July 15, 2020

Addendum #2 – Request for Proposal for the Avila Beach Community Services District Membrane Bioreactor Package System

Interested parties are hereby informed that the Request for Proposals (RFP) issued on June 18, 2020 by the Avila Beach Community Services District for the above project has been amended by the following information. Receipt of the addendum shall be acknowledged by completion and submittal of Receipt of Addenda, Part 3.2 of the RFP.

1. The effluent ammonia design criteria is less than 1 mg/L. Table 1-1 in Section 1.1.2 of the RFP is revised as such.

2. Replace Specification Section 460754 with the revised Specification Section 460754, attached. All changes are shown with strikethrough for deletions and underline for additions (via Microsoft Word Track Changes).

Responses to questions:

1. Question: Section 1, 1.1.2- Effluent Quality for TN and NH3 are both listed as <8 mg/L. Typically, effluent NH3 is < 1 mg/L in a MBR system and a lower value than TN. Is there a limit on nitrates by chance or only NH3 and TN?

   Response: *Specification Section 460754 has been revised to reflect a NH_3 requirement of <1 mg/L.*

2. Question: Section 460754-8, C.- In item 1, a single train is requested, but in item 4 & 5, it seems that a redundant train is required. Also, a separate staging tank listed in item 3 is not required for our system, especially where there is a redundant train. Please clarify if two membrane trains in separate tanks is acceptable.

   Response: *Per Specification Section 460754, 1.05 (C)(1) and 1.05 (F), the MBR System shall consist of a single train. No redundant train is requested or desired as part of this proposed work. Section 460754 has been revised. Note, however, that two membrane trains in separate tanks may be considered if the system meets the maximum system weight and footprint criteria per Table 1-2 in Section 1.1.2 of the RFP with adequate maintenance and operational clearances.*

3. Question: Section 460754-8, D. 1.- Maintained peak flow is listed at 150 gpm for 24-hours, but in other sections, the peak hourly flow of 150 gpm is listed for a max of one hour. Please clarify peak flow and duration to ensure appropriate sizing of the system.

   Response: *The requirement for peak hour flow is 150 gpm sustained over 1 hour. Section 460754, 1.05 (D)(1) has been revised.*

4. Question: Section 460754-8, E. 2.- Net Flux is listed as 5.8 gfd (ADF) and 11.6 gfd (PHF) and in 3.5.1, Table 3-1 as 10 gfd (ADF) & 17 gfd (PHF). Please confirm the max flux cap that is acceptable.

   Response: *Section 460754 1.05 (E)(2) has been revised to reflect the limits shown in Table 3-1 of the RFP.*

5. Question: Section 460754-17, E.1.c.: States membrane tanks can be of Type 304 or 316 stainless steel. Page 5 of the RFP (viii) states "316 stainless steel tanks…" & Table 1-2 on page 7 states 316SS. Can you confirm that 316 SS is the requirement?

   Response: *Yes, Membrane tanks shall be constructed of Type 316 stainless steel, suitable for the coastal outdoor environment. Section 460754, 2.03 (E)(1)(c) has been revised.*

6. Question: The specifications call for a 10' wide tank with a maximum length of 75'. Will systems with a 12' wide tank design be allowed (per Table 1-2, pg. 7)?

   Response: *Yes, a 12' wide tank design would be allowable. Table 1-2 reflects maximum equipment foundation widths from 10 to 20 feet. The specifications have been revised to remove the 10-foot wide x 75-foot long footprint and add the system weight and footprint requirements from the RFP. See Section 1.05 (K) of revised Section 460754, attached.*

7. Question: Can you provide elevations for:
   a. the top of foundation pad the MBR Tank(s) will placed on?
      i. Page 460754-9 states the site elevation at 10' ASL

   b. the elevation of the inlet pipe (size & centerline) to the Chlorine Contact Chamber?
      i. Page 460754-18 states the estimated liquid level elevation at chlorine contact chamber is 17.50'

   Response:
   Assume the following elevations:
   - *Top of foundation pad for MBR Treatment System: 10.5 feet*
   - *Invert elevation of inlet pipe to Chlorine Contact Chamber: 18.0 feet*
   - *Liquid level elevation at Chlorine Contact Chamber: 17.5 feet*

8. Question: What is the permit requirement for frequency of the effluent TN spec of < 8 mg/L (daily, monthly, annual)?
    a. Does system need to meet this spec at Peak Hourly Flow of 150 GPM?

    Response: *Yes, the system needs to meet effluent requirements at specified PHF rates.*

9. Question: Section 460754-8, D.1.: Can you clarify if the system has to provide 24 continuous hours of peak hour flow at 150 GPM?
    a. Please clarify as well if this is a hydraulic requirement only, or both hydraulic and process treatment?

    Response: *See response to Question 4 and revised Section 460754, attached.*

10. Question: Is there a street address we can mail the hardcopy to? FedEx will not deliver to a PO Box.

    Response: *This is provided in Section 1.10.2 (Physical Delivery Address) of the RFP*

11. Question: Will any equalization be provided with respect to the peak hourly flow rate? We ask as the PHF is nearly 3x the PDF and more than 8x the ADF, which is exceptionally high and is driving the overall size of the MBR system.

    Response: *Proposal should assume that no equalization is currently available or planned for operations of the MBR System. The duration of the peak hour flow has been revised per response to Question 4 and revised Section 460754, attached.*

12. Question: The documents refer to a MBR Supply Contract and General Conditions; however, Appendix A is not used and there are no General Conditions in the documents. Shall we supply our standard terms and conditions to be used as a starting point for negotiation or will the Supply Contract or General Conditions be provided for review?

    Response: *Per Section 1.1.7 of the RFP, MBR Equipment Supplier will become a subcontractor to the General Contractor, once awarded. A sample Novation Agreement was provided in the RFP.*

Attachment: Revised Specification Section 460754

SECTION 460754

PACKAGE MEMBRANE BIOREACTOR
TREATMENT SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The MBR SUPPLIER shall supply, furnish, deliver, and assist commissioning a submerged package Membrane Bioreactor (MBR) Treatment System of hollow fiber or flat sheet type for the Avila Beach Community Services District Wastewater Treatment Plant (ABCSD WWTP). The General Contractor, to be selected under a separate contract, will issue the purchase order to the selected MBR SUPPLIER. The Contractor will furnish all labor, rigging, and incidentals required for installation of the MBR System. Once installed, the MBR System shall be complete and operational with all control equipment and accessories as specified herein.

B. The MBR SUPPLIER shall be the single point of contact for the General Contractor for the entire duration of the project. The MBR SUPPLIER shall be responsible for coordinating all inquiries, activities, support, delivery, start-up, commissioning, training and warranty support for components and equipment supplied by the MBR SUPPLIER.

C. The membrane bioreactor tanks will be designed to the exact dimensions and tolerances listed by the MBR SUPPLIER in the proposal and subsequent shop drawings. The MBR SUPPLIER shall coordinate requirements with the General Contractor and review the as-built installation prior to installation of the membrane cassettes.

D. The MBR SUPPLIER will design, manufacture, and deliver a full package MBR treatment plant including, but not limited to, screens, anoxic tanks, aerobic tanks, MBR tanks, membrane system, interconnecting piping, WAS pumps, permeate pumps, aeration equipment, electrical, instrumentation, and all process controls. MBR SUPPLIER is responsible for providing all components required for a fully functional system using their typical control and protective functions including valves and instruments that may not be shown explicitly in the P&IDs or as specified herein.

E. The MBR System will include a feedwater automatic backwashing strainer system, membrane filtration and backwash system, membrane performance maintenance system, membrane cleaning system, membrane scour air system, membrane basin drain/neutralization system, and compressed air system shall be supplied by the MBR SUPPLIER. The MBR System will also include a feed control station, biological aeration system, mixed liquor pumping system sludge/foam wasting system, membrane basin drain/neutralization basin and pump station, and feed chemical dosing systems. The MBR System and the associated ancillary systems including biological treatment will be controlled by an MBR SUPPLIER-supplied control system capable of interface with the existing facility SCADA system for remote monitoring and control. Delineation of the MBR System scope is provided on Contract Drawing P&IDs.

1.02 DEFINITIONS

A. Net Flux Rate: Equals the total amount of permeate produced by the membrane system over a representative period that is available for downstream discharge (excluding backwash water) divided by the total membrane outside surface area in square feet. Units of “Flux Rate” are gallons per square foot per day (gfd). Representative time period includes relaxation, backpulsing, chemical cleaning, etc., as appropriate for flow duration being considered.

B. Transmembrane Pressure (TMP): The pressure differential across the membrane. TMP shall be adjusted for losses from membrane discharge to pressure gauge. Units of TMP are pounds per square inch (psi).

C. Permeability: Equals the flux rate divided by the transmembrane pressure. The units of permeability are gfd/psi.

D. Backwash or Backpulse Clean: Any routine instance a membrane train is taken offline for application of water, and/or chemical solution for the purpose of maintaining permeate production rate of membrane.

E. Relaxation: Any routine instance a membrane train is taken offline by temporarily stopping the permeate pump to maintain net flux rate of membrane system.

F. Maintenance Clean: Any routine instance a membrane train is taken offline for application of a chemical solution that is not considered part of the normal backwash cycle or recovery clean. Maintenance Cleans shall be automatically initiated and shall have a duration of less than 60 minutes. Maintenance clean is typically performed once a week at a period of low influent flow.

G. Recovery Clean: Any non-routine procedure, manual, automated or semi-automated cleaning process that uses one or more cleaning chemicals to reverse the effects of membrane fouling. This may involve removing a membrane train from service and conducting cleaning in a service tank or draining the basin, and then filling with cleaning solution. The membranes may soak for a period of time before the chemical solution is removed from the tank. Recovery cleaning is typically performed no more than annually.

H. Membrane Module or Module: Basic unit of membrane production. The Module may be a single assemblage of fibers in a common potting (element) or flat sheets attached to a support structure.

I. Membrane Cassette or Cassette: A group of membrane modules or multiple elements sharing a common air and permeate connection. A module is the smallest assembled unit of a delivered system that is designed to be removed and replaced as a complete unit.

J. Membrane Train or Train: A grouping of membrane cassettes, located in a concrete or steel structure, which share a common permeate header and pump, a common air supply header, and that are removed from operation as an entity for backpulsing, relaxing, maintenance cleaning, or recovery cleaning.

1.03 SPECIFICATIONS, CODES, AND STANDARDS

A. The MBR SUPPLIER shall comply with the following codes and standards at a minimum when furnishing the Work covered under these specifications.

1. American National Standards Institute (ANSI)

2. American Iron and Steel Institute (AISI)

   a. 4130 – Heat Treated Alloy Steel

   b. 4140 – Heated Treated Hexagon Steel

3. American National Standards Institute (ANSI)

   a. B16.1 – Cast-Iron Pipe Flanges and Flange Fittings, Class 25, 125, 250 and 800.

4. American Society for Testing and Materials (ASTM)

   a. A29/A29M – Steel Bars, Carbon and Alloy, Hot-Wrought and Cold- Finished.

   b. A36 – Structural Steel Specifications.

   c. A48 – Gray Iron Castings.

   d. A53, Grade B – Pipe Specifications

   e. A325 – High Strength Fastener Specifications

   f. A370 – Mechanical Testing of Steel Products.

   g. A536 – Cast Iron Specifications

   h. 303 – Stainless Steel Material Specifications

   i. 304 – Stainless Steel Material Specifications

   j. 316 – Stainless Steel Material Specifications

5. American National Standards Institute (ANSI)

6. American Gear Manufacturers Association (AGMA)

7. American Water Works Association (AWWA)

   a. C504 – Standard for Rubber-Seated Butterfly Valves

   b. C508 – Standard for Swing-Check Valves for Waterworks, 2-inch through 24-inch

   c. C540 – Power Actuating Devices for Valves and Sluice Gates.

   d. C550 – Protective Epoxy Interior Coatings for Valves and Hydrants

8. Hydraulic Institute Standards (HI)

9. American Society of Mechanical Engineers (ASME)

10. American Welding Society (AWS)

11. National Electric Code (NEC)

12. Underwriters Laboratories, Inc. (UL)

13. Institute of Electrical and Electronic Engineers (IEEE)

14. National Electrical Manufacturers Association (NEMA)

15. International Building Code (IBC)

1.04 PROCESS DESCRIPTION

A. The MBR process consists of a suspended growth biological reactor integrated with a membrane-based solids/liquid separation system. Membrane tanks shall be physically separated from the aerobic reactors.

B. The MBR System will include a mixed liquor feed (MLF) and return activated sludge (RAS) system to provide a consistent/controlled RAS recycle ratio. The combined flow will be pumped to the membrane basin at a rate equal to the total RAS and MBR filtrate flow.

C. The MBR System will consist of a number of microfiltration or ultrafiltration membranes complete with skid mounted process equipment, instrumentation and process piping.

D. Membranes will be immersed in separate membrane tanks, in direct contact with mixed liquor. Through the use of a permeate pump, a vacuum is applied to a header connected to the membranes. The vacuum draws the treated water through the membranes. Permeate is then directed to disinfection or discharge facilities. Air shall be introduced to the bottom of the membrane elements, producing turbulence that scours the external surface of the membrane. The scouring action shall transfer solids away from the membrane surface.

E. The MBR System supplied by the MBR SUPPLIER shall be fully functional. The requirements have been substantially detailed. MBR SUPPLIER is responsible for identifying and supplying unspecified components required to provide fully functional equipment or identify operating conditions that could damage the equipment and create a warranty claim.

F. The MBR System shall include, but not be limited to, the following components:

1. Automatic Strainers/Rotary Drum Screens consists of an automatic self-cleaning strainer capable of removing unwanted solids from the MBR System feed.

2. Immersed wastewater membranes arranged in modular units and consist of membranes/cartridges and modules/cassettes and all related piping, valving, and lifting equipment and assemblies.

3. Positive displacement blower to provide low pressure air for membrane air scour. These will be provided by the MBR SUPPLIER.

4. Rotary Lobe pumps will be provided to complete filtration, backwashing, and chemical cleaning. These will be provided by the MBR SUPPLIER.

5. Permeate Pumping System including variable frequency drives (VFDs).

6. Automatic backwashing strainers shall provide straining of MBR feed water. These shall be provided by the MBR SUPPLIER.

7. An aeration system will be provided to introduce dissolved oxygen into the biomass in the aeration zone. The aeration system will be supplied by the MBR SUPPLIER.

8. Air Scour Blower System including VFDs shall be provided by the MBR SUPPLIER and designed to provide air quantities, pressures, turn-down capabilities, and related controls specified and supplied by the MBR SUPPLIER. Air diffusers, blowers, associated piping/valving and all ancillary equipment shall be provided by the MBR SUPPLIER. The MBR SUPPLIER shall be responsible for all air piping located inside the membrane tanks and through the membrane tanks header. A single standby blower shall be provided for the air scour system.

9. Return activated sludge (RAS) Pumping System including VFDs.

10. Membrane cleaning system. The MBR System will be periodically cleaned with chemicals during Clean-In-Place (CIP) and Maintenance of Chemically Enhanced Backwashes. As a minimum sodium hypochlorite and citric acid systems are required. Other systems needed by the MBR SUPPLIER shall be proposed and listed and explained in the proposal. Membranes shall be cleaned in-basin and CIP system shall include chemical tanks, piping/valving, feed pumps (one duty + one standby) and all ancillary equipment.

11. Packaged compressed air systems shall provide pressure regulated control air and membrane integrity air for the MBR System. These will be provided by the MBR SUPPLIER.

12. The MBR System shall be equipped with a waste activated sludge (WAS) system to periodically waste sludge in order to maintain biomass. The WAS system shall include a flowmeter, flow totalizer, and control valve and will be set to a given flow. The WAS system shall be supplied by the MBR SUPPLIER.

13. Interconnecting piping and valves within MBR tanks or on skid mounted equipment.

14. Hydraulic connection points, valves, room on the supplied equipment skid(s), the PLC and the electrical panel will be designed and incorporated by the MBR SUPPLIER to allow for easy integration of UV disinfection equipment in the future.

15. Process Instrumentation Power and Control system shall include process control panels, local control panels for equipment within scope of supply, software programming, and all process monitoring equipment such as turbidity meters, differential pressure transducers, pressure transmitters, flow meters, temperature probes, DO probes, automatic levels, and level measuring devices, main control panel with programmable logic controller (PLC) and human machine interface (HMI) and any required local control panels.

16. All other equipment needed to operate the membrane filtration process reliably and according to design intent.

G. The MBR SUPPLIER shall provide a complete system including all equipment necessary in order to operate the membrane filtration system according to the design intent and performance requirements.

H. The proposed fine screens for the MBR process are 2 MM self contained screw screen, compactor and washer. Should the proposed fine screen not meet MBR SUPPLIER's type and rating requirement, the MBR SUPPLIER shall indicate type and rating of the screening device required for the proposed membrane filtration system on the proposal form.

I. Power available at the site is 480 VAC, 3 phase, 3 wire.

J. Scope of Supply Exclusions:

The following components are specifically not included in the MBR SUPPLIER's scope of supply:

1. UV Disinfection System

1.05 PROCESS PARAMETERS (SYSTEM PERFORMANCE REQUIREMENTS)

A. Influent Flow Rate:

1. The influent flows to the MBR System are as follows in the table.

Parameter	Unit	Flow Rate
Max Daily Flow Rate (MDF)	GPD	37,500
Average Annual Flow Rate (AAF)	GPD	25,000
Peak Hour Flow Rate (PHF)	gpm	150
Peak Day Flow Rate (PDF)	GPD	77,000

2. Maximum Daily Flow (MDF) – The maximum daily flow occurring over a 24-hour period.

3. Average Annual Flow (AAF) – The average flow of a one-day period which is the influent volume in one year divided by the number of days in that year. AAF is typically the nominal capacity of the plant

4. Peak Daily Flow (PDF) – The single greatest flow of a one-day (24 hr) period in a year. PDF serves for design of plant hydraulic capacity.

5. Peak Hour Flow (PHF) – The flow over a 60-minute period which is the influent flow of the highest flow hour in the Peak Day.

B. Influent Conditions:

1. The MBR SUPPLIER shall provide the screening device required for the proposed membrane filtration system. No bypass of the screening will be permitted in any direction. Screening system shall be provided by the MBR SUPPLIER.

2. The MBR system shall receive wastewater with a minimum influent temperature of 16°C, an average influent temperature of 23°C, and a maximum influent temperature of 30°C.

3. The MBR System will receive raw wastewater with the following characteristics in average based on recent wastewater sampling and projected future characteristics:

Parameter	Value	Unit
Influent Quality		
BOD	702	mg/L
TSS	529	mg/L
TN	88	mg/L
NH_3	37	mg/L
Phosphorus	10	mg/L

a. The MBR SUPPLIER's proposed system shall be capable of withstanding variations to the preceding values that are typical in domestic wastewater systems, including the Avila Beach CSD WWTP.

4. The biological process reactor design is part of the package MBR System and shall be provided by the same Manufacturer ~~and designed to achieve effluent conditions of:~~

~~Parameter~~	~~Value~~	~~Unit~~
~~Effluent Quality~~	-	-
~~BOD~~	~~<10~~	~~mg/L~~
~~TSS~~	~~<10~~	~~mg/L~~
~~TN~~	~~<8~~	~~mg/L~~
~~NH_3~~	~~<8~~	~~mg/L~~
~~Turbidity~~	~~<2~~	~~NTU~~

5. The design process reactor mixed liquor suspended solids (MLSS) concentration (@ 8,300 mg/L aeration) entering the MBR tank is the following:

a. 10,375 mg/L under maximum day load condition with one process reactor out of service (temperature range: 16 °C to 30 °C).

C. Process Reliability and Redundancy:

1. The MBR system shall consist of a single train. ~~The MBR cassettes, permeate system, air scour blower system, RAS pumping system, membrane cleaning equipment, control system, and PLC shall be designed and supplied for the addition of extra cassette(s) in the future. No modification shall be required to any system to install extra cassette(s).~~

~~2. The quantity of extra cassette space shall be at least 20 percent of the required number of membrane cassettes included in the base proposal.~~

~~3. One (1) staging tank identical in size to the main MBR tanks will be provided in the design for the MBR system for membrane testing and wet storage in clean water prior to, or during repair/maintenance work.~~

~~4. Membrane trains will be fully isolatable in separate tanks.~~

~~5. One train out of service is defined as an entire group of membrane cassettes connected to its common permeate pump.~~

~~6.~~2. The MBR System shall include provisions for Hot Retrieval of one Membrane Unit.

a. Hot Retrieval is defined is defined at the ability to readily remove one complete membrane unit, including diffusers, with a single pick and without draining the membrane/process zone and without taking other membrane units within the same membrane basin offline.

D. MBR System Capacity:

1. The MBR System shall be capable of treating a sustained peak flow of 150 gpm at the minimum influent temperature for ~~twenty-four (24) hours~~one (1) hour.

2. The MBR System shall have a firm capacity of 77,000 gpd at the minimum influent temperature, for twenty-four (24) hours.

E. Design Membrane Flux Rate:

1. The design flux rate shall be selected to filter all flow conditions at the lowest specified temperature.

2. The design net membrane flux rates shall be as follows:

a. At the ADF, not exceeding

(1) ~~5.8~~10 gfd.

b. At the PHF, for no longer than 24 hours, not exceeding

(1) ~~11.6~~17 gfd.

3. The use of chemicals (coagulants, polymers or flux enhancers) added to the biomass to improve sludge filterability is not permitted. The MBR system shall be designed to meet all performance requirements without the need to add such chemicals.

4. The MBR SUPPLIER shall provide the expected critical flux of the MBR System.

F. The following process-related system design parameters shall be utilized:

Parameter	**Value**	**Unit**
Site Elevation	10	ft ASL
Relative Humidity	5 to 95	%
MLSS Temperature Range	16 to 30	Deg. C
Number of Trains	1	
RAS Recycle, Max	2Q to 5Q	
Membrane Avg. Flux Rate, total, maximum	~~5.8-11.6~~410	gfd

G. Design RAS Recycle Rate:

1. Mixed liquor shall be recirculated from membrane tanks to process reactors at a rate of 2 to 5 times the influent flow to control the MLSS concentration in the membrane tank.

H. Design MBR System MLSS Concentration:

1. MLSS concentration in the membrane tank is controlled by RAS recirculation and wasting rate to a maximum of:

a. 8,300 mg/L under average annual load condition with one process reactor and a single process train in service

10,375 mg/L under maximum day load condition with a single process train in service

I. Effluent Requirements:

1. Effluent (permeate) from the discharge of the MBR System must achieve the following quality limits:

Parameter	Value	Unit
Effluent Quality		
BOD	<10	mg/L
TSS	<10	mg/L
TN	<8	mg/L
NH_3	<~~8~~1	mg/L
Turbidity	<2	NTU

J. Membrane Scour Air:

1. The membrane scour air requirements shall be identified in standard $ft^3/min/100\ ft^2$ (membrane area).

K. ~~Land Requirements~~System Weight and Footprint

1. ~~Approximately 750 square feet (75'L x 10'W) of area has been allowed in the treatment facility as indicated on the Drawings.~~ The MBR Treatment System shall meet the maximum system weight and footprint as summarized in the table below.

System Weight and Footprint		
Maximum Equipment Foundation Width (Feet) [1,3]	Maximum Allowable Static Bearing Pressure (PSF) [2,3]	Maximum Total Equipment Operating Weight (lb) [2,3]
10	750	510,000
15	550	450,000
20	450	360,000

Notes:
[1]Maximum allowable length is 75 feet. Assume 6 inches beyond equipment edges for the foundation on all sides.
[2]Allowable bearing pressures and weights assume center of gravity to be located a maximum of 6 feet above top of concrete.
[3]A linear interpolation can be used for foundations with widths in between those listed. Maximum allowable static bearing pressure and maximum total equipment operating weight must be met.

L. System Environment: All equipment will be housed outdoors; materials shall be rated for outdoor installation in a coastal environment.

1.06 QUALITY CONTROL

A. Membranes, modules and cassettes must be factory certified via in-house inspections of each part. Membrane modules are to have individual birth certificates with serial numbers and be integrity tested during production and pass a standard in factory permeability test.

1.07 SUBMITTALS

A. Refer to Section 013301 – Submittals.

B. General Submittal Requirements: Shop drawings and other data for all materials, equipment, valves, instrumentation, controls, and other items specified in this specification section shall be submitted to the ENGINEER by the MBR SUPPLIER as specified in the Contract Documents. Submit complete shop drawings of all equipment furnished including cut sheets describing purchased subcomponents with the specific subcomponents used for this project properly identified. All submitted information shall include a certification that the submittal describes exactly the equipment to be provided and substitutions subsequent to submittal approval will not be allowed.

1. Equipment name and identification number (e.g., equipment number).
2. Item detailed description and specifications.
3. Item weight(s) both empty and filled with the service fluid.
4. Electrical data, including control and wiring diagrams, as applicable. The wiring diagrams shall show all field connections with identification of terminations between control panels, junction terminal boxes, and equipment items.
5. Complete electrical schematic diagrams, as applicable.
6. Complete dimensioned fabrication, foundation/anchor bolt placement, assembly, and installation drawings.
7. Catalog cut sheets and brochures.
8. Recommended list of spare parts.
9. Elevation of proposed control panel and solenoid bank showing panel-mounted devices, details of enclosure type, single line diagram of power distribution, and current draw of panel, and list of all terminals required to receive inputs or to transmit outputs from the control panel.

C. MBR Treatment System: The following additional information shall be submitted for the MBR equipment package system:

a. Hydraulic Profile
b. Plan Drawings Showing Equipment and Piping Layout
c. Membrane Basins Plan and Sections
d. Membrane Cassettes Plan and Sections
e. Equipment Standard Details

D. Detailed process and instrumentation diagrams (P&IDs) specific to the Project showing the complete MBR treatment system, including all the items specified in

this section as well as the required interconnecting piping. The following components shall be included in the P&IDs submitted to the ENGINEER:

a. Symbol Legend and Abbreviation Index

b. Membrane Train Permeate Piping

c. Membrane Filter Cassette Details

d. Air Scrub Systems

e. Aeration Basin Piping Systems (aeration, RAS, IMLR subsytems)

f. Chemical Clean-in-Place System

g. Neutralization System (if required)

E. Detailed MBR Main Control Panel drawings including the following:

a. Enclosure Fabrication Notes

b. Dimensioned Enclosure Door Layout and Side Profile, including the locations of all lights, latches, and other appurtenances.

c. Back panel layout showing all input and output modules, control and instrumentation devices, power transformers/supplies, electrical receptacles, and all other installed items.

d. 120 VAC and 24 VDC Power Distribution Schematic

e. Wiring Schematics

f. Communications Schematics, including Ethernet module connections

g. Uninterrupted Power Supply

h. Nameplate Details

i. Terminal Strip Detail

F. CIP Chemical Feed System (and Neutralization system, if required) drawings including the following:

a. Chemical feed pumps, valve manifolds, tanks layout

G. Detailed Electrical Interconnection Drawings including the following:

a. Table of Contents

b. Power One Line Diagrams

c. Network Diagrams showing communications between the MBR Main Control Panel, Plant Control and Instrumentation System, and other items via Ethernet cabling systems.

H. Pumps: The following additional information shall be submitted for the pumps to be provided under this specification system:

a. Performance data curves showing head, capacity, horsepower demand, NPSH required, and pump efficiency over the entire operating range of the pump.

b. Assembly and installation drawings including shaft size, seal, coupling, bearings, anchor bolt plan, part nomenclature, material list, outline dimensions, and shipping weights.

I. Aeration Basin Blower System: The following additional information shall be submitted for the Aeration Basin Blower System:

a. Performance data curves showing output pressure, capacity, horsepower demand, and efficiency.

b. Assembly and installation drawings including outline dimensions, installation guidelines and shipping weights.

c. Noise data including noise suppression data on noise enclosures

J. Air Scour Blower System: The following additional information shall be submitted for the Air Scour System:

a. Performance data curves showing output pressure, capacity, horsepower demand, and efficiency.

b. Assembly and installation drawings including outline dimensions, installation guidelines and shipping weights.

c. Noise data including noise suppression data on noise enclosures.

K. Fine Bubble Diffuser System: The following information shall be submitted to include in- basin aeration piping, pipe drops, submerged manifolds, laterals, diffusers, drain pipes, pipe supports, and purge system.

L. Instruments: The following additional information shall be submitted for the instruments to be provided under this specification system:

a. Dimensions.

b. Power requirements

c. Operating Range

d. Materials of Construction

e. Manufacturer's Specific Part Numbers

M. Electrical/Instrumentation and Controls:

a. Network diagram: A drawing showing all network attachments between equipment and control panels.

b. One Line Diagram: A one-line power diagram detailing the system loads.

PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS:

A. All component parts and equipment utilized in the MBR system shall be furnished

as a complete integrated system by one treatment system MBR SUPPLIER.

2.02 ACCEPTABLE MANUFACTURERS

A. The awardee of this contract will be the acceptable manufacturer.

2.03 MBR SYSTEM COMPONENTS

A. Purpose:

1. The MBR SUPPLIER shall provide a complete system including all equipment necessary in order to operate the membrane filtration system according to design intent and performance requirements.

B. Automatic Strainer/Screens:

1. The MBR SUPPLIER shall furnish, two (2) fully automatic self-cleaning strainers capable of removing unwanted solids from the MBR feed.

2. The equipment covered by these specifications is intended to be standard equipment of proven performance as manufactured by reputable concerns.

3. The automatic self-cleaning strainer shall be Model 723 of the Eliminator Series as manufactured by Fluid Engineering, OSC3T by OR-TEC, Inc, or Engineer pre-approved equal.

4. The strainer shall be self-cleaning type designed to screen a maximum flow indicated below, with a maximum clean pressure drop of 0.5 psi (pressure drop at 0% clogged).

Operational Conditions	**Requirements**
Influent Waste	Municipal Sewage
Influent Solids Loading	529 mg/L
Max Influent Flow Rate	150 gpm
Head Loss at Max Flow Rate	6.5
Screen Perforation	2 mm

5. All internal components in contact with process water shall be made of Type 316L stainless steel, if fabricated, and Type 316 stainless steel, if cast or forged. Tungsten Inert Gas (TIG) welding, with inert gas shield and purge for both sides of weld will be used as the fabrication method. The strainer body shall be glass bead finished.

6. The strainer body shall be designed of Type 316 stainless steel, fabricated, and tested to meet the ASME Code requirements for pressure vessels and shall be ASME certified, with flanged ends per ANSI B16.1 class 150.

7. The strainer shall be designed for a working pressure of 150 psig at 150 degrees F.

8. The strainer shall achieve backwashing via a rotating electric motor driven backwash assembly. The backwash assembly shall effectively isolate each

straining element and will utilize a portion of the flow to backwash the isolated element.

9. Manufacturer to provide a screw screen compactor that is a self-contained screw screen, compactor and washer. Screen is to be designed to be a free-standing, self-contained screen mounted in tank with inlet and outlet flange. Screen to be designed to accommodate max hydraulic loads and forces that will be exerted on unit during capacity.

10. The drive motor shall be sized per the MBR SUPPLIER selection, TEFC, operating on a single phase, 60 Hz, 120V power supply. The drive motor will be attached to a gearbox, which will cause the backwashing mechanism to rotate.

11. An electrically actuated, 316 SS, butterfly or ball valve shall be provided for the strainer to allow the backwash water to flow to waste. Full manual overrides shall be provided, in addition to a switch on the control panel to operate the valves manually.

12. A dual element differential pressure gauge (0-10 psi) with two adjustable contacts and Type 316 wetted parts shall be provided for the strainer to monitor the pressure drop across the strainer element. The differential pressure gauge shall be capable of transmitting High and High-High alarms to the control panel. Pressure pulse, equalization, and bleed lines from the vessel tapings to and from the gauge shall be provided, all manufactured from Type 316 stainless steel tubing and fittings.

C. Membrane Elements:

1. The membrane modules shall be comprised of hollow fiber or flat plate membranes designed for immersion in the mixed liquor. The membrane modules shall be attached to common manifolds in groups called racks or cassettes. Each rack/cassette shall contain filtration and air manifolds. Each of the membrane tanks shall be large enough to contain the required number of membrane racks/cassettes and be separated from the remainder of the process volume required for biological reactions. The mixed liquor shall be fed to the membrane tanks from the oxic basins and mixed liquor recycle will flow by gravity or be pumped back to either the oxic basins or the anoxic basins.

2. Membrane elements shall be flat sheet/plate or hollow fibers in separate strands or groups of strands with an outside-in flow configuration, designed for immersion in the mixed liquor.

   a. **Flat Plate Membranes:** Each flat plate membrane cartridge shall be comprised of a solid ABS plastic support plate with a spacer layer between it and a flat-sheet membrane on both sides.

      (1) The materials used to hold the flat plate membranes in place shall be chemically resistant to high concentrations of chlorine for up to 24 hours, and low pH (range 2 to 3) and high pH wash solutions (range 10 to 11) for up to 24 hours, respectively.

(2) The material used for the manufacturing of the membrane sheets shall be Polyvinylidene Fluoride (PVDF).

b. **Hollow-Fiber Membranes:** This includes polymer monolith and laminate hollow-fiber configurations. The membrane modules shall be constructed such that the membranes are held vertically and bonded firmly.

(1) The internal lumens of hollow membrane fibers shall connect into a common area at the top and/or bottom of each module. The membrane modules shall also be attached to a common base to avoid lateral movement of the membrane modules during operation.

(2) The materials used to hold hollow membrane fibers in place shall be chemically resistant to high concentrations of chlorine (minimum 100 mg/L and maximum 5,000 mg/L) for up to 24 hours, and low pH (range 2 to 3) and high pH wash solutions (range 10 to 11) for up to 24 hours, respectively.

(3) The material used for the manufacturing of the membrane fibers shall be Polyvinylidene Fluoride (PVDF) or Polyether Sulfone (PES).

3. The membrane fiber or sheet shall have a high tensile strength and be highly resistant to chemicals including acids, bases and chlorine.

4. Membrane modules shall be interconnected in modular cassettes/racks.

5. Membranes shall allow produce water (permeate) to be drawn through from the outside surface of the membrane to the inside. Membranes shall be a supported hollow fiber of flat plate type. The membranes shall be a proven design of a membrane manufacturer engaged in the production of membrane of this type.

6. The membranes, membrane modules, and membrane cassettes shall be by one manufacturer.

7. Membranes shall be capable of regular backwashing with and without cleaning chemicals to minimize pore fouling.

D. **Membrane Cassettes or Racks:** The MBR SUPPLIER shall provide Membrane Racks/Cassettes that meet the following requirements:

1. Assemble membrane elements or modular unit into units hereinafter called “membrane cassettes”.

2. The membrane rack/cassette shall include connection points for agitation air and permeate water.

3. All metallic components of each membrane rack/cassette shall be

manufactured from stainless steel with a minimum grade of at least Type 316L.

4. All non-metallic components of the membrane equipment shall be UV resistant and have a chemical resistance at least equal to that of the membranes. The pipe connections between the membrane racks/cassettes and the manifold header pipework shall be UV resistant pipe capable of operating at the positive and negative pressures expected for this system.

5. Each frame shall be held in position by a support structure manufactured of stainless steel. The support structure enables the cassette or rack:

   a. To be safely positioned in the membrane tank.

   b. To be kept in (immersed) position in order to be operated according to design intent.

   c. To be removed safely from the membrane tank.

6. Provide isolation valves for the permeate and scour air pipes to provide means of isolating and removing individual cassettes or racks from the remainder of the system, without draining the basin or train or impacting the operation of the system.

7. Each rack/cassette shall be constructed to allow removal using a lifting bracket assembly. Provide one lifting bracket assembly to allow each membrane cassette to be lifted into and out of the membrane tank/mixed liquor and transported away from the membrane compartment for chemical cleaning and/or to a maintenance area.

8. Lifting eyes shall be accessible by the plant operator without entering the membrane tank.

E. Tanks

1. Membrane Tanks:

   a. Membrane tanks will be constructed by the MBR SUPPLIER.

   b. Upon award of this contract, the MBR SUPPLIER shall provide detailed, dimensioned drawings of the required membrane tank, detailed requirements for an overhead crane and embedded piping.

   c. Membrane tanks shall be constructed of ~~Type 304 or~~ Type 316 stainless steel, suitable for the coastal outdoor environment.

F. **Permeate System**:

1. Each membrane cassette shall have an individual permeate collection system allowing filtrate to be collected from each membrane module or element.

2. Each membrane cassette shall be able to be individually isolated.

3. The pipe connections between the membrane cassettes and the manifold header shall be capable of operating at the positive and negative pressures (vacuum) expected for this system.

4. Provide a pumped permeate collection system including pumps, variable frequency drives, controls, isolation valves, check valves, flow meters and pressure gauges.

5. Provide a minimum of one permeate pump system per membrane train

6. Permeate Pump System: The permeate pump shall be of chemical-resistant rotary lobe type, reversible, with varying duty points capable of performing both filtration, backwashing function, and completing chemically enhanced backwashes or Clean in Place (CIP) cleans.

   a. Pumps shall be provided inclusive of check valves, isolation valves, inlet and outlet pressure gauges, and expansion joints.

      Operating Conditions:
      (1) Duty: Continuous
      (2) Drive: Variable Frequency
      (3) Fluid service: Permeate
      (4) Permeate pumps will pump effluent to the chlorine contact chamber located in the main plant treatment building. The total estimated pipe length from the MBR permeate pump to the chlorine contact chamber: 115 LF. Estimated Liquid Level Elevation at chlorine contact chamber: 17.50'.

   b. Pump Construction:

      (1) The pumps shall be of chemical-resistant rotary lobe type and shall be installed in accordance with the manufacturer's recommendations

      (2) Rotors shall be multi-lobe configured to provide a pressure-

   c. The rotary lobe pumps are to be controlled by VFD

      (1) Variable Speed pumps shall operate in the range of 25 to 100 percent. Motor shall be capable of operation at any point on the operating curve or at any speed.

   d. The pumping units shall operate without surging, cavitation, vibration or excessive noise.

   e. Each motor shall be rated for continuous duty and sized such that it shall not be required to provide more than rated nameplate horsepower, at unity service factor, under any operating condition. Motor shall be capable of operation at any point on the operating curve.

   f.

   g. Pumps will primarily be subjected to membrane bioreactor filtrate.

Pumps may be in contact with cleaning solutions:

(1) Sodium hypochlorite, 1000 PPM
(2) Citric acid, 2000 PPM

h. Motor:

(1) Motors intended for utilization with variable frequency adjustable speed drives shall meet NEMA MG1, Part 31 inverter duty requirements. Inverter rated motors shall meet requirements for severe duty, IEEE 841, latest revision

i. Controls:

(1) Each individual pump shall be provided with a local control station and safety disconnect switch for the pump. The local control station shall provide for local – off – remote (LOR) control switch and individual local start and stop pushbutton control, forward and reverse.

(2) Each pump will be remotely started and stopped from the MBR SUPPLIER control system. The Pumps will be shutdown on high and low level in the pump stations.

G. **RAS System**:

1. Membrane tanks shall have a RAS collection system allowing for activated sludge to be pumped back to the bioreactors for further treatment or for membrane tank draining.

2. Provide a minimum of one RAS pump system per membrane train

a. Pumps shall be provided inclusive of check valves, isolation valves, and expansion joints.

b. Operating Conditions:
(1) Duty: Continuous
(2) Drive: Variable Frequency
(3) Fluid Service: RAS Conveyance

3. Provide a RAS collection system including pumps, variable frequency drives, isolation valves, check valves, flow meters and pressure gauges.

4. The pumps shall be controlled from the MBR SUPPLIER Main Control Panel specified herein.

H. WAS System:

1. Membrane tanks shall have a WAS collection system allowing for activated sludge to be pumped to the existing WWTP sludge digester for further treatment and disposal.

2. Provide a minimum of one WAS pump system per membrane train

a. WAS Pumps shall be progressive cavity pumps and provided inclusive of check valves, isolation valves, and expansion joints.

b. Operating Conditions:
   (1) Duty: Continuous
   (2) Drive: Constant Speed
   (3) Fluid Service: WAS Conveyance
   (4) WAS pumps will pump WAS to the sludge digester on the WWTP site located east of the influent lift station. Assume the conveyance will be through a shared 4-inch diameter force main. The total estimated pipe length from the MBR WAS pumps to the sludge digester: 165 LF. Estimated Liquid Level Elevation at chlorine contact chamber: 30.50'.

3. Provide a WAS collection system including pumps, variable frequency drives, isolation valves, check valves, flow meters and pressure gauges.

4. The pumps shall be controlled from the MBR SUPPLIER Main Control Panel specified herein.

I. Fine Bubble Diffuser System:

1. Fine bubble diffuser aeration grids shall be specified by the MBR SUPPLIER and shall include in-basin aeration piping, pipe droplegs, submerged manifolds, laterals, diffusers, drain pipes, pipe supports, and purge system.

2. The system shall include provisions which allow the capability to replace diffusers during periods of average flow without taking the entire MBR System offline.

J. **Cleaning Systems**:

1. Membrane Scour Air System:

a. Provide a complete scour air blower system including blowers, variable frequency drives, control panels, isolation valves, check valves, pressure gauges, discharge pressure safety valves, flow transmitters, low flow switches and high-pressure switches to form a complete functional system.

b. The air scour blowers shall provide cleaning air for membranes. Aeration air for aerobic biological treatment outside the membrane tanks shall be provided by other blowers not included in this package. The air scour blowers shall be complete with motors, base plates, intake air filter, inlet silencers, discharge silencers, check valves, pressure relief valves, butterfly valves, flexible connections, pressure and temperature gauges, vibration isolation pads, inlet filter restriction indicator and spare parts.

c. MBR scour air blowers shall be sized such that sufficient scour air is provided without requiring additional maintenance cleans. The scour air system shall include a standby blower of equal or greater capacity than

the duty blower(s). Blowers shall be sized to provide 150 percent of design air scour.

d. Blowers shall be provide complete with sound enclosure, inlet filters, discharge silencers, pressure relief valves, check valves, isolation valves, throttling valve, motors, temperature and pressure gauges, over-temperature sensor/switch, expansion joints, belts, and baseplates.

e. Operating Conditions:
   (1) Duty: Continuous
   (2) Drive: Variable Frequency
   (3) Fluid service: Process Air Conveyance; Air Scour Conveyance

f. Blower Construction:

   (1) The blowers shall be positive displacement type.

g. Blower Controls:

   (1) The blowers shall be controlled from the MBR SUPPLIER Main Control Panel specified herein.

h. Blower Motor:

   (1) The scour blower motor shall be inverter duty. The manufacturer shall be responsible for the proper selection, testing, installation, and operation of the motors and for coordinating the motors with the blower equipment. Motors shall be new and both materials and workmanship shall be of the very best quality. Motors shall be premium efficiency motors. The MBR SUPPLIER shall ensure that the blowers supplied under this section are compatible with the VFDs and appurtenant electrical equipment.

   (2) Each blower shall be supplied with a sound enclosure designed for outdoor installation covering the entire blower package including the drive motor, the inlet silencer, and the discharge silencer. The sound enclosure must be designed for easy inspection and maintenance of all blower package components.

i. Provide a minimum of one air scour system per membrane train.

j. Blowers shall provide airflow to scour the membranes for control of fouling and to assist in keeping the mixed liquor in the membrane basin in suspension.

k. Scour air transfer to the membrane elements or bundles shall be achieved via even distribution over the rack surface by means of a rack or cassette integrated distribution device or air grid.

l. The MBR SUPPLIER shall provide a total of one (1) installed, standby air scour blower unit in addition to the duty air scour blowers.

2. Backpulse or Relaxation System (if required):

   a. Make provisions for a backpulse cleaning system to allow the reversing of flow through the membranes to dislodge any particles that may have adhered to the membrane surface.

   b. Provide a Relaxation cleaning system to reduce the flow from the membranes to allow for the removal of any particles that may have adhered to the membrane surface.

   c. Backpulsing and Relaxation system shall be fully automated.

3. Automated Chemical Cleaning Systems:

   a. The membranes shall be cleaned "in-place" without removal from the membrane tank. The system shall consist of a chemical feed pump (if required) and storage tank (if required) and include all interior piping, valving, and in-tank piping and supports.

      (1) Maintenance Cleaning: The "maintenance clean" system must be fully automated. This type of cleaning shall not be performed more than once a week and shall not require each MBR tank to be taken out of service for more than 30 minutes.

      (2) Recovery Cleaning (if required): The "recovery clean" system shall be either fully automated or partially automated with only limited operator's attention needed. This type of cleaning shall not be performed more than two (2) times a year. Neutralization system, if required, must be included to handle the soak solution after the cleaning process. The cleaning period shall not require each MBR tank to be taken out of service for more than 12 hours.

   b. Supply all the valves, relief valves, backpressure valves, pumps, skid mounted piping, storage tanks, weighted foot valves, dosing devices and control elements required to perform two chemical cleaning processes: Maintenance Clean and Recovery Clean.

   c. Each Chemical Cleaning system shall consist of a fully independent duty and standby system (common chemical storage tank only).

   d. Chemical cleaning systems shall be fully automatic, specifically:

      (1) No operator intervention shall be required to initiate the maintenance cleaning processes.

      (2) Initiation of the Recovery chemical cleaning process shall be either by a scheduled event from the PLC/HMI system, or by an operator-initiated command at the PLC/HMI system.

      (3) No operator intervention shall be required during the chemical cleaning process.

(4) Upon completion of the cleaning processes, the system shall automatically return to normal operation.

e. The Chemical Cleaning systems shall be able to clean with at least one acid, and at least one oxidizing chemical.

f. The Chemical Cleaning systems shall be able to perform a cleaning sequence consisting of two cleaning steps involving different cleaning chemicals.

g. The automated chemical cleaning shall be performed in situ. Use of separate dip tanks for chemical cleaning is not acceptable.

4. Service Air:

a. Service air is not available. Equipment and valves shall be provided with electric motors. Pneumatically actuated equipment is not acceptable.

5. Process Control:

a. The supply of the membrane filtration system shall include instrumentation to monitor and display the following membrane related parameters online:

(1) Trans-membrane pressure – psi.

(2) Permeability – gal/ft^2-d-psi.

(3) Flux – gal/ft^2-d.

(4) Temperature – °C.

2.04 CHEMICALS

A. The MBR SUPPLIER shall submit a list of datasheets and material safety data sheets regarding the following types of chemicals suitable with his membrane filtration system:

1. Acidic membrane cleaning chemicals.

2. Oxidizing membrane cleaning chemicals.

2.05 HYDRAULIC CONTROL, CLEANING REQUIREMENTS AND MEMBRANE INTEGRITY

A. General:

1. Membrane life span shall be guaranteed to be at least ten (10) years. It is required to establish a starting operating point of the membranes and to track membrane hydraulic developments to evaluate possible operating problems, membrane damage or deficiencies. This Section indicates the type of tests

required prior to system start up, follow up during operational and membrane integrity evaluation.

B. Performance Evaluation:

1. Clean Water Membrane Permeability:

a. Once membranes are clear of their chemical stabilizer; the membrane's initial permeability will be determined by means of a "clean water permeability test". This value will be compared to everyday operational permeability readings to support evaluations of membranes performance and integrity. Permeability decline will indicate performance issues and/or membrane fouling.

b. The clean water permeability test will be run for a period of five (5) minutes, passing potable water through the installed membranes. Fluxes (gal/ft^2-d) and Trans Membrane Pressure (TMP) values will be recorded and the initial membrane system permeability will be determined.

c. The Clean Water Membrane Permeability evaluation will be conducted during the startup per Specification Section 01783 Testing, Startup, Commissioning, and Extended Operation.

2. Loss of Membrane Permeability:

a. The permeability (ratio of flux to trans-membrane pressure) of the membrane filtration system will be monitored regularly through operation. Permeability will be measured before and after chemical cleaning operations and normalized with regards to temperature. The permeability at the end of the warranty period shall not be lower than two thirds of the initial permeability measured at plant start-up, in other words the irreversible loss of initial permeability shall not be greater than one third of the initial permeability.

b. The membrane filtration system must be capable of treating the average influent flows and associated peak flows over the full length of the warranty period.

3. Cleaning Requirements:

a. The MBR SUPPLIER shall indicate anticipated chemical consumption required for chemical cleaning of the membrane filtration system in order to maintain permeability.

4. Membrane Integrity:

a. Provide an on-line turbidity analyzer per membrane train to test for membrane integrity.

b. The integrity of the membrane racks will be measured by means of filtrate turbidity. If filtrate turbidity levels are greater than 0.5 NTU,

membrane integrity might be compromised and repairs or replacement to membranes/membrane banks might be required under the warranty agreement.

2.06 VALVES

A. Supply all necessary valves required for a completely functional, fully automated system.

B. All process valves shall be rated for a working pressure equal to or greater than the pressure rating of the connecting piping, unless piping was chosen specifically for a reason other than pressure rating, in which case the max pressure within the piping will supersede this requirement.

C. The valves associated with the MBR System shall be furnished by the MBR SUPPLIER. Valves supplied loose by the MBR SUPPLIER shall be received, stored, installed, and tested by the CONTRACTOR.

D. All valves of a given type shall be manufactured by a single manufacturer.

E. Flap Valves

1. Flap valves shall be of circular port design with offset single pivoted hinge. They shall be of the iron body bronze mounted type and furnished with flanged end, spigot end, hub end or as called for in the specifications or as indicated on plans.

2. The assembly shall consist of three parts: flap gate, body and hinge pin. The flap gate and body shall be cast iron conforming to ASTM specifications A-126 Class B. The seats and hinge pin shall be furnished of bronze. The flap gate seat ring shall be rolled into a dovetailed groove under pressure to make one inseparable unit. The body seat ring shall be threaded and screwed into place in the body. Both gate and body seat ring faces shall be machined to a smooth finish. Valves shall be manufactured by M&H or approved equal.

F. Swing Check Valves

1. Ends shall be flanged, Class 125, ANSI B16.1. Valves shall be designed for a minimum working pressure of 150 psi. Valve shall be equipped with outside lever and spring. Valves shall be shop coated and lined with epoxy coating. Valves shall be Valmatic AWWA Series, M&H Style 259, or approved equal.

2. Swing Check Valves: Swing check valves shall conform to AWWA C508, and shall be iron body, bronze mounted with the following materials of construction:

Component	Material	Specification
Disc or clapper, seat ring, valve body seat ring	Bronze or brass	ASTM B62, B16, or B584 (alloys C84400 or C87600)

Body and Cap	Cast iron	ASTM A126, Class B
Disc and Hinge or Arm	Cast iron or bronze	ASTM A126, Class B ASTM B62
Hinge Pin	Stainless-steel	ASTM A276, Type 303, 304 or 410
Cover Bolts and Nuts	Stainless-steel	ASTM A193, Grade B8M; ASTM A194, Grade 8M

G. Globe Valves for Chemical Feed System (1/2-inch to 2-inch Diameter)

1. Globe valves shall be a minimum pressure class 350, unless otherwise specified or shown on the drawings. Valve ends shall be threaded or socket weld ends, as approved by the Engineer. All wetted parts and materials that come in contact with the process fluid shall compatible with anhydrous ammonia.

H. Plug Valves

1. Quarter-turn nonlubricated eccentric type with resilient faced plug.
2. Conform to ANSI/AWWA C-504.
3. Valves shall be of the non-lubricated eccentric type, Class 150, with resilient faced plugs. Flanged valves shall be faced and drilled in accordance with ANSI 125/150 lb. standard.
4. Epoxy Coated ASTM A126, Class B Cast Iron body.
5. Valve plug and shaft shall be ASTMA126, Class B cast iron or ASTM A536 ductile iron. Resilient plug facing or replaceable style body seats shall be synthetic rubber, neoprene, or Buna N.
6. Valve shaft seals shall be per Section 10 of AWWA C507-73. All bolts, nuts, springs, washers, and like fittings shall be zinc-coated ferrous metal or stainless steel. Valves shall be shop coated and lined with epoxy coating
7. Port areas shall be at least 80% of full pipe area.
8. Seat rings shall be threaded, or welded of corrosion-resistant 18-8 stainless steel, nickel, or Monel conforming to AWWA C504.
9. Bearings shall be replaceable. Sleeve type and thrust bearings in the upper and lower journals shall be corrosion-resistant stainless steel or bronze.
10. The valves shall be Valmatic Cam-Centric Series, DeZurik Model 118, or approved equal.

I. Butterfly Valves

1. Conform to ANSI/AWWA C-504, latest edition.

2. Butterfly valves shall include a resilient seat of Buna N that is mechanically retained in the valve body and shall meet or exceed requirements of AWWA C-504, latest edition.

3. Valve body shall be ductile iron ASTM A-536. Valve disc shall be ductile iron ASTM A-536 with stainless steel spherically shaped seating surface. Valve shaft shall be constructed of centerless ground ASTM A-276 stainless steel bar, Type 316. Valves shall be flanged body and rated for 150 psi working pressure. Flanges shall conform to ANSI B16. Exposed valves shall be DeZurik BAW, Pratt Model 2FII or approved equal.

4. Epoxy Coated ASTM A126, Class B Cast Iron body.

5. Stainless steel disc and stem

6. EPDM seal.

7. Lug or Wafer Style Body sized for ANSI Class 125/150 flanges.

J. Ball Valves – PVC

1. All PVC ball valves shall be schedule 80 full bore true union design with socket end connections.

2. All PVC ball valves shall have o-rings compatible with the service, either EPDM or Viton.

3. PVC ball valves shall be of the true union type when installed in applications that require the removal of a component and aren't otherwise provided with unions, such that the carrier or main part of the valve can be removed from the piping system thus easily accommodating repairs or replacement.

K. All valves shall be provided with a valve tag heavily stamped or engraved to duplicate the valve symbol shown on the Submittal Drawings, including hexagons and/or circles with notations, as applicable. The tags shall be fabricated of minimum 3/32 inch thick brass or minimum l8 gauge type 302 stainless steel and a minimum of 1 1/4 inch diameter. Valve tags shall be secured to valves with 18 gauge type 304 stainless steel wire or stainless steel ball chain through a hole in the tag.

2.01 PRESSURE GAUGES

Pressure gauges shall be 2-1/2 inches in diameter, bottom connected with white laminated dials and black graduations. Gauges shall be approved for use with anhydrous ammonia. Measuring element shall be a stainless steel bourdon tube with welded, stress-relieved joints. Socket shall have wrench flats. Accuracy shall be ± 1/2 percent range. The pressure gauge shall be Ashcroft, McDaniels, or approved equal.

2.02 VALVE ACTUATORS

A. Provide valve actuators where actuated valves are necessary for fully automated operation. Use of pneumatic actuators is not acceptable.

B. The operators shall be sized based on the maximum expected torque as per valve manufacturer's recommendations. The responsibility for proper operation shall reside with MBR SUPPLIER.

C. Manual Operators.

1. Butterfly Valves. All butterfly valves 6-inch and smaller in size shall be lever operated and valves 8-inch and larger in size shall be equipped with handwheel actuators, unless otherwise deemed suitable by manufacturer. The operators shall be furnished by the manufacturer of the valve, who shall be responsible for the compatibility and adequacy of both the valve and operator. Valve operators shall be sized for the maximum torque developed by the maximum pressure in the pipeline in which the valve is to be for the service and all exposed nuts, bolts, springs, washers shall be stainless steel.

2. Plug and Ball Valves. All plug and ball valves 6-inch and smaller in size shall be lever operated and plug valves 8-inch and larger in size shall be provided with a totally enclosed oil, water, and dust-tight handwheel operated gear

D. Electric Operators. Electric type operators shall include the motor, operator unit gearing, limit switches, torque switches, declutch lever, auxiliary handwheel for operation in case of power failure, reversing starter, switches, mechanical position indicator, and accessories deemed necessary by the vendor. The valve actuator motor and all electrical enclosures shall be weatherproof, NEMA 4, as a minimum unless explosion-proof is indicated on the drawings. The power gearing shall consist of helical gears of heat-treated steel, and worm gearing of hardened alloy steel. The responsibility for proper operation shall reside with the MBR SUPPLIER.

1. Motors shall be adequately sized to operate the valve at the differential pressure for each valve location. The motor shall be of sufficient size to open or close a valve against the maximum specified differential pressure when voltage to the motor is ± 10% of nominal voltage. Motor rating shall be for continuous duty.

2.03 MOTORS

A. Refer to individual equipment specifications for motor requirements.

B. Use of air actuated pumping equipment is not acceptable.

2.04 PIPING AND APPURTENANCES

A. Provide piping, fittings, pipe penetrations, and appurtenances to be used in the MBR System. The pipelines shall be complete with all necessary fittings, supports, anchors, connectors, and testing to provide a functional installation.

B. All pipe, fittings, couplings, and appurtenant items shall be new, free from defects or contamination, and wherever possible, shall be the standard product of the manufacturer.

C. All manifold and lateral pipe and fittings for aerators shall be CPVC pipe, Schedule 80, or 316 stainless steel.

D. Process piping shall be as follows:

Application	Material
Process Piping 0-150 PSI:	**Schedule 80 PVC**
Process Piping 150-300 PSI:	**Schedule 80 PVC**
Aeration Piping 0-120 Degrees F, 0-25 psi:	**Schedule 80 PVC**
Aeration Piping 120-180 Degrees F, 0-25 psi:	**Schedule 80 CPVC**
Aeration Piping 180-300 Degrees F, 0-25 psi:	**Schedule 10/40 Stainless Steel**
Sensory Probe Flexible Backwash lines	**High Pressure PVC tubing with polyester braid, PE tubing, PVC tubing or equivalent.**
Flexible Piping Connections	**EPDM Tigerflex TG Series Rubber reinforced hose or equivalent.**

E. All pipes shall have screwed or flanged joints.

F. Polyvinyl Chloride Schedule Pipe and Fittings

1. Pipe and fittings shall conform to the following requirements:

a. Polyvinyl Chloride Pipe. Polyvinyl Chloride Pipe shall be of unplasticized compounds suitable for use with chemicals and sewage, as specified and shall bear the seal of approval to this effect from an accredited testing laboratory. Pipe shall conform to the requirements of ASTM Designation D1785, Schedule 80 as depicted in 2.01C.

b. Polyvinyl Chloride Pipe Fittings. Fittings shall conform to the requirements of ASTM Designation D2467-76a, Class 12454-B for socket type and ASTM Designation D2464-76 for threaded type.

c. Rigid, Unplasticized Compounds. Compounds for pipe and fittings shall conform to the requirements of ASTM Designation Dl784-81, Class 12454-B.

d. Joints in PVC Pipe and Fittings. Joints shall be the solvent-welded socket or flanged type. Flanges, where shown, shall be 150-pound, and shall be of the same material as the pipe.

e. Bolts. Bolts for use with PVC flanges shall be type 304 stainless steel.

f. Gaskets. Gaskets shall be Teflon, EPDM, or composite.

(1) Full Face or ring gaskets to be used where applicable.

G. Mechanical Couplings

1. Grooved End Couplings. Couplings shall engage and lock the grooved or shouldered pipe ends allowing some degree of contraction, expansion, and angular deflection. Coupling housing shall be of ductile iron or malleable iron and shall consist of two or more segments held securely together by at least two steel bolts. Sealing gasket shall be of such design that internal pressure in the pipe increases the tightness of the seal and shall be of materials suitable for the intended service. The coupling shall have a rated working pressure not less than the pressure rating of the pipe.

2. Flexible Couplings. Flexible (sleeve) couplings shall be of the full sleeve type, split sleeve type, or flanged adapter type, as shown on the Drawings, specified herein, or as otherwise permitted by the Engineer. They shall provide the requisite pipe flexibility without jeopardizing pipe joint integrity due to hydraulic thrust, and shall have the same pressure-rating as the pipe. Couplings shall have all metal bearing surfaces and shall be provided with 316 stainless steel bolts and age hardened steel nuts. Flexible couplings shall be restrained unless the Engineer has given his approval to omit this feature for specific cases.

2.10 PROCESS INSTRUMENTATION

A. Acceptable Manufacturers:

1. Flow, pressure and level instruments

   a. Siemens

   b. Rosemount/Emerson

   c. ABB

   d. Endress & Hauser

   e. Or approved substitute

2. Water chemistry and clarity instruments

   a. Hach

   b. YSI

   c. Or approved substitute

B. Flow switches:

1. Flow switches shall be included to provide flow status in air and water lines from blowers and pumps.

Application	Air	Liquid

Sensor Type / Material	Probe Sensor 316 Stainless Steel	Flat Face Sensor 316 Stainless Steel
Process Connection	0.75” NPT	
Accuracy	+/- 5%	
Housing	304 Stainless Steel NEMA 4X	
Integral LCD	Yes, 4-digit	
Power / Connection	18 to 30 VDC / 0.5” NPT	

C. Flowmeters:

1. Flowmeters shall be included to monitor the permeate flow from each train, the backpulse/CIP flow to the membranes, and each train’s RAS flow. Flow meters shall be magnetic flow meters sized to match the related pump discharge piping with an operating range of 0 to 150 percent of the pump design flow.

Process Connections	ANSI #150 flanged
Housing	Aluminum NEMA 4X
Flowtube	316 Stainless Steel
Liner	PTFE
Accuracy	+/- 0.5%
Operator Interface	Local
Output	4-20 mA DC, scaled pulse output
Power / Connection	85-260 VAC 60 Hz / 0.5” NPT

D. Level Transmitters:

1. Level transmitters shall be included to monitor the liquid levels in all liquid tanks.

Application	Top Entry	Side Entry
Process Connections	3” 150 # Flange (316 Stainless Steel)	1-1/2” to 3” 150 # Flange (316 Stainless Steel) & 1-1/2” NPT Connections available.
Mounting	1-1/2”, 2”, and 3” 150 # Flange (316 Stainless Steel) & 1-1/2” NPT Connections available.	
Output Signal	4-20 mA	
Voltage	11.5 to 30 VDC	
Diaphragm	Contite-sensor with metallic diaphragm alloy C4	
Housing	Aluminum NEMA 4X	
Integral LCD	Yes	

E. Pressure Transmitters:

1. Pressure transmitters shall be supplied to monitor the vacuum applied to

the membranes during filtration and the positive pressure applied during backpulsing.

Mounting	0.5” NPT
Output Signal	4-20 mA
Voltage	11.5 to 30 VDC
Diaphragm	Ceramic
Housing	Aluminum NEMA 4X
Integral LCD	Yes

F. Temperature Transmitters

1. Temperature transmitters shall be included to monitor the liquid temperature in the membrane tanks.

Type	Head mounted temperature, PT 100 Class A (RTD)
Mounting	0.75” NPT process connection
Power Supply	24 V DC
Output Signal	4-20 mA
Voltage	– 125 to 1200 mV
Housing	Transmitter installed in aluminum enclosure mounted directly on sensor
Ambient Temperature Range	– 40 to 85^{o}C

G. Turbidimeters:

1. Continuous on-line turbidimeters, designed for low turbidity range (0-1 NTU) shall be included as a means of verifying the integrity of the membranes by taking water samples from the discharge side of the permeate pumps.

   a. One (1) turbidimeter to be provided for each train.

   b. In addition, one (1) turbidimeter to be provided on the common permeate header, or in the permeate well.

Range	0-1 NTU
Inlet	0.25” FNPT
Output	0.5” FNPT
Output Signal	4-20 mA
Power	120V/1ph/60 Hz
Display	SC 100

Accessories	Sensor, analyzer unit, interconnecting cable, alarm relays for indication of alarm conditions and one (1) calibration kit

H. Pressure Gauges and Switches:

1. Pressure gauges shall be included for the various pumps and blowers and shall be liquid filled and are Ashcroft or approved substitute with 316SS wetted parts and supplied with isolation ball valves/gauge cocks between the pressure gauge and the process line.

2. Pressure switches shall be provided for high-pressure alarms on the permeate collection pipes to prevent over-pressurizing of the membranes during backpulsing. The type of flow switches required are listed in the following table.

Permeate Lines	United Electric J6 Series or approved substitute with 316 Stainless Steel wetted parts and bellows

I. pH Meters

1. Provide one (1) pH meter per MBR System tank to monitor and display pH. The pH meter shall be probe type and be installed in the membrane tank. Data shall be displayed in the main MBR System control panel and shall be used to monitor and control chemical cleaning.

J. Suspended Solids Meters

1. Provide one (1) suspended solids meter per MBR System tank to monitor and display suspended solids concentration. The suspended solids meter shall be probe type and be installed in the downstream side of membrane tanks. Data shall be displayed in the main MBR System control panel but will not be used for any other control function.

K. Dissolved Oxygen Meters

1. Dissolved oxygen monitoring system utilizing a single probe (Hach LDO Luminescent style or approved equal) and interfaced with the project control system.

2. Probe shall be equipped with automatic probe cleaning system, and a non-corrosive mechanical mechanism for easily removing the probe for maintenance.

3. Include one spare probe in the bid price for this item.

2.11 CONTROL SYSTEM

A. The MBR SUPPLIER shall provide the field instrumentation, control panels for the membrane system, PLC and Operator Interface hardware and software.

B. The control system shall allow for complete automation of the membrane system and shall be easily and fully integrated into the new plant Supervisory Control and Data Acquisition (SCADA) system.

1. The control system shall be PLC based with locally mounted human-machine interface unit (HMI). Communications capabilities shall include communication from the PLC to the local HMI and from the PLC to the main plant Allen Bradley ControlLogix PLC and SCADA system.

C. During detailed design, provide; control narrative, complete catalog cuts and shop drawings for each component, control schematics, loop diagrams, and layout diagrams for the MBR control system.

D. Control Panel:

1. The main PLC control panel housing the PLC equipment shall be rated NEMA 12 as it will be located in an electrical or control room.

2. The control panel shall be protected at the incoming power by a transient surge suppressor located in the control panel.

3. Provide 120 V control power using an isolation transformer with 120 VAC surge suppression. All 120 V branch feeders shall be protected by separate circuit breakers.

4. Control relays shall be industrial plug-in type, rated at 10 A.

5. Terminal blocks shall be high density type, rated for 600 VAC, 30A minimum, with test plugs and clearly marked. Provide 25% spare terminals in each assembly.

6. All panel mounted devices shall be clearly marked and identified on the outside and inside of the panel. All terminals, wires, and internal components shall be clearly tagged in accordance with the schematic and wiring diagrams.

7. Uninterruptible Power Supply system (UPS) shall supply power to the entire membrane control system, including all instrumentation. The UPS shall maintain power to PLC processors, power supplies, I/O racks, communication systems, instrumentation and field sensors such that there is no loss of process data or communications during utility power interruptions. UPS shall provide power for 125 percent of the connected load for a minimum of one hour.

8. The PLC shall be Allen Bradley ControlLogix PLC or approved substitute, with hot redundant standby.

9. The control system shall monitor the incoming power and shall identify power interruption events. After a power interruption event the Membrane system shall start up (as per standard start-up procedure) and return to fully automatic operation without any Operator intervention or the generation of any alarms.

E. The PLC-based control panel for the membrane system shall house all necessary control devices, PLC, HMI and alarm functions, remote alarm in order to reliably and safely operate the MBR System and its ancillary components within the overall plant. This includes the control of the RAS pumps and monitoring of mixed liquor solids concentrations in each MBR System tank for scheduling of sludge wasting. The membrane control system shall have a single point power connection with a disconnect facility for servicing.

1. The MBR System control panel shall interface with the motor starters and the variable frequency drive (VFD) units provided by the MBR SUPPLIER for the supplied equipment. Motor starters and VFDs for the membrane system will be located in a separate electrical and control room located adjacent to the MBR System tanks. Power supply to each VFD will be provided from a switchboard/motor control center (MCC). The Switchboard/MCC will be the supplied by the General Contractor.

2. Junction boxes to facilitate field wiring will be provided by the General Contractor.

F. PLC and HMI:

1. PLC and HMI shall comply with the aforementioned CCH SCADA standards.

2. Provide a capacitor energy storage module (ESM) to provide power backup for user programs and data when the main power supply is not available.

3. Provide latest version of programming software. Provide fully documented ladder logic on a USB.

4. Provide Input/Output (I/O) modules with at least 25 percent spare of each I/O type.

5. Provide module slots on I/O racks for all I/O modules with at least 25 percent spare slots.

6. Provided space for module slots required for 8 membrane trains with at least 25 percent spare slots.

7. Provide a graphic HMI mounted on the front of the panel. This Unit will provide graphic display of the process parameters and equipment status. Provide a fully documented HMI program on memory stick.

8. The operation of local HMI shall be provided with security user password entry ability. Provide the capability for the District to reset the user access password(s).

G. Following detailed design, the MBR SUPPLIER shall provide a comprehensive list of all control system analog, discrete and calculated data points including I/O types, tag number and descriptions for communication with the plant PLC and SCADA system.

H. Prior to commissioning time, the MBR SUPPLIER shall confirm with the Officer- in-Charge (OIC) that the list of data points to be communicated to the plant SCADA system has not changed.

I. The MBR SUPPLIER shall provide programming services to facilitate implementation and integration of the requested data communication with the plant SCADA. The SCADA communication shall be implemented via Ethernet IP and data formats shall be compatible with the main plant PLC and SCADA system.

J. All valves and control devices shall be interlocked through the PLC to allow smooth and continuous automatic operation. Variable speed pumps shall also be controlled by the PLC and vary their vacuum/flow output based on level signals from the process tanks.

1. A “Hand-Off-Auto” switch will be provided for each motor. The Auto position will allow automatic PLC operation while the Hand position will allow the operator to bypass the PLC when operating equipment for maintenance, repair, testing, or draining tanks to take them out of service.

K. The HMI system shall be programmed to provide the following features:

1. Monitoring of the system and of individual devices.

2. Control of the system and of individual devices.

3. Adjustment of operating parameters.

4. Operator and supervisor level passwords.

5. Viewing of the current alarm summary.

6. Viewing of the current alarm history.

7. Viewing of short and long term trending of process parameters.

8. The membrane system programmer shall review the CCH SCADA system requirements and maintain reasonable uniformity of programming, configuration, and screen appearance in such areas as:

a. Color conventions (run, stop, alarm, etc.)

b. Symbols.

c. Addressing of libraries.

d. Alarm generation and handling.

e. System diagnostics (Commutations status, PLC health, etc.)

f. Other necessary areas in configuration.

2.12 The MBR SUPPLIER shall provide a detailed process description and control philosophy describing the proposed system, its ancillary components and the various interfaces with the existing plant and plant operation.

2.13 SPARE PARTS

A. Provide the following spare parts all packaged for long-term indoor storage:

1. 5% of total membrane modules
2. One (1) flow meter for each system
3. One (1) level transmitter
4. One (1) pressure transmitter
5. One (1) turbidimeter
6. One (1) pressure gauge and switch for each system
7. One (1) suspended solids meter
8. One (1) pH meter
9. One (1) DO Meter
10. One (1) PLC for the control system
11. One (1) set of special tools required for normal operation and maintenance
12. Other spare parts as required and specified for each specific equipment.

PART 3 - EXECUTION

3.01 MINIMUM STAFFING AND SUPPORT REQUIREMENTS

A. MBR SUPPLIER shall provide detailed description of storage and handling requirements for the system equipment with their response.

B. At a minimum, the MBR SUPPLIER shall provide the following staffing and support for the project to the General Contractor and the ABCSD for the duration of the extended operating period specified herein:

1. Review and approve General Contractor's proposed storage and staging area prior to shipment. Requirements of the selected MBR SUPPLIER would be listed in the general bid documents for construction.
2. Provide five (5) work days on site to observe unloading and transport of the equipment to the General Contractor's storage and staging area.
3. Provide five (5) work days on site, in one trip, to provide instruction and observation of the General Contractor staff during initial installation of the MBR System equipment. Provide remote consultation after that for the

remainder of the installation period. Once selected, the General Contractor may procure additional on-site support for the MBR SUPPLIER as part of a separate line item bid once the construction contract is solicited.

C. The checkout, startup, commissioning, and extended operation of the system will be a multi-phase process consisting of the following steps:

D. Checkout Plan

1. Equipment Operational Readiness Testing

2. Startup

a. Clean water testing and startup

b. Functional acceptance testing and process startup with wastewater

c. System demonstration and reliability acceptance testing (28 days)

3. Performance testing and General Contractor Warranty Services (12 months)

4. Extended equipment warranty.

3.02 INSTALLATION

A. Ensure the system is properly installed by the General Contractor to provide satisfactory service.

3.03 STARTUP, TESTING, COMMISSIONING AND TRAINING

A. Startup, test and commission the MBR System.

B. The MBR SUPPLIER shall assist the General Contractor in the calibration of all instruments supplied under this contract, including I/O checks.

C. Ensure the equipment is installed as required to provide satisfactory service.

D. Inform the General Contractor of all procedures and requirements necessary for the successful installation of the equipment. Attest to the installer's understanding as required.

E. Cooperate with the General Contractor to fulfill the requirements for a successful installation.

F. At a minimum, the following installation verification and commission support staff is required by the MBR SUPPLIER:

1. Provide the General Contractor with a detailed “step by step” checkout plan. A draft of the checkout plan shall be submitted with this proposal.

2. Repeating the testing and startup activities shall have no additional cost to the Owner. Required work days for each activity are tentatively scheduled as below. Should one activity require less work days than tentatively scheduled,

the excess work days shall be reallocated to other activities.

3.04 TRAINING

A. Provide training to the District's operation and maintenance personnel in accordance with the requirements of Section 017900 – Training of Operations and Maintenance Personnel.

3.05 SYSTEM GUARANTEE

A. The MBR SUPPLIER shall provide a written Process Guarantee indicating that the system will function under the prescribed automation and meet the required treatment criteria described in this RFP.

3.06 OFFSITE REMOTE MONITORING SUPPORT

A. Capability of remote monitoring for the supplied equipment is required by the District.

1. The MBR SUPPLIER shall provide a written description of MBR SUPPLIER's capability of remote monitoring and troubleshooting for the supplied equipment.

2. The MBR SUPPLIER shall provide biweekly reports based on the remote monitoring service.

3.07 MEMBRANE MODULE GUARANTEE

A. Provide a membrane guarantee.

a. Conditions under which membrane modules will be considered defective include, but are not limited to, the following:

(1) If the MBR system fails to maintain the net filtrate production capacity with the cleaning frequency stipulated in the Bid Form, the system shall be repaired, modified, or replaced as necessary to obtain the specified net filtrate production capacity.

(2) If the removal of a cassette for manual sludge cleaning is required to maintain net filtrate production capacity and the Membrane System has been substantially operated in accordance with the MBR SUPPLIER's Operation and Maintenance Manual as necessary to obtain the specified net filtrate production capacity. The system shall be repaired, modified or replaced as necessary to obtain the specified net filtrate production capacity.

(3) If the MBR system fails to meet the performance standards stipulated herein,

(4) If the MBR system fails to meet the requirements relating to

permeability the system shall be repaired, modified, or replaced as necessary to obtain the specified water quality standards stipulated herein, the system shall be repaired, modified, or replaced as necessary to obtain the standards.

END OF SECTION