Attachment 9 – Wastewater Service Plan

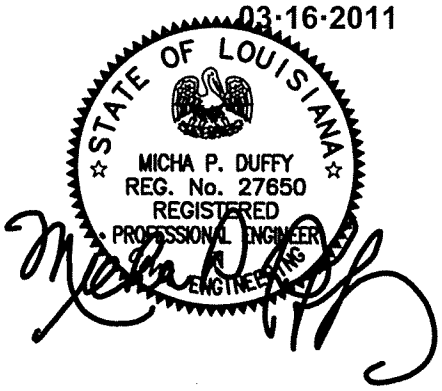
Natchitoches Parish Port
NorthPort Tract

WASTEWATER TREATMENT FACILITY
NORTH PORT TRACT

NATCHITOCHES PARISH, LOUISIANA

Prepared For:

NATCHITOCHES PARISH PORT COMMISSION
P. O. BOX 2215
NATCHITOCHES, LA 71457



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March 16, 2011

Table of Contents

WASTEWATER TREATMENT FACILITY
NORTH PORT TRACT

Natchitoches Parish, Louisiana

PROJECT DESCRIPTION AND SCOPE

The site is a 383 acre tract of land located in Sections 39, 41, 45, and 88, Township 10 North, Range 7 West, of Natchitoches Parish, Louisiana. It is bounded on the east by US Highway 71 and Kansas City Southern (KCS) railroad and on the west by LA Highway 486.

The purpose of this investigation is to provide information about a sewage treatment plant (STP) and construction costs. The STP we are proposing is a package treatment plan which can be expanded to accommodate future expansion if necessary. The first phase will consist of a modular unit designed to treat 100,000 GPD of waste material.

Although a preliminary master plan has been considered, the North Port Tract infrastructure layout has not been finalized. We do know that the most likely location for the STP is near the southeast corner of the property due to the natural low elevation and the close proximity to the discharge location. The sewage will be carried through a network of gravity mains to a lift station that will be centrally located on the property. It will then travel through a force main to the STP. Once treated, the effluent line will gravity flow to Bayou Decorppe.

In this report we have included a brief description of the treatment process, a site map showing the location of the STP, and a cost estimate of the plant.

TREATMENT PROCESS & FEATURES

The plant will utilize a combination of the extended-aeration and return activated sludge processes. The process is called advanced secondary treatment and a rapid sand tertiary filter will follow to obtain the required effluent quality.

Flow enters the plant through a stationary bar screen into the aeration chamber. Design average flow enters the aeration chamber, while surge flow spills over a weir into a flow equalization chamber. The result is that only the surge flow is required to be pumped through the plant. The EQ chamber is critical to the successful operation of the plant, as it provides a smooth and stable flow through the plant – smoothing out surges. Air to the EQ chamber diffused aeration system is provided by a dedicated simplex blower system.

For normal sanitary flows (200-220 mg/l BOD and TSS), the aeration chamber is sized for 24-hour retention. The tanks' bottoms are filleted to prevent solids from settling into corners. Tank aeration and mixing is through the diffused air system, operated by the main plant blowers.

Hopper-style clarifiers provide quiescent zones where remaining solids are settled during the 4-hour retention period. Sludge from the hoppers is continuously returned to the plant headworks, by air-lift sludge pumps. Floatables on the clarifier surface are collected by air-lift skimmers and returned to the plant headworks. Baffles and a v-notch weir trough control the clarifier levels and flow from the clarifier.

The plant operator monitors sludge age and quantity, wasting sludge as necessary into a sludge digester chamber. Supernatant from this chamber is decanted into the aeration chamber. Secondary microorganisms in the digester reduce sludge quantities in the chamber. Diffused air in the chamber is provided by the main plant blower system.

Flow from the clarifier enters the tertiary filter, where it percolates through sand and anthracite media to polish the effluent. The filters' cells are designed to automatically backwash when the media becomes clogged. The filter contains duplex mudwell pumps that remove backwash liquid to the headworks of the plant. Duplex clearwell pumps provide backwash water for the filter cells. A blower system provides air sparging for the media and post aeration to enhanced dissolved oxygen levels in the effluent. Flow passes through the filter exclusively by gravity and enters the disinfection chamber. Disinfection is by tablet chlorination, gas chlorination, hypo-chlorination or ultraviolet radiation. Our preference is UV, as the units only contain 4-6 lamps and are easy to maintain. No chemicals are involved and the bulbs last 12-18 months before replacement.

EXPANDABILITY

Shipping restrictions limit the width of the plant components to 12'. The plant footprint, in the field, is 24' wide. The length will ultimately be determined by how many units are grouped together.

This modular design lends itself to expandability, as the plant can be expanded at will. A similar plant was expanded to 325,000 GPD capacity. The overall dimensions are now 72' wide x approximately 120' long. The plant was delivered in 12' wide sections.

FABRICATION & DELIVERY

Submittal preparation is 1-2 weeks, after receipt of order.

Fabrication and shipment of the complete system is 10-12 weeks, after receipt of approved submittals.

Expect this system to ship in 6-8 eighteen-wheeler truck loads. The plant is pre-assembled prior to shipment and only those items removed for shipping are to be installed in the field. Pricing includes freight to the jobsite. Offloading and installation will be by a general contractor.

The contractor will prepare an appropriate concrete foundation, set the tanks, perform approximately 100' of field welding to attach tanks, coat welded surfaces, mount blower packages, control panels, install handrails, and install tank grating and access stairway.

Contractor site construction time should be 30-45 days.

CONSTRUCTION MATERIALS AND MAINTENANCE

1. Plants are constructed of ¼" structural steel plate, with structural member supports, and are available with the following coatings: asphaltic bitumastic, coal tar epoxy or various two and three-part epoxy paints. Budgetary pricing, previously provided, included coal tar epoxy coating.

2. Plants are provided with sacrificial magnesium anodes for cathodic protection.

3. Plants can be installed at-grade or just enough above ground to prevent surface water from running into the top. Due to the proximity to the 100-year base flood, the top of the plant would have to be located a minimum of 1' above the base flood elevation. Considering that the site will be served with a lift station and force main, it is likely that the plant would be installed above ground. This allows complete access to all plant components and allows the owner to maintain tank coating for extended service life.

CONSTRUCTION COST

Budget pricing for a complete package and installation assumes that utilities are readily available immediately adjacent to the sewer treatment plant proposed location. The scope of this cost estimate does not include any lift stations, force mains or gravity mains to the site.

Budget pricing for the package treatment plant would be $395,000. This includes freight to the jobsite. Offloading and installation will be by a general contractor. Pricing is based on above ground installation with access grating, access handrails, access stairway and coal tar epoxy tank coating inside and out. Three-phase power (240 volt or 480 volt) will be required.

A general contractor would provide a crane for offloading, field welding, a concrete slab and field erection. The estimated cost for said items would be $52,000.

Connection to power and water and fencing would complete the finished product at a cost of $17,000.

A breakdown of these costs is as follows:

Sewage Treatment Package Plant	$395,000.00
Crane & Offloading	$5,000.00
Concrete Slab & Installation	$47,000.00
Electrical	$10,000.00
Fencing	$5,000.00
Water Service for washdown	$2,000.00
Subtotal	$464,000.00
10% Contingency	$46,400.00
Engineering	$38,300.00
Geotechnical Engineering	$4,000.00
TOTAL PROBABLE COST	$552,700.00

APPENDIX A

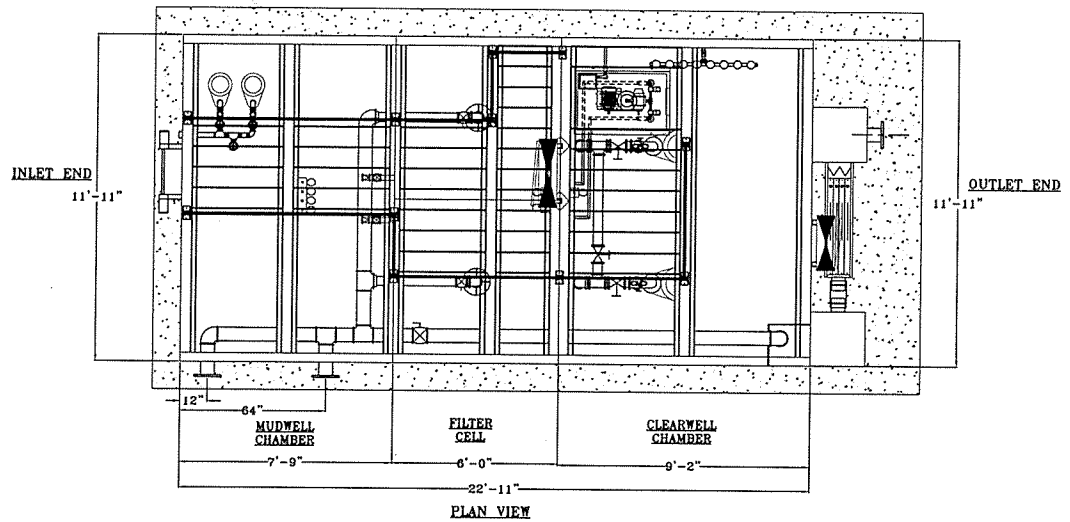
SITE PLAN

COYLE ENGINEERING CO., INC.			DESIGNED / CHECKED	PROJECT TITLE	NATCHITOCHES PARISH PORT COMMISSION
3023 BENTON ROAD P.O. BOX 6177 BOSSIER CITY, LOUISIANA 71171-6177 PHONE (318) 746-8967	GENERAL		DETAILED / CHECKED CAH	PROJECT SUBTITLE	NORTH PORT TRACT - SEWER TREATMENT PLANT
		NO. DATE REVISION DESCRIPTION BY	DATE / SCALE MARCH 2011 1" = 600'	COYLE PROJECT NO.	111003

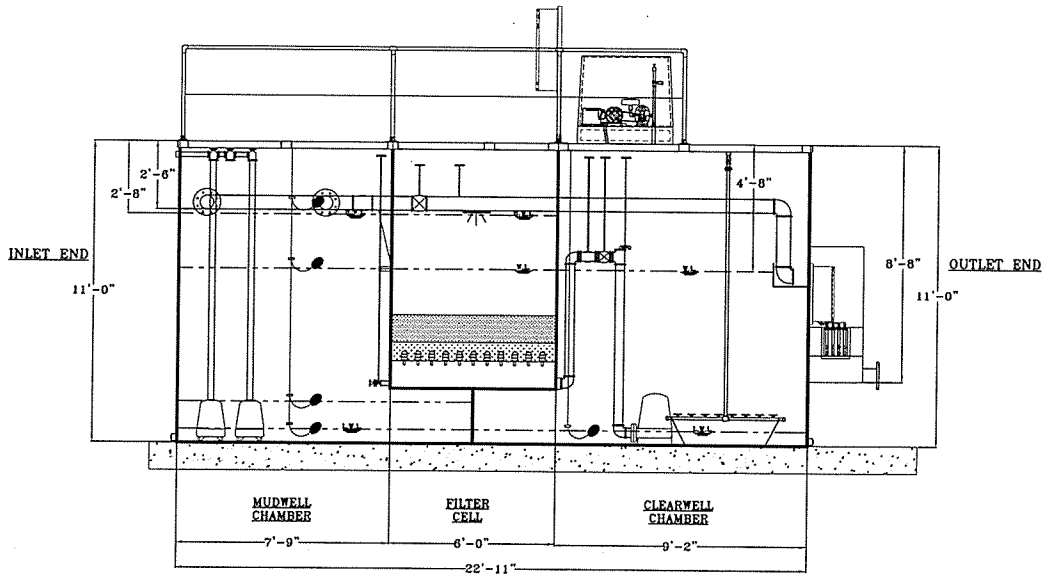
SHEET A1

APPENDIX B

PLANT DRAWINGS



PLAN VIEW



PLAN VIEW

NATCHITOCHES PARISH PORT
SEWAGE TREATMENT PLANT

REVISIONS:
DATE: BY: DESCRIPTION:

PROJECT NAME:
TERTIARY
100,000 GPD
Design Flow Rate: 100,000 GPD

DRAWING:
PLAN & ELEVATION LAYOUT

PROJECT NO.:
2009-TER

SCALE:
NTS

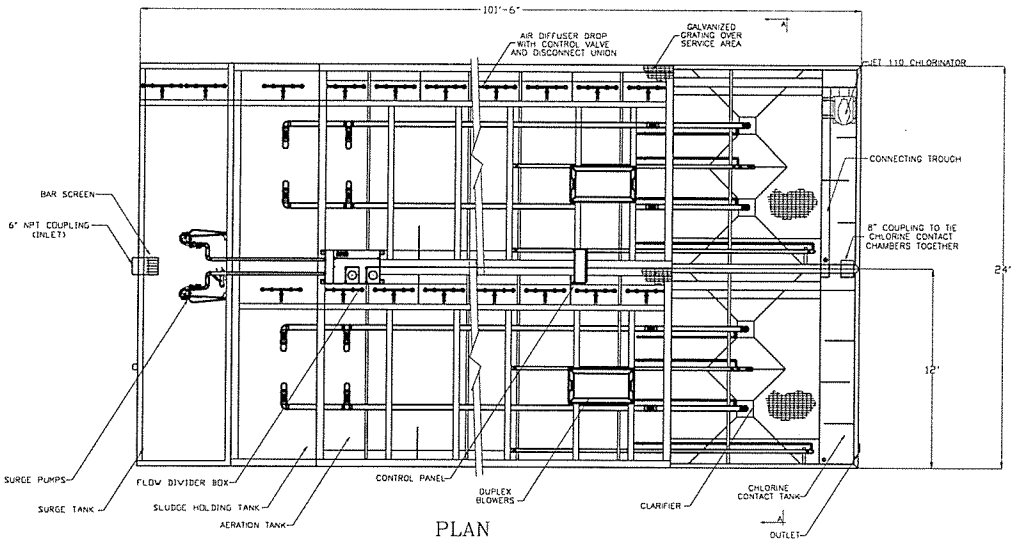
DATE:
3-26-09

DRAWN BY:

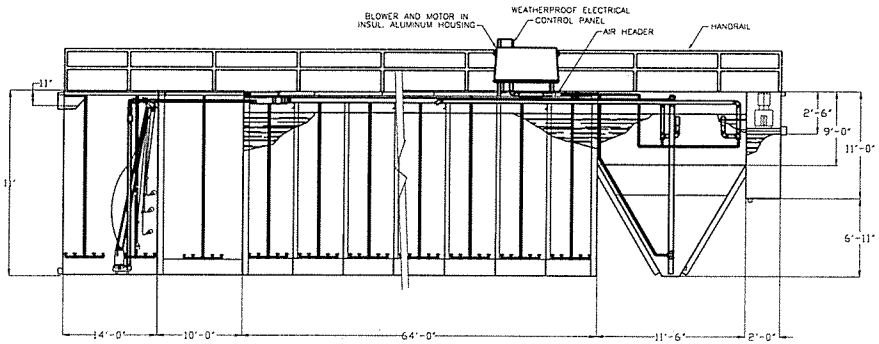
CHECKED BY

APPROVED BY

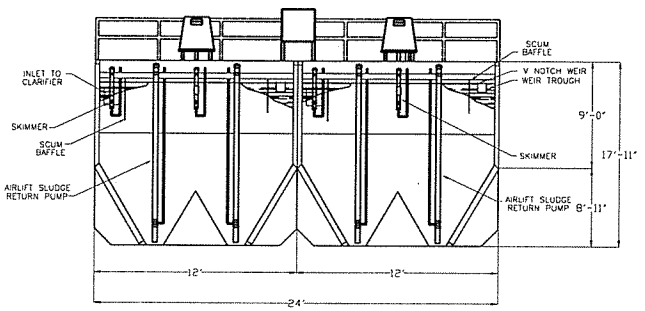
DWG NO.:
B1



PLAN



ELEVATION



SECTION A–A

AERATION CHAMBER	CLARIFIER	CHLORINE TANK
VOLUME: 111,101 GALS	VOLUME: 19,056 GALS	VOLUME: 3052 GALS
DETENTION: 24.2 HRS	DETENTION: 4.1 HRS.	DETENTION: 36 MIN. @ AVERAGE FLOW
AIR DROPLINES: 42 TOTAL	RISE RATE: 398 GPD/SF	
DIFFUSERS: 168 TOTAL	WEIR RATE: 2,750 GPD/FT.	
SHIPPING WEIGHT: 138,000 LBS.	OPERATING WEIGHT: 1,610,000 LBS.	

NOTES
1) CHLORINATOR TYPE: NORWECO XT-4000
2) SKIMMER LINES AND SLUDGE RETURN LINES SHALL BE SCH. 80 PVC.
3) TWO (2) 15 HP OPEN DRIP PROOF ELECTRIC MOTORS: 230 VOLT, 3 PHASE, 60 Hz.
4) TWO (2) POSITIVE DISPLACEMENT ROTARY BLOWERS OPERATING AT 440 CFM AND 5.0 PSI.
5) BIOLOGICAL LOADING: 185.4 LBS. BOD AT 200 PPM.

SLUDGE HOLDING TANK/DIGESTER	FLOW EQUALIZATION CHAMBER
VOLUME: 7,854 GALS	VOLUME 9,600 GALS
AIR DROPLINES: 2 TOTAL	AIR DROPLINES: 2 TOTAL
DIFFUSERS: 8 TOTAL	DIFFUSERS: 8 TOTAL

NATCHITOCHES PARISH PORT
SEWAGE TREATMENT PLANT

REVISIONS:
BY: DESCRIPTION:
DATE:

SLUDGE HOLDING & EQUALIZATION TANKS

DRAWING: PLAN & ELEVATION LAYOUT

PROJECT NO.:

SCALE: NTS

DATE:

DRAWN BY:

CHECKED BY:

APPROVED BY:

DWG NO.: B2

APPENDIX C

SAMPLE SPECIFICATIONS

SAMPLE SPECIFICATIONS FOR OXYGEN CONTROLLED REACTOR WASTE TREATMENT PLANT

GENERAL SPECIFICATIONS

The plant shall essentially consist of an inlet bar screen, rectangular aeration tank with dissolved oxygen controller, air diffusion system with variable frequency driven blower assemblies, hopper type clarifier with necessary baffles and overflow weir trough, sludge return piping, surface skimmers, tertiary filter assembly and chlorination tank.

The treatment unit shall be a dual train configuration consisting of two independent systems. Flow shall be pumped from the equalization chamber into the flow distribution chamber, which consists of a system of fixed and variable weirs designed to divert appropriate flow into the two systems. The distribution chamber shall have the ability to divert excess flow back to the equalization chamber. The distribution chamber shall also incorporate a gravity settling grit reduction system with remote gravity effluent system.

Backwash flow from the tertiary filter shall be pumped by the mudwell pumps back to the flow equalization chamber through an integral discharge line located within one treatment train.

Additional features and accessories are as shown on the Delta Process job drawing or drawings and as hereinafter specified and described.

OPERATING CONDITIONS

The plant shall be capable of treating 100,000 gallons per day of domestic raw sewage waste with a maximum organic loading of ____ pounds of BOD5. Load figures are based on a design population of _____and per capita daily BOD5 of _____ pounds. A minimum of 2100 cubic feet of aeration capacity shall be provided for each pound of BOD5.

CONSTRUCTION

The treatment plant proper shall be constructed of ¼ inch structural grade steel plate adequately braced for either above or below ground installation. All welded steel structural members shall be joined by electric arc welding. Where required for structural strength or water tightness, such welds shall be continuous.

CORROSION PROTECTION

Corrosion protected or corrosion resistant materials shall be used throughout. All tank surfaces shall be sandblasted to a commercial finish (SSPC-SP6). Immediately after sandblasting, one coat of coal tar shall be applied. A second coat shall be applied no later than 48 hours after application of the first coat. Total film thickness of the finished coating shall be approximately 12 mils. All grating shall be hot dip galvanized after fabrication. Cathodic protection shall be provided for below grade plants.

FLOW EQUALIZATION CHAMBER

A welded steel flow equalization chamber shall be provided as shown on the plans to receive the incoming flow. The inlet chamber shall be designed with a bar screen fabricated of one-quarter inch by one-inch flat steel bars on two-inch centers. The bar screen shall be placed at the elevation of the incoming gravity line into the chamber. This compartment will also function as an in-plant pump station.

The flow equalization chamber shall accommodate a minimum volume of 20,000 gallons, below the gravity inlet entry into the chamber. Two (2) BJM centrifugal shredder pumps, with 2HP motors suitable for 230/3/60 power, shall be mounted on stainless steel slide rail removal systems that are permanently

fixed in the chamber. Each slide rail system shall incorporate an integral discharge check valve and shall be independently piped into a 2" coupling in the aeration chamber wall. The 2" discharge piping shall be schedule 80 PVC pipe. The pumps shall be sized for 70 GPM @ 15' TDH. Slide rail systems utilizing individual rail piping shall not be considered an equal.

The flow equalization tank shall be fitted with three diffuser drop lines for aeration of the chamber. Air flow for this purpose shall be supplied from the main plant blower system. Each dropline will have a manual adjusting valve for control of the air flow into the diffusers.

A non-metallic NEMA-4X pump controller shall be provided for automatic operation of the flow equalization pumps. The pump controller shall be manufactured by a U.L. listed facility and shall include a main disconnection, power circuitry breakers, control voltage breaker, motor starters with solid-state, adjustable overload relays capable of phase-loss and out of spec voltage protection. The controller shall also include individually numbered wiring, terminal strip, secondary lightning arrestor, H-O-A switches, pump run lights, selectable alternator, solid-state level control logic, non-resettable elapsed time meters. Level indication shall be accomplished through the use of four (4) Cox Research fiber-optic, non-mercury level control floats supported by a stainless steel support bracket. Pump controllers utilizing mercury or mechanical float switches shall not be considered an equal.

AERATION TANK / OXYGEN CONTROLLED REACTOR

The aeration tank shall be sized to provide 24-hour detention of the design flow. Tank design shall be such as to provide efficient mixing and aeration, and to maintain hydraulic velocities sufficient to prevent deposition of solids.

Oxygen levels in the reactor shall be monitored and maintained through the use of a photovoltaic dissolved oxygen probe and controller. Probes requiring scheduled reagent changes or regular removal for cleaning are not acceptable.

Variable frequency drives shall be utilized on each blower motor and shall be controlled through a 4-20 mA signal from the dissolved oxygen controller. Drives shall be fitted with NEMA-4 enclosures suitable for outside installations. Drives requiring additional protective cabinets shall not be considered equal. Drives shall be required on each 10HP blower motor.

Alternation of the variable frequency drives and blowers shall be accomplished through a time-based algorithm contained within the software of the variable frequency drive. Treatment systems requiring additional control panels with alternators and time clocks shall not be considered an equal.

VARIABLE FREQUENCY DRIVES

SCOPE OF WORK

General: This specification defines the minimum requirements for Variable Frequency Drives (VFD) and accessories for speed control of either constant or variable torque loads.

GENERAL

Furnish complete VFD as specified herein or in the equipment schedule for loads designated to be variable speed. VFD's shall be user-selectable for either constant or variable torque loads.

The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC induction motors. The VFD shall be a six-pulse input design, and the input voltage rectifier shall employ a full wave diode bridge; VFD's utilizing controlled SCR rectifiers shall not be acceptable. The output waveform shall closely approximate a sine wave. The VFD shall be of a PWM output design utilizing current IGBT inverter technology and voltage vector control of the output PWM waveform.

The VFD shall include a full-wave diode bridge rectifier and maintain a displacement power factor of near unity regardless of speed and load.

The manufacturer of the VFD shall demonstrate a continuous period of manufacturing and development of VFD's for a minimum of 40 years. VFD's that are brand-labeled are not acceptable.

The VFD shall produce an output waveform capable of handling maximum motor cable distances of up to 1,000 ft. (unshielded) without tripping or derating.

The VFD shall utilize VVC^{PLUS}, an output voltage-vector switching algorithm, or equivalent, in both variable and constant torque modes. VVC^{PLUS} provides rated RMS fundamental voltage from the VFD. This allows the motor to operate at a lower temperature rise, extending its thermal life. VFD's that cannot produce rated RMS fundamental output voltage or require the input voltage to be increased above motor nameplate value to achieve rated RMS fundamental output voltage are not acceptable. VFD's that utilize Sine-Coded PWM or Look-up tables shall not be acceptable.

The VFD selected must be able to source the motor's full load nameplate amperage (fundamental RMS) on a continuous basis, and be capable of running the motor at its nameplate RPM, voltage, current, and slip without having to utilize the service factor of the motor.

The VFD shall offer a programmable motor parameter that allows the total number of poles of a motor to be programmed to optimize motor performance.VFD shall automatically boost power factor at lower speeds.

The VFD will be capable of running either variable or constant torque loads. In variable torque applications, the VFD shall provide a CT-start feature and be able to provide full torque at any speed up to the base speed of the motor. In either CT or VT mode, the VFD shall be able to provide its full rated output current continuously and 110% of rated current for 60 seconds.

An Automatic Energy Optimization (AEO) selection feature shall be provided in the VFD to minimize energy consumption in variable torque applications. This feature shall optimize motor magnetization voltage and shall dynamically adjust output voltage in response to load, independent of speed. Output voltage adjustment based on frequency alone is not acceptable for single motor VT configurations.

For multi-motor variable torque configurations, user-selectable load profile curves including VT-High, VT-Medium, and VT-Low shall be provided to ensure easy commissioning and improved energy efficiency. VFD's requiring the operator to assign load torque data-points to create a V/Hz profile, are not acceptable.

An initial ramp function shall be available to provide a user-selectable ramp, up to 60 seconds, for applications requiring a faster or slower ramp than the normal ramp.

A Dual Ramp Down feature shall include a Check Valve Ramp Down and a final Ramp feature. The Check Valve Ramp Down shall be programmable to gently seat a check valve and reduce the potential of damage from excess pressure while shutting-down the system. Both time and end speed shall be programmable. On the Final Ramp, the VFD shall be programmable to quickly stop the motor after seating of a check valve or for a more rapid stopping than the normal ramp down setting.

VFD shall offer up to 4 separate PID controllers. One controller shall operate the drive in closed loop, while the other 3 provide control signals to other equipment. VFD's with PI controllers only are not acceptable.

An Autotuning PI controller output feature shall provide automated PI controller settings. Once the user accepts the settings, the VFD will save the settings to memory.

An empty pipe fill mode shall be available to fill an empty pipe in a short period of time, and then revert to the PID controller for stable operation. Pipe fill mode shall have a programmable time to reduce water hammer in the system or fill the pipe at a unit per time rate.

VFD shall offer a motor spinning test that will run the motor at 5 Hz until the OK button is pressed. This feature will allow the user to determine if the motor is running in the correct direction.

An embedded cascade pump controller shall be included to provide lead pump alternation and provide control for up to 3 total pumps. The VFD Pump and 2 other pumps can be controlled either by a starter or softstarter.

Switching of the input power to the VFD shall be possible without interlocks or damage to the VFD at a minimum interval of 2 minutes.

Switching of power on the output side between the VFD and the motor shall be possible with no limitation or damage to the VFD and shall require no additional interlocks.

An Automatic Motor Adaptation (AMA) function shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to spin the motor shaft or de-couple the motor from the load to accomplish this optimization. Additionally, the parameters for motor resistance and motor reactance shall be user-programmable.

The VFD shall have temperature controlled cooling fans for quiet operation, minimized internal losses, and greatly increased fan life.

VFD shall provide full torque to the motor, given input voltage fluctuations of up to +10% to -10% of the rated input voltage (525 to 690VAC, 380 to 480VAC, or 200 to 240VAC). Line frequency variation of ± 2% shall be acceptable.

HARMONICS

The VFD shall provide internal DC link reactors to minimize power line harmonics and to provide near unity power factor. DC Link reactor shall be installed so that power fluctuations to the DC Capacitors shall be reduced to increase Capacitor life. VFDs without a DC link reactor shall provide a 5% impedance line side reactor and provide spare capacitors.

PROTECTIVE FEATURES

VFD shall have input surge protection utilizing MOVs, spark gaps, and Zener diodes to withstand surges of 2.3 times line voltage for 1.3 msec.

VFD shall include circuitry to detect phase imbalance and phase loss on the input side of the VFD.

VFD shall auto-derate the output voltage and frequency to the motor if an input phase is lost. This result will maintain operation without decreasing the life expectancy of the VFD. The use of this feature shall be user selectable and export a warning during the event.

Printed Circuit boards shall be conformal coated to reduce the corrosion effect from environmental gases and other conditions The conformal coating must meet IEC 61721-3-3, Class 3C2 as standard and the VFD shall have an optional 61721-3-3, Class 3C3 coating available.

Automatic "No-Flow Detection" shall be available to detect a no-flow situation in pump systems where all valves can be closed. This shall be functional in closed loop control or when controlled by an external signal.

Dry-pump detection shall be available to detect if the pump has run dry. If this condition occurs, the drive will be safely stoppred. A timer shall be included to prevent nuisance tripping.

End-of-Pump curve detection shall stop motor when the pump is operating outside of its programmed pump curve.

VFD shall provide a flow compensation program to reduce energy by adjusting the Setpoint to match changes in flow (friction loss). Flow compensation shall also operate in Cascade control mode.

VFD shall include current sensors on all three-output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.

VFD shall auto-derate the output voltage and frequency to the motor in the presence of sustained ambient temperatures higher than the normal operating range, so as not to trip on an inverter temperature fault. The use of this feature shall be user-selectable and a warning will be exported during the event. Function shall reduce switching frequency before reducing motor speed.

VFD shall auto-derate the output frequency by limiting the output current before allowing the VFD to trip on overload. The speed of the load can be reduced, but not stopped.

The VFD shall have the option of an integral RFI filter. VFD enclosures shall be made of metal to minimize RFI and provide immunity.

The VFD shall have a motor preheat function with the ability to be programmed to induce a small amount of current to the motor whenever it is at rest. This will prevent condensation inside the motor and help to extend its life without the need for space heaters or other external equipment.

The VFD shall be provided with an optional enclosure that is IP-66/Nema 4X rated. A VFD that is mounted in a separate enclosure will not be acceptable. The enclosure shall be suitable for installations that require protection against windblown dust and rain or splashing water. All cast aluminum parts shall be powder-coated with a durable epoxy that is capable of withstanding harsh environments. All circuit boards shall be conformably coated to meet the requirements of the IEC61721-3-3, Class 3C2 specifications.

INTERFACE FEATURES

VFD shall provide an alphanumeric backlit display keypad (LCP) which may be remotely mounted using a standard 9-pin cable. VFD may be operated with keypad disconnected or removed entirely. Keypad may be disconnected during normal operation without the need to stop the motor or disconnect power to the VFD.

VFD Keypad shall feature an INFO key that, when pressed, shall display the contents of the programming manual for the parameter that is currently viewed on the display. The description shall explain the feature and how the settings can be made by the operator.

VFD shall display all faults in plain text; VFD's which can display only fault codes are not acceptable.

The keypad shall feature a 6-line graphical display and be capable of digitally displaying up to five separate operational parameters or status values simultaneously (including process values with the appropriate engineering unit) in addition to Hand/Off/Auto, Local/Remote, and operating status.

Two lines of the display shall allow "free text programming" so that a site description or the actual name of the equipment being controlled by the VFD can be entered into the display.

Keypad shall provide an integral H-O-A (Hand-Off-Auto) and Local-Remote selection capability, and manual control of speed locally without the need for adding selector switches, potentiometers, or other devices.

All VFD's shall be of the same series, and shall utilize a common control card and LCP (keypad/display unit) throughout the rating range. The control cards and keypads shall be interchangeable through the entire range of drives used on the project.

VFD keypad shall be capable of storing drive parameter values in non-volatile RAM uploaded to it from the VFD, and shall be capable of downloading stored values to the VFD to facilitate programming of multiple drives in similar applications, or as a means of backing up the programmed parameters.

VFD Display shall have the ability to display 5 different parameters pertaining to the VFD or the load including: current, speed, DC bus voltage, output voltage, input signal in mA, or other values from a list of 92 different user-selectable parameters.

VFD display shall indicate which digital inputs are active and the status of each relay.

It shall be possible to toggle between three status read-out screens by pressing the [Status] key. Various operating variables, even with different formatting, can be shown in each status screen.

VFD display shall indicate the value of any voltage or current signal, including the engineering units of measurement, connected to the analog input terminals.

VFD display shall indicate the value of the current at the analog output terminals, including the engineering units of measurement.

A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.

Two-level password protection shall be provided to prevent unauthorized changes to the programming of the VFD. The parameters can be locked via a digital input and/or the unit can be programmed not to allow an unauthorized user to change the parameter settings.

A quick setup menu with factory preset typical parameters shall be provided on the VFD to facilitate commissioning. Use of macros shall not be required.

A digital elapsed time meter and kilowatt hour meter shall be provided in the display.

VFD shall offer as standard an internal clock. The internal clock can be used for: Timed Actions, Energy Meter, Trend Analysis, date/time stamps on alarms, Logged data, Preventive maintenance, or other uses. It shall be possible to program the clock for Daylight Saving Time / summertime, weekly working days or non-working days including 20 exceptions (holidays, etc.). It shall be possible to program a Warning in case the clock has not been reset after a power loss.

A battery back-up option shall be provided to maintain internal clock operation during power interruptions. Battery life shall be no less than 10 years of normal operation.

VFD shall provide full galvanic isolation with suitable potential separation from the power sources (control, signal, and power circuitry within the drive) to ensure compliance with PELV requirements and to protect PLC's and other connected equipment from power surges and spikes.

All inputs and outputs shall be optically isolated. Isolation boards between the VFD and external control devices shall not be required.

There shall be six fully programmable digital inputs for interfacing with the systems external control and safety interlock circuitry. Two of these inputs shall be programmable as inputs or outputs.

The VFD shall have two analog signal inputs. Inputs shall be programmable for either 0 -10V or 0/4-20 mA.

One programmable analog output shall be provided for indication of the drive status. This output shall be programmable for output speed, voltage, frequency, motor current and output power. The analog output signal shall be 0/4-20 mA.

The VFD shall provide two user programmable relays with 75 selectable functions. Two form 'C' 230VAC/2A rated dry contact relay outputs shall be provided.

Floating point control interface shall be provided to increase/decrease frequency in response to external switch closures.

The VFD shall accept a N.C. motor temperature over-temperature switch input, as well as possess the capability to accept a motor thermistor input.

The VFD shall store in memory the last 10 faults with time stamp and recorded data.

Run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until isolation valves, seal water pumps or other types of auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.

The VFD shall be equipped with a standard RS-485 serial communications port and front-of-drive accessible USB port. Danfoss FC or ModBus RTU communications shall be integrally mounted.

A Windows® compatible software program to display all monitoring, fault, alarm, and status signals shall be available. This software program shall allow parameter changes, storage of all VFD operating and setup parameters, and remote operation of the VFD.

ADJUSTMENTS

The VFD shall have an adjustable output switching frequency.

Four complete programming parameter setups shall be provided, which can be locally selected through the keypad or remotely selected via digital input(s), allowing the VFD to be programmed for up to four alternate control scenarios without requiring parameter changes.

In each programming set up, independent acceleration and deceleration ramps shall be provided. Acceleration and deceleration time shall be adjustable over the range from 0 to 3,600 seconds to base speed.

The VFD shall have four programmable "Bypass frequencies" with adjustable bandwidths to prevent the driven equipment from running at a mechanically resonant frequency. The feature shall offer a Semi-Automatic program to simplify the set-up.

VFD shall include an automatic acceleration and deceleration ramp-time function to prevent nuisance tripping and simplify start-up.

In each programming setup, independent current limit settings, programmable between 50% and 110% of the drives output current rating, shall be provided.

PID parameter settings shall be adjustable while the VFD is operating, to aid in tuning the control loop at start up. The VFD will also be capable of simultaneously displaying set-point reference and feedback values with appropriate engineering units, as well as output frequency, output current, and run status while programming the PID function.

The VFD will include a "loss of follower" function to detect the loss of process feedback or reference signals with a live-zero value and a user-selectable choice of responses (go to set speed, min speed, max speed, stop, stop, and trip).

A Sleep Mode function shall be provided to reduce wear and heating of the pump and other equipment in periods where system demand is minimal. This function will operate in both open and closed loop modes:

In closed loop process control, when the output speed drops to a user-programmed minimum value ("sleep frequency") for a specified time ("sleep mode timer"), the drive will enter a sleep mode and either go into standby, or boost mode before entering standby. The drive shall automatically restart the motor once the output of the PID processor exceeds a programmable value "wake up frequency".

Boost mode shall prevent short-cycling of the motor by temporarily adjusting the set-point by a user-programmable percentage. Upon reaching this value, the unit will go into standby.

In open loop, the drive shall be capable of entering sleep mode if the input reference drops below a user-programmable value. When the input reference increases above a user-programmable reference, the drive will automatically start.

An integral motor alternation function shall be provided to enable the output of the drive to alternate between two motors. The alternation interval shall be user-programmable in hours. This function shall operate external relays as required to control the motor alternation sequence. A dwell time shall be integral to the function and can prevent damage to the motor contactors.

The VFD will include a user-selectable Reset function, which enables the selection of between zero and twenty restart attempts after any self-clearing fault condition (under-voltage, over-voltage, current limit, inverter overload, and motor overload), or the selection of an infinite number of restart attempts. The time between restart attempts shall be adjustable from 0 through 600 seconds. An automatic "on-delay" function may be selected from 0 to 120 seconds.

The VFD will include a user-selectable Auto-Restart function that enables the VFD to power up in a running condition after a power loss, to prevent the need to manually reset and restart the VFD. VFD shall catch a rotating motor operating either in forward or reverse at up to full speed.

SERVICE CONDITIONS

The ambient operating temperature of the VFD shall be -10°C to 50°C (14 to 122°F), with a 24-hour average not to exceed 45°C. Storage temperatures shall be -13° F (-25° C) to149/158° F (65/70° C).

0 to 95% relative humidity, non-condensing.

Elevation to 3,300 feet (1000 meters) without derating.

VFD's shall be rated for line voltage of 525 to 690VAC, 380 to 480VAC, or 200 to 240VAC; with +10% to -10% variations. Line frequency variation of ± 2% shall be acceptable.

No side clearance shall be required for cooling of the units.

AIR DIFFUSION

Air diffusion drop pipes of 1.25-inch coal tar coated, schedule 40 malleable steel pipe shall supply air to diffusers. Each drop pipe shall have a plug valve for air adjustment and a union connection to facilitate drop pipe removal. Diffusers shall be spaced a maximum of 12 inches apart so as to insure uniform air bubble distribution. Drop pipes shall be easily removable by one man without the aid of hoists or other mechanical advantage.

CLARIFIERS

The clarifiers shall be designed to provide optimum liquid-solid separation and shall be sized to provide four hours detention of full design flow. A minimum of 4 clarifier hoppers shall be required. Hopper walls shall be sloped a minimum of 1.7 vertical to 1.0 horizontal with the flat bottom area of the hopper no greater than one square foot. Surface rise rate shall not exceed 400 gallons per square foot per day based on a 24-hour runoff period.

The settling tank shall include inlet hydraulic baffling, scum baffles, and effluent weir trough. Adjustable multiple V-notch PVC weir plates secured with stainless steel machine screws shall be provided for final leveling at the effluent trough. The average effluent weir overflow rate shall not exceed __ gallons per day per foot of weir length.

AIR LIFT SLUDGE SYSTEMS

A 4-inch diameter airlift sludge pump, with piping for routing the sludge to the inlet of the aeration tank, shall be provided in each clarifier hopper. A plug valve shall be provided for air adjustment to vary the pumping rate from 50 to 150% of average daily flow. The pump shall be constructed of schedule 80 PVC pipe. A removable plug shall be provided at the top of the pump to allow cleaning and maintenance.

Each individual sludge return line shall be supplied with two 4-inch isolation ball valves. The valves shall be configured for normal sludge return to the inlet of the aeration chamber. The valves shall also be capable of being configured to divert flow into the sludge holding tank.

SLUDGE HOLDING / DIGESTER TANK

A sludge holding tank shall be provided as an integral part of the aeration tank at the inlet end. The compartment shall be of fabricated steel and conform to the design of the aeration tank structure. The compartment shall provide a minimum of 10,000 gallons capacity.

Air shall be supplied by the main plant blowers system.

The sludge holding tank shall be complete with air diffuser assembly, manually operated sludge diversion valve and decant port to the aeration tank.

Digested sludge shall be drawn by manual discharge.

AIR LIFT SCUM PUMPS

Four air-lift scum pumps shall be provided in the clarifier system to return scum to the aeration tank. The pump inlets shall be vertically adjustable to maximize skimmer efficiency. Plug valves shall be provided for air adjustment. The pumps shall be constructed on 2-inch diameter schedule 80 PVC pipe.

BLOWERS

Provide _duplex_ air blowers, with sufficient capacity to furnish total treatment plant air requirements. Each blower shall be capable of delivering __cfm at _6.0_ psi discharge pressure. The blower assembly shall be mounted on a structural steel base and will be complete with inlet filter silencer and vibration isolation pipe coupling. When duplex blowers are provided, each blower shall be equipped with a check valve. Belt drive assemblies shall be furnished complete with sheaves, bushings and belts as required. A fabricated aluminum enclosure shall be furnished for each blower-motor assembly to provide weather protection and noise suppresion. The blower shall be a positive displacement ___ Model __. Blower RPM shall not exceed _____ RPM. Blowers shall have _____" NPT inlet and discharge.

BLOWER MOTOR

Each blower shall be driven by a ___ HP, _3_ phase, _230_ volt, 60-cycle _1,750__ RPM, drip proof electric motor. Motor shall not be loaded beyond nameplate ratings. Motor shall be inverter-duty rated for operation with the specified variable frequency drive.

PIPING

All necessary piping and valves inside the plant shall be provided by the manufacturer. At the exterior wall of the plant, as shown on the plans, the manufacturer shall provided properly sized inlet and outlet NPT couplings. The manufacturer shall not be responsible for piping or valves outside of the treatment plant. All air valve actuators inside the plant shall be readily accessible to the operator.

GRATING

Galvanized bar grating of adequate strength supported by heavy structural steel braces shall be provided over the service access areas of the plant. The grating shall be constructed of rectangular steel bearing bars with cross bars every 4 inches. Sections of grating over areas requiring service access shall be limited to a size readily removable by one man. Access grating shall be supplied over all tank openings on the treatment plant.

TERTIARY FILTER SYSTEM

GENERAL

The contractor shall furnish and install one prefabricated steel tertiary filter of the wastewater treatment system, a tertiary filter system. It shall be complete and ready for operation in accordance with the plans and specifications stated herein and furnished and as an integral section of the secondary treatment system. The tertiary treatment system shall be a Delta Model TF-100.0-C prefabricated steel package unit as manufactured by Delta Process Equipment, Inc. This section of the wastewater treatment system is of the tertiary treatment type, specifically known as rapid sand filter, designed for treating a total of

100,000 gallons per day of 30 PPM-BOD5 domestic sewage based on composite sewage samples of the average daily flow. The complete system includes all necessary equipment for efficient plant operation.

The tertiary filter will be factory assembled, so far as possible, with piping, valving and controls. All surfaces shall be factory painted.

Filters without screened filter nozzles in each cell shall not be acceptable.

PROCESS AND OPERATING INSTRUCTIONS

Influent Characteristics:

The system is capable of treating 100,000 gallons per day of secondary treat domestic sewage, having an organic strength of 30 PPM 5 day BOD, and 30 PPM suspended solids. The tertiary system is subject to the performance of the secondary treatment system. No substances will be introduced in quantities, which are toxic to biological organisms.

INLET CONNECTION

The influent connection to the tertiary filter system shall consist of a flow trough, receiving flow from the clarifier effluent trough with connections to the feed trough of the filter. In addition the feed trough shall be equipped with a tertiary by-pass. The filter cells shall be feed to each cell by a splash plate and shut off valve. This connection shall be from the port trough to the tertiary feed trough as shown on the detail drawings. The by-pass shall consist of a pipe plug within the tertiary feed trough.

FILTRATE HOLDING CHAMBER

Two (2) filtrate holding chambers, each located above the filter media shall be of sufficient capacity and surface area to entrap and hold floating, suspended and Settable solids until such time these solids are returned to the wastewater treatment system during filter media backwash by means of the mudwell and return pumps. The volume of each chamber shall not be less than 100 gallons. Each chamber shall have a minimum water depth of 24 inches above filter media to prevent freezing of filter media.

Means shall be provided in each chamber for manual dumping of the suspended solids into the mudwell. An access and inspection plate shall be provided in the sidewall filtrate holding chamber to allow inspection and maintenance of the filter bed.

FILTER CELLS

There shall be furnished two (2) filter cells for filtering the flow of the Tertiary Filter System. Each cell shall have not less than . square feet of filter surface area based on 1 GPM / sq. ft. for each cell. The filter cells shall be located at the bottom of the filtrate holding chamber. Filtrate shall percolate through the filter bed and filter nozzles to the false bottom. The filter nozzles shall be equipped with an air tail pipe. The filter nozzles shall be of the type, which is equipped with an expansion ring, which will allow the nozzle to be installed in the underdrain plate easily. From the false bottom, filtered water shall flow to the clear well chamber. Each filter shall be accessible for inspection and maintenance of the filter media. The filter media shall be shown on the plans and as herein after specified.

FILTER MEDIA

Filter media shall be furnished in sealed bags not to exceed 100 pounds each. The filter media shall be packed in a pallet and shipped to the plant site with the filter system. The contractor shall position the filter media in the tertiary filter as shown on the plans and in the field. The filter media bed shall consist of eight inches (8") of sand, 0.80 to 1.20 MM effective size with a uniform coefficient of 1.4 through 1.7 and twelve inches (12") of anthracite 1.08 MM effective size with a uniform coefficient of 0.03.

CLEAR WELL

The clear well shall be located as shown on the plans. It shall be so designed so that the filtrate from each of the filter cells can discharge into the clear well from the false bottom underdrain system which is located below the media; then flow through a riser and through the backwash pumps. The clear well shall not have less than _____ gallons for sufficient volume for backwashing based on two 5-minute backwash cycles. An overflow weir shall be provided for gravity effluent discharge to the disinfection system chamber.

BACKWASH PUMPS

Two (2) backwash pumps shall be furnished and installed in the clear well so as to automatically backwash each filter cell through the water distribution manifolds when required maintaining filtration conditions. Each pump shall be designed to provide one 5-minute backwash at a rate of 15 gallons per minute per square feet, and shall be rated at ___ GPM at 15 TDH. The operating horsepower shall be ___ HP, 230 volt, 60 Hz, 3 phase. Both pumps shall be a model ____ and with a 4" discharge and shall be manufactured by BJM Pumps or prior-approved equal. The backwash rate shall be a minimum of 15 GPM per square foot of filter surface area.

MUD WELL CHAMBER

A mudwell chamber of the tertiary filter system shall be of such size as to handle the total volume of the filtrate backwash. The volume of this chamber shall not be less than ____ gallons. A duplex set of pumps shall be provided and installed in the mud well chamber for returning the filtrate backwash liquid to the secondary wastewater treatment. The capacity for each pump shall be _ GPM at 15' TDH. The operating horsepower shall be 3/4 HP, 230 volt, 60 Cycles, 3 Phase. The pumps shall be a model _____ _____ and shall be manufactured by BJM Pumps or prior-approved equal and have a 2 inch discharge.

Stainless steel lifting chain assemblies shall be supplied for removal of mudwell pumps.

TERTIARY BLOWER ASSEMBLY

One (1) positive displacement blower motor unit shall be provided and shall be a Model BF-30-S24 shall be supplied, capable of providing the required CFM for air scouring. The unit shall have the capacity of providing 100% of the air requirements for the tertiary system. The blower unit shall be installed at the location shown on the drawings. The unit shall be completely factory built and tested before shipping. Therefore, the blower speed and horsepower has been corrected for this elevation level. One blower unit shall be installed within a fiberglass Blower housing complete with base and weatherproof hood.

The discharge piping of the blower shall be positioned within the housing to help reduce the vibration and the noise being created by the air discharge. The inlet filter silencer, pressure relief valve, pressure gauge, and check valve shall all be located within the housing with only the blower discharge rubber hose connection being provided as a single line hook up for the blower. The necessary electrical connection from the blower to CP-1 shall be provided and pre-wired. The enclosure shall have ivory finish. The blower motor enclosure unit shall be mounted on four (4) vibration pad dampers tagged VP-1. This will help reduce blower vibration and noise transmission. The fiberglass housing shall be equipped with a 2" blower discharge pipe with a 2" marine rubber hose with 2 stainless steel clamps. Each unit shall be completely factory built and tested before shipping.

The blower shall be capable of delivering _____ CFM when operating at 5 PSI. The blower shall be manufactured by Tuthill or approved equal. The model number shall be _. Blower RPM shall not exceed _ RPM and blower inlet / discharge shall be _____" NPT.

Each motor shall be 2 Horsepower for operation on 230 volt, 3 Phase, 60 Cycle service 1750 RPM. It shall be of the ODP type.

Facilities for air scouring the filter media prior to backwash shall be provided. An air distribution system shall be provided under the filter media.

ELECTRICAL CONTROL CONSOLE CP-3

An electrical control center shall be installed within a Nema 4 electrical weatherproof enclosure and shall be provided for mounting as indicated on the plans.

Each filter cell shall be supplied with an AAWS-2 control System. This system shall automatically air scouring and water wash the filter cell. When the resistance of the flow through that filter cell which is caused by the filter media makes the water level in the filtrate collection chamber to rise to a predetermined liquid level, a liquid level control switch shall initiate the automatic air scour cycle. This automatic air and water wash cycle is controlled by a series of adjustable control timers which will allow easy adjustment of each phase of the air and water wash cycles. The AAWS-2 shall include system light which will indicate the operating position of the control system. This light shall be installed within the control panel.

The enclosure shall be NEMA type 4. The electrical controls shall consist of IEC starters, timers, and switches necessary to automatically control all electrical devices and/or motors on the tertiary treatment system. The blower motor shall be controlled by a H-O-A selector switches and IEC starters. This will be in conjunction with the AAWS-2 control system. Properly sized circuit breakers or fuses shall protect all electrical equipment and circuitry.

All wire and conduit required between the control panels and the electrical power service shall be furnished and installed by the purchaser.

Wiring and conduit between the control panel CP-3 and the tertiary ancillary equipment as listed below shall be pre-wired and tested at the factory:

Solenoid Valve for Air Scourer Cell # 1
Solenoid Valve for Air Scourer Cell # 2
Solenoid Valve for Clear well aeration

All necessary valving and piping shall also be provided.

The main power supply shall be 230 volt, 3 Phase, 60 Cycle, with a control circuit of 120 Volt, 1 Phase, 60 Cycle.

The electrical equipment components, which shall be operated from this control center, are:

Tertiary Blower Unit BM-4 – 2 HP, 230 volt, 3 Phase, 60 Cycle
Backwash Pump P-3 – _____ HP, 230 volt, 3 Phase, 60 Cycle
Backwash Pump P-4 – _____, 230 volt, 3 Phase, 60 Cycle
Mudwell Pump P-5 – ¾ hp, 230 volt, 3 Phase, 60 Cycle
Mudwell Pump P-6 – ¾ hp, 230 volt, 3 Phase, 60 Cycle
Solenoid Valve For Air Scour Cell # 1
Solenoid Valve For Air Scour Cell # 2
Solenoid Valve For Clear well aeration and post aeration

FILTER BY-PASS

A by-pass shall be supplied to allow manual by-pass of the filter cells. The by-pass shall consist of the necessary flow troughs, flow vanes, etc., to direct either to the filter cells or to the tertiary outlet port.

The flow distribution trough shall be so designed as to divert the incoming flow proportionally to each filtrate collection chamber. This shall be done by means of diversion vanes.

POST AERATION SYSTEM

An air distribution manifold shall be installed on one side of the tertiary system with diffuser drop assemblies connected thereto. This manifold shall be designed to create a bank of air to supply the air needs of the post aeration system

The diffuser drop assembly shall be equipped with an air regulating valve, a disconnecting union and a diffuser bar with non-clog air diffuser nozzles mounted on the tee bar. This minimum air velocity shall be maintained to insure sufficient velocity for self-cleaning. The diffusers shall be placed as shown on the drawings.

The air diffuser shall be on the air check diaphragm type constructed with a diaphragm mounted on top of the diffuser body. The diffuser body consists of twenty, 3/16" diameter air discharge holes evenly distributed around the diffuser disk. The diffuser will be supplied with standard male pipe thread connections.

Post aeration blower shall be a linear-driven diaphragm unit capable of operating on ____ power. Blower shall be capable of ____ CFM at 10 psig.

DISINFECTION CHAMBER

A chlorine contact chamber shall be provided having a minimum volume of 2,100 gallons and configured as shown on the drawings.

A tablet type chlorination system shall be provided. The tablet chlorine dispenser shall be a Norweco model IT-4000.

A 90 degree v-notch weir shall be provided for flow measurement within the chlorination contact tank.

EFFLUENT CONNECTION

The effluent connection of the tertiary treatment system shall be located as shown on the plans and shall consist of one 6" NPT coupling.

START UP

After the treatment plant has been installed with all necessary electrical connections completed and influent and effluent piping in place, the manufacturer shall inspect the installation, inform the owner as to any necessary adjustments, and, instruct the plant operator on proper operation of the plant. A maintenance manual shall be provided for the operator. The manual shall include normal operation description, maintenance schedule, wiring diagram, and manufacturer's equipment manuals for major components.

WORKMANSHIP AND EXPERIENCE

All workmanship and materials shall be of the highest quality. The waste treatment plant shall be the product of an experienced manufacturer actively engaged in research and development of sewage treatment facilities.