

PRODUCT EMPHASIS

Membrane Bioreactors 101

The use of MBR technology in wastewater treatment facilities is on the rise

As a result of the U.S. Environmental Protection Agency's Clean Water Act, many of the nation's wastewater treatment facilities were upgraded in the late 1970s and early 1980s to meet secondary treatment standards. Today, in addition to replacing aging equipment, municipalities have to contend with population growth, stringent and changing regulations, tight capital improvement, operation and maintenance budgets and, finally, new technologies.

By Guillermo Garcia

One relatively new and evolving technology is the use of membranes in wastewater treatment applications. Research combining membranes and wastewater treatment started more than 35 years ago, with the first commercial applications appearing in the mid-1980s. In a conventional activated sludge process, the liquid-solid separation takes place in secondary sedimentation tanks, where the process depends on the settling characteristics of the activated sludge and sedimentation basin design. With membranes, the liquid-solid separation is a function of pore size. Currently, membranes can be categorized into four groups depending on pore size.

Combining microfiltration or ultrafiltration membranes with a biological process results in a membrane bioreactor (MBR). The other two types of membranes, nanofiltration and reverse osmosis, have been widely used in the water industry for many years and are now beginning to emerge as additional processes for removing dissolved salts from MBR effluents.

Information provided by four MBR membrane manufacturers shows a rapid increase in both the number of facilities using this technology and the size of facilities in which MBRs are being used. The capacity of older facilities is usually less than 2 million gal per day (mgd), increasing in capacity during the last five years to 6 mgd. This can be compared with other facilities either in construction or final design capable of treating up to 47 mgd. There is no doubt that MBR technology is here to

stay. The question is whether it is cost-effective for a particular facility.

The answer to that question should be based on economics and regulatory compliance. This is best illustrated by two HDR projects—one at an extended aeration plant and another at an activated sludge plant—where these factors were considered in developing the recommended plans.

The aeration plant

In 1999, HDR was retained by a southern California gaming facility to evaluate the operation of its extended aeration wastewater treatment plant, which was unable to meet strict effluent water quality standards mandated by the local regulatory agency. The facility, with a rated capacity of 150,000 gal per day (gpd) average flow, was unable to meet the required effluent quality when flows exceeded 70,000 gpd. The study concluded that the facility was unable to meet discharge requirements due to wide variations in flow rates and organic loading and the rapidly increasing flows generated by the gaming facility.

To improve treatment plant performance and capacity, HDR evaluated various treatment processes for the gaming facility's ability to handle wide variations in flow and organic loading; maximize use of existing facilities; maximize use of available land; design and construct under an accelerated schedule; and facilitate implementation of a future water recycling project.

Insurance You May Not Have Known You Needed

A number of home and business owners hit by the massive weekend storm in the Northeast are discovering yet another type of coverage they didn't know they needed – sewer-backup insurance.

As flood waters and runoff overwhelmed many sewer systems in New Jersey, New York, Massachusetts, Connecticut and elsewhere, sewage backed up in residents' bathrooms and basements. But some property owners there are learning that they aren't covered for backed-up sewage, just as many learned after 2005's Hurricane Katrina that they weren't covered by homeowner insurance for damage from flood waters.

It's a potential problem in many parts of the country, especially in areas vulnerable to heavy rainfalls and flash floods. Claims from backed-up sewage can run as high as \$10,000 to \$20,000 an incident, said Loretta Worters, a spokeswoman for the Insurance Information Institute, a trade group.

The problem is, most business and homeowner policies don't include coverage for sewer-backups unless purchasers pay for a special rider, which costs an extra \$40 to \$50 a year for \$5000 worth of coverage, added on to a typical homeowner policy. (Higher limits are available, and some high-end homeowner policies do include this coverage.)

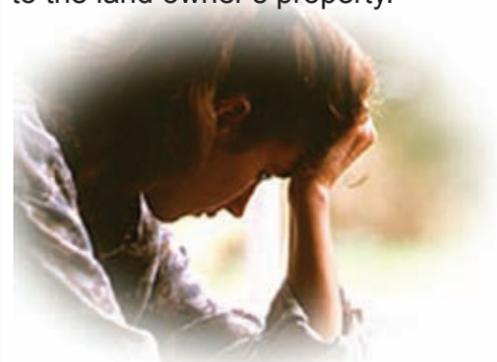
A National Flood Insurance Program spokesman says sales increased nearly 11 percent nationally in the 12 months through February, with 5.4 million policies in effect. (For more information, go to www.floodsmart.gov or call: (888)-379-9531.) More than 100 private insurers make flood insurance available through their agents.

As Printed in:
The Wall Street Journal & Hartford Courant:
By: M.P. McQueen



Proactive

Take a proactive approach by requiring a backflow prevention system to be installed into all newly constructed dwellings. By doing so your municipality and residents will have the ability to disconnect the sanitary sewer line from the dwelling for maintenance, and repair. Installation of a backflow prevention valve during construction will provide easy access for maintenance or cleanout, eliminating the need to remove fences, landscape, or potential damage to the land owner's property.



Buildings in low lying areas prone to high water levels should take this simple precaution to prevent sewage backflow, and costly cleanup procedures. Sewage backflow into a building can be catastrophic. Water is the single most long term destructive substance in the indoor environment.



Valves of this particular design are currently approved and mandated for all new constructions in many towns and municipalities throughout the United States solely for its ability to substantially reduce the amount of damage to a building during a flood. Housing developments, apartments, condominiums, and other establishments have also found valves of this type useful for the collection of delinquent sewage payments as this valve provides a means of disconnect outside the residence.

Sewer cleanout / Backflow prevention valves are easily installed and is far more affordable than any other method available today.



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Sewur Valve™ 4inch Series

Sewer Cleanout/Backflow Prevention Valve

The valve with plunger installed greatly reduces the risk of sewage backflow into your residence, and provides an easy access for emergency cleanout.

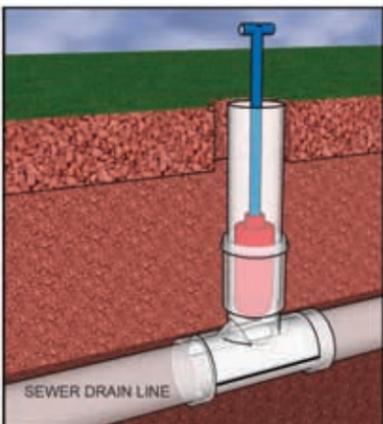
Place this valve inline with your sewer drain line, and place an access pipe to the top port of the valve. The access pipe will allow easy access to the valve's shut-off and clean-out features.

Installing this valve will provide the following benefits:

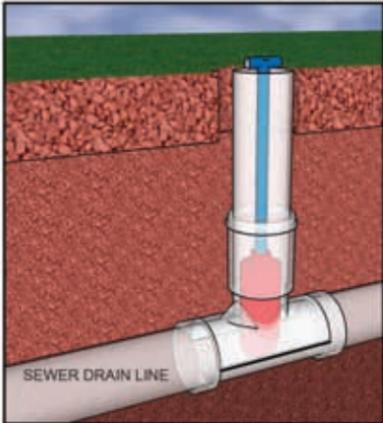
- Great reduction of the possibility of Raw Sewage Backup with the Plunger installed
- Easy access for sewer line cleaning
- Disconnection of the sewer line in low lying areas prone to flooding
- Municipality or water service provider can disconnect prior to repair or cleanout
- Disconnection of line for delinquent payment to service providers

Compatible with SDR and Schedule 40 Piping Systems

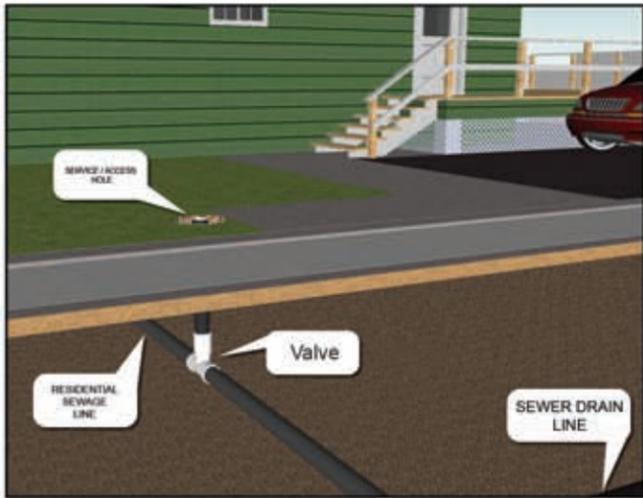
Plunger and Housing meet the same specifications and are interchangeable with other popular brands of this design



Valve shown in open position



Valve shown in closed position



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Fine Screen, Even Finer Discharged Screenings

The Finescreen Monster®, part of JWC Environmental's Monster Separation System®, captures and removes more unwanted solids from wastewater and provides higher open area to maximize hydraulic performance. A two stage cleaning process with modular brushing system and wash water jets ensures the screen stays free flowing and clear. Stainless steel perforated panels are available with 3 or 6mm openings.

Unwanted solids are lifted up and out of the wastewater channel and transported to the integrated Screenings Washer Monster® (SWM) which conditions the screenings through a unique six stage grinding, washing, screening and compacting process that removes nearly all fecal matter. The system produces remarkably clean and dewatered discharge that is easier to handle and less expensive to send to the landfill.

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Grit Removal Added to Monster Separation System

Grit Monster™ is now available with JWC's Monster Separation System® and incorporates a vortex swirl concentrator and the choice of an air-lift pump or specialized grit pump to remove fine particulate such as sand, gravel, coffee grounds and egg shells. Removing this material at the headworks helps protect downstream processes.

The slurry is transferred to a rugged grit classifier for cleaning and dewatering. Grit Monster uses a low-speed agitator with adjustable paddles to ensure consistent grit removal across a wide variety of flows, while also producing a clean and dry discharge ready for the landfill.

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NEW: Ask how MonsterCare™ can protect your grinders!

“WE BELIEVE, IN MONSTERS”



(left) Anthony DeCicco, Superintendent of the Hammonton WWTP, (right) Eric Dickson of Watermark Environmental Systems.

Problem: FOG clogging pumps
Solution: Finescreen Monster®

Monster Separation System® captures and cleans more unwanted solids.

Removing rags, plastics and grease helps the whole treatment process run better. Read more Monster success stories at: www.jwce.com/believe



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Channel Grinder with Screen

Accomplish more wastewater grinding using fewer cutters with the small and powerful Channel Monster model CMD1205. A screening drum allows higher flow rates while using 33% fewer cutters than a typical 18" (460mm) grinder. Fewer cutters results in significant savings over the life of the unit, and it shreds a wide variety of solids, including rags, rocks, leaves, plastics, trash and clothing. Fits in narrow 14" (350mm) wastewater channels.

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This Monster Loves Sludge

The high-efficiency Mini Monster® shreds rags and trash into particles on the inlet side of sludge pumps, spiral heat exchangers and centrifuges. Mini Monster powers tough solids better than macerators which simply drop material into a catch basin for operator removal. No catch basins here! Everything goes through the grinder for proper size reduction and homogenization. Lower power consumption and maintenance costs than macerators.

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Visit us at WEFTEC Booth #2137

NEW: Ask how MonsterCare™ can protect your grinders!

“WE BELIEVE, IN MONSTERS”



(l-r) Tommy Lawson of Heyward Incorporated; John Cook, Operator and David Hancock, Superintendent of the Manchester Creek WWTP

Problem: Clogged sludge pumps
Solution: Muffin Monsters®

Muffin Monster is the sludge grinder you can depend on to last longer. Rags, rocks, plastics, wood and trash are obliterated so sludge pumps run trouble free. Read more Muffin Monster success stories at: www.jwce.com/believe



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New MonsterCare Service Contracts

Maintaining and operating the industry-leading Muffin Monster® sewage grinder will get easier and more efficient thanks to the new MonsterCare service program. MonsterCare offers an affordable arrangement for municipal customers to ensure Muffin Monsters operate at the highest level of efficiency for the longest period of time at a fixed price. It also eliminates unplanned emergency spending.

MonsterCare provides coverage for cutters, reducers, shafts, bearings, seals and many other components inside the grinder, and even includes coverage for standard shipping. When the time comes, grinders are rebuilt by factory professionals at the nearest JWC facility, and are repaired using genuine Monster parts. For information please contact one of our Aftermarket Sales Managers:

- Western region: Pete Garcia, 949-498-2315
- Midwest region: John Grucella, 330-940-3733
- Southeast region: Matt Cluin, 512-990-4831
- Northeast region: Marc Beaudry, 413-269-7498

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Bigger is Better for Extreme Duty Pump Stations

The next generation of wastewater grinders is here with the Channel Monster XD - a bigger, stronger and smarter grinder for high-flow pump stations. The system combines rotating screening drums and a powerful grinder to shred solids and accommodate high flow rates. This helps protect pumps from clogging and eliminates the need to handle wet, smelly screenings inside the pump station.

A more robust design is used on grinders over 32" (812mm) and features a 40000 Macho Monster grinder, with larger 2½" (64mm) hex drive shafts and 7½" (190mm) diameter cutters. The coil screening drums also increase to a ½" (12mm) diameter stainless steel rod. An optional multi-drive option (shown above) provides automatic reversal and allows cutters to clear independently of drum rotation.

Get an up-close view of the larger Channel Monster XD at the WEFTEC show in San Diego, booth 2137.

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New Auger Monster XE Features Tilt and Swivel

The new Auger Monster XE fine screen system features an exclusive pivot design which allows the screening trough to easily pivot and swivel out of the channel for inspection. Additional enhancements include: increased removal efficiency with a 35° inclined auger; dual ultrasonic level detectors run the system only when needed to save electricity; a "fail-safe" mode ensures continuous operation - even when the electronics are disabled; and all frames and covers are made from polished, passivated stainless steel. The Auger Monster is unique because it combines several headworks functions - screen, washer, conveyor and compactor - into one compact footprint. See the upgraded Auger Monster XE at this year's WEFTEC show in San Diego - booth 2137.

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The various treatment alternatives included a parallel extended aeration train, a new conventional activated sludge plant, a sequential batch reactor using existing tanks and an MBR that would also use existing tanks.

The engineering evaluation concluded that the best treatment process for meeting the client's objectives was the MBR process. However, additional work was required to assure the client and consulting engineers that this relatively new process was going to be a success. To this end, the team visited MBR facilities outside the U.S., reviewed operation and maintenance data and interviewed treatment plant operators. The consensus was to use the MBR process, provided that the project specifications included equipment performance bonds, extended performance guarantees and extended membrane guarantees.

The completed project included the following results: The membrane and associated equipment is modular, which facilitated subsequent treatment plant expansions. The facility is now rated for 300,000 gpd average flow. The rated treatment capacity was achieved using the same tanks as the original extended aeration plant.

The process is producing effluent with turbidities about one-tenth the limit set by California's Administrative Code Title 22 standards for recycled water. This is accomplished without secondary sedimentation, flocculation, coagulation and filtration.

The process can handle large fluctuations in organic loads. Sludge production is lower than extended aeration activated sludge. The membranes remove a significant portion of total coliform bacteria, significantly reducing the chlorine demand in the disinfection process.

Activated sludge plant

Early this year, HDR was retained by a southern California agency responsible for wastewater treatment and disposal facilities that serve a community of 30,000 people. The existing facility, rated for an average flow of 4.5 mgd, is a conventional activated sludge plant using irrigation fields and percolation ponds for effluent disposal. Until recently, the solids generated by the treatment process were aerobically digested and land-applied to the irrigation fields. This practice contributed to high nitrogen concentrations found in the groundwater basin underlying the treatment plant site. Recently, the regulatory agency issued a cease-and-desist order prohibiting onsite solids disposal. The agency also anticipated that the revised waste discharge permit would limit total nitrogen effluent concentrations to 5 milligrams per liter (mg/L) or less.

Preliminary work indicated that the treatment capacities of the existing facilities would be lowered from 4.5 to 3.4 mgd once the activated sludge process was modified to operate in the nitrification-denitrification mode. It also suggested that additional facilities would be required to bring the treatment plant capacity back to 4.5 mgd and reduce the total nitrogen concentration to 5 mg/L or less. MBR is one of the technologies being evaluated to identify the recommended project. Conventional treatment process modifications required to maintain treatment capacity and meet the anticipated total nitrogen limit may require additional primary aeration and secondary sedimentation tanks, plus filters to remove organic nitrogen.

However, the MBR alternative being evaluated would not require additional tanks and would allow the existing shallow rectangular secondary sedimentation tanks to be converted into a chlorine contact tank. The basis of the recommended project would be the results of an economic analysis comparing MBR and nitrification-denitrification followed by filtration. Other factors of the evaluation include anticipated wastewater treatment plant expansions to meet projected population growth and the desire to recycle plant effluent for landscape irrigation.

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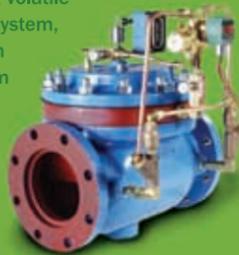


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Why MBR?

For the most part, municipalities that need to increase treatment capacity, improve effluent quality or consider a water recycling program will be confronted with challenges similar to those illustrated by the above examples. The following facts about MBR can help municipalities make an informed decision.

MBR technology continues to evolve at a rapid pace. Now that MBR operating and maintenance data are available, municipalities and the engineering community are no longer concerned about being the first ones to try something new.

MBR can be economical when high quality effluent is required. The process achieves a superior effluent quality with fewer treatment processes. In water reclamation, secondary sedimentation tanks are eliminated, and there is no need for coagulation, flocculation and filtration. The cost for disinfection is reduced because membranes remove pathogens at higher levels than other treatment technologies.

MBR eliminates the need for several treatment processes, thereby requiring less space than other treatment technologies to produce superior effluent quality.

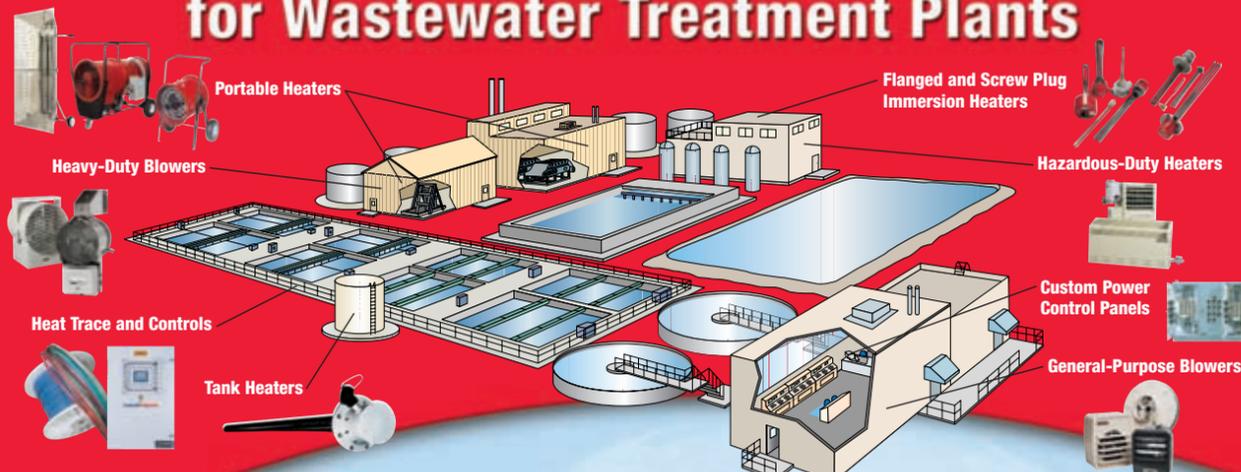
Adding membrane modules can easily expand a well-planned facility that uses MBR. MBR generates fewer solids than conventional processes to produce a higher quality effluent. It is also forgiving and thus requires less operator interaction. The MBR process is well suited for retrofits where existing tanks can be modified to fit the process.

The seven commercially available MBR systems use different membrane pore sizes, methods to clean the membrane, methods to withdraw permeate, hydraulic loading per square ft of membrane surface area and membrane configuration. This represents an additional challenge with the equipment procurement process and the detailed design. The most frequent approach is to preselect a membrane equipment supplier before embarking on the detail design. **WWD**

Guillermo Garcia is senior project manager for HDR, Inc. He can be reached at 949/454-4800 or by e-mail at guillermo.garcia@hdrinc.com.

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