ADDENDUM #1

January 12, 2021

WWTP Upgrades Contract #1

Village of Suffern

Rockland County, New York

Bid Date

February 11, 2021, 3:00 PM

Clarifications

1) Bid opening is to be postponed to February 11, 2021, 3:00 PM
2) Section 405000 has been revised and attached to this addendum.
3) Section 461015 has been revised and attached to this addendum.
4) Section 461190 has been updated to include specifications for trickling filter media. See paragraph 2.6. Section has been attached to addendum.
5) Bidders to submit one of the following with bids:
    A. Proof of current participation in existing approved Apprenticeship Training Program.
    B. Letter stating commitment to participate in existing approved Apprenticeship Training Program in coordination with the Department of Labor
    C. Letter stating commitment to create an approved Apprenticeship Training Program in coordination with the Department of Labor
6) Flow meter info from section 40700 to be deleted.
7) A 6mm opening is acceptable for headworks mechanical bar screen.
8) Envirodyne is an acceptable manufacturer for the trickling filter media, rotary distributor and grit equipment.
9) Parkson is an acceptable manufacturer for the mechanical screen and washer
10) General Contractor to provide monitor and control operations via two operator interface terminals (OIT) at the Sludge Building CP and Headworks RIO consisting of industrial computer with touch screen capability and HMI client application software.
11) The I/O cards include 20% spare.
12) The lighting circuit homeruns will be terminating on the existing lighting panel L8 (EXISTG L8); the panel location can be found on print E-201.
13) The General Contractor is responsible for all removals and the Electrical Contractor is responsible for all disconnects. See multiple contract summary section of the P.M.
14) MCC #3 is a Cutler-Hammer Unitrol unit.
15) The power feeders found on print E-101 shall be PVC-coated galvanized rigid steel conduit, ran above on a rack.
16) The scale on print E-103 is ¼" equals 1'.

17) All panels and equipment shown in the Headworks Electrical Building are new. The building is existing.
18) The power for the new headworks building is to be run underground.
19) Information on the odor control units can be found on Drawings C-104, M-110 and in Section 461180 of the P.M.
20) Section 461015 Vortex Grit Removal System is intended for a complete system.
21) A minimum flow of 0.375 MGD is to be assumed for each trickling filter.
22) The Electrical Contractor shall furnish all of the conduits and conductors for all equipment installed by the General and HVAC Contractors.
23) General and HVAC Contactors to install all equipment, panels and appurtenances.
24) The General Contractor shall install all plumbing and piping for all equipment.

Attachments

Section 405000	Waste Water Control System
Section 461015	Vortex Grit Removal System
Section 461190	Trickling Filter

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NOTE

This Addendum is being distributed through usinglesspaper.com to everyone on the plan holders list. Should there be an issue with the system, please contact Robert Flores, PE at rflores@delawareengineering.com or 518-452-1290.

ATTENTION

PLEASE SIGN BELOW AND email to rflores@delawareengineering.com FAX TO DELAWARE ENGINEERING, DPC AT (518) 452-1335 to verify receipt of this Addendum.

RECEIVED BY: _____

Company Name: _____

SECTION 405000
WASTE WATER CONTROL SYSTEM (WWCS)

PART 1 GENERAL

1.01 SUMMARY

A. All equipment and wiring shall conform to standard electrical practice and to all applicable sections of the NEC reference to low voltage applications.

B. Include, in general, with the WWCS System but without limitation:
   1. Control panel enclosures for new applications.
   2. All necessary hardware, software and programming (both for upgrades to existing systems and for new applications) to perform the WWCS functions described herein and required for operation of the system.
   3. Install Stratix Fiber Optic 8 Port Switches in the PLC and RIO cabinets.
   4. Furnish and install the Sludge Building CP (PLC-1) NEMA 12 enclosure in the Sludge Building.
   5. Furnish and install the Headworks RIO (RIO) NEMA 12 enclosure.

C. The WWCS System shall execute the following functions:
   1. Monitor and control operations via two operator interface terminals (OIT) at the Sludge Building CP and Headworks RIO consisting of industrial computer with touch screen capability and HMI client application software.
   2. Automatically record information pertaining to these operations.
   3. Communicate between hardware components and field instrumentation.
   4. Display all monitored values and alarms at the local operator interface.

D. Include field-testing and services of qualified representatives of the WWCS System supplier.

E. It is the intent of this Contract that the WWCS installations be complete in all respects and ready for use and operation. The Contractor shall be responsible for all details, devices, accessories and special construction necessary to properly finish, install, adjust, test and place in successful continuous operation a complete installation.

F. The Schedules in this Section are not necessarily complete. The Contractor shall not rely on the Schedules but shall thoroughly examine the Contract Documents prior to bid to determine the work required under this Contract.

1.02 QUALITY ASSURANCE

A. All equipment covered by these specifications shall be the products of reputable, qualified, and successful manufacturers who are of proven ability and have long experience in the production of such equipment.

B. All equipment specified in this Section shall be provided by the WWCS System Supplier.

C. The Contractor shall pay all royalty or license fees for use of patented devices or systems and

shall protect the Owner from patent infringement litigation thereon.

D. All components of the WWCS System have been included under this Section so that the OWNER will receive completely coordinated and properly integrated system for efficiency, ease in operation and, correct functional relationship among all elements of the system. Therefore, it is the intent of this Contract that the equipment specified under this Section will be furnished by a single WWCS System Supplier. This does not require that all equipment be manufactured by a single manufacturer, but does require that the WWCS System Supplier be responsible for the satisfactory operation of the instrumentation and metering equipment and the WWCS System furnished hereunder.

1.03 SYSTEMS INTEGRATOR:

The physical layout of the WWCS system is shown on the contract drawings and the equipment specifications. The use of an "or equal" system will require the WWCS supplier to document experience on at least 10 similar systems with major upgrades of equal size or larger subject to the approval of the ENGINEER. The WWCS System shall be in compliance with these specifications and plans.

A. If the Contactor proposes an "or equal" WWCS system, it shall be understood that the proposed system meets or exceeds the specified performance and construction and offers a cost savings to the OWNER. The CONTRACTOR may be responsible for engineering time to review proposed substitutions.

B. The following is a minimum qualifications submittal:

1. WWCS system supplier shall submit, within 15 (fifteen) calendar days of the bid, detailed information on their staff and organization to show compliance with the Quality Assurance requirements of this Section. The Qualifications submittal shall be submitted and favorably reviewed before any further submittals will be accepted. Failure to meet the minimum requirements shall be grounds for rejection as acceptable.

2. Copy of UL-508 certificate for panel fabrication facilities.

3. Five (5) references for water or wastewater projects successfully completed within the last five years. Successful completion shall be defined as a finished project completed on Potential references shall be for projects where the WWCS system supplier's contract, excluding change orders, is $125,000 minimum.

C. The WWCS System Supplier will also be the WWCS System Installer and will designate an experienced employee as the Systems Integrator. The Systems Integrator will be responsible for all planning, field planning, submittals, proposals, on site coordination, installation, proper programming and operation of the fiber equipment, all callbacks, all warranty items and training of the Owners employee's on the system operation and all field programmable system parameters. The Systems Integrator will be the sole contact for the Owner, General Contractor and the Project Engineer. After commencement of the WWCS installation, the

Systems Integrator will be required to be on site at least 1 day (8 hours) per week and will provide the Project Engineer with at least 48 hours notice of the scheduled site visit.

D. The WWCS Systems Supplier will be required to be located within 150 miles of the site and be able to provide onsite assistant within 4 hours if required in the event of an emergency.

E. Warranty: The WWCS Systems Supplier will provide a complete labor, mileage and parts replacement warranty for one year after final acceptance of the work for all equipment provided by the WWCS System Supplier.

F. The WWCS System Integrator must be a UL-508A certified panel shop at the time of Bid, or utilize a UL508 panel shop for all panel design and construction.

1.04 PERFORMANCE REQUIREMENTS

A. The WWCS System Supplier, through the Systems Integrator, shall have total responsibility for the performance and compatibility of the entire WWCS system as shown on the Drawings and as specified herein. The WWCS supplier shall have sole responsibility for the quality and proper functioning all of components shown on the Drawings, as specified herein, and as specified in Section 407000 “Instrumentation Equipment” including those not of the supplier’s manufacture.

1.05 Submittals

A. Shop Drawings

1. The WWCS System supplier shall submit detailed shop drawings, complete information on all components, theory of operation, evidence of chemical compatibility, equipment piping and valve layouts, and detailed electrical wiring and WWCS diagrams.

2. All submittals shall be sufficient in detail to demonstrate that the supplier will furnish the equipment in accordance with the Contract Documents and that the equipment is satisfactory for its intended use. The Contractor shall submit a complete list of parts and supplies for each different item of equipment installed, and a list of parts and supplies that are recommended by the manufacturer to assure efficient operation of the equipment.

3. As a minimum, submit the following documentation with the shop drawings:
   a. Physical description of all hardware.
   b. Functional description of all hardware and programming.
   c. Theory of operation.
   d. Operating procedures.
   e. Listing of programming used.
   f. Internal wiring diagrams for each panel, numbered wire, numbered terminal on the instrument and numbered terminal block. This includes both new panels and upgrades to existing panels.

g. Complete, and in every detail, interconnection wiring diagram and process and instrumentation diagrams (loop diagrams) in accordance with ISAS5.4 Instrument Loop Diagrams, Illustration 7.4, latest revision, showing all field and panel mounted equipment and terminal identification. Use the same component identification as shown on the drawings and indicated herein where possible.
h. List of all inputs and outputs for each PLC.

4. Prior to the Instrumentation and WWCS System Supplier starting work on the WWCS system, a meeting shall be held with the General Contractor, the Electrical Contractor, the WWCS System Supplier, the Engineer, and the Owner. The purpose of the meeting will be to resolve all issues regarding system architecture, WWCS loop functions, and WWCS functions. This meeting typically takes one day and should be scheduled as soon as reasonably possible after the award of the contract (typically 30 days). The WWCS System Supplier is expected to have his project team in place prior to the meeting and all relevant members of that team shall be in attendance at the meeting.

B. Operation and Maintenance Manual - The Contractor shall furnish complete operation and maintenance manuals for the treatment modules including part schedules to assist in assembly, disassembly, and ordering parts. Specific operation and maintenance instructions shall be prepared for the entire system by the WWCS System Supplier. Operation and maintenance instructions for individual components should be included with the package; however, written instructions, drawings, and schematics must cover the complete system, not just specific components.

PART 2 PRODUCTS

2.01 PROCESS EQUIPMENT

See Section 407000 “Instrumentation Equipment”

2.02 SYSTEM WWCS

A. The Control system vendor shall supply the WWCS system and furnish additional components to the WWCS system providing all necessary control functions for totally integrated operation of the plant process. Included in the upgrades, but not limited to, shall be the Mechanical Screens, Grit System, Odor Control, Flow Meter, and Gas Detection. The controls shall be as described hereafter.

B. Control Panels
1. All controls panels which are to be located indoors shall be of NEMA 12 (oil and dust tight) free standing design constructed of 14 gauge cold rolled steel provided with a finish of rust inhibiting primer followed by two (2) coats of industrial grade enamel, white inside and ANSI 61 gray outside. Panel components will be mounted and wired to terminal strips for Contractor field connections. All outdoor enclosures shall be stainless steel NEMA 4X with heaters.

C. Programmable Logic Controller

1. PLCs shall be Allen Bradley CompactLogix with Ethernet capabilities or equal.

2. Factory programmed Programmable Logic Controller (PLC) shall be provided within all control panels. The WWCS system noted herein must be capable of expansion. The PLCs shall be capable of monitoring inputs and providing outputs as required for system logic, and shall include no less than 20% spare analog and discrete inputs and outputs, 20% spare non-volatile logic memory with no less than 8K words, 1920 registers, 2.5 ms/K scan time, and 14 bit analog resolution.

3. The PLC shall accept analog inputs (4-20madc) from system analyzers and transmitters for monitoring and trending on an Operator Workstation (HMI) and Operator Interface Terminal (OIT) as specified herein, as depicted on the Process, Instrumentation and WWCS Diagram and the project specifications.

4. System logic will monitor and control all components as shown on the Drawings or this specification.

The following lists the required PLC, hardware and software requirements, UPS requirements, etc.

5. Sludge Building CP (PLC-1)

A. Rack Layout – The PLC-1 rack shall consist of a Allen Bradley CompactLogix Controller with CPU, Power Supply, Ethernet, 1.5M Memory, and Analog and Digital IO:

2 – 16 Pt. 24VDC Input Cards 1769-IQ16
2 – 16 Pt. Output Card 1769-OB16K
1 – 4 Pt. Analog Input Cards 1769-IF4
1 – 4 Pt. Analog Output Card 1769-OF4CI

B. Power Supply Module – The power supply module shall be a CompactLogix 1769-PA4 120/240V AC Power Supply (5V @ 4 Amp).

C. Central Processing Unit (CPU) – The CPU shall be a CompactLogix EtherNet processor model# 1769-L35E or Engineer Approved Equal.

D. Fiber Optic Modem – Stratix Self Healing Ring Switch with a fault contact. The fault contact will be brought into a spare DI and incorporated into the WWCS system for alarm and monitoring.

E. Uninterruptible Power Supply – The UPS in PLC-1 will be shall be a 1 KVA Smart UPS.

F. Fiber Optic Patch Panel – A Fiber Optic Patch Panel will be incorporated in PLC-1 as to provide a termination for Fiber Optic Cables.

G. Fiber Optic Patch Cables – Fiber Optic Patch Cables will be used in PLC-1 to run from the Fiber Optic Patch Panel to the Fiber Optic Switch.

H. Ethernet switch sized for application. This shall be a Stratix ethernet switch with 16 copper ports. One of the copper ports shall be tied to the fiber switch.

I. Operator Interface Terminal (OIT) – The OIT for PLC-1 shall be a PanelView Plus 7, 15" Color Active Matrix TFT Display. The OIT will have a touchscreen, Standard Communications (Ethernet & RS-232, AC Input and 64MBFlash/64MB RAM.

J. All inputs shall be fused at the PLC control panel by the WWCS vendor.

K. Additional IO Points and Programming shall be added as required by the IO list and the WWCS strategies.

6. Headworks Remote I/O CP

A. Rack Layout – The Headworks Remote IO rack shall consist of a Allen Bradley Communications Module, Power Supply, Fiber Optic Switch- Phoenix 5port with one fiber optic port, and Analog and Digital IO:

2 – 32 Pt. 24VDC Input Cards 1769-IQ32
2 – 16 Pt. Output Card 1769-OB16K
2 – 4 Pt. Analog Input Cards 1769-IF4
1 – 4 Pt. Analog Output Card 1769-OF4CI

B. Uninterruptible Power Supply – The UPS in the remote IO panel shall be a 1 KVA Smart UPS.

C. The remote IO panel shall come in a NEMA 12 panel.

D. Fiber Optic Modem – Stratix Self Healing Ring Switch with a fault contact. The fault contact will be brought into a spare DI and incorporated into the WWCS system for alarm and monitoring.

E. Fiber Optic Patch Panel – A Fiber Optic Patch Panel will be incorporated in Headworks Building RIO as to provide a termination for Fiber Optic Cables.

F. Fiber Optic Patch Cables – Fiber Optic Patch Cables will be used in Headworks Building RIO to run from the Fiber Optic Patch Panel to the Fiber Optic Switch..

G. Ethernet switch sized for application. This shall be a Stratix ethernet switch with 16 copper ports. One of the copper ports shall be tied to the fiber switch.

D. Automatic System Operation – WWTP

1. Automatic system operation shall be based on alarm and WWCS levels displayed on the operator work station (HMI) and operator interface terminal (OIT) in desired engineering units (ft, gpm, %, etc.) as follows:

a. Influent Flow Meter
   1. Influent Flow
   2. Totalized Flow

b. Mechanical Screen
   1. Screen HOA status
   2. Screen Run Status
   3. Screen Fault
   4. Screen operational float
   5. Screen Channel High Level Float

c. Compactor
   1. Compactor HOA status
   2. Compactor Run Status
   3. Compactor general fault

d. Grit Vortex Unit
   1. Grit Vortex HOA status
   2. Grit Vortex Run Status
   3. Grit Vortex general fault

e. Grit Pump
   1. Grit Pump HOA status
   2. Grit Pump Run Status
   3. Grit Pump general fault

f. Grit Classifier
   1. Grit Classifier HOA status
   2. Grit Classifier Run Status
   3. Grit Classifier general fault
   4. Grit Conveyor HOA Status
   5. Grit Conveyor Run Status
   6. Grit Conveyor Fault

g. Gas Monitoring

1. Explosive Gas Level #1
2. Explosive Gas Level #1
3. O2 Level #1
4. O2 Level #2
5. H2S Level #1
6. H2S Level #2

h. Odor Control
   1. Odor Control Unit #1 HOA Status
   2. Odor Control Unit #1 Run Status
   3. Odor Control Unit #1 Fault
   4. Odor Control Unit #2 HOA Status
   5. Odor Control Unit #2 Run Status
   6. Odor Control Unit #2 Fault

i. Operator Alarm Outputs
   1. Alarm Output #1 – Alarm listing
   2. Alarm Output #2 – Alarm listing
   3. Alarm Output #3 – Alarm listing
   4. Alarm Output #4 – Alarm listing
   5. Alarm Output #5 – Alarm listing
   6. Alarm Output #6 – Alarm listing
   7. Alarm Output #7 – Alarm listing
   8. Alarm Output #8 – Alarm listing

E. Operator Controls – Local Control Panels (Supplied by Equipment Suppliers)
   1. Hand-Off-Auto selector switches and call, run, fail pilot lights shall be provided for the, the mechanical influent screen and washer/compactor, and the grit removal system.
   2. Control packages, complete with all logic required for the individual control of the equipment shall be provided for each of the (1) mechanical bar screen, (1) washer/compactor, and (1) grit removal system. These control panels shall be capable of communication with the SCADA as noted herein.

F. Fiber Optic Port Switch (Six) – The fiber optic port switch shall be a Stratix Self Healing Ring or Engineer Approved Equal.

   1. General
      a. The PLCs and Workstations shall be connected to the WWCS network backbone through a 10/100 Industrial Rail Ethernet Switch. The Switch shall support fault tolerant ring architecture and shall provide full duplex capability and redundant power. 10/100 Industrial Rail Ethernet Switch shall provide five or more 10/100 Fast Ethernet ports, plus one standby port via RJ45 interfaces and one V.24 interface for external management. Two uplink ports shall be provided for integrated connectivity

to the fault tolerant Network backbone. Depending upon the fiber used the uplink ports will be Cat 6 cable or multimode fiber with ST connectors.

2. Frame Switching Functions

   a. All data received by the switch from the system bus or at the ports shall be stored and checked for validity. Invalid and defective frames as well as fragments shall be discarded. The switch shall forward valid frames.

   b. The switch shall learn all source addresses per port. Only packets with: unknown addresses, this address or a multi/broadcast address in the destination address shall be sent to this port. The switch shall be capable of learning two thousand (2,000) addresses.

   c. The Switch shall monitor the age of the learned addresses. The Switch shall delete address entries from the data table that exceed a certain age.

   d. The Switch shall support two priority queues. The classification of received data packets to these classes shall be done by: the pre-defined classification in statistical address entries and the priority of the data packet included in the VLAN packet.

   e. On data packets with VLAN tags the switch shall analyze the 3 bit priority field. Data packets with VLAN tags and a maximum long data field shall be transmitted. Data packets received without VLAN tags shall be transmitted without VLAN tags.

3. Specific Functions of the TP/TX Interface

   a. The Switch shall monitor the connected TP/TX line segments for short circuit or interrupt using regular link test pulses in accordance with IEE standard 802.3 10/100BASE-TP/TX. The Switch shall not transmit any data in a TP/TX segment from which it does not receive a link test pulse.

   b. If the reception line pair is incorrectly connected (RD+ and RD- switched) polarity shall be automatically reversed.

   c. 8 Port minimum.

4. Self-Healing Functions

   a. The Switches shall allow the backbone to assimilate a ring architecture. I one does switch fails or the backbone cable is cut, the ring structure shall change itself into a line structure within 0.5 seconds with up to 50 Switches on the network.

5. Voltage Supply

a. The voltage supply shall be redundant 24 VDC power supplies

6. Management

a. The Switch shall support SNMP and Web-based management for extensive diagnosis and configuration functions to allow easy startup procedures and allow network and device information. The Switch shall support TCPP/IP protocol family.

7. Technical Specifications

a. Operating Voltage – 24 VDC -25%, +33%

b. Current Consumption – 0.8 A max. at 24 VDC

c. Overload current protection – thermal fuse

d. Ambient temperature - 0°C to 50°C

e. Storage Temperature - -20°C to 80°C

f. Humidity – 10% to 90% (non-condensing)

g. Port attenuation – 11dB at 1300nm

8. Rail Switch shall be newest RS20 switches by Hirchmann.

2.03 WWCS STRATEGIES – Water Plant

A. The following WWCS strategies describing the operations of each WWCS loop indicated on the Drawings will be considered the essence of the specifications. Furnish and install all necessary equipment, instruments, software modules and appurtenances to achieve the performance as hereinafter described, even though such items may not be included in any specific listing of equipment to be furnished. An involved system of this nature requires emphasis on the functional aspects of the Specifications while the technical details serve to indicate the desired manner in which the end result will be accomplished. The control and monitoring strategies indicated below are for equipment external to any existing or proposed packaged process equipment. Control strategies for the packaged process equipment shall be as described in other parts of this specification and as required for proper operation of the system. The following control strategies are associated with the treatment facility indicated below:

1. Mechanical Influent Screens
   a. The one proposed influent screen shall be operated via a screen vender supplied control panels with communication between the vender control panel and the plant

WWCS. The vender supplied control panel shall provide the control logic for the screens and the WWCS shall monitor the screens only. The WWCS vendor shall review the mechanical screen control panel specification sections and shall coordinate with the screen vendor to ensure compatibility between the systems. The WWCS shall display the "HOA status", "run" status, "general fault alarm", screen operational float status, and screen channel high level float alarm.

b. WWCS: The WWCS shall indicate the operation status for the screen, including HOA status, screen run status, screen general fault, screen operational float status and screen channel high level float alarm. The WWCS system shall display the screens operating status. The WWCS shall initiate an alarm upon a screen general fault and a high liquid level condition. The WWCS shall accept and display each of the above status and alarm conditions. The WWCS vendor shall review the screen panel specification sections and shall coordinate with the screen vendor to ensure compatibility between the systems.

2. Compactor

a. The one proposed screening compactor shall be operated via a compactor vender supplied control panel with communication between the compactor vender supplied CP and the plant WWCS. The vender supplied panel shall provide the control logic for the compactor, with the WWCS monitoring the compactor only. The WWCS vendor shall review the compactor control panel specification sections and shall coordinate with the compactor vendor to ensure compatibility between the systems. The WWCS shall display the "HOA status", "run" status and "general fault alarm".

b. WWCS: The WWCS shall indicate the operation status for the screenings compactor, including "compactor running", "HOA status" and "general fault alarm". The WWCS system shall display each compactor operating status. The WWCS shall initiate an alarm upon a compactor general fault. The WWCS shall accept and display each of the above status and alarm conditions.

3. Vortex Grit Removal System

a. The one proposed grit removal systems consist of a vortex grit stirrer, a grit pump, a grit classifier, and grit conveyor. The grit removal system shall be controlled via a grit removal system vendor supplied PLC with Ethernet communication with the plant WWCS. The vendor supplied PLC shall control the grit removal process with the WWCS monitoring the process only. The WWCS vendor shall review the grit control panel specification sections and shall coordinate with the grit vendor to ensure compatibility between the systems.

b. WWCS: The WWCS shall indicate the operating status for the grit stirrer, grit fluidizing system, grit pump, grit classifier, and grit conveyor, including "grit stirrer run", "grit stirrer general alarm", "grit fluidizing HOA status", "grit fluidizing run", "grit fluidizing general fault", "grit pump HOA status", "grit pump run", "grit pump

general alarm", "grit classifier HOA status", "grit classifier run", "grit classifier general alarm", "grit system timer" setpoint "grit conveyor HOA status", "grit conveyor run", and "grit conveyor general alarm". The WWCS shall accept and display each of the above status and alarm conditions.

4. Odor Control

   a. The two proposed odor control units shall be operated via a odor control vender supplied control panel with communication between the compactor vender supplied CP and the plant WWCS. The vender supplied panel shall provide the control logic for the odor control units, with the WWCS monitoring the odor control units only. The WWCS vendor shall review the odor control vendor control panel specification sections and shall coordinate with the odor control vendor to ensure compatibility between the systems. The WWCS shall display the "HOA status", "run" status and "general fault alarm".

   b. WWCS: The WWCS shall indicate the operation status for the odor control units, including "odor control unit running", "HOA status" and "general fault alarm". The WWCS system shall display each odor control unit operating status. The WWCS shall initiate an alarm upon a odor control unit general fault. The WWCS shall accept and display each of the above status and alarm condition.

5. Gas Monitoring

   a. The WWCS system shall continuously monitor, display and alarm O2 Levels, Explosive gas levels, and H2S Levels.

6. Callout Alarm – Output System
   a. The WWCS shall provide 8 distinct digital alarm outputs within PLC-1. The WWCS shall allow for the operator to categorize each alarm condition in the system into a "callout", no "callout category". The WWCS shall further allow each alarm condition in the "callout category" to be selected by the operator into one of the 8 digital outputs. These outputs shall be sent to the control room by the WWCS vender and incorporated into the control board.

2.04 POWER SUPPLIES

A. Furnish power supplies located in the PLC and RIO cabinets of the d-c solid state type, designed for 2 and 4 wire transmitter loops where integrals instrument power supplies are not provided. Furnish power supplies suitable for use up to 15 instrument loops and designed for 4-20 mAdc current signals.

2.05 SPARE PARTS AND EQUIPMENT

A. Furnish the following spare parts and equipment and store as directed:
   1. One of each type of plug-in, process I/O board for PLC.
   2. 5 - 32GB Thumb Drives
   3. 5 spares for lights, fuses, or other consumable items.

2.06 TOOLS

A. Furnish a complete set of special tools required for the maintenance and operation of this equipment, as designed by the equipment manufacturer.

2.07 SHOP PAINTING

A. Furnish equipment with a complete manufacturer's standard corrosion resistant finish at the point of manufacturer. Engage the instrumentation supplier to provide adequate paint for repainting any areas damaged during delivery, storage or installation.

2.08 SHOP TESTING THE WWCS SYSTEM

A. Prior to shipment of the new WWCS system, factory test all elements of the system, both hardware and software to demonstrate that the total system satisfies all of the requirements of this Specification.

B. Furnish all special testing materials and equipment. Where it is not practical to test with real process variables, provide suitable means of simulation. These simulation techniques shall be subject to the approval of the Engineer.

C. Testing shall not be considered complete until all tests and test documentation has been completed, reviewed, and approved by the Engineer. Tests shall generally conform to the applicable sections of ISA-RP55.1. Demonstrate that all equipment conforms to these Specifications by submitting test results for similar units.

D. Coordinate all of the testing with all other associated suppliers and with the Owner, as specified. Notify the Engineer at least four weeks prior to start of test.

E. As a minimum, test the System at the factory with simulated inputs and outputs. Exercise all components and test all functions over their entire range. During the test, operate the system long enough to demonstrate that it is capable of continuous operation.

F. Submit a minimum of six copies of the results of the factory tests to the Engineer for review.

G. In the event that the conditions specified are not met or if the test is deemed unsatisfactory

for other reasons, correct the fault and retest the entire system until the tests are satisfactory to the Owner all at no additional cost to the Owner.

H. The Owner may elect to have up to three of his authorized representatives present to witness the tests. The Owner's authorized representatives will have access to all parts of the equipment, apparatus and test instruments and will have the right to check any or all readings, calibrations, or any factor necessary to determine whether or not the performances are in accordance with the Specifications.

I. Prior to the Factory Acceptance Test the WWCS vendor shall submit all screen shots to Owner for review. Once approved the WWCS vendor shall integrate them into the system.

J. The Owner reserves the right to waive the presence of any or all of his representatives at any or all witness tests. This right of waiver does not release the manufacturer from performing the required tests.

2.09 ELECTRICAL REQUIREMENTS

A. The power service to the PLC WWCS Panels shall be 120vac, 60 hz, single phase from the UPS provided under this section.

PART 3 EXECUTION

3.01 INSTALLATION

A. The WWCS System supplier shall be responsible install all equipment in accordance with the Drawings and manufacturer's recommendations or as directed by the Engineer.

3.02 PLANT STARTUP AND OPERATOR TRAINING

A. The WWCS supplier shall provide field tests of all the equipment specified to demonstrate compliance with all requirements for complete and ready for operation of all equipment. Final acceptance of the WWCS system will be made after complete system testing in the field is complete and the treatment system has operated for 2 weeks.

B. The WWCS system supplier shall provide a minimum of two (2) work days of onsite service for plant startup. Training shall be conducted by a factory trained plant operator employed by the manufacturer, and shall include all WWCS components.

C. The WWCS system supplier shall also provide a minimum of one (1) work days of onsite operator training. Training shall be conducted by a factory trained plant operator employed by the manufacturer, and shall include all WWCS components.

3.03 FIELD ACCEPTANCE TESTING FOR WWCS SYSTEM

A. The objective of these tests is to demonstrate that the WWCS System is operating and complying with the specified performance requirements.

B. Perform witnessed Functional Acceptance Tests on the complete system. Demonstrate each function to the satisfaction of the Engineer and the Owner on a paragraph-by paragraph basis.

C. Each test shall be witnessed and signed off by both the Contractor and the Engineer upon satisfactory completion.

D. Conduct the actual testing program with prior approved procedures and documentation.

E. For each test description include the following minimum information:
   1. Spec page and paragraph of function or loop demonstrated.
   2. Description of function or WWCS strategy and test to demonstrate it.
   3. Space for sign off and date by the Contractor, the Engineer, and the Owner.

F. After receipt of approval by the Engineer of the documentation and the test procedures and forms, set a date to start the test.

3.04 DEFINITION OF ACCEPTANCE

A. WWCS System acceptance shall be defined as that time when the following requirements have been fulfilled:

   1. All submittals and documentation have been submitted and reviewed and approved.
   2. The complete WWCS System has successfully completed all testing requirements cited herein.
   3. The training program has been completed.

END OF SECTION

SECTION 461015
VORTEX GRIT REMOVAL SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. The Contractor shall provide all labor, material, tools, supervision, transportation and installation equipment to furnish and install one (1) fully operational vortex grit removal systems, complete with a grit pump, control and appurtenances as shown on the drawings and as specified herein. Additionally, the Contractor shall furnish all labor, material, tools, supervision, transportation and installation equipment to furnish replacement parts, rebuild and relocate one grit cyclone classifier.

B. All equipment supplied under this section shall be furnished by or through a single Manufacturer who shall coordinate with the Contractor, the design, fabrication, delivery, installation and testing of the equipment. The Contractor shall have the sole responsibility for the coordination and performance of all components of the equipment with the performance and design criteria specified herein.

C. The Contractor shall be responsible to coordinate all details of the equipment with other related parts of the Work, including verification that all structures, piping, wiring, and equipment components are compatible. The Contractor shall be responsible for all structural and other alterations in the Work required to accommodate the equipment differing in dimensions or other characteristics from the Contract Drawings or Specifications.

1.02 REFERENCES

A. The vortex grit removal system shall, as applicable, meet the requirements of the following industry standards:

1. American Gear Manufacturers Association (AGMA)
2. International Electrotechnical Commission (IEC)
3. American Institute of Steel Construction (AISC)
4. American Society for Testing and Materials (ASTM)
5. American Welding Society (AWS)
6. American Society of Civil Engineers (ASCE)
7. Steel Structure Painting Council (SSPC)

B. Controllers shall, as applicable, meet the requirements of the following Regulatory Agencies.

1. National Electrical Manufacturer's Association (NEMA) Standards
2. National Electrical Code (NEC)
3. Underwriters Laboratory (UL and cUL)

1.03 SUBMITTALS

A. Shop Drawings

1. The manufacturer shall submit six (6) sets of shop drawings. Shop drawings shall include equipment descriptions, specifications, dimensional and assembly drawings, parts lists, and job specific drawings as follows:

a. Certified shop and erection drawings showing important details of construction dimensions, anchor bolt locations, and field connections.
b. Descriptive literature, bulletins, and catalogs of the equipment, including details of the motor, gear reducer and lubrication points.
c. Installation, operation, and start-up procedures including lubrication requirements.
d. Complete motor data.
e. A list of spare parts that are supplied with the equipment.

2. Operation and Maintenance Manuals

a. Manufacturer shall submit three (3) sets of Operation and Maintenance manuals. The manuals shall include contact information of service representatives, equipment descriptions, operating instructions, complete mechanical and electrical drawings, troubleshooting techniques, a recommended maintenance schedule, and the recommended lubricants.

1.04 QUALITY ASSURANCE:

A. All equipment furnished under this Section shall be of a single manufacturer who has been regularly engaged in the design and manufacture of the equipment and demonstrates, to the satisfaction of the Engineer, that the quality is equal to equipment made by those manufacturers specifically named herein. The system manufacturer shall have supplied a minimum of ten (10) vortex grit removal systems that has been in successful operation, at similar installations, for at least five (5) years.

B. The equipment furnished shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with approved drawings, specifications, engineering data, and/or recommendations furnished by the equipment manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING

A. The equipment shall be packaged in containers constructed for normal shipping, handling and storage.

B. The CONTRACTOR shall store and temporarily support equipment prior to installation in strict accordance with the manufacturer’s recommendations and instructions. Protect all exposed surfaces. Keep records of the storage parameters and the dates that storage procedures were performed. The CONTRACTOR shall be responsible for work, equipment, and materials until inspected, tested and finally accepted.

C. Protect the equipment from being contaminated by dust, dirt, vibration and moisture.

D. The unit shall be erected and lubricated in strict accordance with the instructions of the Manufacturer.

1.06 IDENTIFICATION

A. Each unit of equipment shall be identified with a corrosion resistant nameplate, securely affixed in a conspicuous place. Nameplate information shall include equipment model number, serial number, supplier's name, and location.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The physical layout of the system as shown on the contract drawings and the equipment specified herein are based upon the model, RAPTOR SpiraGrit as manufactured by Lakeside Equipment Corporation of Bartlett, IL. The use of this system does not remove any responsibility of the Contractor to verify dimensions and elevations to ensure the equipment will fit within the proposed building and equipment configurations. The use of any system other than the RAPTOR SpiraGrit system will require the manufacturer to provide a modified layout subject to the approval of the ENGINEER. The grit removal system supplied shall be in compliance with these specifications and plans and shall be supplied by one of the following manufacturers:

1. Lakeside Equipment Corporation
2. WesTech
3. Smith and Loveless

B. If the CONTRACTOR proposes an "or equal" system, it shall be understood that the proposed system meets or exceeds the specified performance and construction and offers a cost savings to the OWNER. The CONTRACTOR may be responsible for engineering time to review proposed substitutions.

2.02 GRIT REMOVAL EQUIPMENT

A. Performance Requirements

1. The grit removal system shall be engineered to meet the following requirements at up to the maximum grit chamber hydraulic capacity as noted in paragraph 2.02.E.1. and the average flow as noted in paragraph 2.02.C.4.:

   a. Remove 95% of grit greater than 50-mesh in size.
   b. Remove 85% of grit greater than 70-mesh in size.
   c. Remove 75% of grit greater than 100-mesh in size.

   The efficiency level relates to grit having a specific gravity of 2.65 and to the difference in grit content in the influent channel as compared to that of the effluent channel.

B. The grit cyclone-classifier shall be designed to receive up to the maximum grit slurry pumped flow rate of 250 gal/min and to convey the minimum grit capacity of 35 cubic feet per hour in accordance with CEMA calculations with a maximum trough loading factor of 15%.

C. The vortex grit collection equipment shall be complete with drive assembly with paddles, vortex grit pump, grit fluidizer, self-priming pump, grit cyclone-classifier with supplemental grit washing system, spare parts, anchorage materials, and shall be complete with electrical controls.

D. General Design Summary:

1. Number of Vortex Grit Systems.....- 1
2. Number of Self-Priming Grit Pumps.....- 1
3. Number of Grit Cyclone-Classifiers.....- 1
4. Design Average Flow, mgd.....- 1.80
5. Electrical Power Characteristics, VAC – Hertz – Phase .....- 460 – 60 – 3
6. Motor Electrical Classification.....- Class I – Division 1 – Group D
7. Electrical Enclosure Type .....- NEMA 4/12 painted steel

E. Vortex Grit Chamber Design Summary:

1. Maximum Flow Capacity per Grit Chamber, mgd.....- 4.00
2. Grit Chamber Inlet – Outlet Orientation, degrees .....- 360
3. Grit Chamber Inside Diameter, feet .....- 8.00
4. Grit Hopper Inside Diameter, feet.....- 3.00
5. Grit Chamber Maximum Operating Speed, rev/min .....- 21
6. Grit Chamber Drive Motor Size, hp.....- 1
7. Drive Tube Nominal Diameter, inches.....- 10
8. Grit Fluidization System Minimum Water Flow, gal/min .....- 20
9. Grit Fluidization System Minimum Water Pressure, psig.....- 50
10. Grit Suction Diameter, inches .....- 4

F. Self-Priming Grit Pump Design Summary:

1. Pump Capacity, gal/min .....- 250
2. Total Dynamic Head, feet .....- 43.00
3. Pump Suction Connection Diameter, inches.....- 4
4. Pump Discharge Connection Diameter, inches.....- 4
5. Motor Size, hp.....- 10

G. Grit Cyclone-Classifier Design Summary:

1. Maximum Grit Slurry Flow Rate, gal/min .....- 250
2. Classifier Maximum Grit Conveying Capacity, cu ft/hr .....- 35
3. Cyclone Inlet Diameter, inches .....- 4
4. Cyclone Overflow Diameter, inches .....- 6
5. Classifier Angle of Inclination, degrees.....- 16
6. Classifier Speed Reducer Minimum Torque Rating, in.-lb.....- 7,240
7. Classifier Speed Reducer Minimum Thrust Rating, lb_f.....- 4,100
8. Classifier Motor size, hp .....- 1

H. Materials Quality

1. All fabricated components of the vortex grit chamber and grit cyclone-classifier shall be AISI Type 304 stainless steel). Materials thicknesses identified in PART 2 - PRODUCTS are the minimum requirements for this project. Materials with increased thicknesses will be acceptable.

2. To ensure spare parts availability, all fabricated components shall be manufactured in the United States and shall comply with the New York Domestic Steel Products Act. To ensure prompt service and to ensure spare parts availability in a timely manner and at a reasonable cost, foreign fabricated materials of construction for the components shall not be acceptable for this project.

I. Quality Assurance

1. In order to assure uniform quality, ease of maintenance and minimal parts storage, it is the intent of these Specifications that all equipment called for under this Section shall be supplied by a single manufacturer. The equipment manufacturer shall, in addition to the CONTRACTOR, assume the responsibility for proper installation and functioning of the equipment.

2. Naming a Manufacturer in paragraph 2.01 does not relieve them from complying with the performance requirements, salient features, and the Made in the USA requirements of the Contract Documents. The Contract Documents represent the minimum acceptable standards for the vortex grit removal equipment for this project. All equipment shall conform fully in every respect to the requirements of the respective parts and sections of the drawings and specifications. Equipment that is a "standard product" with the manufacturer shall be modified, redesigned from the standard mode, and shall be furnished with special features, accessories, materials of construction or finishes as may be necessary to conform to the quality mandated by the technical and performance requirements of the specification.

J. Vortex Grit Chamber Equipment

1. General

   a. The vortex grit chamber inlet to outlet orientation shall be as noted in paragraph 2.02.E.2.

   b. The vortex grit chamber shall have an inside diameter as noted in paragraph 2.02.E.3.

   c. The vortex grit chamber grit storage hopper shall have an inside diameter as noted in paragraph 2.02.E.4.

2. Drive Assembly

   a. The grit removal drive mechanism shall consist of an electrical motor, a helical reduction unit, and an enclosed final reduction unit consisting of one pinion and an integral gear/bearing. All components are directly coupled, eliminating the use of chains and V-belts. The drive mechanism shall not be overloaded under normal operating conditions and shall be designed for heavy duty 24 hour per day service.

   b. The external tooth gear shall be an external gear/bearing unit such as manufactured by Rotek, Inc., Kaydon, Inc., or equal. The gear teeth shall be AGMA grade 6 or higher. The gear teeth shall have a core hardness of 250 to 300 BHN, and shall be induction hardened to a surface hardness of 52 to 60 Rc. The bearing raceway shall be hardened to 58 to 60 Rc, precision ground and have a minimum 20.5-inch ball path diameter. The main bearing shall be oil bath lubricated and have an AFBMA theoretical L10 design life in excess of 100 years. The main bearing shall have a seal to prevent contamination of the bearing raceway.

   c. The final reduction pinion shall be made of heat-treated alloy steel and shall be mounted on the output shaft of the reduction gearbox. The gear teeth shall have a core hardness of 300-350 BHN, and shall be induction hardened to a surface hardness of 52 to 60 Rc.

   d. The final reduction pinion and main gear shall have a service factor of 5.0, or greater, at the operating speed as noted in paragraph 2.02.E.5.

e. The helical reduction unit shall drive the pinion of the final reduction unit. The helical reduction unit shall have a minimum service factor of 2.0. The helical reduction unit bearings shall have an AFBMA theoretical L10 design life in excess of 100,000 hours.

f. The grit stirrer drive assembly speed reducer shall be driven by a field-replaceable, NEMA C-flanged, 1,800 rev/min, ball bearing, continuous-duty, totally enclosed, fan-cooled, premium-efficiency, 1.15 S.F., fan-cooled motor with leads to a large conduit box for outdoor operation. The grit stirrer drive assembly motor size shall be as noted in paragraph 2.02.E.6., shall be rated for electrical power characteristics as noted in paragraph 2.02.D.5., and shall be rated for an electrical environment as noted in paragraph 2.02.D.6. The explosion-proof motor shall be furnished with over-temperature thermostats in the windings designed for cut-out at approximately 160 degrees C.

g. The fabricated and machined final reduction unit housing shall be manufactured of A36 steel plate or cast iron. All welds shall conform to applicable specifications of the American Welding Society (AWS). After welding, all mounting and mating surfaces shall be machined to insure proper fit and alignment of the drive pinion and mating gear.

h. The final reduction unit housing shall be designed to prevent water from entering the housing in case of flooding by means of an air bell.

3. Drive Tube

a. The drive tube shall be driven by the main spur gear. The drive tube shall have a nominal diameter as noted in paragraph 2.02.D.7. and shall have a minimum wall thickness of 1/4-inch. The drive tube shall be stainless steel construction.

4. Paddle Assembly

a. The paddle assembly shall consist of four (4) fixed propeller blades. The propeller blades shall be affixed to the drive tube by means of a two (2)-piece collar. The collar shall allow adjustment of the propeller assembly in either an upward or downward position to ensure maximum grit removal.

b. The paddle blades shall be tapered with ample rounded leading edges and a fixed pitch of 45 degrees. The paddle assembly shall be stainless steel construction.

5. Floor Plate

a. To minimize the possibility of organic capture, the grit collector shall have a 1/2-inch thick stainless steel floor plate in the grit chamber. The floor plate shall consist of two (2) removable sections to allow access to the grit storage hopper.

6. Baffle

a. A 1/4-inch thick stainless steel baffle shall be furnished to optimize the vortex grit chamber's hydraulic conditions.

7. Grit Fluidizing System

a. The grit fluidization system shall include a water-scouring system to free the organics that have settled in the grit well. The grit fluidization system shall be designed for a minimum flow rate as noted in paragraph 2.02.D.8. and a minimum water pressure as noted in paragraph 2.02.D.9. The water-scouring supply line shall include a 1-1/2 inch diameter manual stainless steel ball valve and a 1-1/2 inch diameter solenoid valve for water flow control.

b. Solenoid valve shall be brass body suitable for 120 VAC operation with an electrical classification as noted in paragraph 2.02.D.6. Solenoid valves shall be normally closed and rated for up to 100 psig. Solenoid valves shall be slow close type to minimize water hammer.

c. A plant water filter, Keller Filter Products Model 075A, or equal, shall be provided for a 3/4-inch connection, a maximum flow rate of 25 gal/min with a maximum pressure drop of 2 psig, and shall be suitable for a maximum pressure of 125 psig. Water filter shall be a stacked filter element design with washable 80-mesh (200 micron) polyethylene or polypropylene disc elements, polypropylene head and bowl and Buna N gaskets. Y-strainers shall not be acceptable for this project.

d. Designs that utilize a mechanical grit stirrer assembly shall have field replaceable vanes/blades fabricated of material with a minimum Brinell hardness of 600.

8. Grit Suction Piping

a. The grit chamber shall be provided with a grit section pipe to connect to the self-priming pump. The grit suction pipe diameter shall be as noted in paragraph 2.02.D.10.

b. The grit suction pipe shall be Schedule 40S stainless steel pipe.

K. Self-Priming Grit Pump

1. The grit pump shall be a Gorman-Rupp Company Super Series T Model T4A71S-B/F, or equal, self-priming pump. The pump shall be capable of pumping a grit slurry flow rate as noted in paragraph 2.02.F.1. at a total dynamic head (TDH) as noted in paragraph 2.02.F.2.

2. The pump casing shall be Gray Iron No. 30 with a maximum operating pressure of 86 psig. The impeller shall be a two-vane design to handle a 3-inch maximum sphere size and shall be fabricated of G-R Hard Iron (400 Brinell minimum) for superior abrasion resistance. The impeller shaft shall be 4140 alloy steel. The pump shall be provided with a replaceable wear plate of hardened alloy steel or Hi-Chrome for superior abrasion resistance. A removable cover plate shall be provided of Gray Iron No. 30.

3. The pump suction connection diameter shall be as noted in paragraph 2.02.F.3. The suction side of the pump shall be provided with a flap valve fabricated of steel reinforced neoprene.

4. The pump discharge connection diameter shall be as noted in paragraph 2.02.F.4.

5. The pump suction and discharge connections shall be ANSI 125 lb flanges fabricated of Gray Iron No. 30.

6. The bearing housing shall be fabricated of Gray Iron No. 30. The seal plate shall be G-R Hard Iron material or Hi-Chrome for superior abrasion resistance. The shaft sleeve shall be 4130 alloy steel. The radial bearing shall be an open single ball bearing design. The thrust bearing shall be an open double ball bearing design. The bearing and seal cavity shall be oil lubricated by SAE No. 30 non-detergent oil. The bearing and seal cavity shall be provided with oil level sight gauges.

7. Gaskets shall be Buna-N, synthetic fibers, vegetable fibers, PTFE, cork and rubber. O-rings shall be Buna-N.

8. Mounting hardware shall be standard plated steel. A brass pressure relieve valve shall be provided.

9. The pump seal shall be cartridge type, mechanical, oil-lubricated, double floating, self-aligning complete with tungsten carbide rotating and stationary faces, AISI Type 316 stainless steel seat, Viton fluorocarbon elastomers and 18-8 stainless steel cage and spring.

10. The pump shall be driven by an 1,800 rev/min, ball bearing, inverter-duty, 1.0 S.F., totally enclosed, fan-cooled, premium-efficiency, fan-cooled motor with leads to a large conduit box for outdoor operation. The pump motor size shall be as noted in paragraph 2.02.F.5., shall be rated for electrical power characteristics as noted in paragraph 2.02.D.5,. and shall be rated for an electrical environment as noted in paragraph 2.02.D.6. Explosion-proof motor shall be furnished with over-temperature thermostats in the windings designed for cut-out at approximately 160 degrees C.

11. Power transmission from the continuous-duty motor to the pump shall be by means of a set of V-belts and sheaves. Belts and sheaves shall be designed with a minimum 1.5-service factor based on motor horsepower. Sheaves shall be two section units for both drive and driven sheaves and shall consist of a tapered split shaft bushing with three tapped holes to which the sheave is attached by three cap screws. Changing sheaves shall not require a wheel puller. Belts and sheaves shall be covered with a fabricated steel belt guard with a hinged expanded front panel in accordance with OSHA standards.

12. Pump and motor shall be provided on a fabricated steel base with a sliding motor base for belt tension adjustment.

L. Cyclone and Grit Classifier

1. Grit Cyclone

a. The grit cyclone inlet diameter shall be as noted in paragraph 2.02.G.3. and the overflow diameter shall be as noted in paragraph 2.02.G.4.

b. The cyclone shall consist of a heavy-duty fabricated steel volute feed chamber with cylindrical and conical sections of steel and aluminum to minimize overhung weight. Each section of the cyclone shall be completely lined and protected from the high velocity grit by replaceable neoprene liner sections that are chemically resistant to fats-oils-greases (FOG). The cyclone shall be constructed so any

section liner can be replaced independently. The inlet and overflow connections shall be of 150 lb ANSI steel flanges.

c. The cyclone vortex finder shall be made of an abrasion-resistant alloy with an approximate hardness of 500 Brinell. A hinge and quick disconnect clamp shall be provided between the apex assembly and lower cone section to allow removal of material which may clog the apex, without disconnecting any piping on the cyclone itself. The apex shall consist of a steel or aluminum housing with a replaceable manually adjustable neoprene liner. Each cyclone inlet shall be tapped for a 1-1/4 inch diameter NPT gauge connection with a diaphragm-protected pressure gauge.

d. The cyclone underflow shall feed into the classifier for washing and dewatering, and shall be sized so that the proper hydraulic loading is provided to the classifier.

e. The cyclone overflow will feed to piping furnished by the CONTRACTOR, which must be adequately vented to prevent siphoning.

2. Grit Classifier

a. The grit classifier shall be designed to handle a maximum underflow from the cyclone of 30 gal/min. The grit classifier shall comprise a complete stainless steel assembly including drive, helicoid screw conveyor, fabricated trough with supports and necessary anchorage parts.

b. Grit from the grit cyclone shall be discharged into the dewatering section of the trough and removed by the helical screw conveyor oriented at the angle noted in paragraph 2.02.G.5. The grit screw conveyor shall be 12-inch minimum diameter fabricated with stainless steel flights welded to a rotating 3-inch diameter Schedule 40S stainless steel pipe torque tube. The sectional flights shall be a 1/2-pitch design fabricated of 1/4-inch minimum thickness with a field renewable 1/2-inch wide Lincore 60G, or equal, continuous hard weld (minimum 615 Brinell hardness) on the outer leading face of the screw flights for abrasion resistance to silica sand that has a Brinell hardness of 570.

c. The drive end of the grit dewatering screw shall consist of 3-inch minimum diameter stainless steel stub shaft. The upper drive stub shaft and grit dewatering screw conveyor torque tube shall be accurately machined in accordance with paragraph 2.06.F. to allow a welded shrink-fit for the upper drive stub shaft. The lower end of the grit dewatering screw shall consist of 3-inch minimum diameter stainless steel tail stub shaft. The tail stub shaft and the grit dewatering screw conveyor torque tube shall be accurately machined in accordance with paragraph 2.06.F. to allow a welded shrink-fit for the lower stub shaft.

d. The lower end of the screw shall be supported with self-lubricated non-metallic sleeve bearing. The bearing housing shall be bolted to the outside of the classifier tank for ease of field replacement. The lower bearing shall be provided with two (2) neoprene lip seals, a UHMWPE seal plate, and a stainless steel retaining ring. The lower bearing housing shall be provided with a grease connection to allow the housing to be packed with grease. The lower bearing housing shall be bolted to the grit classifier tank with a minimum of eight (8) bolts. Welding the lower bearing housing to the grit classifier tank shall not be acceptable for this project.

e. The grit dewatering screw shall operate in a washing-classifying trough fabricated with 1/4-inch thick stainless steel minimum plate, fitted with a grit inlet and discharge connection. Cyclone inlet housing to the classifier shall be fabricated of 12 gauge stainless steel sheet. The grit discharge chute shall be fabricated of Schedule 10S stainless steel pipe. The grit classifier tank shall be provided with a 4-inch diameter plain end Schedule 40S stainless steel overflow pipe stub. A 2-inch diameter Schedule 40S stainless steel NPT half coupling with pipe plug shall be provided to drain the tank. The supports for the grit cyclone and grit classifier tank shall be fabricated of structural stainless steel sections with a 1/4-inch minimum thickness. The grit classifier shall be provided with an 11-gauge minimum thick stainless steel covers. A neoprene gasket shall be glued to the upper classifier tank lip to prevent leakage between the classifier tank and each cover section.

f. Grit laden wastewater piping from the grit pump to the grit classifier and wash water return piping from the grit classifier shall be provided by the contractor.

g. The grit classifier screw conveyor shall be driven by a direct-connected, cycloidal-helical, hollow-shaft, high-thrust, in-line speed reducer designed for a maximum output speed of 11.6 rev/min. The cyclo element of the speed reducer shall be designed to take a 500 percent shock load without damage. The speed reducer manufacturer shall be a member of AGMA. Combination gear motor designs shall not be acceptable for this project. The speed reducer shall have a minimum torque rating as noted in paragraph 2.02.G.6. and a minimum thrust rating as noted in paragraph 2.02.G.7. The speed reducer shall utilize a taper grip bushing to connect to the drive shaft of the grit dewatering screw conveyor. The use of keys and keyways shall not be an acceptable connection method for this project. The speed reducer shall be bolted to the drive adaptor flange at upper end of the grit classifier tank.

h. The speed reducer shall be driven by a field replaceable NEMA C-flanged, 1,800 rev/min, ball bearing, continuous-duty, totally enclosed, fan-cooled motor with leads to a large conduit box for outdoor operation. The reducer shall utilize a taper grip bushing to connect to the drive shaft of the screw conveyor. The use of keys and keyways shall not be an acceptable connection method for this project. Motor size shall be as noted in paragraph 2.02.G.8., shall be rated for electrical power characteristics as noted in paragraph 2.02.D.5., and shall be rated for an electrical environment as noted in paragraph 2.02.D.6. Explosion-proof motor shall be furnished with over-temperature thermostats in the windings designed for cut-out at approximately 160^{o}C.

i. Chain-drives, belt drives, hydraulic drives, or a separate upper bearing for the transport screw shall not be acceptable for this project.

j. Grit Washing System

1) A wash water supply system shall be provided in the side of the classifier tank to provide supplemental grit washing. The wash water supply system shall include a 3/4-inch diameter minimum, brass body solenoid valve suitable for 120 VAC operation with an electrical rating as noted in paragraph 2.02.D.6. Solenoid valves shall be normally closed and rated for up to 100 psig. Solenoid valves shall be slow close type to minimize water hammer. A ball valve shall be provided. Ball valve shall be 3/4-inch diameter, 1/4-turn, stainless steel body with stainless steel ball and Teflon seats, and shall have an adjustable stop handle for volume control of the grit wash system.

2) A plant water filter shall be provided suitable for a 3/4-inch connection and a maximum flow rate of 25 gal/min and suitable for a maximum pressure of 125 psig. Water filter shall be a stacked filter element design with washable 80-mesh (200 micron) polyethylene or polypropylene disc elements, polypropylene head and bowl and Buna N gaskets. Wye-type strainers shall not be acceptable for this project.

2.03 CONTROL AND INSTRUMENTATION

A. All controls necessary for the fully automatic operation of the vortex grit removal system, self-priming grit pump, and grit cyclone-classifier shall be provided in accordance with NEMA electrical standards.

B. Timers and counters in the PLC shall be used to control the self-priming grit pump and the grit cyclone-classifier. The grit cyclone-classifier shall be electrically interlocked to the operation of the self-priming grit pump and the grit fluidizing solenoid valve.

C. The remote-mounted main control panel (MCP) shall include the following items:

1. Door interlocked fused disconnect
2. Allen-Bradley MicroLogix 1400 programmable logic controller (PLC) with LCD display, 10/100 Base T Ethernet port, relays and timers to monitor equipment-mounted electrical devices and to perform necessary logic functions, and back-up memory module
3. Allen Bradley PanelView+6 (700) TouchScreen OIT, 6.5-in. color display with Ethernet shall be mounted on front door of the main control panel
4. Motor starters for each of the following:
   a. Vortex grit stirrer drive
   b. Grit classifier
5. Variable frequency drive (VFD) with manual speed adjustment and a line reactor for the self-priming grit pump
6. 5-inch by 7-inch window kit to view the pump VFD display
7. Grit pump thermal overload protection
8. Control power transformer fused primary and secondary with 120 VAC transient voltage surge suppressor (TVSS)
9. Full-voltage LED pilot lights for each of the following:
   a. Control power ON (White)
   b. Grit stirrer RUN (Green)
   c. Grit fluidizing system RUN (Green)
   d. Self-priming grit pump RUN (Green)
   e. Self-priming grit pump high temperature ALARM (Red)
   f. Grit Classifier RUN (Green)
   g. Grit Classifier washing system RUN (Green)
   h. Multifunctional overload shutdown grit stirrer - grit pump - classifier fault ALARM (Red)
10. Door-mounted non-resettable elapsed time meters for the following:
    a. Grit stirrer drive
    b. Self-priming grit pump drive

c. Grit classifier drive

11. Remote dry contact outputs for each of the following:
    a. Grit stirrer RUN
    b. Grit fluidizing system RUN
    c. Self-priming grit pump RUN
    d. Self-priming grit pump high temperature ALARM Grit Classifier RUN
    e. Grit Classifier washing system RUN
    f. Multifunctional overload shutdown grit stirrer - grit pump - classifier fault ALARM
12. White phenolic nameplates with black lettering
13. 600 VAC terminal block
14. U.L. label for the project application
15. Electrical enclosure shall be provided in accordance with paragraph 2.02.D.7.

D. An operator local control station (LCS) for the vortex grit system shall contain the following items:

1. HAND-OFF selector switch for the vortex system grit paddle drive
2. HAND-OFF-AUTO selector switch for each of the following:
    a. Grit fluidizing system solenoid valve
    b. Self-priming grit pump
3. E-STOP pushbutton (Red)
4. White phenolic nameplates with black lettering
5. NEMA 4/7/9 4-hole cast aluminum explosion-proof enclosure

E. An operator local control station (LCS) for the grit cyclone-classifier shall contain the following items:

1. HAND-OFF-AUTO selector switch for each of the following:
    a. Grit classifier drive
    b. Grit classifier grit washing system solenoid valve
2. E-STOP pushbutton (Red)
3. CYCLE/RE-SET pushbutton – shall allow the grit system to be re-set after the E-STOP pushbutton is pulled out. The CYCLE/RE-SET pushbutton shall also allow the plant operations staff to run the grit removal system through a complete cleaning cycle via the PLC logic by holding in the pushbutton for a pre-set time.
4. White phenolic nameplates with black lettering
5. NEMA 4/7/9 4-hole cast aluminum explosion-proof enclosure

F. Control Strategy:

1. The main control panel shall fully operate the each grit removal system as follows:

    a. With the selection of the AUTO mode at the associated grit pump, grit fluidizing system, grit classifier and grit washing system, the main control panel shall initiate a run cycle based on an operator set timer.
    b. The number of starts per hour and the run duration shall be set by the operator via the main control panel OIT.

2.04 ANCHOR BOLTS

A. Equipment manufacturer shall furnish all anchor bolts of ample size and strength required to securely anchor each item of equipment. Bolts, washers, and hex nuts shall be AISI Type 304 stainless steel unless noted otherwise. Anchor bolts shall be expansion-type or epoxy-type stainless steel.

B. Anchor bolts shall be set by the CONTRACTOR. Equipment shall be placed on the foundations, leveled, shimmed, bolted down, and grouted with a non-shrinking grout.

2.05 SHOP SURFACE PREPARATION AND PAINTING

A. Electric motors, speed reducers, and other self-contained or enclosed components shall be supplied with the manufacturer's standard finish coating.

B. Rust preventative compound shall be applied to all machined, polished, and nonferrous surfaces that are not to be painted.

C. Clean all stainless steel surfaces and provide glass bead blast or chemically passivate all external non-wetted stainless steel to a uniform finish with Citrisurf 2050 and/or 2210. Chemical passivated stainless steel products shall not produce any hazardous wastes during the passivation process. The grit removal equipment manufacturer shall clearly identify the passivation procedure methodology and shall certify that no hazardous wastes were produced.

2.06 SOURCE QUALITY CONTROL

A. All structural stainless steel and carbon steel components shall be fabricated in the United States and shall conform to the requirements of "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" published by the American Institute of Steel Construction.

B. All stainless steel parts and assemblies shall be fabricated from sheets and plates of AISI Type 304 stainless steel conforming to AISI 304 and ASTM A666, unless noted otherwise. Fabricate all rolled or extruded shapes to conform to ASTM A276. All stainless steel tubular products and fittings shall conform to ASTM A269, A351, and A403.

C. All welding in the factory shall use shielded arc, inert gas, MIG, or TIG method. Add filler wire to all welds to provide for a cross section equal to or greater than the parent metal does. Fully penetrate butt welds to the interior surface and provide gas shielding to interior and exterior of the joint.

D. Field welding of stainless steel will not be permitted.

E. Assembly bolts, nuts, and washers shall be AISI Type 304 stainless steel furnished in accordance with ASTM A193.

F. All surfaces that are specified to be machined shall be designed and fabricated to provide a runout of not more than 0.005 inches and a concentricity to within 0.005 inches.

G. Design and fabrication of structural steel members shall be in accordance with AISC and AWS Standards. The manufacturer shall comply with the American Welding Society (AWS) and the American Institute of Steel

Construction (AISC) most current listed standards and qualifications in 2004 D1.1, the criteria per the requirements of Section 6 - Inspection - Structural Welding Code. Evidence of such AWS and AISC compliance shall be submitted with shop drawing submittals as follows:

1. The fabrication facility shall successfully meet the quality certification requirements of the AISC Quality Certification Program with a Category I or higher. The AISC Quality Certification Program will confirm that the AISC certified shop has the personnel, organization, experience, procedures, knowledge, equipment, capability and commitment to produce fabricated steel or stainless steel of the required quality for the wastewater treatment equipment.

2. AWS Certified Welding Inspectors (minimum 2 on staff) shall conform to all standards, current or previous as listed in section 6.1.4 AWS QC1, Standard and Guide for Qualification and Certification of Welding Inspectors.

3. AWS Non Destructive Testing Inspectors (Level I, II, III) for Magnetic Particle and Ultra-Sonic testing (minimum 2 on staff) shall conform to all standards, current or previous as listed in and in conformance with The American Society for Non-Destructive Testing (ASNT-TC-1A).

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be installed in strict conformance with the manufacturer's installation instructions, as submitted with Shop Drawings, Operation & Maintenance Manuals and/or any pre-installation checklists. Installation shall utilize standard torque values and be installed secure in position and neat in appearance. Installation shall include any site preparation tasks, pre-installation tasks as determined by the manufacturer; such as unloading, touch-up painting, etc. and any other installation tasks and materials such as wiring, conduit, controls stands, as determined by the customer and/or specified by the manufacturer.

3.02 FIELD PREPARATION AND PAINTING

A. Finish field preparation and painting shall be performed as specified in Section 099100.

B. The CONTRACTOR shall touch-up all shipping damage to the paint and stainless steel as soon as the equipment arrives on the job site.

C. The CONTRACTOR shall supply paint for field touch-up and field painting.

D. The CONTRACTOR shall finish paint electrical motors, speed reducers, and other self-contained or enclosed components with oil-resistance enamel.

E. Prior to assembly the CONTRACTOR shall coat all stainless steel bolts and nut threads with a non-seizing compound.

3.03 INSTALLATION

A. The manufacturer shall schedule two (2) trips to the project site for equipment start-up assistance as noted in paragraph 3.02.B. for the CONTRACTOR and for operating training as noted in paragraph 3.05.A. for OWNER personnel.

B. After the CONTRACTOR has installed the vortex grit removal system and the equipment is capable of being operated, the equipment manufacturer shall furnish a qualified representative for a minimum of three (3) days (up to 24 hours) to inspect the equipment and to supervise field-testing and start-up for the CONTRACTOR.

C. After the equipment has been placed into operation, the manufacturer's representative shall make all final adjustments for proper operation.

3.04 FIELD QUALITY CONTROL

A. Operational Test

1. Prior to acceptance by OWNER, formal start-up and testing of all equipment and control systems shall be conducted by the CONTRACTOR, in the presence of the ENGINEER and a representative of the equipment vendor, to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.

B. Manufacturer Training

1. A representative of the of the vortex grit removal system Manufacturer shall, at the successful completion of start-up provide one (1) 8-hour day of on-site training for the operators and shall demonstrate the basic operation and maintenance procedures. This training may not be conducted until such time that all start-up and testing has been successfully completed. The vendor is cautioned that these training sessions must be scheduled in advance and have prior approval to be considered completed.

2. Follow-up service: The manufacturer’s representative shall return to the facility at the end of the Warranty period to address any operational issues which have arisen. This inspection does not eliminate the possible need for the representative to return sooner if equipment problems arise.

3.05 WARRANTY

A. A written one year standard warranty from the date of the successful equipment start-up shall be provided by the equipment Manufacturer to guarantee that there shall be no defects in material or workmanship in any item supplied.

3.06 SPARE PARTS

A. The following spare parts shall be provided:

1. One (1) set of V-belts for the self-priming grit pump
2. One (1) set of liners for the grit cyclone
3. One (1) grit classifier lower bearing with seal set and wear sleeve
4. One (1) set of spare fuses of each size and type

Spare parts shall be individually boxed with the project name and part number clearly identified on each individual box. All spare parts shall be shipped in a separate crate and clearly labeled. Spare parts shall be stored indoors by the CONTRACTOR in a temperature-controlled environment.

END OF SECTION

SECTION 461190
TRICKLING FILTER

PART 1 - GENERAL

1.1 SUMMARY

A. Provide trickling filter media and rotary distributor as specified in this section.

B. All equipment supplied under this section shall be furnished by or through a single Manufacturer who shall coordinate with the Contractor, the design, fabrication, delivery, installation and testing of the equipment. The Contractor shall have the sole responsibility for the coordination and performance of all components of the equipment with the performance and design criteria specified herein.

C. The Contractor shall be responsible to coordinate all details of the equipment with other related parts of the Work, including verification that all structures, piping, wiring, and equipment components are compatible. The Contractor shall be responsible for all structural and other alterations in the Work required to accommodate the equipment differing in dimensions or other characteristics from the Contract Drawings or Specifications.

1.2 MATERIAL OF CONSTRUCTION FOR ROTARY DISTRIBUTOR

A. Center column, support truss, tub and tie rod will be HDG.

B. Hardware, anchor bolts/fasteners and other miscellaneous materials items will be 304 SS.

1.3 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 013300, copies of all materials required to establish compliance with the Section. Submittals shall include at least the following:

1. Certified shop and erecting drawings showing all important details of construction, dimensions, weld requirements and anchor bolt locations.

2. Descriptive literature, bulletins and/or catalogs of the equipment.

3. A complete total bill of materials for all equipment.

4. Complete description of surface preparation and shop prime painting.

5. Certified copies of field test report.

1.4 QUALITY ASSURANCE

A. Only the equipment of a manufacturer of the type described in this section of the specifications, which has been in actual service at least five years shall be considered.

B. Manufacturer's Field Reports

1. Carefully inspected all fabrication at the site of fabrication by factory inspectors.

2. Use inspection means necessary to assure the proper fit of all field connections and compliance with all material and fabrication requirements of the specifications.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping

1. Deliver all pieces in the largest pieces practical for field assembly by the Contractor.

2. Permanently tag individual pieces with welded erection marks or stainless-steel tags to cross reference with information on the Manufacturer's erection and assembly drawings.

3. Protect mechanical components from the weather and package suitably to facilitate handling and storage.

1.6 FIELD SERVICE

A. B. Services of the Manufacturer’s Representative

1. The manufacturer shall furnish an engineer experienced in the erection, alignment and operation of the equipment furnished and this section for a minimum of 1 day to supervise the erection and adjustment of the equipment and to certify its readiness for operation. Each day shall include a full 8-hour working day on the project site, travel time shall be additional to these requirements.

2. The manufacturer’s engineer shall be present at:

   a. Frequent intervals to ensure proper erection and satisfactory operation of equipment,
   b. Beginning of uncrating, assembly, and installation
   c. Final installation and alignment.

3. A factory representative who has complete knowledge of the proper operation and maintenance of the equipment furnished shall be provided for 1 day as defined above, and in addition to the days required above, to instruct representatives of the Owner and the Engineer on proper operation and maintenance of the equipment after the final operational test is successful, and the operation and maintenance manuals have been furnished and approved.

PART 2 - PRODUCTS

2.1 GENERAL DESIGN

A. The trickling filter media and rotary distributor specified in the section shall be an EIMCO-KCP Rotary Distributor as provided by Rebuild-it Services Group (RSG), or equal.

Item	**Description**	**Details**
1	Internal Diameter of the Trickling Filter	40 feet
2	Quantity (Nos)	Two (2)

3	Type of Mechanism	Central Driven Type
4	Efficiency of filters (%)	87%
5	Maximum flow	1,388 gpm per filter
6	RPM (min/max)	0.75 to 1.5
7	No of arms	2

B. Description

1. The rotary distributors shall be suitable for evenly distributing typical screened, de-gritted, and settled wastewater onto trickling filter media.

2. The rotary distributor shall be rotated by reaction forces of fluid flowing through orifices and shall operate freely over the entire design flow range. Arms shall be sized for the maximum liquid velocity listed.

3. Distributors shall be designed such that the two arms are in operation and capable handling high flows; a drive mechanism shall be in place to keep the rotary turning during low flow operations. The head, as measured from the top of the filter media to the water level in the center barrel, shall not exceed the specified maximum operating head at the maximum flow rate.

C. Drive unit shall be hydraulic with no motor.

D. Materials: All structural steel shall conform to the requirements of ASTM A36. Steel pipe used for structural members shall conform to ASTM A 53. Steel members in contact with liquids either continuously or intermittently, shall have a minimum thickness of 1/4-inch. All aluminum shall be type 5052, 6061, or 6063 alloy unless noted. Stainless steel shall be per ASTM A240, stainless steel pipe shall be per ASTM A312.

E. Fabrication: Shop fabrication and welding of structural members shall be in accordance with the latest edition of the “Structural Welding Code”, AWS D 1.2 for aluminum, of the American Welding Society. All welded connections shall develop the full strength of the connected elements and all joined or lapped surfaces shall be completely seal welded with a minimum 3/16-inch fillet weld. Intermittent welding shall not be allowed.

1. Edge Grinding: Sharp projections of cut or sheared edges of metals shall be ground to a radius by multiple passes of a power grinder as required.

2. Structural Design: The ratio of unbraced length to least radius of gyration (slenderness ratio) shall not exceed the values listed in the AISC manual. In addition, all structural members and connections shall be designed so that the unit stresses will not exceed AISC allowable stressed by more than one-third when subject to extreme live load conditions of wind, ice, seismic, and operation loads. All steel design shall be in accordance with the AISC Manual of Steel Construction, latest edition, and the Uniform Building Code (UBC), latest edition.

2.2 CENTER ASSEMBLY

A. A. The center assembly shall be the top bearing support type and shall consist of a stationary base and center mast, a rotating center barrel with support cage, thrust bearing, stabilizing

bearing, barrel seal and lubrication fittings. The center assembly shall be shop assembled, adjusted, aligned and shipped as a complete unit.

B. Base and Center Mast: The stationary base shall be of fabricated galvanized steel and arranged for bolting to the concrete center pier. The center of the base shall be open to allow for influent flow into the center barrel. A pipe center mast designed to withstand any overturning moments shall extend vertically from the base to the top of the distributor where it shall support the thrust bearing assembly. The base shall be grouted in place only after complete assembly and leveling of the distributor.

C. Center Barrel and Support Cage: The rotating center barrel shall be a minimum of 1/4-inch fabricated aluminum of sufficient strength and size to handle the specified flows. The center barrel shall include an annular baffle with an adjustable weir to divide the flow between the primary and secondary arms. Opening shall be provided with flanged connections for attachment of distribution arms. The center barrel shall be designed to properly distribute the flow to the arm eliminating eccentric loads as the distributor starts or stops. A support cage shall be furnished, fabricated of structural members arranged as a supporting frame between the center barrel and the thrust bearing assembly. The cage shall be equipped with top connections for tie rod arm supports.

D. Upper Bearing: The upper bearing shall be located above the influent at the top of the stationary center mast. The bearing shall be an oil lubricated, precision 4-point contact bearing. Designed for an ABMA L10 life of over 30 years at full hydraulic load. The bearing housing shall include a filler pipe, oil level plug, and an oil drain plug.

E. Barrel Seal: A seal shall be provided between the stationary base and the rotating barrel. It shall be a mechanical seal and shall be designed to withstand the full hydraulic head in the center barrel. It shall consist of a weighted replaceable annular ring of Buna-N attached to the stationary base, with the outer portion resting on a replaceable seal plate.

2.3 DISTRIBUTION ARMS

A. Distribution Arms: Distribution arms shall have a rectangular tapered cross section of fabricated aluminum. Each arm shall be provided with openings to accept spreader assemblies. The spreader assemblies shall consist of an interchangeable orifice and a spreader.

B. Interchangeable orifices: Orifices shall be sized and located to provide uniform flow distribution over the entire area of the filter bed. Orifices will be interchangeable at the spreader and shall have a minimum opening of 1-inch diameter to minimize plugging.

C. Spreaders: Spreaders shall be of high-strength polycarbonate construction and shall be located to provide uniform flow distribution over the entire area of the filter bed. Assemblies that use two bots or more to connect to the arms shall not be acceptable.

D. A large 2-inch vent and a quick opening flushing gate shall be provided for each distribution arm.

E. The arms shall be vertically supported from the top of the support cage by 304 stainless steel tie rods, turnbuckles and end attachments, and they shall be laterally braced by horizontal stainless-steel stranded cable with adjustable end attachments.

2.4 ANCHORAGE AND FASTENERS

A. Anchor Bolts: All anchor bolts shall be existing. Supplier shall supply hex nuts and flat washers.

B. Fasteners: All structural fasteners shall be a minimum of 1/2-inch diameter and made of type 304 stainless-steel. The equipment supplier shall furnish all fasteners required for the assembly of the equipment.

2.5 SPARE PARTS

A. One (1) Wedge tight, quick opening flush gate

B. Ten (10) Adjustable orifice plates

C. Ten (10) Flow spreaders nozzles

D. One (1) Distribution arm gasket

E. One (1) complete set of seals & gaskets

2.6 TRICKLING FILTER MEDIA

A. MANUFACTURERS

1. Brentwood Industries, Inc. of Reading, Pennsylvania.

2. Or equal

B. DESIGN CRITERIA

1. The provided media shall be vertical type flow and rated for 55% BOD removal.

C. MATERIALS

1. The media modules shall be manufacture from flame resistant, self-extinguishing polyvinyl chloride (PVC). Due to high flammability and excessive creep, polypropylene (PP) shall not be acceptable.

2. PVC sheets material shall be conducive to biomass growth and UV protected. PVC Sheets shall be resistant to rot, fungi, bacteria and inorganic/organic acids and alkalies as commonly found in municipal wastewater.

3. The media manufacturer shall supply a signed certificate from the raw material vendor that certifies all PVC resin supplied for this project contains a minimum of 1.5% (by

weight) combined TiO2 and carbon black (minimum 0.5% of either component) as UV inhibitors.

4. PVC sheets conforming to ASTM D1784 cell classification 12344B with the following properties:

	Property	ASTM	Units	Value
1	Specific Gravity	D792	gm / cu.cm	1.50 *max.*
2	Tensile Strength	D638 / D882	psi	6,000 *min.*
3	Flexural Modulus	D790	psi	525,000 *min.*
4	Flexural Strength	D790	psi	11,000 *min.*
5	Elastic Modulus	D638 / D882	psi	360,000 *min.*
6	Impact Resistance	D5420	in. lbs. / mil	0.8 *min.*
7	Heat Deflection	D648	^{o}F (264 psi)	158 *min.*
8	Flammability	D635		<25 mm <5 sec.

D. MEDIA SUPPORT GRATING

1. Pultruded fiberglass grating shall be installed on the concrete supports. The Contractor shall confirm the concrete supports meet or exceed the loading requirements. Nominal 12-inch wide by 2-inch tall grating shall be capable of supporting the design load. Grating shall provide 50% void space and sufficient contact with Media Modules to prevent media deformation. The FRP grating, with a net support span of 24-inch, shall have a maximum service load not less than 2,100 PSF under uniform load. Product data shall be submitted to the engineer for review.

2. Support grating shall be Creative Pultrusion SupergrateTM Pultruded Grating T5020 or approved equal.

E. STRUCTURED PVC MEDIA MODULES:

1. PVC sheets shall be thermoformed into corrugated sheets with dedicated bond points to allow precise alignment of sheets during assembly. PVC Media Modules shall be assembled from corrugated sheets. Sheets shall be solvent bonded at dedicated bond points into a vertical-corrugated pattern.

2. The sheet gauge for each module shall be sufficient to provide the following minimum load bearing strengths:

   a. Modules in the top layer shall have a minimum bearing capacity of 1000 PSF.
   b. Modules in the intermediate layers shall have a minimum bearing capacity of 400 PSF or 40PSF per foot of media height above the module as installed in the filter whichever is greater.
   c. Media modules in the bottom layer shall have a load bearing capacity calculated 40 PSF per foot of media height or 1000 PSF, whichever is greater.

3. The finished modules shall be suitable for normal wastewater temperatures between 50°F and 75°F.

4. Media Modules shall be Brentwood Industries model VF3400.

a. Media module shall have square/rhombus shaped openings designed to minimize plugging.
b. Flute height for each corrugation shall be 1.34 in. There shall be a minimum of 18 sheets per 24-in. wide assembled Media Module.
c. Each Structured PVC Media Module must provide a minimum surface area of 27 sq. ft. / cu. ft. with a minimum of 95% void-to-volume ratio.

5. Media Modules assembled from non-thermoformed sheets, sheets with glued or thermo-bonded joints, and sheets which do not provide dedicated bond points for precise sheet alignment shall not be accepted.

F. PROTECTIVE SURFACE GRATING:

1. Protective Surface Grating shall consist of interlocking polypropylene panels. When installed the grating shall provide a continuous protective surface for the Media Modules, minimize hydraulic impact, provide additional UV protection, and allow operator access to the top of the media.

a. Grating panels shall have nominal measurements of: 24 in. in width, 24 in. in length, 1-¼ in. in height, and shall weigh approx. 2 lbs.
b. Opening in the grating shall be nominal 2 in. by 2 in. to protect media from hydraulic impact.
c. Grating shall have a non-skid surface.
d. Grating must not adversely impact or damage media.
e. Grating design shall be interlocking such that hold down ties, clips or fasteners are not required

2. Grating shall be Brentwood Industries “AccuGrid” or approved equal.

G. MEDIA SHEET TESTING

1. ISO certified manufacturers can submit their ISO Certificate and historic media testing data and are not subject to mandatory media sheet testing. Non ISO certified Manufacturers are required to do mandatory media sheet testing as described herein. ISO certification shall be for both the media sheet forming and media module assembly facility (facilities). Media Manufacturers having only partial ISO certification are required to do mandatory media testing described as follows.

2. Testing of PVC sheets used in the fabrication of media modules to be used in this project shall be conducted at the media manufacturer’s material testing laboratory or an independent laboratory approved in writing by the Engineer prior to the start of testing.

3. Testing shall be performed on both the thinnest and heaviest gauge to be used in this project. The engineer and/or owner shall select media sheets from modules delivered to the job site. Parameters to be tested shall include all eight (8) parameters as shown in Table in 2.02 D of this specification. Testing shall conform to all ASTM standards shown in the same Table and shall result in a certified report signed and sealed by a registered PE. Reports from previous projects are not acceptable.

4. Failure of any one test to meet the required standards will be considered as grounds for rejection of the material. In such an event, the Engineer may request tests on additional sheets, at no cost to the Owner, as necessary to determine the acceptability of the material.

5. Non-testing of sheets shall be deemed as grounds for not meeting the material properties as shown in Table 2.02D and potential rejection of the media products. All costs associated with media sheet testing shall be borne by the media manufacturer bidding the job.

H. MODULE TESTING

1. ISO certified manufacturers can submit their ISO Certificate and historic media testing data and are not subject to mandatory media testing. Non ISO certified Manufacturers are required to do mandatory media testing as described herein. ISO certification shall be for both the media sheet forming and media module assembly facility (facilities). Media Manufacturers having only partial ISO certification are required to do mandatory media testing described as follows.

2. Non ISO certified trickling filter media manufacturer shall provide one structural test for each different media type and each different strength gradation to be used in the project. The structural testing shall be done at the media manufacturers' test facility or at an independent laboratory approved in writing by the project engineer. The structural tests shall conform to the following criteria:

   a. The test sample shall consist of four 2 ft. wide by 2 ft. high by 4 ft. long media modules stacked two modules high with two modules in each layer. The arrangement of the stacked modules shall simulate the geometry as placed in the trickling filter.
   b. Modules intended for the base layer shall be tested on a simulation of the media support system. Modules intended for all other layers shall be tested on a flat base.
   c. Test loads shall be the design load of the media as specified. The test load shall be at a temperature of 75 oF ±2 oF .
   d. A preload equal to 10% of the design load shall be applied to act as a seating load, which shall be retained for 1 hour.
   e. After 1 hour, the deflection shall be noted and considered zero and the load increased in 10 percent increments of the design load. Each loading shall be held for 5 minutes and the deflection recorded at the end of the 5-minute period. Incremental loading shall continue until failure.
   f. Maximum allowable deflection at the design load shall be 1.0 percent. The term "deflection" shall mean the vertical deflection expressed as percent of the vertical distance between the top and bottom surfaces of the stack of media after the pre-load.

3. The project engineer shall have the opportunity to witness the media testing or the test results meeting the specified load criteria and maximum allowable deflection shall be certified by a P.E. and submitted to the project engineer for approval prior to the installation of the media.

4. All tested modules shall come from random pulls of media delivered to the site by the Contractor and/or Engineer. Media packs from the production run and other projects shall not be accepted. Test data from previous projects are not acceptable.

5. If any of the modules tested in any strength gradation exhibit a compressive deflection greater than 1%, additional testing will be required of eight additional modules to determine the structural suitability of the media. If the additional testing indicates the media does not meet the specified strength, then the media manufacturer shall replace all

media of that strength gradation with new media meeting the specifications and passing the structural testing. The engineer shall have the right to send packs shipped to the jobsite to an independent lab for further testing if in his opinion the packs do not appear to have the strength specified. All expenses shall be at the cost of the media manufacturer.

I. SITE TESTING REQUIREMENTS

1. For Non-ISO certified manufacturer, 5% (approximately 1 in 20 packs) of the constructed media modules will be pulled by the Contractor and measured for tolerance. Tolerance tests will be done in accordance with design engineer's instructions and reports for each test will be completed by the Contractor for review by the design engineer. For ISO certified manufacturer, QA/QC documents of the media pack assembly facility shall be submitted in lieu of the onsite tolerance testing reports.

2. If any of the modules tested by the Contractor are out of tolerance by ¼", Contractor is required to inspect all finished media modules for that gradation and pull modules that are out of alignment. Additional compression testing will be required of eight additional modules to determine the structural suitability of the media. If any of the additional testing indicates the media does not meet the specified strength, then the media Manufacturer shall replace all media of that type or strength gradation with new media meeting the specifications and passing the structural testing. Prior to resuming module production, the manufacturer shall perform a review of assembly procedures, identify the cause of the failures, implement corrective actions and repeat the testing, with all expenses at the cost of the Manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

A. The equipment shall be installed properly to provide a complete working system. Installation shall follow the manufacturer's recommendations.

B. The existing dome, ventilation shall be removed and reinstalled by the Contractor after the installation of the new equipment.

C. Only one trickling filter may be out of service at any time.

3.2 MANUALS

A. The equipment supplier shall furnish three copies of operation and maintenance manuals, which will be retained at the installation site to assist plant operators. The manual shall include the supplier's erection and assembly recommendations, a complete parts list, and a list of recommended spare parts.

3.3 SHOP ASSEMBLY AND INSPECTION

A. The equipment specified herein shall be factory assembled as far as practical to verify that all mating parts can be field assembled. All mating parts shall be trial fit and match marked. The manufacturer shall submit certification of shop trial assembly and photographs of assembly before shipment. The customer and installing contractor shall be given the opportunity to witness the shop assembly.

B. Shop inspection shall be performed by a qualified inspector and certified by the manufacturer. The inspection shall be documented, and all deficiencies noted, corrected, re-inspected and final completion formally authorized. Final shipment authorization shall be by the manufacturer to ensure completion of all fabrication, assembly, and inspection requirements. Inspection records and evidence of inspector qualification shall be submitted to the owner upon request.

3.4 FIELD SERVICE

A. The equipment supplier shall provide the service of a qualified representative for two trips and two days to inspect the mechanism installation, assist in start-up, and instruct plant personnel in the proper operation and maintenance of the mechanism.

3.5 FIELD TESTING

A. Operational Test: After installation and inspection, flow shall be introduced to the distributor, and it shall be carefully observed. Any excessive tipping, binding, jerking, or unusual motion shall be noted, and corrective action taken. Once the flow is resumed, a pan test shall be performed at both minimum and maximum flows to ensure that flow is uniformly distributed over the entire media. If, after several attempts, the unit does not successfully pass the operational and pan test, the faulty portion of the equipment shall be replaced, and the test rerun.

END OF SECTION