

8.5. Finding #5

Adequate utilities, access roads, drainage, sanitation and/or other necessary facilities have been or are being provided.

8.5.1. Water Source and Requirements

Adequate water from the Chatham County Department of Public Works has been reserved. The development team first reserved 200,000 GPD for Williams Corner, but it will reduce that figure to below 100,000 GPD when the zoning process is completed. The developer has also already discussed current water main locations (on the Williams Corner side of Lystra Road) and size (12" main). Internal meter locations and expected fees for tapping on to the water system were also discussed.

Please refer to the following letter, from the Chatham County Department of Public Works.

8.5.2. Wastewater Management

The current design load for the proposed development is less than 50,000 GPD. This volume is based on design guidelines from the NC Division of Water Quality *Rules* referencing the design of reuse wastewater treatment systems. Actual wastewater use will be further reduced since all the buildings will be using low-flow devices to meet our “Green Building Development Guidelines.” The treatment system is a reuse wastewater treatment facility. Wastewater will be treated and the high-quality effluent will be used to irrigate the prepared landscaping, natural areas, and as a water supply for landscape water features. Current plans are for two 50,000 GPD US Filter Membrane Bioreactor (MBR) plants to be installed to meet DWQ redundancy rules.

Preliminary discussions with the Division of Water Quality have been taking place for the last six months and an application for fast-track permitting is planned to be requested at the first of October 2005. The preliminary soils report performed by Soil and Environmental Consultants has determined that the site will easily accommodate the 50,000 GPD of treated effluent the project will generate. The 90-day storage requirement will be made up of multiple storage ponds that will also serve as application areas during normal disposal periods. At no point during preconstruction, construction, and operation phases will the wastewater treatment system not have any required permits from the NC Division of Water Quality, Chatham County, or any other regulatory body. All estimates and calculations are conservative based on preliminary soil reports and comparative use information. Unless otherwise recommended by NCDWQ, the 50,000 GPD will be built and the excess capacity reserved for future use.

The project will be using a pre-engineered membrane bioreactor (MBR) package treatment plant designed and manufactured by US Filter. This plant uses membrane technology and addition chemical and UV treatment to accomplish its remarkable polished effluent characteristics. This MBR plant design has won out over a number of competing designs for the following reasons:

1. The treatment plant and all accessory structures are compact, taking up less than a 40-ft. by 100-ft. area for the MBR plants and a 25-ft. x 25-ft. area for the sludge tank.
2. The system is relatively simple to operate and maintain, requiring less operator involvement.
3. US Filter MBR packages are modular, allowing for easy expansion and repair.

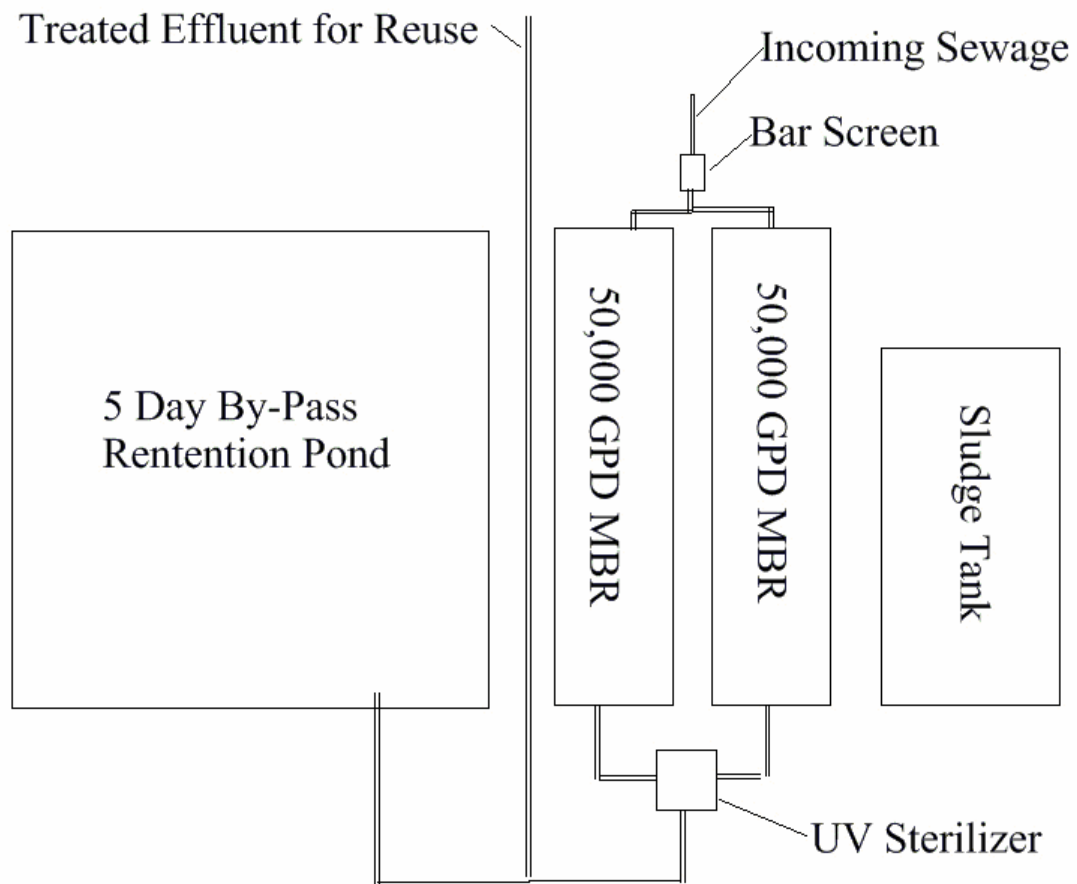
4. There will be very minimal odor from this plant. Membrane filtration eliminates the need for open clarifiers, weirs, sludge returns, and maintenance normally associated with a passive clarification process. In addition, sludge haulers contracted for the handling of the disposal of the wetted sludge will use a closed transfer system to pump out the sludge tank.
5. The membrane technology reduces pathogen passage through the facility. The pore size of the membrane, 0.1 micron, is much smaller than the size (3.0 microns) of enterobacteria and other common pathogens, like crypto or giardia. Consequently, there is a positive barrier against these pathogens passing through the system.
6. The optional equipment available to further reduce noise and nutrient levels is less expensive to purchase and maintain than the equipment that would have to be added to other reuse treatment facilities to accomplish the same results.

The added benefit of a reuse wastewater system is that the water requirements of the project do not include use of Chatham County potable water or well water for irrigation. The developer is also working with other projects and landowners near the project to evaluate any possibility of taking their irrigation systems off the Chatham County water supply and using some of the project's reuse water.

8.5.2.1. Water/Sewer Impact Statement

Water will be provided by Chatham County and the amount required, less than 100,000 GPD, is readily available (letter attached). The wastewater treatment system is an onsite reuse system and does not impact Chatham County Utilities.

8.5.2.2. Basic 50,000 GPD MBR Layout



8.5.2.3. MBR Facility Overview

August 15, 2005

Reference: MBR Express – 50,000 GPD
Memcor Packaged Membrane Bioreactor

US Filter Memcor is pleased to offer our proposal for a Packaged Membrane Bioreactor. As the world leader in Water and Wastewater process equipment, US Filter has the unique qualifications and experience necessary to provide you an advanced state-of-the-art process equipment solution and design to meet the specific requirements of your wastewater treatment facility. Our process design specialists have prepared the enclosed design presentation, which provides a general overview of the systems process and equipment selections for your evaluation.

Execution in process equipment supply is only achieved through the combination of supplying the highest quality equipment and project management excellence. US Filter will assign a specific project manager to work exclusively with your design team who shall be devoted to on time deliverables and project completion. Upon receipt of formal agreement, your project manager will be assigned, and will be available to answer any questions regarding the execution of this proposal.

An important factor in the evaluation and selection of your equipment supplier is their ability to support and service the product. US Filter has more local and regional support centers than any other manufacturer in the industry. Our mission is that of a process solutions provider, not simply an equipment supplier.

In 2003 US Filter was named the top ranking supplier in “Overall Service and Performance” by Frost and Sullivan. Our commitment is to posture a leadership role in the achievement of a long-term partnership that shall be mutually beneficial to all parties. Leadership can only be achieved with an informed and satisfied customer base. US Filter cannot be successful unless the products, systems, and services we provide make our customers successful. US Filter will offer to your plant operations team training and exposure to similar US Filter treatment facilities. This is achieved through ongoing technical group seminars, held annually in your region at no cost.

Sincerely yours,

Jason C. Boyd
Technical Sales Manager
USFilter/Memcor

Proposal

Pre-engineered / Pre-assembled Packaged Membrane BioReactor Model PMBR 50

SECTIONS

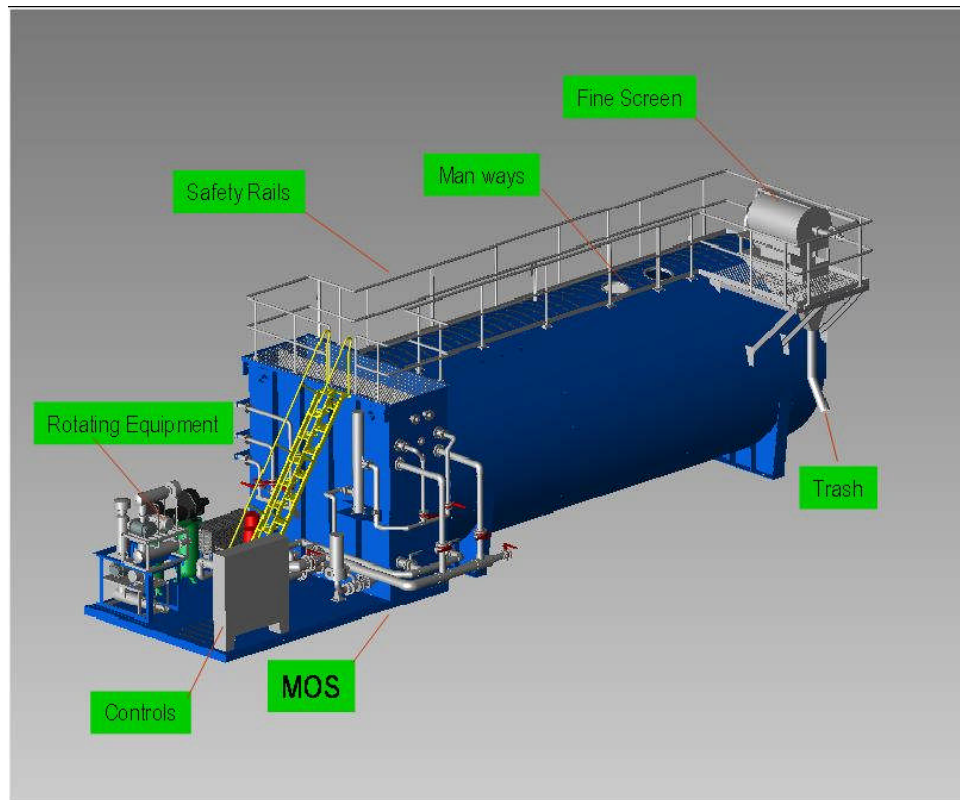
- 1.0 General Process Description
- 2.0 Controls
- 3.0 General Process Features and Benefits Summary
- 4.0 System General Configuration
- 5.0 Process and Instrument Diagram
- 6.0 Scope of Supply Packaged MBR
- 7.0 Optional Equipment
- Appendix A: Standard Terms and Conditions
- Appendix B: P&ID

General Process Description

Packaged MBR

The Packaged MBR is a pre-engineered Membrane Bio-Reactor (**MBR**) system that uses the most advanced membrane technology today to achieve a compact and robust advanced treatment package. It is a complete factory preassembled treatment plant that contains many of the operational features of the most advanced municipal plants. The highly automated design provides many important features to meet the demands of the most stringent environmental requirements.

The Packaged MBR's compact design minimizes foot print requirements and elevation allowing it to meet the most difficult installation requirements. Preassembled, skidded and tested rotating equipment, piping, valves, and controls minimize onsite labor and expedite the installation and commissioning of the treatment plant.

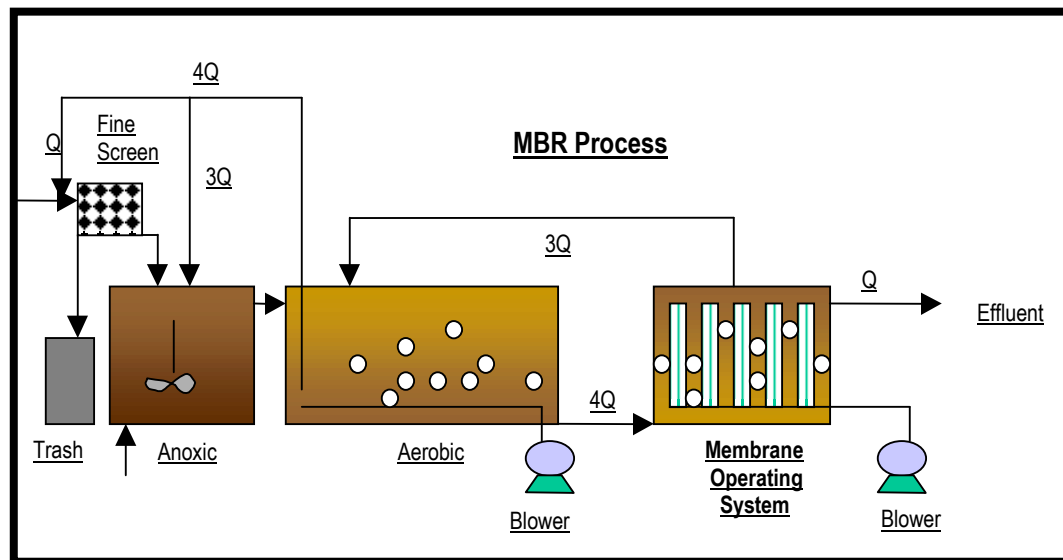


There are a number of optional features available to meet the needs of virtually any application. Options include:

- Equipment enclosure, to house rotating equipment and controls. Preassembled on rotating equipment skid

- Dissolved Oxygen control for advanced Nitrogen Removal and energy reduction
- Chemical Phosphorus removal
- Inline standby equipment

General Process Diagram



MBR Process

Prescreen

Proper prescreening is an important element in all immersed membrane MBR applications. The purpose of the screening is not to protect the integrity of the membrane fibers but to reduce the occurrence of fibrous materials from becoming entangled in the fiber bundles. The accumulation of fibrous materials in the modules will ultimately reduce module performance and make cleaning and maintenance more time consuming. A 2mm perforated screen is very effective in removing fibers and necessary for adequate pretreatment of the influent before entering the MBR process. In addition to influent screening the Packaged MBR is designed to re-screen mixed liquor to maintain the best operating environment for the membranes. This reduces maintenance on the membrane system and improves long term membrane performance. Screenings shall be collected in a hopper for removal.

The screen shall be designed and constructed as a 2mm perforated plate system, and will be provided as part of the US Filter quotation.

Influent Equalization

If influent equalization is required it will be supplied as an option or supplied by others. Memcor will work closely with your engineer to provide the proper sizing for the application.

Biological Process

The anoxic and aerobic tanks including, piping, diffusers, access covers, and vents are included with the Packaged MBR equipment package.

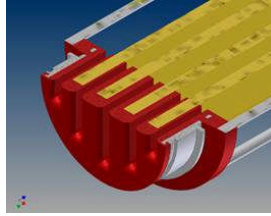
Membrane Operating System (MOS)

The MOS, the heart of the MBR system, will be an assembly with two (2) integral membrane-operating tanks. The MOS is an integral part of the Aerobic Process but it is specifically designed as a separate basin to optimize the operating environment of the membranes. Applying a low vacuum to the membrane modules pulls water through the membranes and pumps the filtered water to the next process step. Mixed liquor is continuously injected uniformly with air into each membrane module fiber bundle. The resulting cross flow across the membrane fibers continuously scours and cleans the membrane surface. The solids, organics, microorganisms, bacteria, and viruses cannot pass through the membrane and remain in the mixed liquor; and are ultimately destroyed by the process and age.

The membrane operating systems are easily isolated from the main process tanks to allow the membrane basins to be used as cleaning basins. When necessary a Clean in Place (CIP) is performed to restore membrane permeability. As a result, membrane cleaning and service never impair biological performance. The MOS is designed with independent operating systems, which enable membrane cleaning to be scheduled during periods of low flow to optimize overall performance of the system. An integral permeate holding tank is provided for storage of treated water for screen washing, membrane maintenance cleaning and for membrane chemical cleaning.

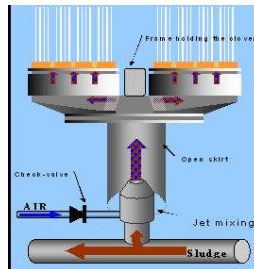
Biologically active mixed liquor is pumped from the biological reactor to the MOS where liquid/solids separation is accomplished by the proprietary MemJet® operating employed as an integral part of the US Filter Membrane Operating System (MOS) design. The jet system has several important functions:

- The combination of air and mixed liquor introduced at the base of the module provides an essential scrubbing action on the membranes as mixed liquor moves upward across the membrane surfaces. This uniform fluid flow across all membrane surfaces prevents the polarization or thickening of suspended solids within the membrane modules.



Membrane
Module

- There is a small back pressure where mixed liquor and air are combined at the base of the module. This helps provide uniform distribution of mixed liquor and air across the entire membrane basin.



- Creating a two phase system (air and mixed liquor) improves module performance by keeping aerated surfaces wetted at the base of the module and prevents dehydration of solids onto these surfaces. This ultimately keeps aeration uniform through all modules and across the entire array of modules in the MOS.

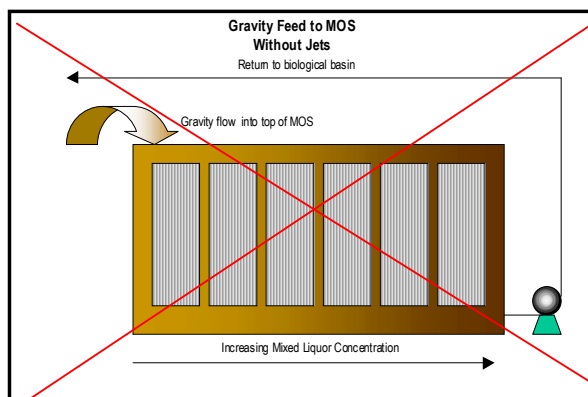


Full rack assembly with
integral jet system

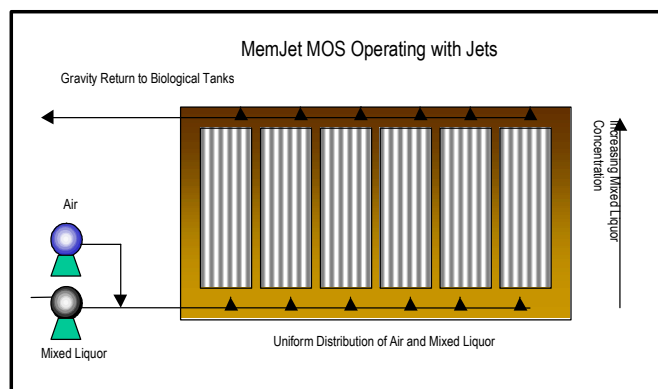
- Membrane scouring is accomplished by creating an airlift at the base of each module. As air bubbles rise they create liquid cross-flow upward along the membrane surface. The airlift displaces liquid at the base of the membrane tank during normal operation. The benefit of the jet system is that it replenishes displaced liquid at the bottom of the

MOS minimizing down flow liquid patterns. Competitive systems which simply allow recycle mixed liquor to enter the top of the MOS will not achieve uniform distribution and effective fluid cross flow resulting in the random polarization of solids in membrane modules.

Non US Filter Design



US Filter Design



As illustrated above the jet system provides uniform liquid distribution from the bottom to the top of the tank. All membranes are exposed to the same mixed liquor environment and performance is consistent. In a non-uniform environment membranes are subject to a concentration gradient resulting in varying performance. This will have a negative effect on both normal operation and cleaning efficiency.



Ease of Maintenance

The US Filter MOS design is based on the ability to clean membranes in the active basin. Membranes are not removed from the operating tank and/or placed in a separate tank for extended soaking and cleaning. The jet system and the module design with narrow fiber bundles provide a system that is very effective for cleaning the Membrane System in place within the MOS.

This process is safe, operator friendly, and significantly reduces the time required for cleaning membranes. Normal cleaning using separate soaking tanks is about 24 hours per membrane rack. The MemJet® process allows cleaning chemicals to be circulated into the fiber bundles to remove organic and inorganic fouling of the fibers. With an in place cleaning process all modules in an entire MOS can be cleaned in 24 hours, and without having to remove them from the basin.

Another benefit of cleaning all membranes at the same time is they will operate at the same flux and at the same operating pressure. Operating clean membranes on the same suction line as fouled membranes causes them to operate at higher than design flux, resulting in rapid fouling. Cleaning all membranes at the same time means uniform and predictable fouling providing the operator more control over the MBR operations.

Operational and maintenance flexibility

Organics, bacteria, and viruses are rejected by the membrane system and retained in the biological process. Membrane filtration eliminates the need for clarifiers, weirs, sludge returns, and maintenance normally associated with a passive clarification process. It also allows the operation of the biological system at a much higher level of mixed liquor suspended solids. This ensures a more efficient biological process operating at low food to microorganism ratios with substantially less sludge production.

Since most of the maintenance and process adjustments associated with clarifiers are eliminated with a membrane filtration process, operation of the treatment process is easily automated and can be controlled with a microprocessor.

1.0 Controls

Process Controls and MCC Panel: One (1) PLC, pre-programmed process control panel utilizing Conventional I/O capable of directing operation of all MBR equipment functions shall be provided. Equipment operating schedule shall be field adjustable. The control system configuration is based on an Allen-Bradley (AB) Micrologix Processor capable of communication with an AB Panel View 550 Operator Interface. The PLC is supplied with at least 15% spare capacity in both I/O and memory. This configuration allows easy expansion of additional devices in the future and will meet US Filter and UL 508 standards. This Enclosure will contain both the Controls PLC and the Packaged MBR's Motor Control Center (MCC). The Control Panel will be designed and configured using the following:

- AB Micrologix Processor
- PV 550 Ethernet Operator Interface
- Surge suppression
- UPS
- Analog Input cards (instrumentation)
- Digital I/O
- Fused terminal blocks
- 24 VDC Power Supply

Also the MCC portion of the Control Panel shall include the main disconnect for the Motor Starters and VFD's proposed herein, which would include the following motors:

- Filtrate Pump(s)
- Membrane Re-circulation Pump(s)
- Membrane Operating Blower(s)

The various process steps are controlled by a microprocessor, which receives information from liquid level control switches and instruments located throughout the system. This information, along with preset timers, determines process control for the system. The control system operates the plant according to a preset treatment strategy that is field adjustable to meet changing conditions or requirements. Included in the control design are complete diagnostic capabilities and automated membrane maintenance sequences. Automated control logic includes sequencing for:

- Operational Fiber Relaxation.
- Maintenance cleaning processes for external fiber bundle, fiber module, and fluid transfer systems.
- Manual overrides for component operation.
- An Operator Interface with complete diagnostics, maintenance alerts, emergency alerts, and signaling of maintenance program sequencing.

- Software based Alarm Paging Modem to alert operators with alarms
- Optional Voice Alarm Dialer
- Manual maintenance for Clean In Place (CIP)

As an Option, the Control Panel and MCC could be furnished with a main HMI package, which will be used as a SCADA through Ethernet. Using the basic SCADA in the control room, the operator has the ability to monitor the Plant operations. All alarms are displayed, logged, and printed for the operator. Every pump/motor/fan/mixer can be run in automatic, or if desired, manual mode. The HMI PCs are supplied with the following software packages and respective licenses:

Allen Bradley RSView32 Development
PC Anywhere for remote monitoring of the plant
Microsoft platform including Office

The optional SCADA HMI systems and the proposed Control Panel Operator Interface provide operations personnel insight into the total process through graphic displays. The structure of these displays allows operators to navigate through the entire system. The graphic displays reflect real-time conditions such as flow rates, liquid levels, system pressures, pump and equipment condition, and alarm occurrences, allowing quick assessment of the process status at all times. Operators can also call up real-time and historical trend displays to pinpoint irregular or unusual conditions.

3.0 General Process Features and Benefits Summary

The proposed wastewater treatment system provides the most advanced wastewater process available. Its capability of reliably providing exceptional water quality with minimal sludge production offers many user benefits. The integration of MemJet® immersed membrane system into the preassembled Packaged MBR complete process offers many benefits for both the installation and the overall operation of the system. Continuous fine screening of influent and the mixed liquor creates an optimum environment for the immersed membrane system. Removing trash and fine inert materials improves mixed liquor filterability, improving membrane permeability. This optimized operating environment will reduce membrane maintenance, lowering overall energy and chemical use, and enhancing membrane life. A summary of benefits include:

- High quality effluent
 - BOD < 5 mg/l
 - TSS < 5 mg/l
 - Turbidity < 0.2 NTU
- Low solids production
 - 20% reduction in solids produced
- Physical Barrier to Microorganisms provided by Microfiltration
- High rate, robust biological process capable of continuous operation at 12,000 mg/l MLSS

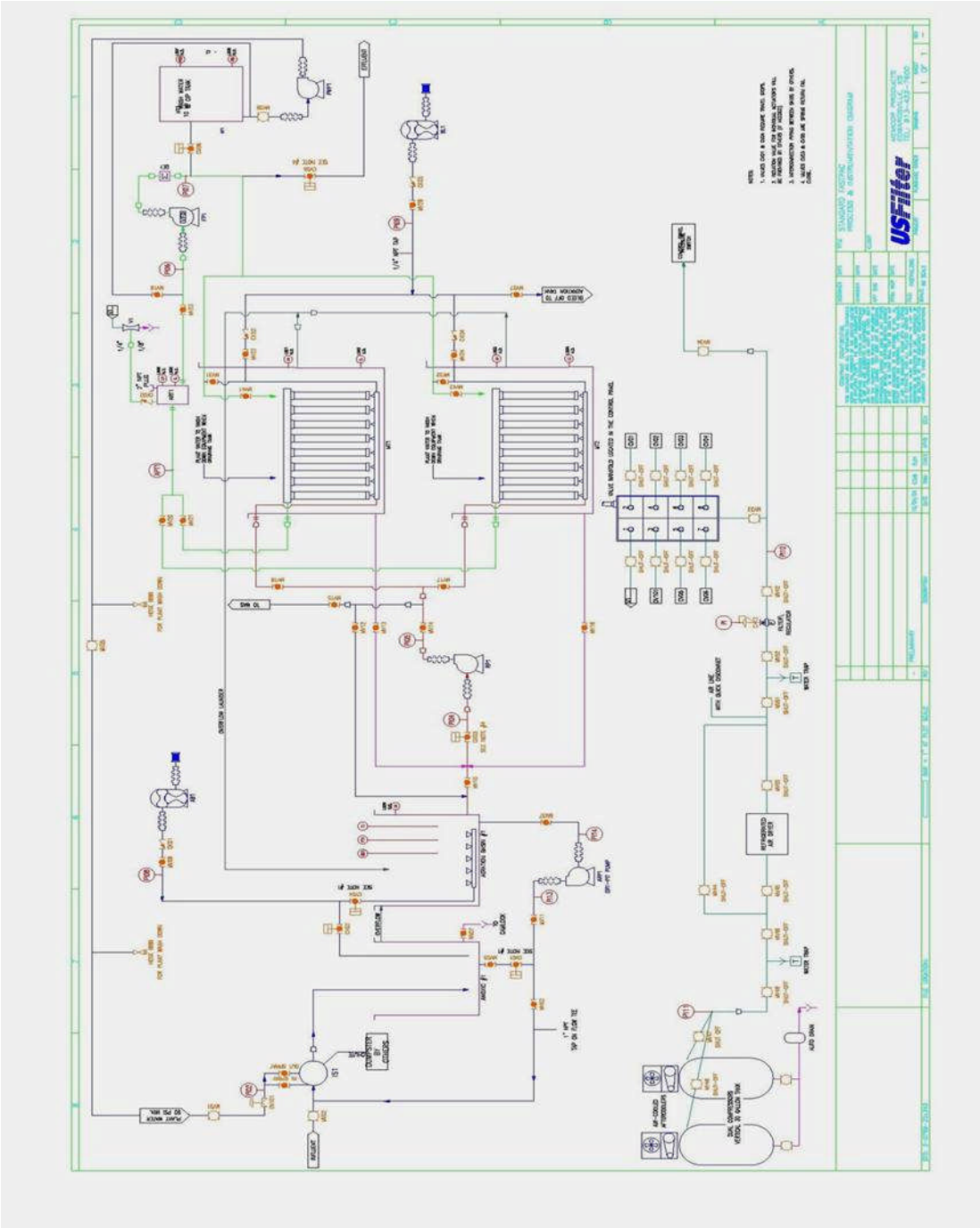
- Very small overall plant footprint
- Eliminates clarifier,
- Provide a stable nitrification performance (even in cold climates) through the maintenance of sensitive nitrifying bacteria.

4.0 System General Configuration (PMBR Model 50)

Description	Phase 1
Number of Equipment Trains	1
ADF / Train (MGD)	Up to 50,000 GPD
Number of MOS /Train	2
Blank Rack Positions/MOS	N/A
Membrane Rack/MOS	1
Membranes / MOS	72
Max Flow /MOS (Max Hour Peak)	100,000 GPD
Mixed liquor Recirculation Pumps / MOS	1
Permeate Pumps /MOS	1

The MOS systems are all designed to operate independently of each other. Any MOS can be taken out of service without affecting the operation and performance of remaining MOS

Attachment “B”



8.5.2.4 Wastewater Calculations

Building	Sq' or Units	Design GPD	
Flex Space I	50,000	3,000	
Medical Office	135,000	16,200	
Vet	6,000	1,800	
Retail/Office I	146,000	8,760	
Daycare	12,500	3,000	25 GPD per 120 occupants
Residential Townhomes	40	14,400	
Total Estimated Design Load¹		47,160	Gallons Per Day (GPD)
5-day Side-stream Detention Pond		235,800	Total Storage Gallons
		31,520	Cubic Feet
Required Storage		262,500	150x125x16
Acres		0.43	Lined Storage
90-day Storage Pond		4,244,400	Gallons
		567,357	Cubic Feet
Required Storage		4,305,000	
As acres		4.71	Acres needed for storage ponds

¹Design loads are based on monitored use of similar facilities.

8.5.3. Access Roads

The proposed Williams Corner development is planned to have two full-movement driveways and one right-in/right-out driveway onto US 15-501. There will be one full-movement and one right-in-right out driveway onto Lystra Road. The full-movement driveway on US 15-501 will align with the existing Polks Landing Road. (See Kimley-Horn & Associates Traffic Impact Analysis for detailed study and improvements.)

The drive traveling through the development from Lystra Road to 15-501 is planned to be named Williams Corner Road. The drive entering the development at the north end along US 15-501 has not been named. Both of these drives are planned to be state-maintained.

Please see Site Plan and Traffic Study for schematics.

8.5.4. Storm Water Runoff

In order to meet the watershed protection ordinance, this site will provide stormwater management facilities that meet the requirements of the high-density option from the future NPDES Phase II stormwater regulations. The main criteria that will be addressed are as follows:

1. The measures shall control and treat the difference in stormwater runoff volume leaving the project site between the pre- and post-development conditions for the 1-year / 24-hour storm. Runoff drawdown time shall be between 2 to 5 days.
2. All structural stormwater treatment devices will be designed to provide a minimum of 85% average annual removal for Total Suspended Solids from stormwater runoff generated from proposed impervious surfaces.

See Section 8.5.4.2, Stormwater Impact Analysis.