

## SECTION 11000

### SBR WASTEWATER TREATMENT SYSTEM 40,000 GPD

#### PART 1 – GENERAL

##### 1.01 Scope of Work:

A. A complete operable Sequencing Batch Reactor (SBR) wastewater treatment system shall be furnished by the Contractor. Precast concrete basins shall be furnished by wedotanks.com, LLC., 2885 Sanford SW, PO Box 18078, Grandville, MI 49418. The wedotanks.com contact numbers are 866-374-2083 (phone) and 866-681-7694 (fax) or e-mail [info@wedotanks.com](mailto:info@wedotanks.com). or approved equal that has been previously submitted and approved by the engineer prior to the bid date. In order to be considered an approved equal, the manufacturer shall submit of complete set of sealed shop drawings by a North Carolina Professional Engineer showing all structural design with calculations (10) DAYS prior to the bid date to the Engineer for approval. Manufacturers or suppliers who wish to submit optional equipment shall do so at their own cost. There is no guarantee that optional equipment will be approved.

B. The system is based on precast concrete design tankage as shown on the contract drawings. Field erected steel plants shall not be allowed. Concrete cast in place basins will be considered provided they meet all contract and process requirements with respect to sizes, volumes, capacities, etc., provided the Contractor submits sealed structural design for review. Owner reserves the right to reject equipment and/precast manufacturer which is not listed or preapproved.

##### 1.02 System Source & Quality Assurance:

A. The SBR System shall be supplied by a Contractor of good reputation. Pre-approved equipment and suppliers are specified. System controls shall be Programmable Logic Controller (PLC) based. Alternate suppliers may be approved by the Engineer provided the manufacturer's experience includes a minimum of ten installations where equipment of similar size and design has been in operation successfully in a similar process for a minimum of five years. Alternate suppliers shall be approved in writing and included in an addendum prior to bid.

B. The Contractor shall have full responsibility for the functional operation of all SBR Systems, including components from the influent pump station through the effluent pumps, as specified or approved by Engineer. This Contractor shall be responsible for all work necessary in order to select, furnish, install equipment and connections, calibrate, and place into operation the SBR System along with all other equipment and accessories as specified herein.

**1.03 Acceptable Manufacturers:**

- A. These specifications and accompanying drawings are based upon the use of the following tank system: HTI Systems, LLC/wedotanks.com, LLC tank system; phone no.: 866-374-2083 fax no.: 866-681-7694. Additional manufacturers may be approved under the conditions specified herein.
- B. or Engineer's approved equal.

**1.04 Service:**

- A. The Contractor shall furnish the services of a factory trained representative(s) to inspect the installing contractor's equipment installation, supervise the initial operation of the equipment, instruct the plant operating personnel in proper operation and maintenance, and provide process assistance.

**1.05 SBR Functional Requirement:**

- A. The Contractor shall be completely responsible for the proper installation of a functional system, including but not limited to: diffused aeration equipment, transfer pumps, Aerator/Mixer/Decanters, blowers, valves, UV-disinfection, and controls. All equipment shall perform as specified and the completed installation shall operate in accordance with the requirements of the plans and specifications.
- B. Any supplier wishing to bid other than the specified supplier shall provide the following:
  - 1. A letter signed by an officer of the company certifying compliance with the specifications without exception. In addition, the supplier must certify the proposed motors will be Warranted by the motor supplier as outlined in the specified Warranty.
  - 2. A field test report documenting that proposed or similar units have been field tested.
  - 3. Proof of manufacturing and testing facilities.
  - 4. Installation list with contacts and phone numbers for a minimum of ten installations of similar size in operation for five years. List shall include location.
  - 5. Complete drawings of similar facilities.

## **1.06 Related Sections:**

- A. "Section 03310 – Concrete Work"
- B. "Section 03480 – Precast Concrete Tank"
- C. "Section 11910 – Submersible Dosing Pumps"
- D. "Section 15060 – Pipes and Pipe Fittings"
- E. "Section 15100 – Valves and Related Appurtenances"

## **1.07 Design Criteria**

- A. The SBR wastewater treatment plant shall be designed using the following criteria:
  - 1. 0.040 MGD average daily hydraulic flow
  - 2. 4 peak factor hourly, 1 daily
  - 3. 400 mg/l BOD<sub>5</sub> maximum influent concentration
  - 4. 350 mg/l total suspended solids maximum influent concentration
  - 5. 85 mg/l total nitrogen maximum influent concentration
  - 6. 15 mg/l phosphorus maximum influent concentration
- B. The wastewater treatment plant shall be designed to provide effluent within the following limits:
  - 1. 10.0 mg/l BOD<sub>5</sub>, monthly average
  - 2. 15.0 mg/l BOD<sub>5</sub>, daily maximum
  - 3. 5.0 mg/l total suspended solids, monthly average
  - 4. 10.0 mg/l total suspended solids, daily maximum
  - 5. 4.0 mg/l NH<sub>3</sub> as nitrogen, monthly average
  - 6. 6.0 mg/l NH<sub>3</sub> as nitrogen, monthly average
  - 7. 14 per 100 ml fecal coliform, monthly average
  - 8. 3 mg/l Nitrate/Nitrite (daily maximum)

**1.08 Jobsite Conditions:**

- A. Wastewater temperature 50 °F to 70 °F
- B. Jobsite elevation 11 feet MSL
- C. Ambient air temperature 40 °F to 100 °F
- D. F/M ratio 0.080 lb BOD<sub>5</sub>/lb MLSS – Day
- E. MLSS at low water level 4,500 mg/l
- F. Cycles 4 /day/basin
- G. Aeration 3 hrs/cycle
- H. Mixing 1.5 hrs/cycle

**1.09 Basin Sizes:**

- A. The SBR system shall be field erected in 2 basins as shown on the contract drawings:

- Volume: 22,259 **(26,187)** gallons (at maximum operating level)
- Inside Dimensions: 30 ft. x 11.67 ft.
- Side Water Depth:
  - Minimum Operating Level: 5.2 ft. **(8.09)**SWD
  - Maximum Operating Level: 8.5 ft. **(10.00)**SWD
- Top Of Wall: 11.5 **(12.0)** ft.

- B. The aerobic digester shall be field erected in one (1) basin as shown on the contract drawings:

- Volume: 8,904 **(10,474)** gallons (at maximum operating level)
- Inside Dimensions: 12 ft. x 11.67 ft.
- Side Water Depth:
  - Minimum Operating Level: 2 ft. SWD
  - Maximum Operating Level: 8.5 **(10.0)** ft. SWD
- Top Of Wall: 11.5 **(12.0)** ft.

- C. Equalization/Holding shall be field erected in one (1) basin as shown on the contract drawings:

Volume: 10,056 gallons (at maximum operating level)  
Inside Dimensions: 12 ft. x 11.67 ft.  
Side Water Depth:  
    Minimum Operating Level: 1.5 ft SWD  
    Maximum Operating Level: 9.6 (10.0) ft. SWD  
Top Of Wall: 11.5 (12.0) ft.

- D. Post-Equalization/Holding shall be field erected in one (1) basin as shown on the contract drawings:

Volume: 5,393 gallons (at maximum operating level)  
Inside Dimensions: 8.33 ft. x 16.33 ft.  
Side Water Depth:  
    Minimum Operating Level: 2.1 ft SWD  
    Maximum Operating Level: 5.3 ft. SWD  
Top Of Wall: 7 ft.

- E. Fixed media filters shall be field erected in two (2) basins as shown on the contract drawings:

Volume: 3,454 gallon each  
Inside Dimensions: 8.33 ft. x 7.92 ft.  
Side Water Depth: 7 ft.

- F. Effluent Tank / (UV disinfection) tank shall be field erected in one (1) basin, as shown on the contract drawings.

#### **1.10 Submittals:**

- A. The Contractor shall submit certified drawings showing final tankage and equipment layout. This layout shall be coordinated with the pre-cast concrete tank supplier.
- B. Working drawings, including arrangement and erection drawings of equipment, schematic control diagrams, electrical connection diagrams, complete description of the control systems and equipment operating characteristics, shall be furnished.
- C. Provide certification stating that all handrails, ladders and steps are in compliance with applicable codes and standards.
- D. Signed and sealed structural drawings by North Carolina Professional Engineer.

### **1.11 Field Service:**

- A. Competent factory representative(s) shall be provided for the purpose of final inspection, start-up and adjustment of the treatment plant provided under this item. In addition, this same representative shall spend at least two days solely training and instructing the operator in the operation and maintenance of this plant.
- B. The Contractor shall be required to supply the engineer with five complete sets of as-built drawings and operation and maintenance manuals after equipment has been installed. Any changes or modifications shall be reflected in the as-built drawings.

## **PART 2 – PRODUCTS**

### **2.00 General:**

- A. System's Integrator is responsible for the integration of the various control panels and controls. System's Integrator shall warrantee all equipment controls and programming and performance standards. No other option shall be bid unless pre-approved by the Engineer.

### **2.01 Sequencing Batch Reactors:**

- A. This section specifies the sequencing batch reactor treatment system. The system shall be a two (2) basin fill and draw activated sludge process. Each of the basins shall, in turn, be filled with screened raw wastewater and aerated in a batch mode. After aeration, the mixed liquor shall be allowed to settle. The treated supernatant shall then be withdrawn from the basin utilizing an effluent decanter mechanism and discharged. The system shall consist of aeration system, submersible mixers, sludge wasting system, blowers, effluent decanters, automatic influent valves, preprogrammed process control panel, in-basin liquid monitoring, piping, air piping, and supports.
- B. Scope of Supply:
  - 1. SBR aeration system including piping, diffusers, headers and supports.
  - 2. SBR aeration system blowers.
  - 3. Wastewater mixers.
  - 4. Waste activated sludge pumps.
  - 5. Automatic valves.

6. Decant mechanism.
7. Control system including PLC, cabinet, and field controls.

C. Operation:

1. Each tank shall be equipped with the necessary switches, relays, valves, and timers to automatically perform the following sequence: fill (static, anoxic, aerobic), react, settle, decant, and sludge removal. The pre-programmed process control system shall be designed to allow the plant operator to easily select batch or independent tank operation. The influent shall be continuous during all cycles. The Contractor and its System's Integrator shall be responsible for furnishing all equipment and programming for a complete and operable system.

D. Process Performance Guarantee Bond:

1. The Contractor shall guarantee the performance of the process by providing a process guarantee. If during the process performance testing or during routine operation, the SBR system is unable to achieve the required effluent limits when operating in accordance with contract documents, the Contractor shall make whatever modifications they deem necessary to the treatment system and/or its operation to achieve the required limits. The Contractor's potential liability shall be 100% of its contract value.

E. Aeration System:

1. All necessary diffuser bars, drop pipes and air headers shall be installed in the SBR basins. The air comes in contact with the wastewater by means of coarse bubble diffusers suspended on a quick coupled air supply pipe drop. Each supply pipe drop shall have an easily accessible ball valve to regulate the air supply to the diffusers. Diffusers shall be capable of delivering a minimum of 10 cfm each.

F. Decanter:

1. Option A – Ashbrook:
  - a. Decant mechanism shall be provided to remove treated effluent, while meeting process requirements. Decanter shall be constructed of type 304 stainless steel and fiberglass. All supports and hardware shall be type 316 stainless steel.

2. Option B – Tsurumi Floating Pump Decanter Model FHP2-15T:

a. Pump Construction:

- i. Impeller: Multi vane, semi-open design, solids handling non-clog, gray iron casting.
- ii. Shaft Seal: Double mechanical seals with silicon carbide faces.
- iii. Casing: Gray iron casting
- iv. Pump has a suction buoyant inlet check ball valve with housing.
- v. Shielded ball bearing

b. Float Construction:

- i. Fiberglass reinforced plastic filled with polystyrene foam having an integral lifting lug.

c. Motor Construction:

- i. Dry-type submersible injection motor
- ii. Insulation: Class F
- iii. Frame: Gray iron casting
- iv. Shaft: Stainless steel
- v. Internal thermal and amperage sensor

d. Accessories:

- i. Stainless steel lifting chain
- ii. Motor cable, 32 feet in length
- iii. Hose coupling on pump discharge
- iv. One flexible hose complete with stainless steel clamps.
- v. Guide system including support, stop plate, guide pipe, and guide fixing plate as part of the floating pump decanter.

- vi. Three copies of the Operation and Maintenance Manual.
- e. Controls:
  - i. The controls for the floating decant pump will be provided by the Process Control System Supplier. Refer to the Description of Operation in Section 17500 for a description of the controls.
- 3. Option C – Wagner Decanter:

G. Automated Valves:

- 1. Motor actuated valves shall be supplied by the Contractor for the SBR influent pipes and decanter discharge pipes. Motor operations shall be 120 volt. Valves shall be lubricated plug valves designed for watertight outdoor conditions. Two limit switches shall be provided for each valve, which will indicate open or closed position.

H. Waste Activated Sludge Pumps:

- 1. See “Section 11910 – Submersible Dosing Pumps” for requirements.

I. Process Control Panel (PLC):

- 1. A panel shall be capable of controlling and monitoring all SBR functions and other activities as well as field devices. The panel shall be located in blower control building or by blower system and shall be stainless steel NEMA 4X rating. All switches, run lights, indicators shall be door mounted. The panel shall contain all breakers, IEC contactors, transformers, terminal blocks, relays, etc. In order to provided a complete operable control system. See “Section 10500 – SCADA System” and Division 13.

J. Submersible Mixers:

- 1. Each SBR basin shall contain two submersible mixers which will keep solids in suspension during the fill and react phases of the batch cycle. The mixers shall be mounted on a guide rail and be adjustable in depth and rotation. A NEMA 4X stainless steel disconnect switch shall be provided at the top of tank for each mixer.

**2.02 Air Blowers, Motors and Accessories:**

- A. Two SBR basin air blowers shall be furnished and installed under this item. The blowers shall be rotary positive displacement blowers each having a capacity of 383

standard cubic feet per minute at 6.0 pounds per square inch operating discharge pressure. The blowers shall be Dresser-Roots model Urai-56 blowers or equal with Baldor 15 horsepower electric motors, or equal by Spencer, Kaiser, or equal.

- B. One blower shall be provided to aerate the flow equalization basin. It shall output 30 standard cubic feet per minute at 6.0 pounds per square inch operating discharge pressure. It shall be a Dresser-Roots model Urai-24 blower with a Baldor 2 horsepower motor, or equal by Spencer, Kaiser, or equal.
- C. One blower shall be provided to aerate the aerobic digester and provide air for filter air scour. It shall output 40 standard cubic feet per minute at 6.0 pounds per square inch operating discharge pressure. It shall be a Dresser-Roots model Urai-24 blower with a Baldor 2 horsepower motor, or equal by Spencer, Kaiser, or equal.
- D. The blower casings shall be gray cast iron. The impeller shafts shall be constructed from a common ductile iron casing. Impellers are to be straight, two-lobe, involute type, operating without rubbing or liquid seals or lubrication, and shall be positively timed. The timing gears shall be machined, heat-treated alloy steel. The spur tooth gears shall be mounted on the impeller shafts on a tapered fit, secured by lock nuts. The impellers/shafts are to be supported on single row ball bearings. A positive lip-type seal shall be provided at each bearing, designed to prevent leakage of lubricant into the air streams. The impeller sides of the lip-type seals shall be vented to atmosphere to eliminate carry-over into the air streams.
- E. The air blower units shall be completely factory assembled. The air blowers and motors shall be mounted on heavy steel base plates along with related equipment such as couplings and belt guards. The steel base plates shall be provided with flanges suitable for installation with anchor bolts. Air blowers without base plates shall not be acceptable. The blower openings shall be sealed after rust inhibiting powder is injected and prior to shipment. Blowers shall be provided with check valves, pressure relief valves, flexible connectors, intake filters, silencers etc.
- F. The blowers shall be driven by continuous duty, energy efficient, horizontal mounted, totally enclosed fan cooled electric motors sized as previously specified.
- G. The air blowers and motors shall be mounted on a heavy steel base plate of suitable size and design. The blower shall be belt driven by the motor.

### **2.03 Equalization General:**

- A. The equalization basin shall be as shown on the drawings. A pumping system and a flow control box shall be provided capable of delivering effluent to the SBR basins at the design head. The equalization tank shall have total capacity of 10,000 gallons. The top of the tank shall be covered with aluminum bar grating.

#### **2.04 Post Equalization General:**

- A. The post equalization basin shall be as shown on the drawings. A pumping system and a flow control box shall be provided capable of delivering effluent to the filters at the maximum design head. The post-equalization tank shall have total capacity of 6,000 gallons. The tank shall have sloped floor to the submerged pumps. The top of the tank shall be covered with aluminum bar grating.

#### **2.05 Submersible Pumps:**

- A. See “Section 11910 – Submersible Dosing Pumps” for requirements.

#### **2.06 Control Panel:**

- A. A NEMA 4X stainless steel control panel shall be provided which shall automatically alternate the lead pump for subsequent pumping cycles. The panel shall contain required breakers, contactors, hand/off/auto switches, run lights, and all necessary controls required for automatic operation. A red, high water alarm light shall be provided to indicate high water conditions. Mercury level floats shall be provided in the flow equalization basin for pump control and alarm activation. See “Section 10500 – SCADA System” and Division 13.

#### **2.07 Flow Control Box:**

- A. An aluminum flow control box shall be provided to equalize the wastewater flow rate into the filter. A pre-SBR flow splitter box shall be installed in the pre-equalization chamber. The post-SBR flow splitter box shall be installed in the post-equalization chamber.

#### **2.08 Aerobic Digester:**

- A. Sludge shall be pumped to the digester from the SBR basins by means of submersible rail pumps. The contents of the digester chamber shall be aerated with the amount of air to be regulated by ball valves. A PVC or aluminum decanting device shall be located in the digester chamber for the purpose of returning supernatant back to the flow equalization basin. The inlet to the decanting device shall be positioned manually by a winch and stainless steel cable assembly located on top of chamber or the decanting device may be a telescoping valve. The flow through the decanting device shall be regulated by a ball valve located on the decant line and shall be easily accessible from above. The air supply for the digester shall be provided by the digester blowers. Air diffusion shall be provided for the digesters by coarse bubble diffusers. The air diffusion system shall be capable of providing a minimum of 15 cubic feet per minute per 1,000 cubic feet of capacity.

## **2.09 Tertiary Filters:**

### **A. Option A – PYRADECK:**

1. Two fixed media filters shall be furnished and installed. The precast concrete filter/clear well tank shall be constructed of 5,000 psi concrete at 28 days. Tank openings shall be covered with aluminum bar grating.
2. The two filters shall each have 48 square feet of surface area. The fixed media filters shall be PYRADECK filters. The water shall flow from the filters to the UV units and then to the effluent tank.
3. One submersible dewatering pump shall be installed in each cell to remove water from the cell during maintenance.

### **B. Option B – Statiks 900 Fixed Plate Cloth Media Filtration**

1. Filter tankage and internal components shall be 304 stainless steel or non-corrosive materials.
2. Acrylic cloth media shall remove solid particles down to 10  $\mu\text{m}$ .
3. Effective surface area of each element shall be 6  $\text{ft}^2$ .
4. Filter shall hold four filtering elements for a total potential surface area of 24  $\text{ft}^2$ .
5. Design hydraulic surface loading rate is 3.0  $\text{gpm}/\text{ft}^2$  at average daily flow and 7.0 – 8.0  $\text{gpm}/\text{ft}^2$  for instantaneous peaks.

## **2.10 Ultraviolet Disinfection Tank:**

- A. The precast concrete tank shall be steel reinforced and have compressive strength of 5000 psi @ 28 days. The tank shall have an integral stainless steel flow channel designed to accept the ultraviolet disinfection module. The tank shall be as shown on the drawings.

## **2.11 Ultraviolet Disinfection Modules:**

- A. The ultraviolet module system shall consist of two Trojan models 3000 PTP ultraviolet disinfection unit or approved equal, designed for an average daily flow as specified with 65% light transmission at 253.7 nanometers. See Section 11307 UV Disinfection System.

### **2.12 Ultraviolet Disinfection Control Panel:**

- A. A NEMA 4X power distribution panel shall be provided which will power and control the UV system. It shall include a 120 volt power supply, green led run lights, elapse time indicators, and ultraviolet intensity monitor.

### **2.13 Effluent Basin General:**

- A. The effluent basin shall be as shown on the drawings. A pumping system shall be provided capable of delivering effluent to the storage basin and five day upset pond at the design heads. The post-equalization tank shall have total capacity as shown. The tank shall have sloped floor to the submerged pumps. The effluent tank shall have total capacity as shown. The top of the tank shall be covered with aluminum bar grating.

### **2.14 Effluent Pumps:**

- A. See “Section 11910 – Submersible Dosing Pumps” for requirements.

### **2.15 Turbidimeter:**

- A. See “Section 11715 – Continuous On-Line Turbidimeter” for requirements.

### **2.16 Control Panel:**

- A. A NEMA 4X stainless steel control panel shall be provided which shall automatically alternate the lead pump for subsequent pumping cycles for the effluent disposal system pumps. The panel shall contain required breakers, contactors, hand/off/auto switches, run lights, and all necessary controls required for automatic operation. A red, high water alarm light shall be provided to indicate high water conditions. Mercury level floats shall be provided in the flow equalization basin for pump control and alarm activation.

## **PART 3 - EXECUTION**

### **3.01 Project Completion:**

- A. It is the intent of these specifications that a complete and fully operational wastewater treatment system of the type specified shall be furnished. It is also intended that Contractor make all adjustments, alterations, replacements and tests specified and required for a complete, satisfactory and trouble-free operating installation in accordance with the specifications.

- B. The Contractor along with the System's Integrator and suppliers shall provide installation and startup assistance and training, guarantee the process performance and license the owner, if required, for any processes that are described in applicable United States patents.

**3.02 Installation:**

- A. The Contractor shall install the treatment unit in accordance with the manufacturers' installation instructions, as shown on the Contract Drawings and as specified.
- B. The Contractor shall coordinate all work with his sub-contractor System's Integrator. After the installation has been completed and checked, the contractor shall furnish to the Engineer a letter of certification that all equipment is installed in accordance with the Contract Documents and the SBR system is ready for start-up and final inspection.

**3.03 Start Up & Operator Training:**

- A. The Contractor shall provide the services of a manufacturers' field representative(s) to advise on the equipment field installation and assist with start-up.
- B. The Contractor in conjunction with the System's Integrator and manufacturers' representatives shall do a functional check of each item furnished and startup of the process. During this time, they shall provide operation training which shall include familiarization of the owner's personnel with the SBR process, its requirements and review of the operation and maintenance manuals.

**3.04 Operation and Maintenance Manual:**

- A. The Contractor shall furnish five Operation and Maintenance Manuals during startup. These manuals shall include maintenance instructions for all equipment provided by the Contractor.

**END OF SECTION 11000**