

Attachment DTR 1.1 – 4  
Design Calculations

[COG000000485]

## DESIGN CALCULATIONS AND PLANT DESIGN FEATURES

### PROPOSED GRANBURY EAST WWTP IMPROVEMENTS (PHASE I) - CITY OF GRANBURY, TEXAS

#### Influent Quality Characteristics

| Parameter          | Concentration (mg/L) |
|--------------------|----------------------|
| BOD <sub>5</sub>   | 250                  |
| TSS                | 250                  |
| NH <sub>3</sub> -N | 35                   |
| TP                 | 7                    |
| TKN                | 45                   |

#### Influent Flow Characteristics

| Flow             | Gallons per Day (gpd) | Gallons per Minute (gpm) |
|------------------|-----------------------|--------------------------|
| Q <sub>ave</sub> | 1,000,000             | 694                      |
| Q <sub>pk</sub>  | 3,000,000             | 2083                     |

| Loading          | Pounds per Day |
|------------------|----------------|
| BOD <sub>5</sub> | 2085           |
| TSS              | 2085           |
| NH <sub>3</sub>  | 292            |

#### Process Design

Treatment facility will be design to produce an effluent quality in compliance with the proposed permitted parameters of:

| Parameter         | Concentration   |
|-------------------|-----------------|
| CBOD <sub>5</sub> | 5 mg/L          |
| TSS               | 12 mg/L         |
| NH <sub>3</sub>   | 2 mg/L          |
| DO                | 4 mg/L          |
| E. coli           | 126 CFU/ 100 mL |

In order to achieve the required removal efficiencies, the Membrane Bioreactor (MBR) process operated in a continuous flow mode has been chosen. The 7-day low reactor temperature is 20°C. The anticipated operating ranges for MLSS and RAS are 4,000 mg/L to 10,000 mg/L for the bioreactor tank and 4,000 mg/L to 14,000 mg/L in the membrane tank, respectively. Other assumptions include a solids

#### **Mechanical Bar Screen**

| <u>Design Parameter</u>                        | <b>TCEQ Requires</b>            | <b>Actual Provided</b> |
|--|---------------------------------|------------------------|
| No. of Screens                                 | Not Specified                   | 1                      |
| Bar Screen Slope (Degrees)                     | Not Specified                   | 60° from Horizontal    |
| Bar Spacing (inch)                             | > or = 0.25, but < or =<br>1.75 | 0.25                   |
| Velocity Through Screen @ Design Flow (ft/sec) | > or = 1.0, but < or =<br>3.0   | 1.59                   |

**Manual Bar Screen**

| <u>Design Parameter</u>                        | <b>TCEQ Requires</b>        | <b>Actual Provided</b> |
|--|-----------------------------|------------------------|
| No. of Screens                                 | Not Specified               | 1                      |
| Screen Width (ft)                              | Not Specified               | 3                      |
| Screen Depth (ft)                              | Not Specified               | 5                      |
| Screen Wetted Depth (ft)                       | Not Specified               | 0.8                    |
| Screen Slope (degrees)                         | > or = 30, but < or = 60    | 60° from Horizontal    |
| Screen Spacing (inch)                          | > or = 0.5, but < or = 1.75 | 1                      |
| Velocity Through Screen @ Design Flow (ft/sec) | 1.0 < V < 3.0               | 1.05                   |

**Grit Removal Unit**

| <u>Design Parameter</u>                    | <b>TCEQ Requires</b> | <b>Actual Provided</b> |
|--|----------------------|------------------------|
| No. of Units                               | Not Specified        | 1                      |
| Unit Type                                  | Not Specified        | Stacked Discs          |
| Unit Diameter (ft)                         | Not Specified        | 9'-0"                  |
| Flow through Grit Unit @ Design Flow (mgd) | Not Specified        | 6.0                    |
| Flow through Grit Unit @ Peak Flow (mgd)   | Not Specified        | 9.0                    |

**Fine Screens**

| <u>Design Parameter</u> | <b>TCEQ Requires</b> | <b>Actual Provided</b> |
|-------------------------|----------------------|------------------------|
| No. of Screens          | 1 Duty, 1 Redundant  | 2 (1+1)                |
| Screen Opening (inch)   | Less than 0.25 inch  | 0.079 (2 mm)           |

\*Bid Alternative: 2 fine screens with 1 mm openings.

**Influent Lift Station Pumps**

| <u>Design Parameter</u>     | <b>TCEQ Requires</b> | <b>Actual Provided</b> |
|-----------------------------|----------------------|------------------------|
| No. of Pumps                | 1 Duty, 1 Redundant  | 2 (1+1)                |
| Type of Pumps               | Not Specified        | Submersible            |
| Capacity of Each Pump (gpm) | Not Specified        | 2,800                  |
| Head of Each Pump (ft)      | Not Specified        | 35                     |

**Anaerobic Basin - BNR**

| <u>Design Parameter</u>               | <b>TCEQ Requires</b> | <b>Actual Provided</b> |
|---------------------------------------|----------------------|------------------------|
| No. of Basins                         | Not Specified        | 1                      |
| Area of Each Basin (ft <sup>2</sup> ) | Not Specified        | 558                    |
| Side Water Depth (ft)                 | Not Specified        | 15                     |
| Total Volume (ft <sup>3</sup> )       | Not Specified        | 8,370                  |
| Mixing Type                           | Not Specified        | Submersible Mixers     |

**Anoxic Basin - BNR**

| <u>Design Parameter</u>               | <b>TCEQ Requires</b> | <b>Actual Provided</b> |
|---------------------------------------|----------------------|------------------------|
| No. of Basins                         | Not Specified        | 1                      |
| Area of Each Basin (ft <sup>2</sup> ) | Not Specified        | 1,113                  |
| Side Water Depth (ft)                 | Not Specified        | 15                     |
| Total Volume (ft <sup>3</sup> )       | Not Specified        | 16,695                 |
| Mixing Type                           | Not Specified        | Submersible Mixers     |
| Anoxic Recycle Pumps                  | 1 Duty, 1 Redundant  | 2 (1 +1)               |

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**Aeration Basin-BNR**

| <u>Design Parameter</u>                  | <b>TCEQ Requires</b>                   | <b>Actual Provided</b> |
|--|--|------------------------|
| No. of Basins                            | Not Specified                          | 1                      |
| Area Of Each Basin (ft <sup>2</sup> )    | Not Specified                          | 1,782                  |
| Side Water Depth (ft)                    | Not Specified                          | 15                     |
| Total Aeration Volume (ft <sup>3</sup> ) | Not Specified                          | 26,730                 |
| Organic Loading (lbs/day/1000 cu.ft.)    | Design must be based on BNR biological | 78.00                  |
| Mixing Type                              | Not Specified                          | Submersible Mixers     |
| Aerobic Recycle Pumps                    | 1 Duty, 1 Redundant                    | 2 (1+1)                |

**Membrane Basin - MBR**

| <u>Design Parameter</u>                | <b>TCEQ Requires</b> | <b>Actual Provided</b> |
|--|----------------------|------------------------|
| No. of Basins                          |                      | 2                      |
| Membrane Type                          |                      | Hollow Fiber           |
| Area Of Each Basin (ft <sup>2</sup> )  |                      | 202.5                  |
| Side Water Depth (ft)                  |                      | 8.3                    |
| Total Volume (ft <sup>3</sup> )        |                      | 3,362                  |
| No. of Membrane per Train              |                      | 8                      |
| No. of Membrane Modules per Train      |                      | 128                    |
| Total Membrane Area (ft <sup>2</sup> ) |                      | 55,111                 |
| Net Membrane Flux at ADF (gfd)         |                      | 9.1                    |
| Net Membrane Flux at Peak (gfd)        |                      | 18.2                   |

**Ultraviolet Disinfection**

| <u>Design Parameter</u>                     | <b>TCEQ Requires</b> | <b>Actual Provided</b> |
|---|----------------------|------------------------|
| Peak Design Flow (MGD)                      | Not Specified        | 8.0                    |
| No. of Channels                             | Not Specified        | 2                      |
| No. of Banks per Channel                    | Minimum of 2         | 2                      |
| No. of Modules per Bank                     | Not Specified        | 1                      |
| No. of Lamps per Module                     | Not Specified        | 12                     |
| No. of Lamps per Channel                    | Not Specified        | 24                     |
| UV Transmittance at 253.7 nm (MBR Filtrate) | Not Specified        | 75%                    |

**MBR WAS Pumps**

| <u>Design Parameter</u>     | <b>TCEQ Requires</b> | <b>Actual Provided</b>                        |
|-----------------------------|----------------------|---|
| No. of Pumps                | 1 Duty, 1 Redundant  | 1 per MBR channel, 3 total (1 On-shelf spare) |
| Type of Pumps               | Not Specified        | Self-Priming Centrifugal Pumps                |
| Capacity of Each Pump (gpm) | Not Specified        | 2,778   |
| Head of Each Pump (ft)      | Not Specified        | 8   |

**Solids Storage Tanks**

| <u>Design Parameter</u>                                       | <b>TCEQ Requires</b> | <b>Actual Provided</b> |
|---|----------------------|------------------------|
| No. of Solids Storage Tanks                                   | Not Specified        | 2                      |
| Storage Volume, cu. ft. (Approximate)                         | Not Specified        | 36,750                 |
| No. of Days of Sludge Storage @ 0.5% Solids                   | Not Specified        | 3.10                   |
| No. of Days of Sludge Storage @ 1.0% Solids (from thickening) | Not Specified        | 6.21                   |
| No. of Days of Sludge Storage @ 2.0% Solids (from thickening) | Not Specified        | 12.41                  |
| No. of Days of Sludge Storage @ 3.0% Solids (from thickening) | Not Specified        | 18.62                  |

\*Equipment sizing for mixing system for tank refer to aeration below.

**Solids Transfer Storage Pump Station**

| <u>Design Parameter</u>     | <b>TCEQ Requires</b> | <b>Actual Provided</b>         |
|-----------------------------|----------------------|--------------------------------|
| No. of Pumps                | 1 Duty, 1 Redundant  | 2 ( 1 + 1)                     |
| Type of Pumps               | Not Specified        | Double-Disc suction lift pumps |
| Capacity of Each Pump (gpm) | Not Specified        | 140                            |
| Head of Each Pump (ft)      | Not Specified        | 30                             |

**Polymer Feed System**

| <u>Design Parameter</u> | <b>TCEQ Requires</b> | <b>Actual Provided</b> |
|-------------------------|----------------------|------------------------|
| No. of Units            | 1 Duty, 1 Redundant  | 2 (1 + 1)              |

**Dewatering System**

| <u>Design Parameter</u> | <b>TCEQ Requires</b> | <b>Actual Provided</b> |
|-------------------------|----------------------|------------------------|
| No. of Units            | 1 Duty, 1 Redundant  | 2 (1 + 1)              |

**Plant Water Pumps**

| <u>Design Parameter</u>     | <b>TCEQ Requires</b> | <b>Actual Provided</b>         |
|-----------------------------|----------------------|--------------------------------|
| No. of Pumps                | 1 Duty, 1 Redundant  | 2 (1+1)                        |
| Type of Pumps               | Not Specified        | Self-priming Centrifugal Pumps |
| Capacity of Each Pump (gpm) | Not Specified        | 140                            |
| Head of Each Pump (ft)      | Not Specified        | 185                            |

**Reuse Pumps**

| <u>Design Parameter</u>     | <b>TCEQ Requires</b> | <b>Actual Provided</b>         |
|-----------------------------|----------------------|--------------------------------|
| No. of Pumps                | 1 Duty, 1 Redundant  | 2 (1+1)                        |
| Type of Pumps               | Not Specified        | Self-priming Centrifugal Pumps |
| Capacity of Each Pump (gpm) | Not Specified        |                                |
| Head of Each Pump (ft)      | Not Specified        |                                |

## Aeration Requirements

### Aeration Basin - BNR

| <u>Design Parameter</u>                                    | <u>TCEQ Requires</u>  | <u>Actual Provided</u> |
|--|---|------------------------|
| Aeration Requirements (SCF/day/lb BOD <sub>5</sub> )       | Design must be based on BNR biological process model to support MBR | 3,200                  |
| Oxygen Required (lb O <sub>2</sub> / lb BOD <sub>5</sub> ) | Design must be based on BNR biological process model to support MBR | 2.2                    |
| Oxygen Required (lb/day)                                   | Design must be based on BNR biological process model to support MBR | 1032                   |
| Air Provided (SCFM)  | Design must be based on BNR biological process model to support MBR | 1,000                  |

### Solids Storage Tank Aeration

| <u>Design Parameter</u>                   | <u>TCEQ Requires</u> | <u>Actual Provided</u> |
|---|----------------------|------------------------|
| Aeration Mixer Requirements per Tank (HP) | 0.5 HP / 1000 CF     | 9                      |

## Facility Design Features

### A. Emergency Power Requirements

In accordance with 30 TAC § 217.36 and due to the number and duration of power outages that have occurred in the past, the treatment facility must incorporate an on-site automatically starting generator capable of continuously operating all critical wastewater treatment system units. The fuel tank must be sized for a runtime greater than the longest power outage in the power records. This generator will provide sufficient power for the following units.

- 1.0 1 - Mechanical Bar Screen
- 2.0 1 - Grit Slurry Pump
- 3.0 2 - Fine Screen
- 4.0 2 - Influent Submersible Pumps
- 5.0 3 - MBR Filtrate Pumps
- 6.0 3 - MBR Blowers
- 7.0 3 - MBR RAS/WAS Pumps
- 8.0 3 - Solids Storage Blowers
- 9.0 2 - Ultraviolet Disinfection Banks
- 10.0 Effluent Metering Station
- 11.0 Lighting Panels and Control Equipment

An automatic transfer switch will be included to transfer electrical loads to the generator during an outage. In accordance with 30 TAC § 217.37, the disinfection system will automatically restart during a power outage and upon transfer back to the main power source.

## **B. Alarm Features**

The facility will be equipped with a Supervisory Control and Data Acquisition (SCADA) system to monitor the operation of all critical treatment units. The control room will include a computer with graphic display of the treatment units that will indicate status and alarm conditions. The computer system will include an autodialer to alert facility personnel of the following conditions.

- 1.0 Power Outage
- 2.0 Mechanical Coarse Screen High Level
- 3.0 Bar Screen Channel High Level
- 4.0 Grit Channel High Level
- 5.0 Mechanical Fine Screen Channel High Level
- 6.0 Influent Pumps
- 7.0 MBR Equipment Failure
- 8.0 Ultraviolet Disinfection
- 9.0
- 10.0

The autodialer will store prerecorded messages concerning each alarm condition and the procedure to be followed and will call up to 8 different phone numbers until the alarm condition is acknowledged. The bar screen will also be equipped with local alarm lights for high level.

## **C. Design Features for Reliability and Operating Flexibility**

- 1.0 Bar Screen: the mechanical bar screen structure will include a bypass channel with a manual screen for use when needed. Slide gates will be used to isolate each channel as required.
- 2.0 Grit Chamber: The grit chamber will include a bypass channel and slide gates to allow the chamber to be taken out of service for maintenance and repair.
- 3.0 Aeration basins-BNR: One aeration basins will be included, capable of continuous operation. Piping and valves will be included to allow each unit to be individually isolated for draining, cleaning or repairs.
- 4.0 Fine Screens: The fine screen structure will include two (2) fine screens, one will be capable of handling design and peak flows and the second will be a redundant back up. Slide gates will be used to isolate each channel as required.
- 5.0 MBR Filtrate Pumps: The MBR System will have triplex filtrate pumps layout. A filtrate pump will be dedicated to each MBR tank if either of the duty pumps are to fail, then a redundant filtrate pump may transfer filtrate from either of the two MBR tank.
- 6.0 MBR Blowers: The MBR System will have a triplex blower layout. A blower will be dedicated to each MBR tank if either of the duty blowers are to fail, then a redundant blower capable of supplying aeration to either of the two MBR tanks.

- 7.0 UV Channels and Banks: Each UV channel will have a minimum of two UV banks to allow for a single redundant back up maintenance or equipment failure. The channels will each be sized to handle the design flow of the plant to provide redundancy during maintenance repair or failure in a single channel. Slide gates will be used to isolate each of the channels.

**D. Overflow prevention**

The following design features will be used to prevent the overflow of wastewater from treatment units.

- 1.0 Based on historical flow data, the facility design includes a peaking factor of 3 to insure adequate hydraulic capacity.
- 2.0 The facility hydraulic design, including piping, channels, weirs, troughs and other features, will be sized to allow the 2-hour peak flow to pass through the facility without exceeding minimum freeboard requirements.

## DESIGN CALCULATIONS AND PLANT DESIGN FEATURES

### PROPOSED GRANBURY EAST WWTP IMPROVEMENTS (PHASE II) - CITY OF GRANBURY, TEXAS

#### Influent Quality Characteristics

| Parameter          | Concentration (mg/L) |
|--------------------|----------------------|
| BOD <sub>5</sub>   | 250                  |
| TSS                | 250                  |
| NH <sub>3</sub> -N | 35                   |
| TP                 | 7                    |
| TKN                | 45                   |

#### Influent Flow Characteristics

| Flow             | Gallons per Day (gpd) | Gallons per Minute (gpm) |
|------------------|-----------------------|--------------------------|
| Q <sub>ave</sub> | 2,000,000             | 1389                     |
| Q <sub>pk</sub>  | 6,000,000             | 4167                     |

| Loading          | Pounds per Day |
|------------------|----------------|
| BOD <sub>5</sub> | 4170           |
| TSS              | 4170           |
| NH <sub>3</sub>  | 584            |

#### Process Design

Treatment facility will be design to produce an effluent quality in compliance with the proposed permitted parameters of:

| Parameter         | Concentration   |
|-------------------|-----------------|
| CBOD <sub>5</sub> | 5 mg/L          |
| TSS               | 12 mg/L         |
| NH <sub>3</sub>   | 3 mg/L          |
| DO                | 4 mg/L          |
| E. coli           | 126 CFU/ 100 mL |

In order to achieve the required removal efficiencies, the Membrane Bioreactor (MBR) process operated in a continuous flow mode has been chosen. The 7-day low reactor temperature is 20°C. The anticipated operating ranges for MLSS and RAS are 4,000 mg/L to 10,000 mg/L for the bioreactor tank and 4,000 mg/L to 14,000 mg/L in the membrane tank, respectively. Other assumptions include a solids storage tank

#### **Mechanical Bar Screen**

| <u>Design Parameter</u>                        | <b>TCEQ Requires</b>            | <b>Actual Provided</b> |
|--|---------------------------------|------------------------|
| No. of Screens                                 | Not Specified                   | 2                      |
| Bar Screen Slope (Degrees)                     | Not Specified                   | 60° from Horizontal    |
| Bar Spacing (inch)                             | > or = 0.25, but < or =<br>1.75 | 0.25                   |
| Velocity Through Screen @ Design Flow (ft/sec) | > or = 1.0, but < or =<br>3.0   | 2.60                   |

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**Manual Bar Screen**

| <u>Design Parameter</u>                        | <b>TCEQ Requires</b>        | <b>Actual Provided</b> |
|--|-----------------------------|------------------------|
| No. of Screens                                 | Not Specified               | 1                      |
| Screen Width (ft)                              | Not Specified               | 3                      |
| Screen Depth (ft)                              | Not Specified               | 5                      |
| Screen Wetted Depth (ft)                       | Not Specified               | 0.8                    |
| Screen Slope (degrees)                         | > or = 30, but < or = 60    | 60° from Horizontal    |
| Screen Spacing (inch)                          | > or = 0.5, but < or = 1.75 | 1                      |
| Velocity Through Screen @ Design Flow (ft/sec) | 1.0 < V < 3.0               | 2.11                   |

**Grit Removal Unit**

| <u>Design Parameter</u>                    | <b>TCEQ Requires</b> | <b>Actual Provided</b> |
|--|----------------------|------------------------|
| No. of Units                               | Not Specified        | 2                      |
| Unit Type                                  | Not Specified        | Stacked Discs          |
| Unit Diameter (ft)                         | Not Specified        | 9'-0"                  |
| Flow through Grit Unit @ Design Flow (mgd) | Not Specified        | 6.0                    |
| Flow through Grit Unit @ Peak Flow (mgd)   | Not Specified        | 9.0                    |

**Fine Screens**

| <u>Design Parameter</u> | <b>TCEQ Requires</b> | <b>Actual Provided</b> |
|-------------------------|----------------------|------------------------|
| No. of Screens          | 1 Duty, 1 Redundant  | 3 (2+1)                |
| Screen Opening (inch)   | Less than 0.25 inch  | 0.079 (2 mm)           |

\*Bid Alternative: 1 fine screen with 1 mm opening

**Influent Lift Station Pumps**

| <u>Design Parameter</u>     | <b>TCEQ Requires</b> | <b>Actual Provided</b> |
|-----------------------------|----------------------|------------------------|
| No. of Pumps                | 1 Duty, 1 Redundant  | 3 (2+1)                |
| Type of Pumps               | Not Specified        | Submersible            |
| Capacity of Each Pump (gpm) | Not Specified        | 2,800                  |
| Head of Each Pump (ft)      | Not Specified        | 35                     |

**Anaerobic Basin - BNR**

| <u>Design Parameter</u>               | <b>TCEQ Requires</b> | <b>Actual Provided</b> |
|---------------------------------------|----------------------|------------------------|
| No. of Basins                         | Not Specified        | 2                      |
| Area of Each Basin (ft <sup>2</sup> ) | Not Specified        | 558                    |
| Side Water Depth (ft)                 | Not Specified        | 15                     |
| Total Volume (ft <sup>3</sup> )       | Not Specified        | 16,740                 |
| Mixing Type                           | Not Specified        | Submersible Mixers     |

**Anoxic Basin - BNR**

| <u>Design Parameter</u>               | <b>TCEQ Requires</b> | <b>Actual Provided</b> |
|---------------------------------------|----------------------|------------------------|
| No. of Basins                         | Not Specified        | 2                      |
| Area of Each Basin (ft <sup>2</sup> ) | Not Specified        | 1,113                  |
| Side Water Depth (ft)                 | Not Specified        | 15                     |
| Total Volume (ft <sup>3</sup> )       | Not Specified        | 33,390                 |
| Mixing Type                           | Not Specified        | Submersible Mixers     |
| Anoxic Recycle Pumps                  | 1 Duty, 1 Redundant  | 2 (1+1)                |

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**Aeration Basin-BNR**

| <u>Design Parameter</u>                  | <b>TCEQ Requires</b>  | <b>Actual Provided</b> |
|--|---|------------------------|
| No. of Basins                            | Not Specified   | 2                      |
| Area Of Each Basin (ft <sup>2</sup> )    | Not Specified   | 1,782                  |
| Side Water Depth (ft)                    | Not Specified   | 15                     |
| Total Aeration Volume (ft <sup>3</sup> ) | Not Specified   | 53,460                 |
| Organic Loading (lbs/day/1000 cu.ft.)    | Design must be based on BNR biological process model to support MBR | 78.00                  |
| Mixing Type                              | Not Specified   | Submersible Mixers     |
| Aerobic Recycle Pumps                    | 1 Duty, 1 Redundant   | 2 (1+1)                |

**Membrane Basin - MBR**

| <u>Design Parameter</u>                | <b>TCEQ Requires</b> | <b>Actual Provided</b> |
|--|----------------------|------------------------|
| No. of Basins                          | Minimum of 2         | 3                      |
| Membrane Type                          | Not Specified        | Hollow Fiber           |
| Area Of Each Basin (ft <sup>2</sup> )  | Not Specified        | 202.5                  |
| Side Water Depth (ft)                  | Not Specified        | 8.3                    |
| Total Volume (ft <sup>3</sup> )        | Not Specified        | 5,042                  |
| No. of Membrane per Train              | Not Specified        | 10                     |
| No. of Membrane Modules per Train      | Not Specified        | 160                    |
| Total Membrane Area (ft <sup>2</sup> ) | Not Specified        | 68,889                 |
| Net Membrane Flux at ADF (gfd)         | Not Specified        | 9.7                    |
| Net Membrane Flux at Peak (gfd)        | Not Specified        | 19.4                   |

**Ultraviolet Disinfection**

| <u>Design Parameter</u>                     | <b>TCEQ Requires</b> | <b>Actual Provided</b> |
|---|----------------------|------------------------|
| Peak Design Flow (MGD)                      | Not Specified        | 8.0                    |
| No. of Channels                             | Not Specified        | 2                      |
| No. of Banks per Channel                    | Not Specified        | 3                      |
| No. of Modules per Bank                     | Not Specified        | 1                      |
| No. of Lamps per Module                     | Not Specified        | 12                     |
| No. of Lamps per Channel                    | Not Specified        | 36                     |
| UV Transmittance at 253.7 nm (MBR Filtrate) | Not Specified        | 75%                    |

**MBR WAS Pumps**

| <u>Design Parameter</u>     | <b>TCEQ Requires</b> | <b>Actual Provided</b>                        |
|-----------------------------|----------------------|---|
| No. of Pumps                | Not Specified        | 1 per MBR channel, 4 total (1 On-shelf spare) |
| Type of Pumps               | Not Specified        | Centrifugal Wastewater Pumps                  |
| Capacity of Each Pump (gpm) | Not Specified        | 2,778   |
| Head of Each Pump (ft)      | Not Specified        | 8   |

**Solids Storage Tanks**

| <u>Design Parameter</u>                                       | <b>TCEQ Requires</b> | <b>Actual Provided</b> |
|---|----------------------|------------------------|
| No. of Solids Storage Tanks                                   | Not Specified        | 2                      |
| Storage Volume, cu. ft. (Approximate)                         | Not Specified        | 36,750                 |
| No. of Days of Sludge Storage @ 0.5% Solids                   | Not Specified        | 3.10                   |
| No. of Days of Sludge Storage @ 1.0% Solids (from thickening) | Not Specified        | 6.21                   |
| No. of Days of Sludge Storage @ 2.0% Solids (from thickening) | Not Specified        | 12.41                  |
| No. of Days of Sludge Storage @ 3.0% Solids (from thickening) | Not Specified        | 18.62                  |

\*Equipment sizing for mixing system for tank refer to aeration below.

**Solids Transfer Storage Pump Station**

| <u>Design Parameter</u>     | <b>TCEQ Requires</b> | <b>Actual Provided</b>         |
|-----------------------------|----------------------|--------------------------------|
| No. of Pumps                | Not Specified        | 2 ( 1 duty plus 1 standby)     |
| Type of Pumps               | Not Specified        | Double-Disc suction lift pumps |
| Capacity of Each Pump (gpm) | Not Specified        | 140                            |
| Head of Each Pump (ft)      | Not Specified        | 30                             |

**Polymer Feed System**

| <u>Design Parameter</u> | <b>TCEQ Requires</b> | <b>Actual Provided</b> |
|-------------------------|----------------------|------------------------|
| No. of Units            | 1 Duty, 1 Redundant  | 2 (1+1)                |

**Dewatering System**

| <u>Design Parameter</u> | <b>TCEQ Requires</b> | <b>Actual Provided</b>    |
|-------------------------|----------------------|---------------------------|
| No. of Units            | 1 Duty, 1 Redundant  | 1 Mechanical, 2 Redundant |

**Plant Water Pumps**

| <u>Design Parameter</u>     | <b>TCEQ Requires</b> | <b>Actual Provided</b>  |
|-----------------------------|----------------------|-------------------------|
| No. of Pumps                | 1 Duty, 1 Redundant  | 2 (1+1)<br>Self-priming |
| Type of Pumps               | Not Specified        | Centrifugal Pumps       |
| Capacity of Each Pump (gpm) | Not Specified        | 140                     |
| Head of Each Pump (ft)      | Not Specified        | 185                     |

**Reuse Pumps**

| <u>Design Parameter</u>     | <b>TCEQ Requires</b> | <b>Actual Provided</b>  |
|-----------------------------|----------------------|-------------------------|
| No. of Pumps                | 1 Duty, 1 Redundant  | 2                       |
| Type of Pumps               | Not Specified        | -priming Centrifugal Pu |
| Capacity of Each Pump (gpm) | Not Specified        |                         |
| Head of Each Pump (ft)      | Not Specified        |                         |

## Aeration Requirements

### Aeration Basin - BNR

| <u>Design Parameter</u>                                    | <u>TCEQ Requires</u>  | <u>Actual Provided</u> |
|--|---|------------------------|
| Aeration Requirements (SCF/day/lb BOD <sub>5</sub> )       | Design must be based on BNR biological process model to support MBR | 3,200                  |
| Oxygen Required (lb O <sub>2</sub> / lb BOD <sub>5</sub> ) | Design must be based on BNR biological process model to support MBR | 2.2                    |
| Oxygen Required (lb/day)                                   | Design must be based on BNR biological process model to support MBR | 1032                   |
| Air Provided (SCFM)  | Design must be based on BNR biological process model to support MBR | 1,000                  |

### Solids Storage Tank Aeration

| <u>Design Parameter</u>                    | <u>TCEQ Requires</u> | <u>Actual Provided</u> |
|--|----------------------|------------------------|
| Aeration Mixing Requirements per Tank (HP) | 0.5 HP/ 1000 CF      | 9                      |

## Facility Design Features

### A. Emergency Power Requirements

In accordance with 30 TAC § 217.36 and due to the number and duration of power outages that have occurred in the past, the treatment facility must incorporate an on-site automatically starting generator capable of continuously operating all critical wastewater treatment system units. The fuel tank must be sized for a runtime greater than the longest power outage in the power records. This generator will provide sufficient power for the following units.

- 1.0 1 - Mechanical Bar Screen
- 2.0 1 - Grit Slurry Pump
- 3.0 2 - Fine Screen
- 4.0 2 - Influent Submersible Pumps
- 5.0 3 - MBR Filtrate Pumps
- 6.0 3 - MBR Blowers
- 7.0 3 - MBR RAS/WAS Pumps
- 8.0 3 - Solids Storage Blowers
- 9.0 Ultraviolet Disinfection
- 10.0 Effluent Metering Station
- 11.0 Lighting Panels and Control Equipment

An automatic transfer switch will be included to transfer electrical loads to the generator during an outage. In accordance with 30 TAC § 217.37, the disinfection system will automatically restart during a power outage and upon transfer back to the main power source.

## **B. Alarm Features**

The facility will be equipped with a Supervisory Control and Data Acquisition (SCADA) system to monitor the operation of all critical treatment units. The control room will include a computer with graphic display of the treatment units that will indicate status and alarm conditions. The computer system will include an autodialer to alert facility personnel of the following conditions.

- 1.0 Power Outage
- 2.0 Mechanical Coarse Screen High Level
- 3.0 Bar Screen Channel High Level
- 4.0 Grit Channel High Level
- 5.0 Mechanical Fine Screen Channel High Level
- 6.0 Influent Pumps
- 7.0 MBR Equipment Failure
- 8.0 Ultraviolet Disinfection
- 9.0
- 10.0

The autodialer will store prerecorded messages concerning each alarm condition and the procedure to be followed and will call up to 8 different phone numbers until the alarm condition is acknowledged. The bar screen will also be equipped with local alarm lights for high level.

## **C. Design Features for Reliability and Operating Flexibility**

- 1.0 Bar Screen: the mechanical bar screen structure will include a bypass channel with a manual screen for use when needed. Slide gates will be used to isolate each channel as required.
- 2.0 Grit Chamber: The grit chamber will include a bypass channel and slide gates to allow the chamber to be taken out of service for maintenance and repair.
- 3.0 Aeration basins-BNR: Two aeration basins will be included, capable of continuous operation. Piping and valves will be included to allow each unit to be individually isolated for draining, cleaning or repairs.
- 4.0 Fine Screens: The fine screen structure will include three (3) fine screens, two will be capable of handling design and peak flows and the third will be a redundant back up. Slide gates will be used to isolate each channel as required.
- 5.0 MBR Filtrate Pumps: The MBR System will have a four filtrate pumps layout. A filtrate pump will be dedicated to each MBR tank if either of the duty pumps are to fail, then a redundant filtrate pump may transfer filtrate from either of the three MBR tanks.
- 6.0 MBR Blowers: The MBR System will have a four blower layout. A blower will be dedicated to each MBR tank if either of the duty blowers are to fail, then a redundant blower capable of supplying aeration to either of the three MBR tanks.

- 7.0 UV Channels and Banks: Each UV channel will have a minimum of two UV banks to allow for a single redundant back up maintenance or equipment failure. The channels will each be sized to handle the design flow of the plant to provide redundancy during maintenance repair or failure in a single channel. Slide gates will be used to isolate each of the channels.

**D. Overflow prevention**

The following design features will be used to prevent the overflow of wastewater from treatment units.

- 1.0 Based on historical flow data, the facility design includes a peaking factor of 3 to insure adequate hydraulic capacity.
- 2.0 The facility hydraulic design, including piping, channels, weirs, troughs and other features, will be sized to allow the 2-hour peak flow to pass through the facility without exceeding minimum freeboard requirements.