 (12")			X	Replace	3	Aeration Tank Yard	PM	$12,800	$12,800	
Aluminum Stop Gates & Slots					3	Aeration Tank IDC	PM			
Type "C"		X		[Need new stop gates/frames.]	3	Aeration Tank IDC	PM			
STP-1		X		Existing stop gate / guide rehab'd in Contract 26.	3	Aeration Tank IDC	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
STP-3	X			Stop gates / guides replaced with slide gate in Contract 26.	3	Aeration Tank IDC	PM			
STP-11	X			Stop gates / guides replaced with slide gate in Contract 26.	3	Aeration Tank IDC	PM			
STP-13		X		Existing stop gate / guide rehab'd in Contract 26.	3	Aeration Tank IDC	PM			
Type “D”					3	Aeration Tank IDC	PM			
STP-2		X		Existing stop gate / guide rehab'd in Contract 26.	3	Aeration Tank IDC	PM			
STP-4	X			Stop gates / guides replaced with slide gate in Contract 26.	3	Aeration Tank IDC	PM			
STP-6	X			Stop gates / guides replaced in Contract 26.	3	Aeration Tank IDC	PM			
STP-8	X			Stop gates / guides replaced in Contract 26.	3	Aeration Tank IDC	PM			
STP-9	X			Stop gates / guides replaced in Contract 26.	3	Aeration Tank IDC	PM			
STP-10	X			Stop gates / guides replaced with slide gate in Contract 26.	3	Aeration Tank IDC	PM			
STP-12		X		Existing stop gate / guide rehab'd in Contract 26.	3	Aeration Tank IDC	PM			
Preservation/Painting	X				3	Aeration Tank IDC	PM			
Aeration Tank T- 301A					3	T-301A	PM			
Stop Gates & Slots (Type “E”)					3	T-301A	PM			
STP-5	X			Stop gates / guides replaced in Contract 26.	3	T-301A	PM			
24” x 24” HWO Alum. Slide Gates					3	T-301A	PM			
SL-1	X			Gate operator replaced in Contract 26.	3	T-301A	PM			
SL-7	X			Gate operator replaced in Contract 26.	3	T-301A	PM			
12" x 12" HWO Alum. Slide Gates					3	T-301A	PM			
SL-2	X			Slide gate has broken rib at bottom; rusting handwheel. Replaced in Contract 26.	3	T-301A	PM			
SL-5	X			Gate works; rusted at handwheel. Replaced in Contract 26.	3	T-301A	PM			
24” Sq. HWO Sluice Gates					3	T-301A	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
SLU-1	X			Visible cracks in wall near sluice gate.	3	T-301A	PM			
SLU-2	X			Visible cracks in wall near sluice gate.	3	T-301A	PM			
Diffused Air Grid A-301A	X			Witnessed operation on 1/4/05.	3	T-301A	PM			
6” SS Air Feeder Pipe	X				3	T-301A	PM			
6” Butterfly Air Valve PA –14	X			Valve has been replaced by WWTP staff.	3	T-301A	PM			
6” & 4” PVC Air Distribution Laterals	X				3	T-301A	PM			
Ceramic Diffusers	X			Replaced with membrane diffusers in Contract 26.	3	T-301A	PM			
4” Air Blowoff Assembly	X				3	T-301A	PM			
Preservation/Painting	X				3	T-301A	PM			
Aeration Tank T- 301B					3	T-301B	PM			
Stop Gates & Slots (Type “E”)					3	T-301B	PM			
STP-7	X			Stop gates / guides replaced in Contract 26.	3	T-301B	PM			
24” x 24” HWO Alum. Slide Gates					3	T-301B	PM			
SL-3	X			Gate operator replaced in Contract 26.	3	T-301B	PM			
SL-8	X			Gate operator replaced in Contract 26.	3	T-301B	PM			
12" x 12" HWO Alum. Slide Gates					3	T-301B	PM			
SL-4	X			Slide gate broken has broken rib at bottom; rusting at handwheel. Gate replaced in Contract 26.	3	T-301B	PM			
SL-6	X			Slide gate "frozen" – handwheel won't turn. Gate replaced in Contract 26.	3	T-301B	PM			
24” Sq. HWO Sluice Gates					3	T-301B	PM			
SLU-3	X				3	T-301B	PM			
SLU-4	X				3	T-301B	PM			
Diffused Air Grid A-301B	X			Not in operation on 1/04/05.	3	T-301B	PM			
6” SS Air Feeder Pipe	X				3	T-301B	PM			
6” Butterfly Air Valve PA –17	X			Valve has been replaced by WWTP staff.	3	T-301B	PM			
6” & 4” PVC Air Distribution Laterals	X			PVC air distribution laterals and header replaced in Contract 26.	3	T-301B	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Ceramic Diffusers	X			Replaced with membrane diffusers in Contract 26.	3	T-301B	PM			
4” Air Blowoff Assembly	X				3	T-301B	PM			
Preservation/Painting	X				3	T-301B	PM			
Aeration Tank T- 302A					3	T-302A	PM			
30” x 18” HWO Alum. Slide Gates					3	T-302A	PM			
SL-9	X			Gate slightly bowed; broken concrete at gate. Gate replaced in Contract 26.	3	T-302A	PM			
SL-10	X			Gate operable. Gate replaced in Contract 26.	3	T-302A	PM			
12" x 12" HWO. Alum. Slide Gates					3	T-302A	PM			
SL-13	X			Gate operable. Gate replaced in Contract 26.	3	T-302A	PM			
SL-15	X			Gate operable. Gate replaced in Contract 26.	3	T-302A	PM			
24" x 24" HWO Alum. Slide Gates					3	T-302A	PM			
SL-17	X			Gate operable. Gate operator replaced in Contract 26.	3	T-302A	PM			
24" x 24" HWO Downward – Operating Alum. Slide Gates					3	T-302A	PM			
SL-19	X			Gate operable. Gate operator replaced in Contract 26.	3	T-302A	PM			
SL-20	X			Gate operable. Gate operator replaced in Contract 26.	3	T-302A	PM			
24” Sq. HWO Sluice Gates					3	T-302A	PM			
SLU-5	X				3	T-302A	PM			
SLU-6	X				3	T-302A	PM			
Diffused Air Grid A-302A	X			Witnessed operation on 1/04/05.	3	T-302A	PM			
6” SS Air Feeder Pipe	X				3	T-302A	PM			
6” Butterfly Air Valve PA –13	X			Valve has been replaced by WWTP staff.	3	T-302A	PM			
6” & 4” PVC Air Distribution Laterals	X				3	T-302A	PM			
Ceramic Diffusers	X			Replaced with membrane diffusers in Contract 26.	3	T-302A	PM			
4” Air Blowoff Assembly	X				3	T-302A	PM			
Preservation/Painting	X				3	T-302A	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Aeration Tank T- 302B					3	T-302B	PM			
30” x 18” HWO Alum. Slide Gates					3	T-302B	PM			
SL-11	X			Gate replaced in Contract 26.	3	T-302B	PM			
SL-12	X			Gate replaced in Contract 26.	3	T-302B	PM			
12" x 12" HWO Alum. Slide Gates					3	T-302B	PM			
SL-14	X			Slide gate stuck. Gate replaced in Contract 26.	3	T-302B	PM			
SL-16	X			Slide gate operable; concrete broken at bottom of gate. Concrete repaired and gate replaced in Contract 26.	3	T-302B	PM			
24" x 24" HWO Alum. Slide Gate					3	T-302B	PM			
SL-18	X			Gate Operator replaced in Contract 26.	3	T-302B	PM			
24" x 24" HWO Downward – Operating Alum. Slide Gate					3	T-302B	PM			
SL-21	X			Gate Operator replaced in Contract 26.	3	T-302B	PM			
SL-22	X			Gate Operator replaced in Contract 26.	3	T-302B	PM			
24” Sq. HWO Sluice Gates					3	T-302B	PM			
SLU-7	X				3	T-302B	PM			
SLU-8	X				3	T-302B	PM			
Diffused Air Grid A-302B	X			Not in operation on 1/04/05.	3	T-302B	PM			
6” SS Air Feeder Pipe	X				3	T-302B	PM			
6” Butterfly Air Valve PA –16	X			Valve has been replaced by WWTP staff.	3	T-302B	PM			
6” & 4” PVC Air Distribution Laterals	X			PVC air distribution laterals and header replaced in Contract 26.	3	T-302B	PM			
Ceramic Diffusers	X			Replaced with membrane diffusers in Contract 26.	3	T-302B	PM			
4” Air Blowoff Assembly	X				3	T-302B	PM			
Preservation/Painting	X				3	T-302B	PM			
Aeration Tank T- 303A					3	T-303A	PM			
Stop Gates & Slots (Type “E”)					3	T-303A	PM			
STP-18	X			Replaced in Contract 26.	3	T-303A	PM			
24” x 24” HWO Alum. Downward – Operating Slide Gates					3	T-303A	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
SL-23			X	Gate is inoperable and needs to be replaced. Top of slide on weir gate is severely corroded.	3	T-303A	PM			
SL-24			X	Gate is inoperable and needs to be replaced. Top of slide on weir gate is severely corroded.	3	T-303A	PM			
12" x 12" HWO Alum. Slide Gate					3	T-303A	PM			
SL-27		X		Slide gate appears to be operable. Gate replaced in Contract 26.	3	T-303A	PM			
SL-29		X		Slide gate stuck but appears operable. Gate replaced in Contract 26.	3	T-303A	PM			
Diffused Air Grid A-303A	X			Witnessed operation on 1/04/05.	3	T-303A	PM			
6” SS Air Feeder Pipe	X				3	T-303A	PM			
6” Butterfly Air Valve PA –12	X			Valve has been replaced by WWTP staff.	3	T-303A	PM			
6” & 4” PVC Air Distribution Laterals	X				3	T-303A	PM			
Ceramic Diffusers		[X]		Replaced with membrane diffusers in Contract 26.	3	T-303A	PM			
4” Air Blowoff Assembly	X				3	T-303A	PM			
Preservation/Painting	X				3	T-303A	PM			
Aeration Tank T- 303B					3	T-303B	PM			
Stop Gates & Slots (Type “E”)					3	T-303B	PM			
STP-19	X			Replaced in Contract 26.	3	T-303B	PM			
24” x 24” HWO Alum. Downward – Operating Slide Gates					3	T-303B	PM			
SL-25	X			Gate Operator replaced in Contract 26.	3	T-303B	PM			
SL-26	X			Gate Operator replaced in Contract 26.	3	T-303B	PM			
12" x 12" HWO Alum Slide Gates					3	T-303B	PM			
SL-28		X		Slide gate stuck but appears operable. Replaced in Contract 26.	3	T-303B	PM			
SL-30		X		Slide gate stuck but appears operable. Replaced in Contract 26.	3	T-303B	PM			
Diffused Air Grid A-303B	X			Not in operation on 1/04/05.	3	T-303B	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
6” SS Air Feeder Pipe	X				3	T-303B	PM			
6” Butterfly Air Valve PA –15	X			Valve has been replaced by WWTP staff.	3	T-303B	PM			
6” & 4” PVC Air Distribution Laterals	X			PVC air distribution laterals and header replaced in Contract 26.	3	T-303B	PM			
Ceramic Diffusers		[X]		Replaced with membrane diffusers in Contract 26.	3	T-303B	PM			
4” Air Blowoff Assembly	X				3	T-303B	PM			
Preservation/Painting	X				3	T-303B	PM			
Aeration Tank Center Channel				Date of Inspection: 1/04/05.	3	AT Center Channel	PM			
Aluminum Stop Gates & Slots (Type “H”)					3	AT Center Channel	PM			
STP-14			[X]	Replaced under Contract 26.	3	AT Center Channel	PM			
STP-15			[X]	“ “ “ “	3	AT Center Channel	PM			
STP-16			[X]	“ “ “ “	3	AT Center Channel	PM			
STP-17			[X]	“ “ “ “	3	AT Center Channel	PM			
STP-20			[X]	“ “ “ “	3	AT Center Channel	PM			
STP-21			[X]	“ “ “ “	3	AT Center Channel	PM			
STP-22			[X]	“ “ “ “	3	AT Center Channel	PM			
STP-23			[X]	“ “ “ “	3	AT Center Channel	PM			
Preservation/Painting	X				3	AT Center Channel	PM			
Aeration Tank Effluent Channel				Date of Inspection: 1/04/05.	3	AT Effluent Channel	PM			
Fixed Aluminum Effluent Weirs		X		Aluminum weirs are pitted.	3	AT Effluent Channel	PM			
Aluminum Stop Gates & Slots		[X]		[marginal overall]	3	AT Effluent Channel	PM			
STP-24			[X]	Stop gate in place. [unsatisfactory – replace stop gate & guide]	3	AT Effluent Channel	PM	$3,800	$3,800	
STP-25			[X]	Stop gate removed. [unsatisfactory – replace stop gate & guide]	3	AT Effluent Channel	PM	$3,800	$3,800	
STP-26			[X]	Stop gate removed. [unsatisfactory – replace stop gate & guide]	3	AT Effluent Channel	PM	$3,800	$3,800	
STP-27			[X]	Stop gate removed. [unsatisfactory – replace stop gate & guide]	3	AT Effluent Channel	PM	$3,800	$3,800	
Preservation/Painting					3	AT Effluent Channel	PM			
Aeration Tank Effluent Distribution Chamber				Date of Inspection: 1/04/05. Safety chains are rusting – need replacement.	3	AT Eff. Dist. Channel	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Effluent Distribution Weir Plate "A" (1'-9" Wide Aluminum)					3	AT Eff. Dist. Channel	PM			
East Side	X				3	AT Eff. Dist. Channel	PM			
West Side	X				3	AT Eff. Dist. Channel	PM			
Effluent Distribution Weir Plate "B" (4'-0" Wide Aluminum)					3	AT Eff. Dist. Channel	PM			
East Side	X				3	AT Eff. Dist. Channel	PM			
West Side	X				3	AT Eff. Dist. Channel	PM			
Aluminum Stop Gates & Slot (Type "F")					3	AT Eff. Dist. Channel	PM			
STP-33	X			Stop gate in place.	3	AT Eff. Dist. Channel	PM	$3,800	$3,800	
STP-34	X			Stop gate retrofitted with HWO.	3	AT Eff. Dist. Channel	PM	$3,800	$3,800	
Aluminum Stop Gates & Slots (Type "G")					3	AT Eff. Dist. Channel	PM			
STP-28			[X]	Stop gate removed. [unsatisfactory – replace stop gate & guide]	3	AT Eff. Dist. Channel	PM	$4,000	$4,000	
STP-29			[X]	Stop gate removed. [unsatisfactory – replace stop gate & guide]	3	AT Eff. Dist. Channel	PM	$4,000	$4,000	
STP-30	X			Stop gate was replaced with a manually operated slide gate under Contract 26.	3	AT Eff. Dist. Channel	PM			
STP-31	X			Stop gate was replaced with a manually operated slide gate under Contract 26.	3	AT Eff. Dist. Channel	PM			
STP-32			[X]	Stop gate removed. [unsatisfactory – replace stop gate & guide]	3	AT Eff. Dist. Channel	PM	$4,000	$4,000	
20" DI Aeration Effluent/Influent to FST T-331	X				3	AT Eff. Dist. Channel	PM			
20" DI Aeration Effluent/Influent to FST T-332	X				3	AT Eff. Dist. Channel	PM			
24" DI Aeration Effluent/Influent to FST T-333	X				3	AT Eff. Dist. Channel	PM			
24" DI Aeration Effluent/Influent to FST T-334	X				3	AT Eff. Dist. Channel	PM			
Preservation/Painting	X				3	AT Eff. Dist. Channel	PM			
Aeration Tank Drain System (Yard Piping)				Date of Inspection: 1/04/05.	3	AT Drain System	PM			
8" DI Tank Drain Header Pipe	X				3	AT Drain System	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
8" Tank Drain Valves	[X]			Condition and operation to be confirmed by WWTP staff. [satisfactory]	3	AT Drain System	PM			
TD-3 (From AT-301A)	X			Inspect.	3	AT Drain System	PM			
TD-14 (From AT-301B)	X			Inspect.	3	AT Drain System	PM			
TD-4 (From AT-302A)	X			Inspect.	3	AT Drain System	PM			
TD-13 (From AT-302B)	X			Inspect.	3	AT Drain System	PM			
TD-5 (From AT-303A)	X			Inspect.	3	AT Drain System	PM			
TD-12 (From AT-303B)	X			Inspect.	3	AT Drain System	PM			
8" Tank Drain Valves From Aeration Tank Effluent Distribution Chamber					3	AT Drain System	PM			
TD-6	X				3	AT Drain System	PM			
TD-7			{X}	Valve operator/post indicator tipped. {Per Town, not operable.} Not used.	3	AT Drain System	PM	$8,800	$8,800	
TD-8			{X}	{Per Town, not operable.} Not used.	3	AT Drain System	PM	$8,800	$8,800	
TD-9			{X}	{Per Town, not operable.} Not used.	3	AT Drain System	PM	$8,800	$8,800	
TD-10			{X}	{Per Town, not operable.} Not used.	3	AT Drain System	PM	$8,800	$8,800	
TD-11	X				3	AT Drain System	PM			
8" Clean Out Valves					3	AT Drain System	PM			
CO-1	X				3	AT Drain System	PM			
CO-2			{X}	{Per Town, not operable.} Not used.	3	AT Drain System	PM	$23,700	$23,700	
CO-3			{X}	{Per Town, not operable.} Not used.	3	AT Drain System	PM	$23,700	$23,700	
CO-4			{X}	{Per Town, not operable.} Not used.	3	AT Drain System	PM	$23,700	$23,700	
CO-5			{X}	{Per Town, not operable.} Not used.	3	AT Drain System	PM	$23,700	$23,700	
CO-6	X				3	AT Drain System	PM			
BLOWER BUILDING					3		PM			
Basement – Blower Room (3/002)				Date of Inspection: 12/28/04; 1/04/05.	3	Rm 002	PM			
Air Blower System	X			Overall condition and performance is satisfactory.	3	Rm 002	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
2'-8" x 4'-0" Air Intake Fixed Louver	X				3	Rm 002	PM			
48" x 30" Insulated Air Intake Duct	X				3	Rm 002	PM			
Electrostatic Type Air Filter Units (Includes Pre-filter & Secondary Filter)	X				3	Rm 002	PM			
Air Filter Unit A-311		X		[Replace filter plate assembly.]	3	Rm 002	PM			X
Drive Motor M-311	X				3	Rm 002	PM			
Pre-Filter	X				3	Rm 002	PM			
Secondary Filter	X			Ionization units replaced. [new power packs required]	3	Rm 002	PM			
12" Filter Isolation Butterfly Valve PA-1	X				3	Rm 002	PM			
Air Filter Unit A-312		X		[Replace filter plate assembly.]	3	Rm 002	PM			
Drive Motor M-312	X				3	Rm 002	PM			X
Pre-Filter	X				3	Rm 002	PM			
Secondary Filter	X			Ionization units replaced. [new power pack required]	3	Rm 002	PM			
12" Filter Isolation Butterfly Valve PA-2	X				3	Rm 002	PM			
12" SS Filtered Air Supply Header	X				3	Rm 002	PM			
8" SS Blower Suction Pipes	X				3	Rm 002	PM			
Air Blower Units (PD Rotary-Lobe Type)	X			Overall condition and performance is satisfactory.	3	Rm 002	PM			
Biological Blower B-301 (Variable Speed)	X			Overall condition and performance satisfactory.	3	Rm 002	PM			
Casing	X				3	Rm 002	PM			
Motor M-301 (60 HP VS)		X		Motor recently rebuilt in 2003. DC motor susceptible to carbonization caused from atomized blower lube oil.	3	Rm 002	PM			X
SCR DC Speed Controller	X			DC drive experiences circuit board problems – WWTP staff request replacement with VFDs with AC bypass. [Unsatisfactory – Replaced recently in 2007 with AC Tech VFD/Westinghouse motor under Nstar rebate; okay now.]	3	Rm 002	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
8” Suction Valve PA-3	X			Oil droplets visible on valve.	3	Rm 002	PM			
10”x8”x8” Conc. Reduced Expansion Joint	X				3	Rm 002	PM			
Inlet Silencer	X				3	Rm 002	PM			
8” Spring-Loaded Vacuum Relief Valve	X				3	Rm 002	PM			
8”x6”x8” Conc. Reduced Expansion Joint	X				3	Rm 002	PM			
Outlet Silencer	X				3	Rm 002	PM			
6” Spring-Loaded Pressure Relief Valve	X				3	Rm 002	PM			
8” Discharge Check Valve CK-24	X				3	Rm 002	PM			
8” Discharge Valve PA-4	X				3	Rm 002	PM			
6” M.O. Unloading Valve V-321	X				3	Rm 002	PM			
Lubrication System	X			Visible oil at breather cap.	3	Rm 002	PM			
Oil Cooler Heat Exchanger		X		Exchanger not working properly: oil vaporization/atomization still occurring - oil/visible on blower, valves and piping.	3	Rm 002	PM			X
Manometer/Pressure Gauges	X			Pressure reading: 7.75 psi.	3	Rm 002	PM			
Blower Inertia Pad w/ Vibration Adsorbers	X				3	Rm 002	PM			
Preservation/Painting	X				3	Rm 002	PM			
Biological Blower B-302 (Variable Speed)	X			Overall condition and performance satisfactory.	3	Rm 002	PM			
Casing	X				3	Rm 002	PM			
Motor M-302 (60 HP VS)		X		Motor recently rebuilt in 2003 – DC motor susceptible to carbonization caused from atomized blower lube oil.	3	Rm 002	PM			X
SCR DC Speed Controller	X			DC drive experiences circuit board problems – WWTP staff request replacement with VFD with AC bypass. [Unsatisfactory – Replaced recently in 2007 with AC Tech VFD/Westinghouse motor under Nstar rebate; okay now. Eliminated oil DC drive problem.]	3	Rm 002	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
8” Suction Valve PA-5	X				3	Rm 002	PM			
10”x8”x8” Conc. Reduced Expansion Joint	X				3	Rm 002	PM			
Inlet Silencer	X				3	Rm 002	PM			
8” Spring-Loaded Vacuum Relief Valve	X				3	Rm 002	PM			
8”x6”x8” Conc. Reduced Expansion Joint	X				3	Rm 002	PM			
Outlet Silencer	X				3	Rm 002	PM			
6” Spring-Loaded Pressure Relief Valve	X				3	Rm 002	PM			
8” Discharge Check Valve CK-25	X				3	Rm 002	PM			
8” Discharge Valve PA-6	X				3	Rm 002	PM			
6” M.O. Unloading Valve V-322	X				3	Rm 002	PM			
Lubrication System	X			Recently replaced oil pump on blower casing.	3	Rm 002	PM			
Oil Cooler Heat Exchanger		X		Oil vaporization/atomization still occurring – oil visible on blower, valves & piping.	3	Rm 002	PM			X
Manometer/Pressure Gauges	X			Temp. reading: 58°F. Pressure reading: 7.2 psi.	3	Rm 002	PM			
Blower Inertia Pad w/ Vibration Adsorbers	X				3	Rm 002	PM			
Preservation/Painting	X			Some painting touchup required at blower inlet flange.	3	Rm 002	PM			
Biological Blower B-303 (Constant Speed)	X			Overall condition and performance satisfactory; witnessed blower in operation.	3	Rm 002	PM			
Casing	X				3	Rm 002	PM			
Motor M-303 (60 HP CS)	X				3	Rm 002	PM			
SCR DC Speed Controller				None – constant speed.	3	Rm 002	PM			
8” Suction Valve PA-7	X				3	Rm 002	PM			
10”x8”x8” Conc. Reduced Expansion Joint	X				3	Rm 002	PM			
Inlet Silencer	X				3	Rm 002	PM			
8” Spring-Loaded Vacuum Relief Valve	X				3	Rm 002	PM			
8”x6”x8” Conc. Reduced Expansion Joint	X				3	Rm 002	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Outlet Silencer	X				3	Rm 002	PM			
6” Spring-Loaded Pressure Relief Valve	X				3	Rm 002	PM			
8” Discharge Check Valve CK-26	X				3	Rm 002	PM			
8” Discharge Valve PA-8	X				3	Rm 002	PM			
6” M.O. Unloading Valve V-323	X				3	Rm 002	PM			
Lubrication System	X			Recently replaced oil pump on blower casing; visible oil at breather cap and on oil cooler system.	3	Rm 002	PM			
Oil Cooler Heat Exchanger		X			3	Rm 002	PM			X
Manometer/Pressure Gauges	X			Temp. reading: 92°F. Pressure reading: 7.2 psi.	3	Rm 002	PM			
Blower Inertia Pad w/ Vibration Adsorbers	X				3	Rm 002	PM			
Preservation/Painting	X				3	Rm 002	PM			
8” SS & 10” SS Filtered Air Discharge Header	X				3	Rm 002	PM			
6” SS Air Distribution to Aeration Tanks T-301A & T-301B	X				3	Rm 002	PM			
6” Isolation Butterfly Valve PA-11	X				3	Rm 002	PM			
Air Flow Tube F-301	X			Air Flow Reading: 307 scfm.	3	Rm 002	PM			
6” SS Air Distribution to Aeration Tanks T-302A & T-302B	X				3	Rm 002	PM			
6” Isolation Butterfly Valve PA-10	X				3	Rm 002	PM			
Air Flow Tube F-302	X			Air Flow Reading: 440 scfm.	3	Rm 002	PM			
6” SS Air Distribution to Aeration Tanks T-303A & T-303B	X				3	Rm 002	PM			
6” Isolation Butterfly Valve PA-9	X				3	Rm 002	PM			
Air Flow Tube F-303	X			Air Flow Reading: 220 scfm. (Note: Total Air Flow = 967 CFM; Capacity of Blower B-303 is 1060 SCFM).	3	Rm 002	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
3-Ton Capacity Bridge Crane H-381	X				3	Rm 002	PM			
Crane Rails	X				3	Rm 002	PM			
3 Ton Plain Type Trolley	X				3	Rm 002	PM			
Chain & Hook	X				3	Rm 002	PM			
Preservation/Painting	X				3	Rm 002	PM			
FINAL SETTLING TANKS				Date of Inspection: 12/21/05; 1/04/05. Tank not used.	3		PM			
Final Settling Tank T- 331 (45' Dia.)	X			Overall condition and performance satisfactory. Tank & mechanisms infrequently used due to difficulty in balancing flow rates.	3	T-331	PM			
Rotating Influent Baffle		X		Bottom of baffle has visible rusting – needs repainting.	3	T-331	PM			
Rotating Sludge Well	X				3	T-331	PM			
Drive Motor Unit M-331 (1 HP)		X		Micro switches for high torque don't release properly (rods & switches corroded from moisture – replaced seals).	3	T-331	PM			
Speed Gear Reducer	X				3	T-331	PM			
Torque Cage	X				3	T-331	PM			
Sludge Collector Truss Arm w/ Scraper Blades & Squeegees	X				3	T-331	PM			
PVC RAS Suction Pipes	X				3	T-331	PM			
Submerged Orifice Valves	X				3	T-331	PM			
Scum Skimming Arm & Blade	X				3	T-331	PM			
Scum Trough	X				3	T-331	PM			
Aluminum Scum Baffle	X				3	T-331	PM			
Aluminum V-Notch Weir	X				3	T-331	PM			
20" CI Influent Pipe	X				3	T-331	PM			
20" CI Effluent Pipe	X				3	T-331	PM			
10" CI RAS Drawoff Pipe	X				3	T-331	PM			
6" CI Sludge Drawoff Pipe	X				3	T-331	PM			
6" CI/DI Secondary Scum Drawoff Pipe	X				3	T-331	PM			
Preservation/Painting		X		Influent well baffle needs repainting; some rusting of walkway supports.	3	T-331	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Final Settling Tank T- 332 (45' Dia.)	X			Overall condition and performance satisfactory. Tank & mechanisms infrequently used due to difficulty in balancing flow rates. {Pavement damage around tank about 20 ft.} Tank not used.	3	T-332	PM			
Rotating Influent Baffle		X		Bottom of baffle has visible rusting – needs repainting.	3	T-332	PM			
Rotating Sludge Well	X				3	T-332	PM			
Drive Motor Unit M-332 (1 HP)		X		Micro switches for high torque don't release properly (rods & switches corroded from moisture-replaced seals.)	3	T-332	PM			
Speed Gear Reducer	X				3	T-332	PM			
Torque Cage	X				3	T-332	PM			
Sludge Collector Truss Arm w/ Scraper Blades & Squeegees	X				3	T-332	PM			
PVC RAS Suction Pipes	X				3	T-332	PM			
Submerged Orifice Valves	X				3	T-332	PM			
Scum Skimming Arm & Blade	X				3	T-332	PM			
Scum Trough	X				3	T-332	PM			
Aluminum Scum Baffle	X				3	T-332	PM			
Aluminum V-Notch Weir	X				3	T-332	PM			
20" CI Influent Pipe	X				3	T-332	PM			
20" CI Effluent Pipe	X				3	T-332	PM			
10" CI RAS Drawoff Pipe	X				3	T-332	PM			
6" CI Sludge Drawoff Pipe	X				3	T-332	PM			
6" CI/DI Secondary Scum Drawoff Pipe	X				3	T-332	PM			
Preservation/Painting		X		Influent Well baffle needs repainting; some rusting of walkway supports.	3	T-332	PM			
Final Settling Tank T- 333 (75' Dia.)	X			Overall condition and performance satisfactory.	3	T-333	PM			
Rotating Influent Baffle	X				3	T-333	PM			
Rotating Sludge Well	X				3	T-333	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Drive Motor Unit M-333 (1 HP)		X		Micro switches for high torque don't release properly (rods & switches corroded from moisture-replaced seals).	3	T-333	PM			
Speed Gear Reducer		[X]		[marginal – replaced gear seals – leaking oil]	3	T-333	PM			
Torque Gage		[X]		[marginal - can't read]	3	T-333	PM			
Sludge Collector Truss Arm w/ Scraper Blades & Squeegees	X			[WWTP staff have replaced broken collector squeegees]	3	T-333	PM			
PVC RAS Suction Pipes	X				3	T-333	PM			
Submerged Orifice Valves	X				3	T-333	PM			
Scum Skimming Arm & Blade	X				3	T-333	PM			
Scum Trough	X				3	T-333	PM			
Aluminum Scum Baffle	X				3	T-333	PM			
Aluminum V-Notch Weir	X				3	T-333	PM			
Algae Sweep Mechanism	X			Recently installed during UV upgrade during 2003/2004.	3	T-333	PM			
24" DI Influent Pipe	X				3	T-333	PM			
24" DI Effluent Pipe	X				3	T-333	PM			
10" DI RAS Drawoff Pipe	X				3	T-333	PM			
10" RAS Drawoff Valve RS-1			X	Not operable.	3	T-333	PM	$23,700	$23,700	
10" DI Sludge Drawoff Pipe	X				3	T-333	PM			
10" Sludge Draw Valve SD-3			X	Not operable.	3	T-333	PM	$23,700	$23,700	
6" DI Secondary Scum Drawoff Pipe	X				3	T-333	PM			
Preservation/Painting	X			Some rusting of walkway support members visible.	3	T-333	PM			
Final Settling Tank T- 334 (75' Dia.)	X			Overall condition and performance satisfactory.	3	T-334	PM			
Rotating Influent Baffle	X				3	T-334	PM			
Rotating Sludge Well	X				3	T-334	PM			
Drive Motor Unit M-334 (1 HP)		X		Micro switches for high torque don't release properly (rods & switches corroded from moisture – replaced seals).	3	T-334	PM			
Speed Gear Reducer		[X]		[WWTF staff worked on reducer – leaking hydraulic seal]	3	T-334	PM			
Torque Cage	X				3	T-334	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Sludge Collector Truss Arm w/ Scraper Blades & Squeegees		[X]		[marginal – broken blades & squeegees at end of arm]	3	T-334	PM	$8,300	$8,300	
PVC RAS Suction Pipes	X				3	T-334	PM			
Submerged Orifice Valves	X				3	T-334	PM			
Scum Skimming Arm & Blade	X				3	T-334	PM			
Scum Trough	X				3	T-334	PM			
Aluminum Scum Baffle	X				3	T-334	PM			
Aluminum V-Notch Weir	X				3	T-334	PM			
Algae Sweep Mechanism	X			Recently installed during UV upgrade during 2003/2004.	3	T-334	PM			
24” DI Influent Pipe	X				3	T-334	PM			
24” DI Effluent Pipe	X				3	T-334	PM			
10” DI RAS Drawoff Pipe	X				3	T-334	PM			
10” RAS Drawoff Valve RS-2			X	Replace	3	T-334	PM	$23,700	$23,700	
10” DI Sludge Drawoff Pipe	X				3	T-334	PM			
10” Sludge Drawoff Valve SD-4			X	Replace	3	T-334	PM	$23,700	$23,700	
6” DI Secondary Scum Drawoff Pipe	X				3	T-334	PM			
Preservation/Painting	X			Some rusting of walkway support members visible.	3	T-334	PM			
Secondary Scum Well T-335	X			Overall condition and performance satisfactory.	3	T-335	PM			
6” DI Scum Pipe from FST T-331	X				3	T-335	PM			
6” DI Scum Pipe from FST T-332	X				3	T-335	PM			
6” DI Scum Pipe from FST T-333	X				3	T-335	PM			
6” DI Scum Pipe from FST T-334	X				3	T-335	PM			
6” DI Scum Drawoff to Secondary Scum Pumps Located in 10 Sludge Handling Bldg.	X				3	T-335	PM			
BLOWER BUILDING					3		HV			
First Floor – Operating Platform A (3/101)					3	Rm 101	HV			
Unit Heater UH-2 (East Side) w/ Thermostat	X				3	Rm 101	HV			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Exhaust Fan EF-1 w/ Auto Damper & 12” x 6” Duct to Pump Room Ceiling	X				3	Rm 101	HV			
Exhaust Fan EF-2 on Roof (Interconnected w/ AMU-2)	X				3	Rm 101	HV			
Preservation/Painting	X				3	Rm 101	HV			
First Floor - Electrical Control Room (3/102)					3	Rm 102	HV			
Unit Heater UH-3 w/ Thermostat	X				3	Rm 102	HV			
Combination Louver L-4 (12”x24” Fixed w/ M.O. Damper; Intlk w/ EF-4)	X				3	Rm 102	HV			
Exhaust Fan EF-4 w/ R.A. Thermostat	X				3	Rm 102	HV			
AMU-1 Located on Roof w/ Prefab Curb (Nat. Gas Fired)			X	AMU-1 has not worked in years (reason is un-known). {rusted} Inspect.	3	Rm 102	HV	$9,300	$9,300	
18”x20” Duct w/ 1” Insulation	X				3	Rm 102	HV			
Preservation/Painting	X				3	Rm 102	HV			
First Floor – Operating Platform B (Storage Platform) (3/103)					3	Rm 103	HV			
Unit Heater UH-2 (West Side) w/ Thermostat	X				3	Rm 103	HV			
Combination Louver L-1 (72”x32” Fixed w/ M.O. Damper)	X				3	Rm 103	HV			
18”x84” Plenum w/ Access Door	X				3	Rm 103	HV			
AMU-2 Located on Platform w/ Vibration Isolator Mounts (Hot Water Coil Type)	X			Hot water heating coil was replaced, after it split when the circulator motor was on order.	3	Rm 103	HV			
20”x12” Duct w/ Manually Adjustable Diffusers w/ Dampers	X				3	Rm 103	HV			
Two 16”x16” Fixed Louvers L-2 for Boiler	X				3	Rm 103	HV			
Temperature Control Box for Boiler	X				3	Rm 103	HV			
Temperature Control Sensor w/ Sun Shade for Boiler (Exterior)	X				3	Rm 103	HV			
Preservation/Painting	X				3	Rm 103	HV			
Basement - Pump Room (3/001)					3	Rm 001	HV			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Unit Heater UH-1 w/ Thermostat	X				3	Rm 001	HV			
12”x18” Discharge Register	X				3	Rm 001	HV			
Remote Temperature Control Console for AMU-1	X				3	Rm 001	HV			
Preservation/Painting	X				3	Rm 001	HV			
Basement – Blower Room (3/002)					3	Rm 002	HV			
Combination Fixed/M.O. 24”x24” Louver L-3 (Intlk. w/ EF-3)	X				3	Rm 002	HV			
Exhaust Fan EF-3 on Roof (Intlk w/ L-3))	X				3	Rm 002	HV			
R.A Thermostat for EF-3	X				3	Rm 002	HV			
Preservation/Painting	X				3	Rm 002	HV			
Basement – Boiler Room (3/003)					3	Rm 003	HV			
Unit Heater UH-4 w/ Thermostat	X				3	Rm 003	HV			
Gas Boiler (Hot Water) w/ 8” Metal Flue, Barometric Damper & 15 Gal. Expansion Tank	X			{Had to replace controls and igniter transformer once. Otherwise o.k. does not run much, since heat from the equipment keeps building warm enough.}	3	Rm 003	HV			
Circulator Pump C-1 (Inline 1/12 hp)	X				3	Rm 003	HV			
Circulator Pump C-2 (Inline ½ hp)	X			{Little rust. Sealant was replaced few times.}	3	Rm 003	HV			
Fixed 16”x16” Louver L-2	X				3	Rm 003	HV			
Preservation/Painting	X				3	Rm 003	HV			
BLOWER BUILDING					3		P			
First Floor – Operating Platform A (3/101)					3	Rm 101	P			
¾” to 1-1/2” Heating Supply & Return Piping (w/ Insulation)	X				3	Rm 101	P			
3” Roof Drain Piping	X				3	Rm 101	P			
2” & ¾” Plant Water Piping w/ Valved Feed to Equipment	X				3	Rm 101	P			
¾” Hose Bibbs	X				3	Rm 101	P			
Fire Extinguisher	X				3	Rm 101	P			
Preservation/Painting	X				3	Rm 101	P			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
First Floor - Electrical Control Room (3/102)					3	Rm 102	P			
¾" to 1-1/2" Heating Supply & Return Piping (w/ Insulation)	X				3	Rm 102	P			
½" Gas Up to AMU-1	X				3	Rm 102	P			
Fire Extinguisher	X				3	Rm 102	P			
Preservation/Painting	X				3	Rm 102	P			
First Floor – Operating Platform B (Storage Platform) (3/103)					3	Rm 103	P			
¾" to 1-1/2" Heating Supply & Return Piping (w/ Insulation)	X				3	Rm 103	P			
4" Roof Drain	X				3	Rm 103	P			
3" Vents Thru Roof	X				3	Rm 103	P			
½" Gas Feed	X				3	Rm 103	P			
Preservation/Painting	X				3	Rm 103	P			
Basement - Pump Room (3/001)					3	Rm 001	P			
¾" to 1-1/2" Heating Supply & Return Piping (w/ Insulation)	X				3	Rm 001	P			
1" Pump Drains	X				3	Rm 001	P			
2" & ¾" Plant Water Piping w/ Valves	X				3	Rm 001	P			
¾" Hose Bibb	X				3	Rm 001	P			
Fire Extinguisher	X				3	Rm 001	P			
Preservation/Painting	X				3	Rm 001	P			
Basement – Blower Room (3/002)					3	Rm 002	P			
¾" to 1-1/2" Heating Supply & Return Piping (w/ Insulation)	X				3	Rm 002	P			
3" Floor Drains	X			Grate is rusted	3	Rm 002	P			
3" Roof Drains & 4" Roof Drain Piping	X				3	Rm 002	P			
6" Storm Drain to DMH Outside Bldg. (w/ 10" Sleeve & Mechanical Seal)	X				3	Rm 002	P			
½" Gas Piping	X				3	Rm 002	P			
¾" City Water Pipe & ¾" Hose Bibbs	X				3	Rm 002	P			
Fire Extinguisher	X				3	Rm 002	P			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Preservation/Painting	X				3	Rm 002	P			
Basement – Boiler Room (3/003)					3	Rm 003	P			
1" City Water Feed Pipe	X				3	Rm 003	P			
1" Water Meter	X				3	Rm 003	P			
1" Reduced Pressure Backflow Preventer	X				3	Rm 003	P			
1" Natural Gas From Gas Meter (Located Outside Building)	X				3	Rm 003	P			
¾" to 1-1/2" Heating Supply & Return Piping (w/ Insulation)	X				3	Rm 003	P			
3" Floor Drain	X				3	Rm 003	P			
¾" Gas Vent	X				3	Rm 003	P			
Fire Extinguisher	X				3	Rm 003	P			
Preservation/Painting	X				3	Rm 003	P			
AERATION TANKS					3		E/I			
Aeration Tank T-301A					3	T-301A	E/I			
Conduits & Wiring	X				3	T-301A	E/I			
Pull Boxes					3	T-301A	E/I			
WP Receptacles	X				3	T-301A	E/I			
DO Probe AE-301A			X	No DO Probe. Probe was moved to Tank T-301B in Contract 26.	3	T-301A	E/I	$2,300	$2,300	
DO Transmitter AIT-301A			X	No DO Transmitter; moved to Tank T-301B in Contract 26.	3	T-301A	E/I	$1,600	$1,600	
Preservation/Painting				N/A	3	T-301A	E/I			
Aeration Tank T-301B					3	T-301B	E/I			
Conduits & Wiring	X				3	T-301B	E/I			
Pull Boxes					3	T-301B	E/I			
WP Receptacles	X				3	T-301B	E/I			
DO Probe AE-301B		X		DO works; moved here from T-301A in Contract 26. Conduit and wiring replaced.	3	T-301B	E/I	$2,300	$2,300	
DO Transmitter AIT-301B		X		DO transmitter works; moved here from T-301A in Contract 26. conduit and wiring replaced.	3	T-301B	E/I	$1,600	$1,600	
Preservation/Painting				N/A	3	T-301B	E/I			
Aeration Tank T-302A					3	T-302A	E/I			
Conduits & Wiring	X				3	T-302A	E/I			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Pull Boxes					3	T-302A	E/I			
WP Receptacles	X				3	T-302A	E/I			
DO Probe AE-302A			X	No DO Probe. Probe was moved to Tank T-302B in Contract 26.	3	T-302A	E/I	$2,300	$2,300	
DO Transmitter AIT-302A			X	No DO Transmitter; moved to Tank T-302B in Contract 26.	3	T-302A	E/I	$1,600	$1,600	
Preservation/Painting				N/A	3	T-302A	E/I			
Aeration Tank T-302B					3	T-302B	E/I			
Conduits & Wiring	X				3	T-302B	E/I			
Pull Boxes					3	T-302B	E/I			
WP Receptacles	X				3	T-302B	E/I			
DO Probe AE-302B		X		DO works; moved here from T-302A in Contract 26. Conduit and wiring replaced.	3	T-302B	E/I	$2,300	$2,300	
DO Transmitter AIT-302B		X		DO transmitter works; moved here from T-302A in Contract 26. Conduit and wiring replaced.	3	T-302B	E/I	$1,600	$1,600	
Preservation/Painting				N/A	3	T-302B	E/I			
Aeration Tank T-303A					3	T-303A	E/I			
Conduits & Wiring	X				3	T-303A	E/I			
Pull Boxes					3	T-303A	E/I			
WP Receptacles	X				3	T-303A	E/I			
DO Probe AE-303A			X	No DO Probe. Probe was moved to Tank T-303B in Contract 26.	3	T-303A	E/I	$2,300	$2,300	
DO Transmitter AIT-303A			X	No DO Transmitter; moved to Tank T-303B in Contract 26.	3	T-303A	E/I	$1,600	$1,600	
Preservation/Painting				N/A	3	T-303A	E/I			
Aeration Tank T-303B					3	T-303B	E/I			
Conduits & Wiring	X				3	T-303B	E/I			
Pull Boxes					3	T-303B	E/I			
WP Receptacles	X				3	T-303B	E/I			
DO Probe AE-303B		X		DO works; moved here from T-303A in Contract 26. Conduit and wiring replaced.	3	T-303B	E/I	$2,300	$2,300	

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
DO Transmitter AIT-303B		X		DO transmitter works; moved here from T-303A in Contract 26. Conduit and wiring replaced.	3	T-303B	E/I	$1,600	$1,600	
Preservation/Painting				N/A	3	T-303B	E/I			
BLOWER BUILDING					3		E/I			
First Floor – Operating Platform A (3/101)					3	Rm 101	E/I			
Conduits & Wiring	X				3	Rm 101	E/I			
Unit Heater UH-2 Motor/Wiring	X				3	Rm 101	E/I			
Receptacles (Interior & Exterior)	X				3	Rm 101	E/I			
Lighting Fixtures/Switches	X				3	Rm 101	E/I			
Exterior Lighting Fixtures/Switches	X				3	Rm 101	E/I			
Handset/Speaker	X				3	Rm 101	E/I			
Preservation/Painting				N/A	3	Rm 101	E/I			
First Floor - Electrical Room (3/102)					3	Rm 102	E/I			
Conduits & Wiring	X				3	Rm 102	E/I			
Receptacles	X				3	Rm 102	E/I			
MCC No.5 (277/480V, 30A, 4W)	X			Primary sludge pump timers - disconnected (Ray) [new indicator lights/sockets to be installed by Town]	3	Rm 102	E/I			
Auto Transfer Switch	X				3	Rm 102	E/I			
15KVA Transformer	X				3	Rm 102	E/I			
Receptacle Panel RP5	X				3	Rm 102	E/I			
Lighting Panel L4	X				3	Rm 102	E/I			
Wiring to AMU-1 on Roof			[X]	AMU-1 not working – check wiring? [unsatisfactory – corroded]	3	Rm 102	E/I	$1,000	$1,000	
Gas Supply & Gas Drain Solenoid Valves			[X]	AMU-1 not working – check wiring? [unsatisfactory – corroded]	3	Rm 102	E/I	$1,200	$1,200	
Unit Heater UH-3 Motor/Wiring	X				3	Rm 102	E/I			
Lighting Fixtures/Switches	X				3	Rm 102	E/I			
Handset/Speaker	X				3	Rm 102	E/I			
Instrumentation Panel IP-05	X				3	Rm 102	E/I			
Preservation/Painting				N/A	3	Rm 102	E/I			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
First Floor – Operating Platform B (Storage Platform) (3/103)					3	Rm 103	E/I			
Conduits & Wiring	X				3	Rm 103	E/I			
Receptacles	X				3	Rm 103	E/I			
Unit Heater UH-2 Motor/Wiring	X				3	Rm 103	E/I			
AMU-2 Motor (3 HP)/Wiring	X				3	Rm 103	E/I			
Discharge air Thermostat	X				3	Rm 103	E/I			
Freezstat					3	Rm 103	E/I			
3-Way Hot Water Valve					3	Rm 103	E/I			
Louver L-1 Damper Motor/Wiring	X				3	Rm 103	E/I			
Lighting Fixtures/Switches (Interior & Exterior)	X				3	Rm 103	E/I			
Handset/Speaker				None observed	3	Rm 103	E/I			
Preservation/Painting				N/A	3	Rm 103	E/I			
Basement - Pump Room (3/001)					3	Rm 001	E/I			
Conduits & Wiring	X				3	Rm 001	E/I			
Pull Boxes	X				3	Rm 001	E/I			
Receptacles	X				3	Rm 001	E/I			
Unit Heater UH-1 Motor/Wiring	X				3	Rm 001	E/I			
AMU-I Remote Control Console	X				3	Rm 001	E/I			
Lighting Fixtures/Switches	X				3	Rm 001	E/I			
Handset/Speaker	X			Speaker only	3	Rm 001	E/I			
Preservation/Painting				N/A	3	Rm 001	E/I			
Basement – Blower Room (3/002)					3	Rm 002	E/I			
Conduits & Wiring	X				3	Rm 002	E/I			
Receptacles	X				3	Rm 002	E/I			
Air Filters AF-311& AF-312	X				3	Rm 002	E/I			
Motor M-311	X				3	Rm 002	E/I			
Motor M-312	X				3	Rm 002	E/I			
Differential Pressure Switches					3	Rm 002	E/I			
Air Filter Control Panel					3	Rm 002	E/I			
Power Disconnect Switches	X				3	Rm 002	E/I			
Running Timers	X				3	Rm 002	E/I			
Alarm Lights	X				3	Rm 002	E/I			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Biological Blower B-301				[Blower motor and DC drive replaced with new motor & VFD in 2007]	3	Rm 002	E/I			
Motor B-301	X			Motor rebuilt by Ray [see update above]	3	Rm 002	E/I			
Vent Blower Motor (1 HP)	X				3	Rm 002	E/I			
Isolation Transformer	X				3	Rm 002	E/I			
SCR Drive Power Unit				Blower drive not in operation. [see update above]	3	Rm 002	E/I			
AC Line Circuit Breaker				Blower drive not in operation. [see update above]	3	Rm 002	E/I			
SCR Power Module				Blower drive not in operation. [see update above]	3	Rm 002	E/I			
Low Oil Pressure Cutout	X				3	Rm 002	E/I			
Field Economy Circuit				Blower drive not in operation. [see update above]	3	Rm 002	E/I			
Speed Indicator	X				3	Rm 002	E/I			
Motor Load Ammeter	X				3	Rm 002	E/I			
Speed Potentiometer	X				3	Rm 002	E/I			
Start-Stop PB w/ Lockout	X				3	Rm 002	E/I			
Manual-Remote Selector Switch	X				3	Rm 002	E/I			
High Disch. Air Temperature Switch ATS-301	X				3	Rm 002	E/I			
No Oil Flow Switch OPS-301	X				3	Rm 002	E/I			
Tachometer Generator				Blower drive not in operation.	3	Rm 002	E/I			
Biological Blower B-302				[Blower motor and DC drive replaced with new motor & VFD in 2007]	3	Rm 002	E/I			
Motor B-302	X			Motor rebuilt by Ray [see update above]	3	Rm 002	E/I			
Vent Blower Motor (1 HP)				Blower drive not in operation. [see update above]	3	Rm 002	E/I			
Isolation Transformer	X				3	Rm 002	E/I			
SCR Drive Power Unit				Blower drive not in operation. [see update above]	3	Rm 002	E/I			
AC Line Circuit Breaker				Blower drive not in operation. [see update above]	3	Rm 002	E/I			
SCR Power Module				Blower drive not in operation. [see update above]	3	Rm 002	E/I			
Low Oil Pressure Cutout	X				3	Rm 002	E/I			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Field Economy Circuit				Blower drive not in operation. [see update above]	3	Rm 002	E/I			
Speed Indicator	X				3	Rm 002	E/I			
Motor Load Ammeter	X				3	Rm 002	E/I			
Speed Potentiometer	X				3	Rm 002	E/I			
Start-Stop PB w/ Lockout	X				3	Rm 002	E/I			
Manual-Remote Selector Switch	X				3	Rm 002	E/I			
High Disch. Air Temperature Switch ATS-302	X				3	Rm 002	E/I			
No Oil Flow Switch OPS-302	X				3	Rm 002	E/I			
Tachometer Generator				Blower drive not in operation.	3	Rm 002	E/I			
Biological Blower B-303					3	Rm 002	E/I			
Motor B-303	X				3	Rm 002	E/I			
Start-Stop PB w/ Lockout	X				3	Rm 002	E/I			
High Disch. Air Temperature Switch ATS-303	X				3	Rm 002	E/I			
No Oil Flow Switch OPS-303					3	Rm 002	E/I			
Running Status					3	Rm 002	E/I			
High Temperature & Low Oil Pressure Alarms for Blowers to IP-05	X				3	Rm 002	E/I			
Air Unloading Valves	[X]			Did not see operate; per WWTP staff ok. [confirmed]	3	Rm 002	E/I			
Valve V-321/Motor M-321 Wiring & Status	[X]			Did not see operate; per WWTP staff ok. [confirmed]	3	Rm 002	E/I			
Valve V-322/Motor M-322 Wiring & Status	[X]			Did not see operate; per WWTP staff ok. [confirmed]	3	Rm 002	E/I			
Valve V-323/Motor M-323 Wiring & Status	[X]			Did not see operate; per WWTP staff ok. [confirmed]	3	Rm 002	E/I			
Air Flow Tube FE-301					3	Rm 002	E/I			
Flow Indicator FI-301	X				3	Rm 002	E/I			
Flow Transmitter FT-301	X				3	Rm 002	E/I			
Pressure Transmitter FT-301	X				3	Rm 002	E/I			
Air Flow Tube FE-302					3	Rm 002	E/I			
Flow Indicator FI-302	X				3	Rm 002	E/I			
Flow Transmitter FT-302	X				3	Rm 002	E/I			
Pressure Transmitter FT-302	X				3	Rm 002	E/I			
Air Flow Tube FE-303					3	Rm 002	E/I			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Flow Indicator FI-303	X				3	Rm 002	E/I			
Flow Transmitter FT-303	X				3	Rm 002	E/I			
Pressure Transmitter FT-303	X				3	Rm 002	E/I			
Lighting Fixtures/Switches	X			{Consider changing to metal halide lights for energy efficiency and reduction in bulb replacement.}	3	Rm 002	E/I			
Preservation/Painting	X				3	Rm 002	E/I			
Basement – Boiler Room (3/002)					3	Rm 002	E/I			
Conduits & Wiring	X				3	Rm 002	E/I			
Receptacles	X				3	Rm 002	E/I			
Unit Heater UH-4 Motor/Wiring	X				3	Rm 002	E/I			
Boiler Emergency Shutoff Switch	X				3	Rm 002	E/I			
NEMA 12 Circulator Panel	X				3	Rm 002	E/I			
Lighting Fixtures/Switches	X				3	Rm 002	E/I			
Preservation/Painting	X				3	Rm 002	E/I			
FINAL SETTLING TANKS					3		E/I			
Final Settling Tank T- 331 (45' Dia.)					3	T-331	E/I			
Final Settling Tank Drive Motor M-331				Not in operation at time of inspection.	3	T-331	E/I			
Electric Control Panel					3	T-331	E/I			
30A Safety Switch NEMA 4 Encl.)	X				3	T-331	E/I			
Stop-Start PB	X				3	T-331	E/I			
Overload Alarm Bell (NEMA 4 Encl.)		X		Bell functional (per Ray) - corroded	3	T-331	E/I	$275		$275
10A Relay (NEMA 4X Encl.)	X				3	T-331	E/I			
Duplex W.P. Outlet	X				3	T-331	E/I			
Overload Torque Switches		X		Microswitches randomly stick (per Ray)	3	T-331	E/I	$275		$275
Floodlight	X				3	T-331	E/I			
Preservation/Painting				N/A	3	T-331	E/I			
Final Settling Tank T- 332 (45' Dia.)					3	T-332	E/I			
Final Settling Tank Drive Motor M-332				Not in operation at time of inspection.	3	T-332	E/I			
Electric Control Panel					3	T-332	E/I			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
30A Safety Switch NEMA 4 Encl.)	X				3	T-332	E/I			
Stop-Start PB	X				3	T-332	E/I			
Overload Alarm Bell (NEMA 4 Encl.)		X		Bell functional (per Ray) - corroded	3	T-332	E/I	$275		$275
10A Relay (NEMA 4X Encl.)	X				3	T-332	E/I			
Duplex W.P. Outlet	X				3	T-332	E/I			
Overload Torque Switches		X		Microswitches randomly stick (per Ray)	3	T-332	E/I	$275		$275
Floodlight	X				3	T-332	E/I			
Preservation/Painting				N/A	3	T-332	E/I			
Final Settling Tank T- 333 (75' Dia.)					3	T-333	E/I			
Final Settling Tank Drive Motor M-333	X				3	T-333	E/I			
Electric Control Panel					3	T-333	E/I			
30A Safety Switch NEMA 4X Encl.)	X				3	T-333	E/I			
Stop-Start PB	X				3	T-333	E/I			
Overload Alarm Bell (NEMA 4X Encl.)		X		Bell functional (per Ray) – corroded	3	T-333	E/I	$275		$275
10A Relay (NEMA 4X Encl.)	X				3	T-333	E/I			
Duplex W.P. Outlet	X				3	T-333	E/I			
Overload Torque Switches		X		Microswitches randomly stick (per Ray)	3	T-333	E/I	$275		$275
Floodlight	X				3	T-333	E/I			
Preservation/Painting				N/A	3	T-333	E/I			
Final Settling Tank T- 334 (75' Dia.)					3	T-334	E/I			
Final Settling Tank Drive Motor M-334	X				3	T-334	E/I			
Electric Control Panel					3	T-334	E/I			
30A Safety Switch NEMA 4X Encl.)	X				3	T-334	E/I			
Stop-Start PB	X				3	T-334	E/I			
Overload Alarm Bell (NEMA 4X Encl.)		X		Bell functional (per Ray) - corroded	3	T-334	E/I	$275		$275
10A Relay (NEMA 4X Encl.)	X				3	T-334	E/I			
Duplex W.P. Outlet	X				3	T-334	E/I			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	SYSTEM NO.	EQUIPMENT NO. / ROOM #	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U							
Overload Torque Switches		X		Microswitches randomly stick (per Ray)	3	T-334	E/I	$275		$275
Floodlight	X				3	T-334	E/I			
Preservation/Painting				N/A	3	T-334	E/I			
Secondary Scum Well T-335					3	T-335	E/I			
Secondary Scum Pump P-361 (Located in 10 Sludge Handling Bldg.)					3	T-335	E/I			
Stop-Start PB w/ Pilot Light (NEMA 4X)	X				3	T-335	E/I			
Secondary Scum Pump P-362 (Located in 10 Sludge Handling Bldg.)					3	T-335	E/I			
Stop-Start PB w/ Pilot Light (NEMA 4X)	X				3	T-335	E/I			
									$503,200	$71,100

APPENDIX E

CONDITIONS SURVEY DATABASE

WEST ISLAND WPCF

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U					
SOUTH ELEVATION				All exterior observations were made visually from the ground. No ladders or other lift-equipment was used to access above-ground wall surfaces or the roof.				
Wood Siding		X		Cedar shingle siding hasn't been painted in many years. Siding is very dried-out. Curled shingles observed. Numerous cracked and missing shingles observed. Shingles have shrunk; joints between shingles and at interface joints with wood trim have opened-up. Nails were observed to be pulling-out. Replace damaged and missing cedar shingles and paint shingles.	A			
Wood Trim		X		Wood trim hasn't been painted in many years. Wood has shrunk and interface joints at wood shingles and CMU have opened-up. Rotted trim observed over door heads. Nails were observed to be pulling-out. Some rusting nails also observed. Replace damaged trim; re-nail existing trim to wall; paint wood trim.	A			
CMU Wall	X			Split-face CMU exhibited a minor cracked joint at bottom-left corner near Kalwall. Vinyl weep tubes extend ~3" beyond face of CMU and were not blocked.	S & A			
Ext. Door A101 (double-door)		X		Door and frame exhibit rusting. Paint doors and frame. Corroded, rusting hardware, but intact & functional. Some hardware won't last five more years.	A			
Ext. Door A104 (single - Chem. Rm.)		X		Door and frame are rusting. Paint door & frame. Hardware intact & functional. Some hardware won't last five more years.	A			
Ext. Door A105 (single - Stairway)		X		Door & frame are rusting. Paint door & frame. Hardware intact & functional. Some hardware won't last five more years.	A			
Windows	X				A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U					
Insul. Translucent Panel	X			Minor peeling paint observed at ferrous metal components. Prepare & paint ferrous components.	S & A			
Roof		X		Discoloration at shingles may be the result of extractive bleeding, or bleed-through of the black pigment in the asphalt beneath the mineral granules. This phenomenon is typically attributable to defective material. Shingle replacement in the near future may be warranted (possibly around 5-year timeframe). Unable to assess shingle condition beneath solar PV array (5-panels-high x 15-panels-wide; approximately 60% of roof length). Flashing around boiler flue penetration appears to be in good condition. No splashblocks at base of roof leaders. Reattach soffit screen where it's become displaced from soffit boards.	A			
Concrete Foundation	X				S			
Finish/Paint			X	Building has not been painted in many years. The entire building requires painting.	A			
Joint Sealants			X	Sealant in masonry control joints is hard and cracking. No longer an effective moisture barrier. Replace all sealant.	A			
Louver - Bathroom Exhaust	X			Rusting screw is staining frame.				
EAST ELEVATION								
CMU Wall	X			Condition similar to South Elevation.	S & A			
Wood Siding		X		Similar comments as South Elevation. Shingles in slightly better physical condition than south elevation.	A			
Wood Trim		X		Similar comments as South Elevation. Trim is in slightly better physical condition than south elevation. Rake trim is pulling away from the underlying roof construction.	A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U					
Wood Louver	X			Numerous insect nests (wasp/hornet) observed on underside of blades.	HV & A			
Louvers	X				HV & A			
Ext. Door A102 (single - Process Area)	X			Door was locked. Appeared to be in very good condition from the exterior, but operability was not ascertained.	A			
Concrete Foundation	X				S			
Finish/Paint			X	See South Elevation comments.	A			
Joint Sealants			X	See South Elevation comments.	A			
NORTH ELEVATION								
CMU Wall	X			Entire north elevation is comprised of split-face CMU. Condition similar to South Elevation. No noticeable cracks were observed.	S & A			
Wood Trim		X		Condition similar to South Elevation. Trim is in slightly better physical condition than south elevation.	A			
Ext. Door A103 (Single - Process Area)				Some corrosion observed. Glass vision lite was dirty.	A			
Insul. Translucent Panel	X			Condition similar to South Elevation.	S &A			
Stairs (Concrete)	X				S &A			
Handrail	X				A			
Roof		X		Not able to observe north-facing roof from ground. Assumed condition to be similar to south-facing roof. Roof leader was missing bottom 90-degree elbow.	A			
Concrete Foundation	X				S			
Finish/Paint		X		See South Elevation comments. Finishes are in marginally better physical condition than south elevation, but recommendations remain the same.	A			
Joint Sealants			X	See South Elevation comments.	A			
					S/A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U					
WEST ELEVATION					S/A			
Wood Siding		X		Entire wall is clad in cedar shingles. Similar comments as East Elevation. Indications of animal intrusion (extensive claw marks) on wood siding at northwest building corner.	S/A			
Wood Trim		X		Similar comments as South Elevation. Trim is in slightly better physical condition than south elevation. Indications of animal intrusion (claw marks) on cornerboard at northwest building corner. Trim was missing from beneath middle window pediment.	S/A			
Wood Louver	X			Numerous insect nests (wasp/hornet) observed on underside of blades.	HV & A			
Windows	X				A			
Concrete Foundation	X				S			
Finish/Paint		X		Building finish is in similar physical condition as at north and east elevations.	A			
Joint Sealants			X	Caulking at wood trim joints has deteriorated. Replace caulking.	A			
PROCESS AREA - ROOM A 101				All interior observations were made visually from the ground. No ladders or other lift-equipment was used to access above-ground wall surfaces or the roof.				
CMU Walls	X			Walls were very wet from condensation. Cracks in mortar joints were observed at bottom corners of some window openings. Paint finish was in good condition. Rake-out and repoint cracked mortar joints.	S & A			
Ceiling - FRP Coated Plywood	X			Ceiling was very wet from condensation. Rusty fasteners were observed on splines between ceiling panels. Replace rusting fasteners.	A			
Windows	X			Extremely dirty; mildew & algae-covered in places; numerous spider webs. Windows were not tested for operability. Staff reported they were functional. Clean windows.	A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U					
Doors				See building elevations for exterior door comments.	A			
Louvers				N/A				
Insul. Translucent Panels	X			Panels were very wet from condensation and appeared to be in very good condition.	S & A			
Alum. Stairs at Door A101	X			Corrosive pitting observed on aluminum surfaces.	A			
Handrail at stairs	X			Minimal corrosive pitting observed. A little dirty. Rusty safety chains. Replace safety chains with stainless steel chains.	A			
Alum. Stairs at Anoxic RBC's	X			Corrosive pitting observed on aluminum surfaces.	A			
Handrail at stairs	X			Minimal corrosive pitting observed. A little dirty. Rusty safety chains. Replace safety chains with stainless steel chains.	A			
Concrete Stairs	X			Corrosive pitting observed in metal safety nosings. No wall-mounted handrail on east or north walls leading up to exterior door.	S & A			
Handrail at stairs	X			Minimal corrosive pitting observed. A little dirty. Rusty safety chains. Replace safety chains with stainless steel chains.	A			
Alum. Stairs at Clarifiers	X			Corrosive pitting observed on aluminum surfaces.	A			
Handrail at stairs	X			Minimal corrosive pitting observed. A little dirty. Rusty safety chains. Replace safety chains with stainless steel chains.	A			
Alum. Stairs at Filtration Units	X			Corrosive pitting observed on aluminum surfaces.	A			
Handrail at stairs	X			Minimal corrosive pitting observed. A little dirty. Rusty safety chains. Replace safety chains with stainless steel chains.	A			
Coat Rack for Safety Equipment	X				A			
Concrete Floors	X			Minor spalling and cracks at exterior door threshold.	S & A			
Joint Sealants			X	Masonry control joint sealant was in poor condition.	A			
Elevated Catwalk Framing		X		Ferrous surfaces of catwalk framing exhibits localized rusting. Paint finish is peeling especially at horizontal traffic-bearing surfaces. Touch-up paint rusted walkway surfaces.	A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U					
CONTROL ROOM - A 102								
Door A106 - single w/ wide sidelight	X			Good condition; functions well.	A			
Vision Panel								
Cabinets	X				A			
Walls	X			Minor crack observed in gypsum wallboard at top left corner of sidelight.	A			
Ceiling	X			Concealed-spline suspended acoustical ceiling with 12"-square tiles.	A			
Floor (Concrete)	X			Finish coating is a little worn.	S & A			
Finish/Paint	X				A			
STAIR - A 103								
Door A108 - single	X			Good condition; functions well.	A			
Window	X				A			
Floor (Concrete)	X				S & A			
Walls	X				S & A			
Ceiling	X				A			
Stairs	X			Concrete-filled metal pan switchback stair with intermediate landing is in very good condition. Paint finish is in very good condition. Minor crack in concrete fill at middle of intermediate landing.	A			
Handrails	X			Railings are in very good condition. Paint finish is in very good condition.	A			
Finish/Paint	X			Paint coatings on painted surfaces are in very good condition.	A			
ELECT. ROOM - A 105								
Door A109	X			Good condition; functions well. Resilient silencers were missing from frame. Provide new silencers.	A			
Window	X			Window blind was damaged.	A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U					
Floor (Concrete)	X			Floor coating is a little worn. Repaint floor.	S & A			
Walls	X				S & A			
Ceiling	X				A			
Finish/Paint	X				A			
CHEMICAL ROOM - A 106								
Floor (Concrete)	X			Minor spalling and cracks at exterior door threshold. Finish coating is in very good condition, minor scuffs and abrasions.	S & A			
Walls	X			CMU and gypsum wallboard walls are in very good condition. Paint finish is in very good condition.	S & A			
Ceiling	X			Concrete plank ceiling in very good condition.	A			
Door A106 (single ext.)		X		Door & frame exhibit rust. Paint door & frame. Hardware intact & functional. Some hardware won't last five more years.	A			
Louver	X				HV & A			
Finish/Paint	X				A			
TOILET ROOM - A 107								
Door A107		X		Door binds a little and exhibits minor spot rusting. Adjust door to eliminate binding and paint door and frame.	A			
Floor (Concrete)	X			Concrete is in very good condition. Floor coating is a little worn. Repaint floor.	A			
Walls	X			Gypsum wallboard is in very good condition. Paint finish is in very good condition.	A			
Ceiling	X			Suspended 2'x4' acoustical panel ceiling is in very good condition.	A			
Mirror	X				A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U					
Soap Dispenser		X		No fixed soap dispenser exists. A bottled liquid soap dispenser is provided. Provide wall-mounted soap dispenser or continue to use store-purchased liquid soap dispenser.	A			
Pt & Tp Dispensers	X			Dispensers are functional.	A			
STAIR - A 203								
Door A201 - single (Boiler Room door)		X		Good condition. B-Labeled fire door was propped open with foreign floor stop. Fire doors in stairs must not be propped open. Does not latch on its own. Hardware needs to be adjusted so door latches on its own. Resilient silencers were missing from frame. Adjust hardware & provide new silencers.	A			
Door A202 - single (Elect. Room II door)		X		Good condition. B-Labeled fire door was propped open with foreign floor stop. Fire doors in stairs must not be propped open. Missing one hinge and resilient silencers were missing from frame. Provide new hinge & provide new silencers.	A			
Floor (Concrete)	X				A			
Walls	X				S & A			
Ceiling	X				A			
Stairs	X			See Stair A-103 comments.	A			
Handrails	X			See Stair A-103 comments.	A			
Finish/Paint	X			See Stair A-103 comments.	A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U					
BOILER ROOM - A 201								
Floor (Concrete)	X			Unfinished concrete floor is in very good condition.	S & A			
Walls	X			CMU and gypsum wallboard walls are in very good condition. Paint finish is in very good condition.	S & A			
Ceiling	X			Gypsum board ceiling is in very good condition. Paint finish is in very good condition.	A			
Finish/Paint	X				A			
ELECT. ROOM II - A 202								
Floor (Concrete)	X			Unfinished concrete floor is in very good condition. Minor crack observed in floor.	S & A			
Walls	X			CMU and gypsum wallboard walls are in very good condition. A minor crack was observed in the gypsum board over one corner of the vision panel. Paint finish is in very good condition.	S & A			
Vision Panels	X				A			
Ceiling	X			Gypsum board ceiling is in very good condition. Paint finish is in very good condition.	A			
Finish/Paint	X				A			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U					
PROCESS AREA - ROOM A 101								
Aerobic RBC No. 1	X				PM			
Motor	X				PM			
Drive/Bearings	X				PM			
Aerobic RBC No. 2	X				PM			
Motor	X				PM			
Drive/Bearings	X				PM			
Anoxic RBC No. 1	X				PM			
Motor	X				PM			
Drive/Bearings	X				PM			
Anoxic RBC No. 2	X				PM			
Motor	X				PM			
Drive/Bearings	X				PM			
Clarifier No. 1	X	X		Condition=S; Performance=M (Problematic settling and solids removal issues)	PM			
Solenoid Valve - WS Air Lift	X	X		Condition=S; Performance=M (Staff drains off sludge manually on a daily basis due to ineffective air lift pumps.)	PM			
Solenoid Valve - Scum Air Lift	X				PM			
Motor	X				PM			
Drive/Bearings	X				PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U					
Clarifier No. 2	X	X		Condition=S; Performance=M (Problematic settling and solids removal issues)	PM			
Solenoid Valve - WS Air Lift	X	X		Condition=S; Performance=M (Staff drains off sludge manually on a daily basis due to ineffective air lift pumps.)	PM			
Solenoid Valve - Scum Air Lift	X				PM			
Motor	X				PM			
Drive/Bearings	X				PM			
Dual Media Sand Filter No. 1	X	X		Condition=S; Performance=M (Problematic blinding of filter and frequent backwashing when experiencing high influent flow & solids loadings; blinding impacted by solids carryover from clarifiers.)				
Filter Backwash Pump No. 1	X				PM			
Solenoid Valve - Air Scour	X				PM			
Dual Media Sand Filter No. 2	X	X		Condition=S; Performance=M (Problematic blinding of filter and frequent backwashing when experiencing high influent flow & solids loadings; blinding impacted by solids carryover from clarifiers.)	PM			
Filter Backwash Pump No. 2	X				PM			
Solenoid Valve - Air Scour	X				PM			
B-1 Blower	X				PM			
B-2 blower	X				PM			
B-3 blower	X				PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U					
Air Supply Piping (steel pipe)		X		Internal corrosion: Staff has seen internal corrosion in the steel pipe when replacing solenoid valves at various locations in the piping system.	PM			
UV Disinfection	X				PM			
Ultrasonic Level Sensor at V-notch Weir	X				PM			
					PM			
Sodium Bicarbonate Mix Tank	X							
Level Control Probe	X				PM			
Mixer	X							
LMI Feed Pump		X		Manufacturer no longer makes refurbishing kits for this model; will need to purchase new pump in the future.	PM			
Piping, Valves & Appurtenances	X				PM			
Solenoid Valve - Potable Water Supply	X				PM			
3" Motor Oper. Butterfly Valve	X				PM			
Painting/Preservation - General			X	Various components of tanks, equipment and piping are in need of surface preparation and painting.	PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U					
CONTROL ROOM - A 102								
Panel P1	X				I			
Panel P2	X			Flow Equal. Pumps and Effluent Pumps sometimes trip out on power transfer and need to be reset manually. Same pumps sometimes trip out on start/stop of sodium bicarbonate equipment.	I			
STAIR - A 103								
None								
ELECT. ROOM - A 105								
None								
CHEMICAL ROOM - A 106								
Methanol Day Tank	X				PM			
LMI Feed Pumps	X				PM			
Piping and Valves	X				PM			
Manual Feed Pump	X				PM			
TOILET ROOM - A 107								
None								
STAIR - A 203								
None								
BOILER ROOM - A 201								
None								
ELECT. ROOM II - A 202								
None								

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U					
SITE								
Sampling Manhole	X				PM			
Pretreatment Tanks	X	X		Condition=S; Performance=M (Need better access or better method for sludge removal in all four tanks.)	PM			
Flow Splitter Box	X				PM			
Tank No. 1	X				PM			
Tank No. 2	X				PM			
Tank No. 3	X				PM			
Tank No. 4	X				PM			
Flow Equalization Tanks	X				PM			
Tank No. 1	X				PM			
Tank No. 2	X				PM			
EQ-1 - Flow Equal. Pump	X	X		Condition=S; Performance=M (No influent metering or level control system to pace pumping to Aerobic RBCs.	PM			
EQ-2 - Flow Equal. Pump	X	X		" " "	PM			
LE/LT 1503	X				PM			
Valve Pit - Flow Eq.	X				PM			
Effluent Pumping Station	X				PM			
EFF-1 - Effluent Pump	X				PM			
EFF-2 - Effluent Pump	X				PM			
Effluent Level/Pump Control System	X				PM			
Valve Pit - Effluent Pump Station	X				PM			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U					
SOUTH ELEVATION								
Prefab. Chimney	X				HV			
Plumbing Vent				Can't see vent to inspect	P			
Louver - Bathroom exhaust	X				HV			
Wall Hydrant - Freezeproof	X				P			
Chemical Room Louver			X	Louver has shield install partially blocking outside & inside restricting air flow. May not meet code.	HV			
Chemical Room Ventilation Panel	X				HV			
EAST ELEVATION								
Alum. Louvers (2)	X				HV			
Wall Hydrant - Freeze-proof	X				P			
LP Gas Pipe - Pressure Regulator	X				P			
Vent Pipe	X				P			
NORTH ELEVATION								
Roof Exhaust Fan	X				HV			
Roof Exhaust Fan	X				HV			
Plumbing Vents (2)				Can't see vents to inspect	P			
WEST ELEVATION								
Wall Exhaust Fan	X				HV			
Wall Exhaust Fan	X				HV			
PROCESS AREA - ROOM A 101								
Floor Drains	X			One FD-A - cover was removed	P			
Drain Piping at Tanks	X			Light grey pipe. Some rust at concrete	P			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U					
Cleanouts	X				P			
Backflow Preventer	X				P			
Waste piping	X				P			
Vent Piping	X			Black pipe	P			
Cold Potable Water Piping					P			
Hose Bibb	X				P			
LP Gas Piping	X				P			
LP Gas Piping - Paint		X		Orange pipe	P			
Compressed Air Piping	X				P			
Compressed Air Piping - Paint		X		Green pipe	P			
Emergency Shower/Eye Wash	X		X	No HW, recirculation, or tempered water	P			
Fire Extinguishers		X			FP			
Roof Exhaust Fan / Damper			X	Unable to inspect. Excessive moisture in Process Area; may need additional ventilation or add dehumidification.	HV			
Ductwork, Damper				Can't see ductwork/damper	HV			
64" x 64" Damper	X				HV			
64" x 64" Damper	X				HV			
Chemical Room Temperature Sensor	X				HV			
44" x 52" Exhaust Register	X				HV			
Radiant floor heat panels	X				HV			
Radiant floor heat distribution				Can't see underfloor distribution	HV			
Hot Water Supply & Return Piping	X				HV			
Hot Water Supply & Return Insulation	X			Blue pipes	HV			
Thermostats	X				HV			
CONTROL ROOM - A 102								
Lab Sink with faucet	X				P			
Hot Water Heater - Electric	X			Heater is not instantaneous type	P			
Cold Potable Water Piping	X			Partially visible	P			
Waste Piping	X			Partially visible	P			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U					
Tank Vent	X				P			
Hot Potable Water Piping	X			Partially visible	P			
Heating coil HC-1				Can't see to inspect, Mezzanine Floor	HV			
Supply Fan, in-line				Can't see to inspect, Mezzanine Floor	HV			
Motorized Damper 12" x 24"				Can't see to inspect, Mezzanine Floor	HV			
Supply Air Filter				Can't see to inspect, Mezzanine Floor	HV			
Ductwork				Can't see to inspect, Mezzanine Floor	HV			
Fin Tube Radiator	X				HV			
Thermostat & Temperature Sensor	X				HV			
STAIR - A 103								
Fire Extinguisher		X		Needs annual recharge / inspection	FP			
Unit Heater	X				HV			
Hot Water Supply & Return Piping	X			Blue pipes	HV			
Thermostat	X				HV			
ELECT. ROOM I - A 105								
Heating				???	HV			
Exhaust Ductwork	X				HV			
CHEMICAL ROOM - A 106								
Cold Potable Water Piping				Light blue pipe	P			
Unit Heater	X				HV			
Hot Water Supply/Return Piping	X			Blue pipes	HV			
Emergency Shower / Eye Wash	X		X	No HW, recirculation, or tempered water	P			
Sprinkler Head	X				FP			
Ductwork / MO Damper	X				HV			
MO Damper	X				HV			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U					
TOILET ROOM - A 107								
Lavatory with faucet	X				P			
Mop Receptor with faucet	X				P			
Water closet	X				P			
Waste & Vent Piping				Can't see piping	P			
Cold Potable Water Piping	X			Partially visible	P			
Hot Potable Water Piping	X			Partially visible	P			
Bathroom Exhaust Fan				Can't see the fan - above ceiling	HV			
Exhaust Ductwork				Can't see ductwork -above ceiling	HV			
Exhaust Register	X				HV			
Fin Tube Radiator	X				HV			
Floor Drain	X				P			
STAIR - A 203								
Fire Extinguisher		X		Needs annual recharge / inspection	FP			
BOILER ROOM - A 201								
Cold Water Piping	X				HV/P			
Unit Heater	X				HV			
Water Meter	X				P			
Backflow Preventer	X				P			
Boiler		X		Rusted	HV			
Expansion Tank	X				HV			
Circulating Pump	X				HV			
Circulating Pump	X				HV			
Circulating Pump	X				HV			
Circulating Pump	X				HV			

COMPONENT ITEM	CONDITION			COMMENTS AND OBSERVATIONS	DISCIPLINE	COMPONENT COST	YEARS 0 TO 5	YEARS 5 TO 10
	S	M	U					
Check Valves	X				HV			
Isolation Valves	X				HV/P			
Balancing/Flow Measuring Valves	X				HV			
Air Separator	X				HV			
Pressure Gauges	X				HV/P			
4-Way Mixing Valve	X			Rust on valve body	HV			
Hot Water Supply Piping	X				HV			
Hot Water Return Piping	X				HV			
Thermostat	X				HV			
Hose Bibb	X				P			
LP Gas Piping	X				P			
Floor Drain	X				P			
Three-way Control Valve					HV			
Chimney / Flue Pipe		X		Some rust	HV/P			
Ventilation Air Duct	X				HV			
Combustion Air Duct	X				HV			
Water Temperature Sensor	X				HV			
ELECT. ROOM II - A 202								
Unit Heater	X				HV			
Thermostat	X				HV			
Hot Water Supply & Return Piping	X				HV			
OUTSIDE								
LP Tank	X				P			
LP Pining	X				P			