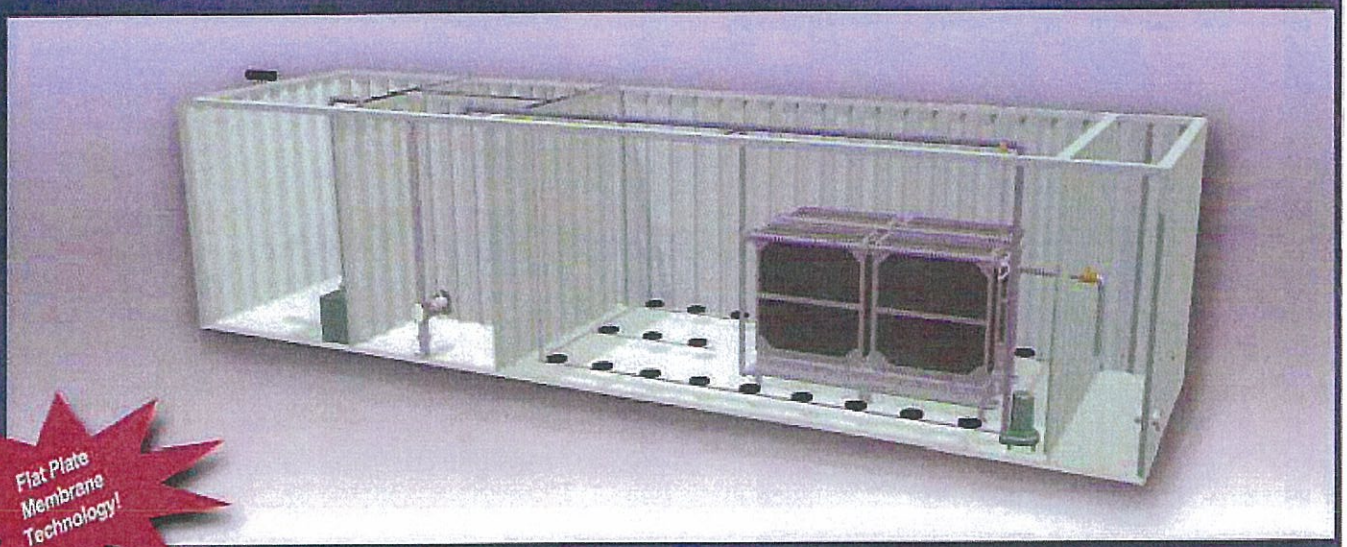
Appendix U

TITAN™ MBR

MEMBRANE BIOREACTOR FOR WASTEWATER TREATMENT



Flat Plate Membrane Technology!

BACKED BY DECADES OF PROCESS DESIGN EXPERIENCE

SUPERIOR MEMBRANE CLEANING AND DURABILITY

EXTREMELY HIGH EFFLUENT QUALITY

BY SMITH & LOVELESS INC.

TITAN™ MBR

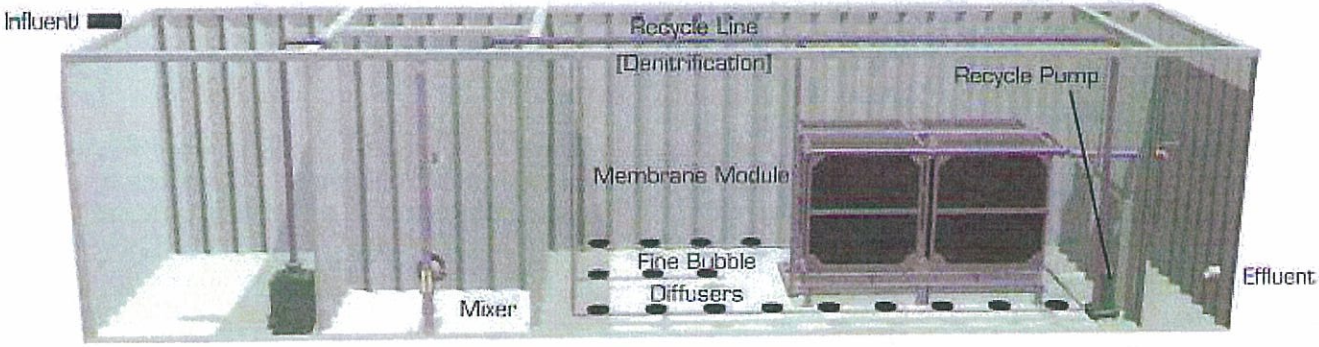
Smith & Loveless Inc. proudly introduces **TITAN MBR™**, our latest pre-engineered wastewater treatment system for municipal and industrial applications. The innovative **TITAN MBR™** marries the wastewater treatment engineering expertise of S&L with exciting submerged membrane technology. The combination yields a *dynamic* membrane biological reactor (MBR), a system that provides end-users with high-quality treatment performance, minimal operational requirements, and a robust design that will stand the test of time. **TITAN MBR™** delivers results with value-added engineering experience available only from S&L.

***TITAN MBR™** is the complete MBR package — developed by Smith & Loveless Inc., the company with 60 years of wastewater engineering and manufacturing experience.*

TITAN™ MBR System Overview & Diagram

Plants come in standard and custom designs, and result in smaller footprints than conventional systems. The submerged membrane eliminates clarifiers and sand filters while still producing *significantly better* effluent quality. Integral zones can be added to meet particular effluent goals, including nutrient removal, disinfection and post-aeration.

TITAN MBR™ Design & Technical Data	
Flow Capacities:	5,000 GPD and larger
Effluent Quality:	< 3 mg/l BOD & < 1 mg/l TSS
Turbidity:	< 0.2 NTU
TKN	< 2 mg/l
NH_3	< 1 mg/l

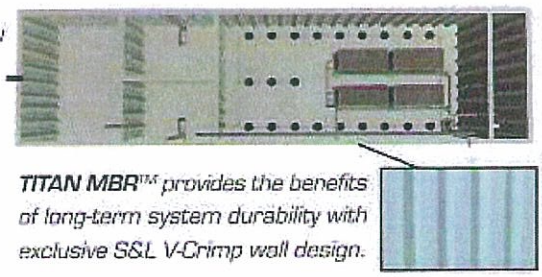


Flow Equalization | Dual Anoxic Zones [Denitrification] | Aeration Zone with Submerged, Flat Plate Membrane Modules | Clearwell & Chlorination

S&L Design Benefits

- 60 years of S&L engineering & manufacturing expertise
- Easy-clean Flat-Plate membrane design
- S&L-exclusive epoxy-coated, V-Crimped tank walls
- Proven factory-built designs and quality-control
- Flexible process options with minimal operation required
- Process guarantees and full customer support

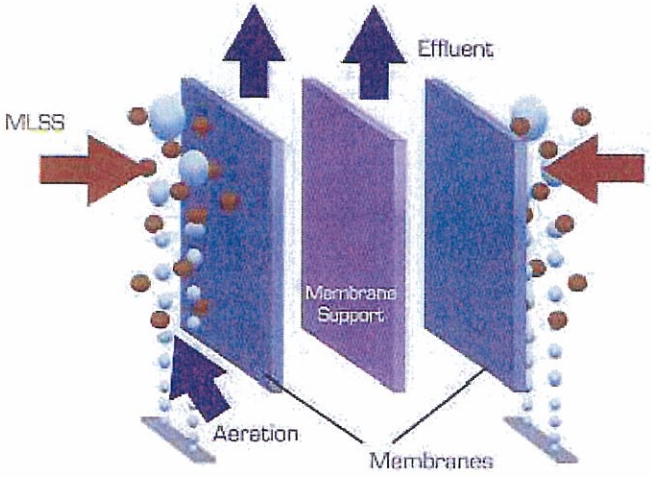
Top View



***TITAN MBR™** provides the benefits of long-term system durability with exclusive S&L V-Crimp wall design.*

TITAN™ MBR Flat-Plate Membrane Design Efficiently Delivers Results

TITAN MBR™ Flat-Plate Membranes—rated at the microfiltration level—maintain high permeability and flux rates even at peak-day rates. They stack within a fully submerged module inside the aeration zone. Sufficient transmembrane pressure created by gravity drives the flow through the membranes. Clean water discharges into a clearwell while blocked solids remain suspended in the aeration zone. Diffusers beneath the module scour the membranes *while also* providing air supply to the bacteria. Chemical cleaning occurs efficiently in-place—typically on a semi-annual basis*—with simple chemical injection.



TITAN™ MBR Membrane Advantages

Provides Long-Term Durability

Composed of PVDF [polyvinylidene fluoride] and a non-woven polyester fabric, the vertical membrane surfaces do not touch each other during operation. A robust design prevents breakage experienced in other designs and produces higher flux rates over time.

Effectively Combats Problem Constituents

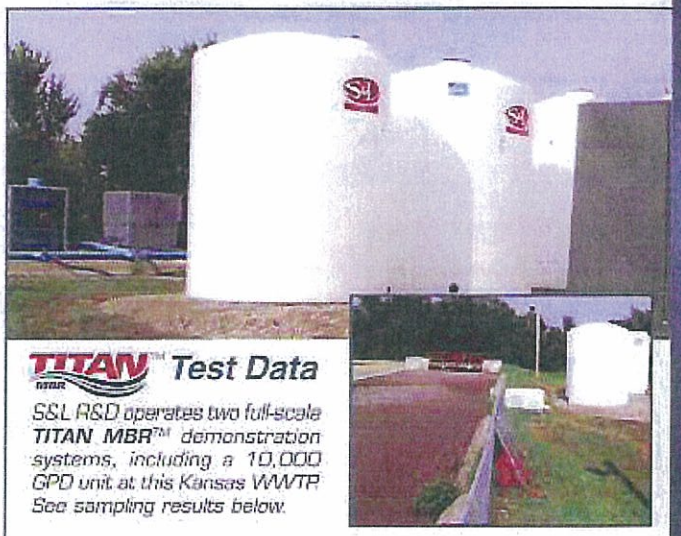
TITAN MBR™ membranes eliminate clogging problems experienced in hollow fiber designs. The Flat-Plate design with its smooth, continuous surface prevents the build-up of solids that result from hollow fibers being bundled by stringy solids—like hair.

Offers More Economical Cleaning Methods

TITAN MBR™ membranes utilize less chemicals and equipment than other designs. No backpulsing is required, which eliminates associated pumping equipment. **TITAN MBR™** membranes facilitate air scouring in the aeration zone much more effectively than hollow fiber designs by the simple fact of their flat surfaces.

TITAN MBR™ Membrane Data [Typical]	
Type:	Submerged, PVDF+PET Flat-Plate
Design Flux:	15 gpd/sf
Pore Sizing:	.08 microns [MF]
TMP Range:	[Trans Membrane Pressure] 1.03 - 2.90 psi
Cleaning:	In-Place; Semi-annual cycle*; 4 hrs.

*Depending upon the application



TITAN™ MBR Test Data

*S&L R&D operates two full-scale **TITAN MBR™** demonstration systems, including a 10,000 GPD unit at this Kansas WWTP. See sampling results below.*

Actual Plant Data

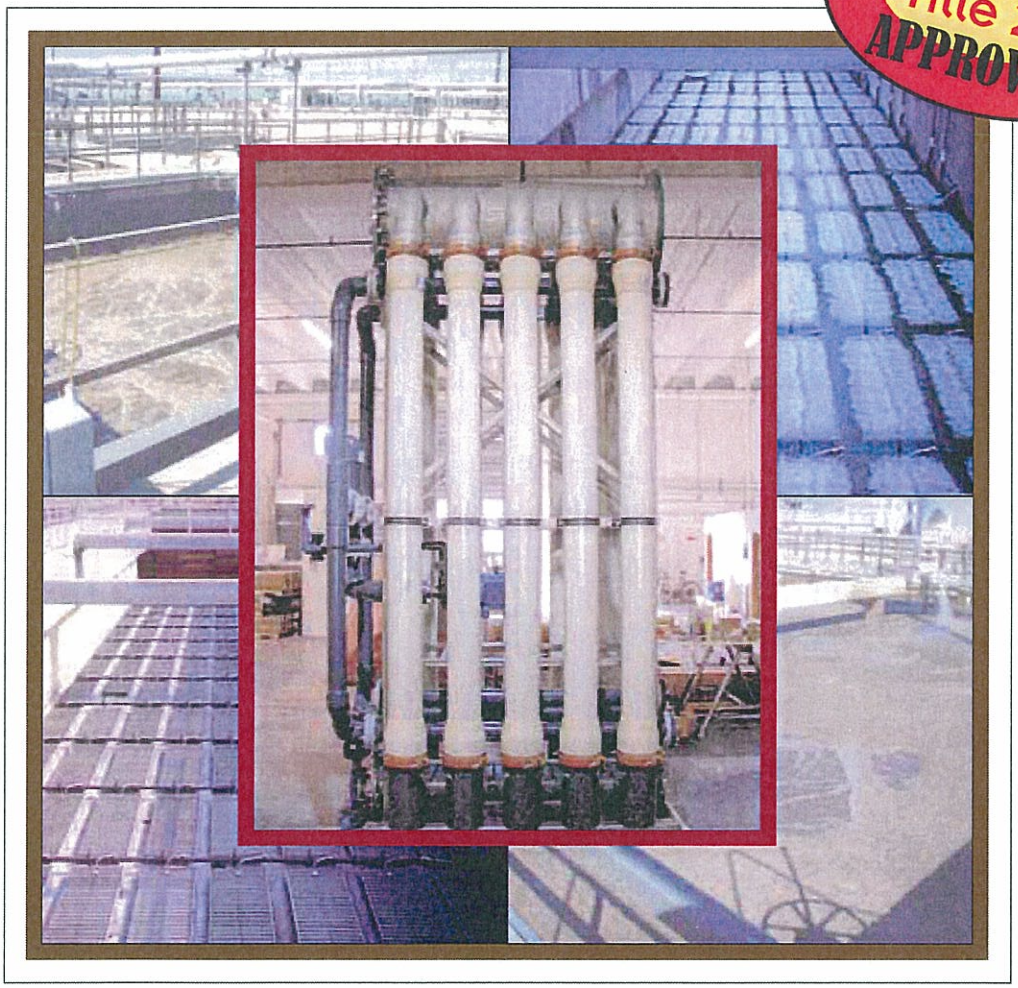
Weekly Sample	Influent BOD mg/l	Influent TSS mg/l	Influent TKN mg/l	Effluent BOD mg/l	Effluent TSS mg/l	Effluent TKN mg/l	Effluent NH_3 mg/l
Sam. 1	276	148	36	NA	BDL	NA	0.30
Sam. 2	270	224	36	NA	BDL	0.90	0.40
Sam. 3	359	178	53	1.2	BDL	0.60	1.30
Sam. 4	228	204	28	1.7	BDL	0.71	0.03
Sam. 5	275	157	43	0.6	BDL	0.38	0.05
Sam. 6	246	157	37	0.0	BDL	0.53	0.03
Sam. 7	126	244	21	4.0	BDL	0.15	0.65
Sam. 8	195	244	47	4.0	BDL	0.64	0.10
Sam. 9	330	139	58	2.0	BDL	0.69	0.87
Sam. 10	70	202	29	0.9	BDL	0.81	0.02
Sam. 11	294	230	34	0.0	BDL	0.62	0.02
Sam. 12	35	196	47	0.0	BDL	0.39	0.12
Sam. 13	336	127	47	0.0	BDL	0.34	0.07
Sam. 14	360	210	34	0.0	BDL	0.19	0.02
Sam. 15	265	174	31	1.5	BDL	0.00	0.22
AVG.	**243**	**189**	**39**	**1.2**	**BDL**	**0.51**	**0.28**

NA = Results Not Available
BDL = Below Detectable Limits

PARKSON CORPORATION

DYNALIFT™ MEMBRANE BIOREACTOR SYSTEM

California Title 22 APPROVED



Parkson DynaLift™ MBR

California Title 22 APPROVED

Membrane bioreactors are an advanced wastewater treatment process that combines an activated sludge biological process with membrane filtration. The process produces an extremely high quality effluent suitable for reuse or discharge.

DynaLift MBR Highlights

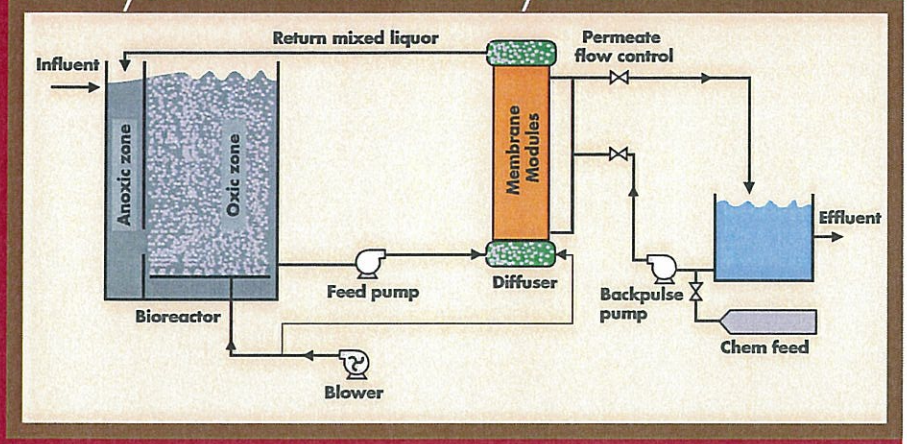
The innovative DynaLift MBR design uses energy efficient, airlift-assisted tubular membranes. The membrane system is located outside the biological reactor and can be installed at the most convenient and accessible location at a plant site. No membrane system components are submerged in the biological mixed liquor. This permits independent operation and optimization of the biological and membrane systems.

The biological treatment process can be designed for a wide variety of applications such as nutrient removal including chemical precipitation of phosphorus. This flexibility ensures the most efficient treatment of the waste stream. The membrane system is independently optimized to provide the best performance for the specific application. The DynaLift MBR system is provided and guaranteed by Parkson.

DynaLift MBR System Advantages

FEATURES	BENEFITS
External membrane system	Easy to design, build, retrofit, operate and maintain
Rugged tubular membranes	Long membrane life; excellent membrane integrity
Ultrafiltration membranes	Excellent pathogen removal
Easy access	Safe, easy and economical cleaning
Airlift assisted cross-flow pumping	Excellent membrane scouring and turbulence with significantly reduced pumping head and HP – lower HP than immersed systems
Low membrane TMP	Long membrane life; reduced cleaning requirements
Long sludge age process	High quality effluent; excellent process stability; low membrane fouling; less waste sludge production
MLSS up to 15,000 mg/L	Smaller aeration tanks; smaller footprint plant
Guaranteed effluent quality	Meet strict discharge standards and water reuse requirements
Complete system supply	Single source accountability to owner

DynaLift™ MBR System



The biological process is a long sludge age design that provides excellent BOD removal and nitrification. Anoxic and anaerobic zones are added as needed for nutrient removal. Increased mixed liquor concentrations mean more biological treatment capacity within the same footprint. Long sludge age treatment results in less waste sludge production, excellent process stability, low membrane fouling and lower overall operating costs.

Proven Tubular Membranes

The DynaLift MBR system uses X-Flow® tubular membranes. X-Flow tubular membranes have been used for over 30 years in very demanding industrial high-solids applications. Some applications involve solids concentrations exceeding 40,000 mg/L. Tubular membranes provide a wide-channel, non-clogging design that is rigidly supported for ruggedness and long life.

X-Flow tubular membranes were originally developed in the early 1970s for industrial separation applications. Since the first installations, these membranes have been used in thousands of food processing, purification, concentration, waste separation and wastewater treatment applications. Tubular membranes have been used in these difficult applications for over 30 years and have a proven track record of long life and low maintenance.

DynaLift Membrane System Advantages

- **Achieves and maintains high membrane flux**
- **Distributes MLSS evenly across membrane surface**
- **Operates on low head**
- **Safe, efficient cleaning**
- **Reduced chemical consumption**
- **Long membrane life**

Low Operating TMP

DynaLift systems typically operate at a trans-membrane pressure (TMP) of only a few psi. A low pressure circulation pump is provided to move MLSS from the bioreactor through the membranes. Low TMP reduces membrane fouling.

Low Cross-flow Energy

To eliminate high pumping energies, the DynaLift system positions the membranes in a vertical orientation. This simple change allows turbulent cross-flow to be maintained using air injection at the bottom of the membrane module. In this way, MLSS is transported by an "airlift" pump through the system. This innovative design approach eliminates much of the energy needed in conventional cross-flow designs.

High Turbulence

The key to maintaining operation of any cross-flow design is providing high turbulence at the membrane surface. Air injected at the bottom of the DynaLift™ membrane modules creates extreme turbulence inside each membrane tube. This reduces fouling, improves performance and decreases cleaning cycles.

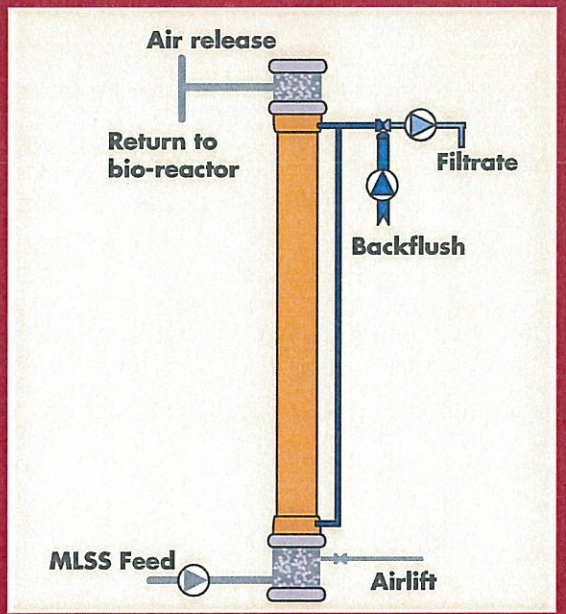
Safe, Easy and Economical Cleaning

DynaLift MBR system cleaning is safe, dry and fully automated. Cleaning solution is pumped directly to the out-of-basin membrane skids. This eliminates the need to remove membranes from a basin or handle the membrane modules. Workers are never exposed to tanks of cleaning solution or wastewater sludge. No cranes are required.

Retrofit capabilities

DynaLift membrane systems can be retrofitted into nearly any existing biological treatment process. Since the membranes are located outside the reactor basin, the biological process can be optimized independently of the membrane system – a key advantage. A simple concrete slab to support the membrane skid can be constructed at the most convenient location. The Parkson DynaLift system can be designed to accommodate current as well as future treatment requirements. Expandability is as simple as adding an additional membrane skid.

DynaLift Membrane Airlift Feature



DynaLift MBR Primary System Components

- **Fine screen**
- **Biological treatment process**
- **Low-head MLSS feed pump**
- **Low-pressure blower**
- **Tubular ultrafiltration membranes**
- **Filtrate flow control and storage**
- **Backwash pumping system**
- **Chemical cleaning system**
- **Integrated controls system**

PARKSON CORPORATION

ISO 9001:2000 Certified
Quality Management System

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