
APPENDIX C.3
MBR PRELIMINARY PROPOSAL



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MBR Preliminary Proposal

Village of Taos Ski Valley MBR, NM

October 28th, 2015

Ovivo Proposal #100215-1-AK-R1

Prepared For

FEI Engineers

Kee Venkatapathi, CWP

5325 S Valentia Way

Greenwood Village, CO 80111

Phone (303) 300-3464

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FEI Engineers
5325 S Valentia Way
Greenwood Village, CO 80111
Phone (303) 300-3464

RE: Village of Taos Ski Valley, NM– Preliminary Proposal #100215-1-AK-R1, Membrane Bioreactor System

Mr. Venkatapathi:

Thank you very much for your interest in the Ovivo Membrane Bioreactor (MBR) system and for giving us the opportunity to propose our system. We are providing the revised proposal based on the revised design criteria and your suggestions as of 10/13/2015

For over 15 years, Ovivo has been supplying our MBR technology offering simple membrane equipment packages to meet project specification or complete solutions to wastewater treatment problems. Ovivo's multidisciplinary staff brings more true MBR system experience than any other company. Our MBR systems include multiple, proven technologies allowing flexible, adaptable operation. This adaptability to operate over a range of different conditions improves overall system performance compared to conventional treatment processes and MBRs with hollow-fiber membranes. At Ovivo, our goal is to provide customers with comprehensive system solutions to their wastewater problems.

With this proposal, we have included Design summary, Biowin modeling reports, Scope of supply, Preliminary Layout, Operation and Maintenance estimates and Screening requirements. Please let us know if you need any more information to help you with your analysis.

Main advantages of proposed MBR design for Village of Taos Ski Valley:

Minimal construction requirement

All process basins will be retrofitted in existing structures. The pre-anoxic basin could be retrofitted in the existing rectangular EQ/AX basin by partitioning the basin. The required Pre-aeration volume can be retrofitted partly in EQ/AX basin and partly in Aeration basin and would work in series. The Post Anoxic basin would be retrofitted in aeration basin as well by partitioning the basin. The membranes can be retrofitted in the two existing clarifiers. This design would lead to low construction cost and speedier total project execution schedule.

Ability of the proposed MBR system to handle the 0.44MGD Peak

The proposed design can handle the peak of 0.44MGD both hydraulically and biologically and meet the treatment limits specified in the attached Design Summary. The membranes can handle 2Q or 0.62MGD peak hydraulically. The equipment and process basins are sized to handle 0.44MGD max

Flexibility to handle startup flows

OVIVO MBR presents unique ability to handle start up flows and loads because the plant can be run at low MLSS of about 5,000mg/l. With ability to bypass certain process basins at startup, the system can meet the required limits. Biowin report for startup condition is attached for review

Solids handling

Sludge will be periodically wasted from the MBR basins where the mixed liquor concentration is the highest (10,000mg/l-12,000mg/l). This results in reduced sludge volume in comparison with other technologies and hence reduced solids processing requirement.

Intermittent treatment during construction

OVIVO's deployable MBR system- microBLOX is available for rental for treating the incoming flow during construction. Based on the startup conditions provided on 10/23/2015, we would require Two (2) microBLOX units of size 8.5'W x 45'L x 12'H. These are permit compliant units that would be provided complete with screens to permeate pumps (and UV disinfection if required) and meet the startup treatment limits. They would need a 6" equipment pad for installation.

Evaluation of MBR technology

MBR technology has both cost based and non-cost based advantages over conventional technologies. While comparing costs, the total installed costs need to be taken into account. **Conventional technologies would require clarifier, tertiary treatment and higher disinfection capacity to achieve good effluent quality.**

1. **Modular expansion capability:** MBR systems are normally designed and built in modular formats. Existing MBR systems can be extended by adding further modules
2. **Smallest footprint:** Decoupling of HRT and SRT and running at high MLSS allows MBR to accomplish treatment in a small footprint
3. **Consistent and high quality effluent:** Value of MBR process is not only in high quality but more so in consistency of it independent of shock loads and flows.
4. **No tertiary treatment equipment:** MBR does not need any tertiary treatment to achieve the required effluent quality.
5. **Reduced Disinfection:** Membranes being ultrafiltration, create a physical barrier for microorganisms (pathogens, bacteria and viruses) to permeate. The effluent is nearly "disinfected" quality. This means reduced disinfection requirements saving equipment , O&M and energy costs
6. **Consistent effluent quality:** Operation at higher MLSS concentration results in more consistent performance with concentrated active biomass. The typical MLSS in MBR basins are 8,000 – 12,000 mg/l, compared to 3,000 – 7,000mg/L for CAS systems. This can reduce the HRT significantly. The elevated biomass concentration allows for very effective removal of both soluble and particulate biodegradable materials at higher loading rates. It also tolerates for wider changes in hydraulic loading without going into shock. Furthermore, increased SRT, usually exceeding 10 days, ensures complete nitrification, an important consideration in securing consistent effluent quality.
7. **Reduced operations costs:** MBR systems operation needs no permanent operator attendance, no operating chemicals, long sludge discharge intervals, little processing sequences and consistent effluent quality, will guarantee the minimum operating cost. To operate and maintain MBR minimal daily and weekly operator tasks are required. It can be remote operated. MBR technology is nearly "Plug & Forget" system.
8. **Lower waste sludge production:** The ability of MBR hold higher concentrations of MLSS, and having much longer SRT than in CAS, allowed the MBR system to produce less waste sludge compared to CAS systems and consequently needs less sludge disposal frequency

9. Less sludge dewatering: MBR systems are designed to work with higher MLSS concentration and less frequent SRT (compared to CAS systems), resulting in low frequency sludge dewatering. Sludge dewatering takes place directly from the MBR basin tank-no need for process-clarifier/sludge holding tank.
10. Ease of operation and less operator attention: In CAS systems, there are many factors that sludge settling characteristics can change from one day to another. This requires time spent in lab analysis of several sludge samples. Subsequent adjustments to the plant (i.e. adjusting process cycles of CAS) might be needed, to maintain good settling characteristics. MBR process is not dependent on sludge settleability and can be remote monitored.

Equipment and service Price

The preliminary pricing for the proposed attached scope of supply is approximately _____. This includes field service and freight. The cost of microBLOX rental would be _____ and does not include freight.

This Preliminary Proposal constitutes a non-binding estimate of price for certain goods and/or services. We look forward to working with you on this project. Please do not hesitate to contact me or our local representative, Steve Hansen of AmbienteH2O at 303-433-0364, shansen@ambienteh2o.com, if you have any questions.

Ashwini Khare

Regional Manager, MBR Systems
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Enclosure

Cc: Steve Hansen, AmbienteH2O

Membrane Technology Experience

As an MBR system supplier, Ovivo has multiple membrane technologies available. Ovivo's approach is to utilize the membrane technology that can provide the best value to each project. For the Whitefish MT project, Ovivo's proposal includes OV-416 membrane units which utilize Microdyn-Nadir membrane technology. The OV416 Membrane Unit is simply an upgraded version of the BIO-CEL Module (made by Microdyn-Nadir) using PES Nadir[®] UP150 membranes (also made by Microdyn-Nadir). Microdyn-Nadir is a premier membrane manufacturer that has an exclusive long-term commitment with Ovivo. Ovivo's membrane units OV100, 200, 300, 416, 460, and 1900 all use the same membrane, the UP-150, which has been produced by Microdyn-Nadir since 1991, and it is Title 22 approved.



OV400 Membrane Technology

Ovivo's decision to develop OV technology using Microdyn-Nadir membrane sheets was both data driven and based on experiential factors. For example, we know that; screen by-pass (damaging debris) is responsible for 76% plate failures. We also know the plant design and site conditions can lead diffuser clogging and or localized dewatering. Once diffusers are clogged, or dewatered solids collect in the channels between the plates, air scouring is selectively pushed to specific areas. Sustained higher air scouring in some areas can lead to excessive aeration, also called over aeration. Dewatering and over-aeration are the second leading causes of reduced capacity and have caused 21% of the plate damage identified in a recent survey of 185 facilities. In fact, over-aeration will soon take the number one spot as the primary cause of membrane failure/replacement. For these reasons and others, Ovivo engineers set out to design a membrane unit that uses non-clogging diffusers and is:

LEADING CAUSES

MEMBRANE DAMAGE

REDUCED CAPACITY

74%
FINE
SCREENING

#1
PLANT
DESIGN

21%
SITE
CONDITIONS

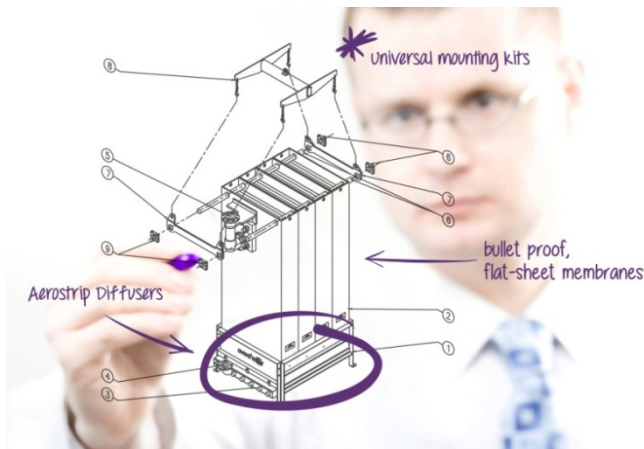
#2
SITE
CONDITIONS

1. Resistant to debris damage
2. Easy to recover from dewatering
3. Easily installed in any size, shape tank
4. Easily retrieved

To accomplish these performance goals, Ovivo chose the Microdyn BIO-CEL technology using UP150 membranes as the basis for the OV416.

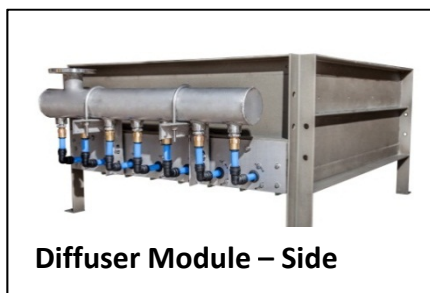
The UP150 membrane that is used in the OV416 has been **in production since 1991** and is **installed in 1,000s of locations** worldwide through a network of partners. The BIO-CEL Membrane Module was introduced to the market in 2005 and since then approximately 1,700 modules and approximately **1,200,000 m² of membrane area have been installed worldwide**. Applications range from municipal to food production plants to electronics, from tuna processing in Mexico to Dairies in South Africa and the United Kingdom.

Ovivo improved on the BIO-CEL design by replacing the OTT tube-style diffuser with **Aerostrips (1,500 installations)**. Since becoming the licensee in 2013, there are already **31 U.S. MBR projects**, multiple Membrane Thickening Projects (MBTs) and 7 KUBOTA replacement projects underway.



Some of the key U.S. projects underway include a 4 MGD job in KY, a 2.5 MGD job in FL (expandable to 5.0 MGD), a 1.0 MGD (expandable to 2.0 MGD). The OV is selected for all of the jobs and dozens of others. 5 plants are operating now and 7 should be online before the end of April. For comparison, the SP technology Ovivo use to integrate the Canton project (world's largest MBR) is installed in U.S. plants. The quick acceptance of the technology was due in large part to the intuitive advantages of the non-clogging diffuser and the pliability of the flat-sheets (versus rigid plates).

Diffuser clogging is virtually eliminated using Aerostrip Diffusers as is the potential for membrane dewatering. At the moment, if localized dewatering occurs, the plates must be manually (physically) cleaned.



Diffuser Module – Side



Diffuser Module – Top View



Diffuser

In the event a system upset, the OV unit can be serviced quickly. The main reason for this is the flexibility of the pliable flat sheets. If dewatering occurs the solids simply fall out once lifted and or aerated. Another advantage of the fused, 2 mm, pliable sheets, instead of the 6mm, rigid plates (or fibers for that matter) is the resistance to debris damage. Damaged sheets heal within about 4 minutes even from severe damage such as cuts, tears or abrasions. This sheet maximizes self-healing and is truly **BulletProof**.



For these reasons, the OV416 membrane has longer life compared to other manufacturers and so we can offer upto **10-yr non-prorated membrane warranty if required at an additional cost**. For Life Cycle Cost Analysis, the membrane replacement should be based on the membrane warranty offered by the supplier. For Ovivo MBR systems, with 10 yr warranty there is only one membrane replacement in a 20 yr period.

The manufacturing process of OV-416 is sophisticated and efficient. Its fully automated and goes through the following steps:

- Casting of polyethersulfone (PES) on non-woven polyester sheet
- Drying process
- Coated sheets along with polyester spacer layer and adhesion layers are ultrasonically welded
- Measuring, cutting of membrane sheet
- Placement of attachments, grommets and connections
- Assembly of membrane cassette

The membranes are currently manufactured in Germany and the diffusers assembled in Austin. The current lead time is 8-10 weeks for membrane units, however we always have spare in our stock which can be shipped immediately if required. It is anticipated that membrane manufacturing would begin in US in the next couple of years at which point the lead time will be reduced to 4-6 weeks.



To summarize, market feedback and field observations suggested that ideal membrane unit should have the following features and we were to achieve all these through the OV416 membrane unit:

1. Easily fit into any geometry tank for retrofit projects (square, circular, shallow or deep)
2. Use **UF** membranes as another barrier for (direct potable) reuse or RO feed
3. Be less susceptible to poor screening and debris
4. Allow for overaeration
5. Have non-clogging diffusers
6. Minimize dewatering potential
7. Have a higher packing density
8. Meet **Buy America**

As System Supplier, Ovivo is focussed on all the system components and how well they work with each other to provide a user-friendly and efficient system for the end user. Membrane is just one part of the equation; system efficiency, ease of operation and maintenance should all be considered.

Screening requirements vary widely between different MBR manufacturers. It is dictated by variety of reasons like spacing between individual membrane sheets/plates or fibers, susceptibility to clogging due to presence of fiber in influent.

Ovivo recommends a **3 mm perforated** plate fine screen and **no RAS screening** for our Ovivo membrane unit. These simple screening requirements result in lower capital and O&M costs, as well as less plant complexity, and should be taken into account when evaluating different MBR technologies.

Coarse Screening

Coarse screens are required if the fine screens have 2mm apertures or smaller in order to protect the screen. They should be considered in front of 3mm bar screens if the influent is a combined sewer that flows by gravity to the MBR (not pumped)

Grit Removal

Many Ovivo MBR Systems are installed without grit removal. In most cases, the drivers for including grit removal is either protection of fine screens, especially for fine screen apertures less than 3mm, or for reducing the overall risk of damaging membranes, especially in larger systems. In general, grit concentration in the raw influent flow should be less than 5 mg/l.

Fine Screening

All Ovivo MBR Systems are required to have fine screens. Ovivo MBR System warranty requires that influent be pre-screened. Screening requirements are as follows:

1. 3.0 mm (3.2 mm acceptable) aperture size or less for perforated plate type screens
2. 1.0 mm slot size for bar type screens

In addition to the above requirements, it is recommended that the Coarse Suspended Solids (CSS) concentrations should be maintained at < 200 mg/l. No warranty limit is imposed on it my Ovivo.

It is up to the screen supplier to guaranty screen performance. Moreover, membrane damage caused by screenings is not covered under warranty unless the screen is furnished by Ovivo as part of the MBR System.

FOG Removal

Generally we recommend FOG be no more than 20% of BOD5, by weight, for municipal applications.

GE Power & Water
Water & Process Technologies



Taking ZeeWeed* MBR technology to the next level



GE imagination at work

Addressing Our Customer's Challenges

GE has always strived to help our customers create sustainable water supplies to alleviate scarcity issues, provide cleaner water bodies, meet the needs of growing populations and industries, and meet or exceed the world's highest standards for water reuse. As the global membrane bioreactor leader, with over 5,000,000 m³/d (1.32 BGD) of ZeeWeed MBR capacity, our MBR systems have continued to combine proven ultrafiltration technology with biological treatment for municipal, commercial and industrial wastewater treatment and water reuse applications.

With over 25 years of proven MBR experience, GE continues to set the industry standards for research & development, membrane manufacturing, system design and customer support. When our customers challenged us to find a solution to their biggest challenges: productivity, footprint, operation simplicity and energy costs, we answered. Building on two decades of ZeeWeed MBR product innovation, GE now introduces the new LEAPmbr to address our customers key wastewater treatment challenges and provide the low energy and advanced performance solution demanded by the global wastewater treatment and reuse market.

At GE we manufacture our membranes utilizing the most advanced mass production methods, while delivering the most reliable MBR membrane product in the world, living up to our reputation as quality leaders. With LEAPmbr, we continue this tradition with the release of our most robust, highest performing ZeeWeed 500 series product to date, delivering the lowest installed and operating costs in the history of our ZeeWeed products.

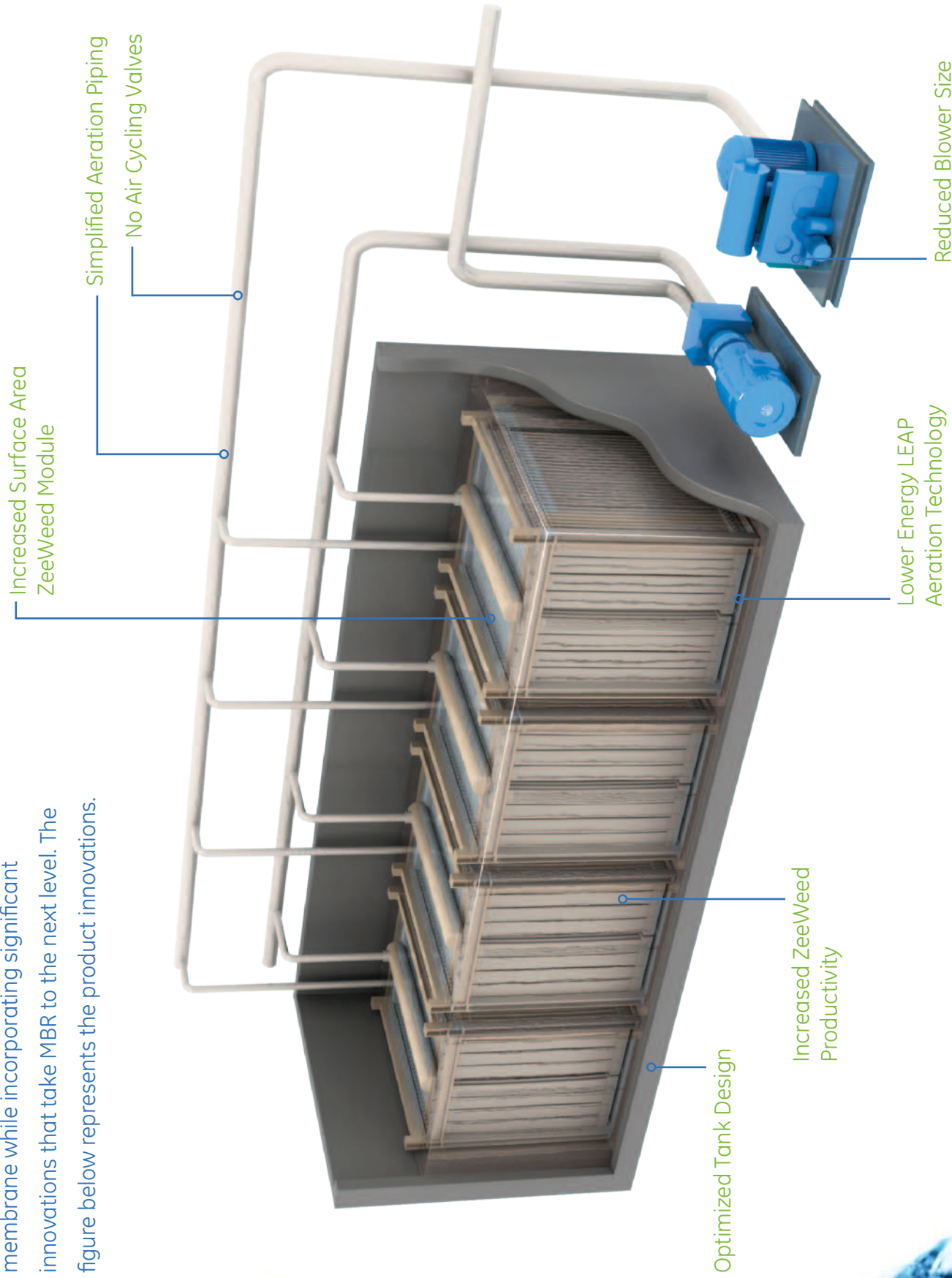
The design of an MBR plant is a balance between flexibility and simplicity, both in design and operation. GE's approach is to incorporate maximum flexibility into our plant designs to give operators a complete toolbox to manage all events; GE achieves this by providing automation that simplifies operator touch. With the new LEAPmbr, we have achieved a new level of simplicity, while not compromising on flexibility.

What is LEAPmbr?

Our new level of Zeeweed MBR technology was developed to address our customers' challenges of productivity, footprint, simplicity and energy savings. LEAPmbr builds on our 25 years of MBR experience to deliver the most advanced Zeeweed MBR solution to date. At its core, LEAPmbr uses the industry's most trusted leading ZeeWeed membrane while incorporating significant innovations that take MBR to the next level. The figure below represents the product innovations.

LEAPmbr

simple • reliable • efficient



Increased Productivity

Boost your productivity 15% with our latest ZeeWeed membrane.



Smaller Footprint

Save on construction costs with a flexible design that reduces your MBR footprint by 20%.



Simplified Design

Simplify your design by reducing membrane aeration equipment and controls by 50%.



Energy Savings

Reduce your operating costs with a 30% energy savings.



Guaranteed Reliability

Have the confidence of the strongest, most reliable membrane in the industry.



Case Studies

Marco Island Florida, USA

During the winter months, the population of Marco Island, Florida can double due to tourism, which places an increased demand on the wastewater treatment facility. In 2007, the existing conventional treatment facility was expanded to a membrane bioreactor (MBR) since it required an increased treatment capacity but lacked space to expand plant footprint.

The effluent produced at Marco Island exceeds the discharge requirement and provides high-quality reuse water which is a continuous and reliable supply of irrigation water for golf courses and residential properties.

Marco Island was selected for testing of the LEAPmbr technology beginning in May 2010. Process testing was done compared to previous aeration and performance standards. The results of over a year of testing have demonstrated significant energy savings and productivity improvements.



Facility in Southern Ontario, Canada

The population of Southern Ontario continues to steadily grow, and several membrane bioreactors facilities with GE ZeeWeed membranes have been installed to treat the increased capacity demand and address tighter regulatory requirements. An existing MBR facility in Southern Ontario utilizing ZW500d membrane modules was retrofitted with LEAPmbr technology in early 2011.

Process testing was done to verify product performance at various operating conditions.

Test results showed considerable increased system performance at reduced aeration flow rates compared to previous aeration methods. Not only that, but LEAPmbr also eliminated foaming issues that had previously existed at the wastewater facility.

Increased performance, lower energy levels and simplified operation were successfully demonstrated for LEAPmbr in this full scale application.



Contact our team of global experts for more information or a plant specific presentation.

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www.ge-energy.com/LEAPmbr

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GEA19111 (07/2011)



GE imagination at work

APPENDIX C.4
FINE SCREEN

Lakeside's *RAPTOR*® Micro Strainer

**Ideal for small
treatment plants**



- Removes solids that pass through other screens
- Single operational unit screens, compacts and dewateres
- Minimizes maintenance costs

Innovative Screening Solutions

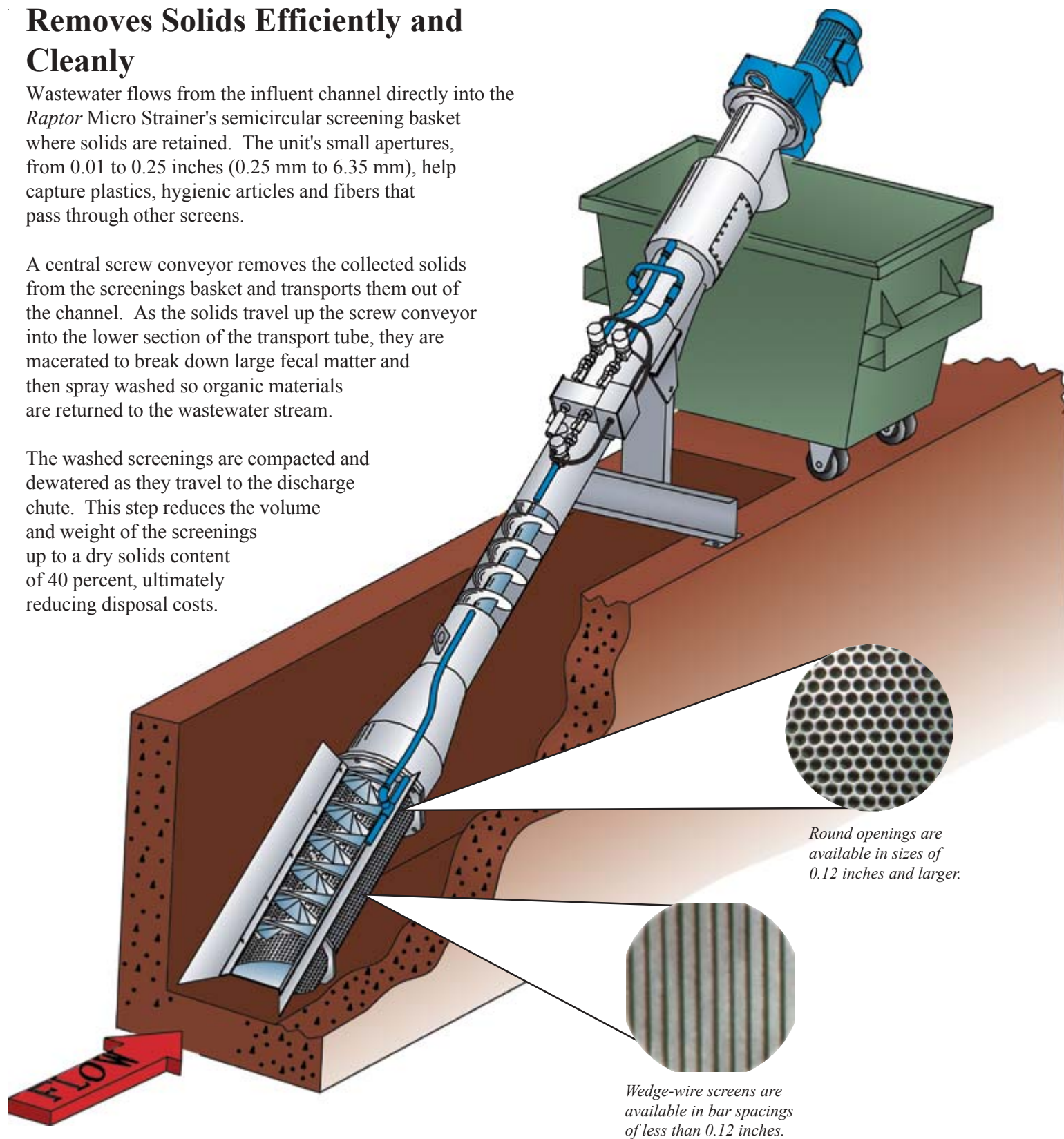
The Lakeside *Raptor* Micro Strainer meets and exceeds the expectations of operators worldwide by providing innovative screening solutions. Not only does the *Raptor* Micro Strainer remove solids from narrow channel installations but it also washes and dewateres the captured screenings. The *Raptor* Micro Strainer features simple design and operation and high removal efficiency with low disposal costs.

Removes Solids Efficiently and Cleanly

Wastewater flows from the influent channel directly into the *Raptor* Micro Strainer's semicircular screening basket where solids are retained. The unit's small apertures, from 0.01 to 0.25 inches (0.25 mm to 6.35 mm), help capture plastics, hygienic articles and fibers that pass through other screens.

A central screw conveyor removes the collected solids from the screenings basket and transports them out of the channel. As the solids travel up the screw conveyor into the lower section of the transport tube, they are macerated to break down large fecal matter and then spray washed so organic materials are returned to the wastewater stream.

The washed screenings are compacted and dewatered as they travel to the discharge chute. This step reduces the volume and weight of the screenings up to a dry solids content of 40 percent, ultimately reducing disposal costs.



Design Features

Superior Design and Construction

- All stainless steel construction for superior corrosion resistance.
- The simple mechanical design requires very little maintenance which is ideal for small plants.
- A hinged structural support permits the unit to pivot out of the channel so all maintenance can be done above floor level.
- An uncomplicated drive assembly makes the unit easier to service and reduces maintenance costs.
- The unit is shipped fully assembled to minimize installation expenses.
- Lower polymer bearing blocks promote longer brush life and can be replaced without disassembling the screen.
- Thicker materials than competing units (0.25 in. thick outer tube and 0.12 in. thick basket) provide longer life.
- All mating parts are machined to ensure proper rotation.



The Raptor Micro Strainer's enclosed drive assembly reduces maintenance expenses.



The stainless steel, shaftless screw conveyor improves screening performance.



Exceptional Efficiency and Handling

- The unique screening basket and 35° to 45° angle of inclination provide high removal efficiency.
- A two-stage screenings wash water system aids in returning organic material to the wastewater stream.
- An integrated screening press reduces the volume and weight of screenings for lower disposal costs and cleaner operation.
- An enclosed transport tube and optional bagging attachment reduce odors and offer a clean working environment to the operator.
- An optional insulation and heating system permits operation in cold climates.

Additional *Raptor* Micro Strainer Features

Control Panel

Lakeside control panels are PLC equipped for versatile and efficient operation. Explosion-proof designs are available.



Operation is completely automatic.

Factory Pre-Wired

Factory pre-wired solenoid valves save installation costs.



Optional Bagging Attachment

The optional continuous bagging attachment provides a clean work area.



Optional Weather Protection System

Available for all sizes of screens and transport tubes, the Lakeside weather protection system protects to 13° below zero (minus 25° C).



Constructed of fiberglass reinforced polyester laminate.

Lakeside *Raptor* Screening Products

Fine Screen - Unique 3-plane screen design provides greater screenings removal efficiency without blinding.

Complete Plant - Screens inorganics and removes grit in one self-contained unit.

Rotating Drum Screen - With bar spacings as narrow as 0.01 inches, screens the finest solids.

Septage Acceptance Plant - Removes inorganic solids from municipal, industrial and septic tank sludge.

Wash Press - Lowers disposal costs by reducing the volume and weight of screenings.

Other Lakeside Screening Products

CSO Screens

Stormwater Screens

Water Intake Screens

Hydronic T telescoping rake bar screen cleaner



LAKESIDE
Water Purification Since 1928

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Bartlett, IL 60103
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E-mail: sales@lakeside-equipment.com

11/4/2015

LAKESIDE EQUIPMENT CORPORATION
PO Box 8448 Bartlett, IL 60103-8448

LAKESIDE MICRO STRAINER

Maximum Water Level= 19.88 in.

LEC: 1.4

JOB: Taos Ski Valley, New Mexico

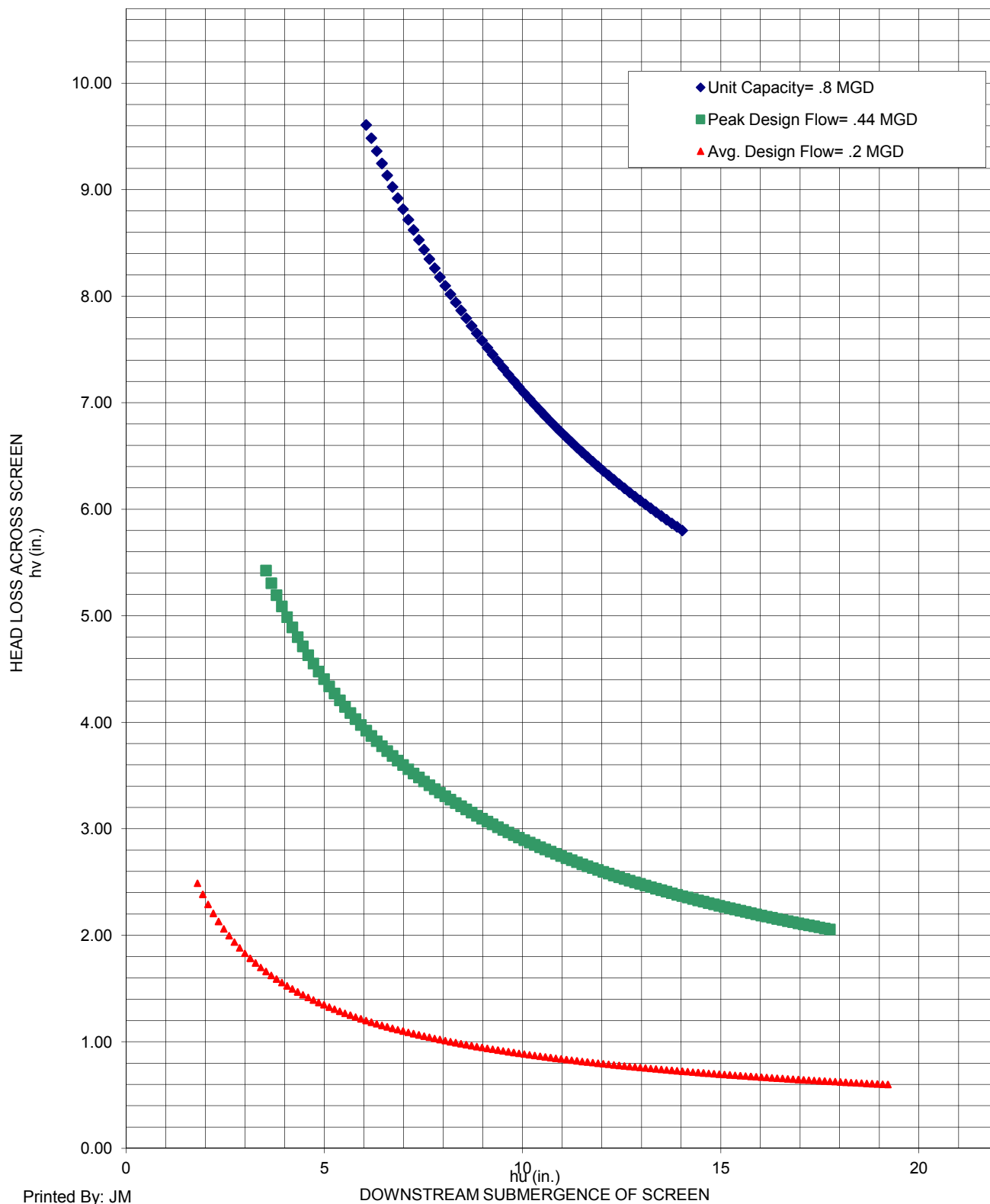
(Hu + Hv)

Diameter: 12"

ENG: TEC

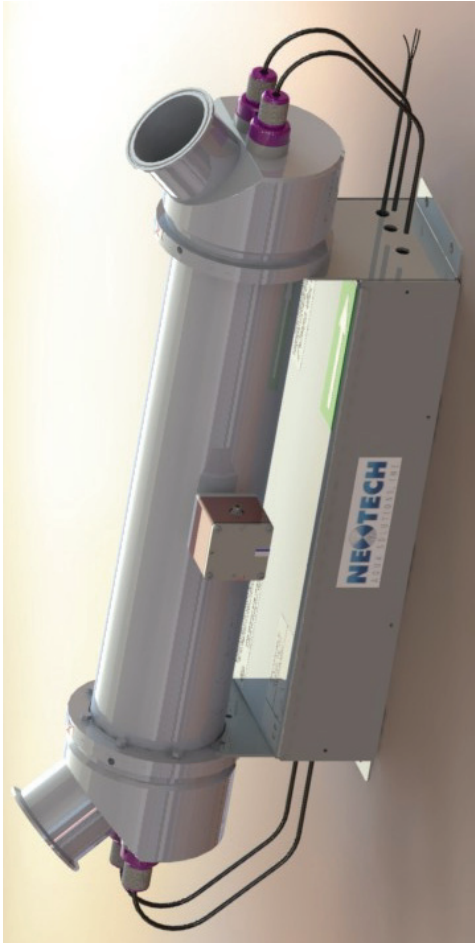
Model: 12MS-0.125

: 1/8"



Printed By: JM

NeoTech D428™



PRODUCT BENEFITS

- Dual lamp efficiency processes up to 300 gallons per minute
- 75% smaller footprint compared to standard UV systems
- May be mounted vertically or horizontally
- Up to four units may be controlled with a single micro-control box
- Built for 120V or 230V single phase power providing maximum flexibility
- No flow, no problem – guaranteed 60 minutes
- Water contact finish – Ra-15
- Controller- Remote
- Alarms, Remote Control, 4-20 mA output
- Real time dosimetry, 100% dosage assurance – with constant flow
- UV monitor is NIST traceable
- Sanitization in place – hot water or steam
- No-tool lamp change
- NSF Standard 50 certified
- Warranty one year parts and labor

SPECIFICATIONS

Flow Rate - gpm (m³/hr.) - 99% UVT @ 40mJ/cm²^A	300 (68)
Flow Rate - gpm (m³/hr.) - 99% UVT @ 30mJ/cm²^A	300 (68)
Flow Rate - gpm (m³/hr.) - 95% UVT @ 40mJ/cm²^A	226 (51.3)
Flow Rate - gpm (m³/hr.) - 95% UVT @ 30mJ/cm²^A	300 (68)
Number of High Output Amalgam Lamps	2
*Lamp Life - Hours	9000
Operating Power - watts	235
Operating Pressure - psi (bar)	150 (13)
Operating Temperature - °F (°C)	36 - 104 (2 - 40)
Pressure Drop at rated flow - psi (bar)	2.8 (0.24)
Dry Weight - pounds (kg)	54.8 (24.9)
Dimensions (L x H x D) - inches	30.6 x 7.9 x 11.4
Dimensions (L x H x D) - millimeters	776 x 201 x 290
*Sanitary Fittings - Standard	3 in.

^ At rated pressure drop.

* Lamp life is based on a maximum of one on-off cycle per day and room temperature water.

+ All units come standard with sanitary tri-clamp fittings for improved reliability, sanitation, and ease of installation. Alternative connections are available upon request.

The NeoTech D428™ is specially designed to disinfect water and is an essential component in advanced oxidation processes.

This high-efficiency UV system utilizes NeoTech Aqua's patented ReFlex™ chamber technology, reflecting over 99% of the 254nm UV generated. It is the highest efficiency, smallest footprint, and lowest operating cost UV system in the water treatment industry.

With only two twenty-eight inch lamps, the D428™ provides users the most convenient and lowest cost service schedule of any low pressure or medium pressure UV system today.

MAXIMUM UV PENETRATION

The NeoTech D428™ provides users an unparalleled level of engineering sophistication by maximizing UV distribution in a patented 99% reflective chamber. This unique technical advantage also reduces the number of lamps and power requirements by up to 90% compared to standard UV systems.

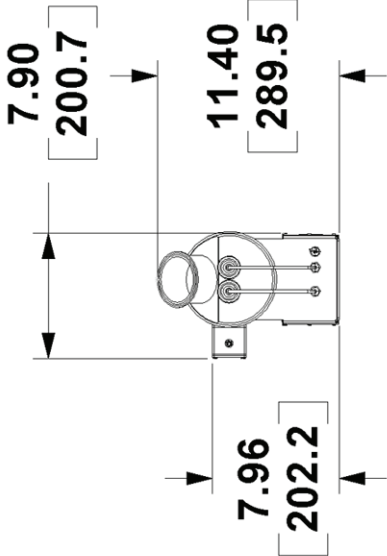
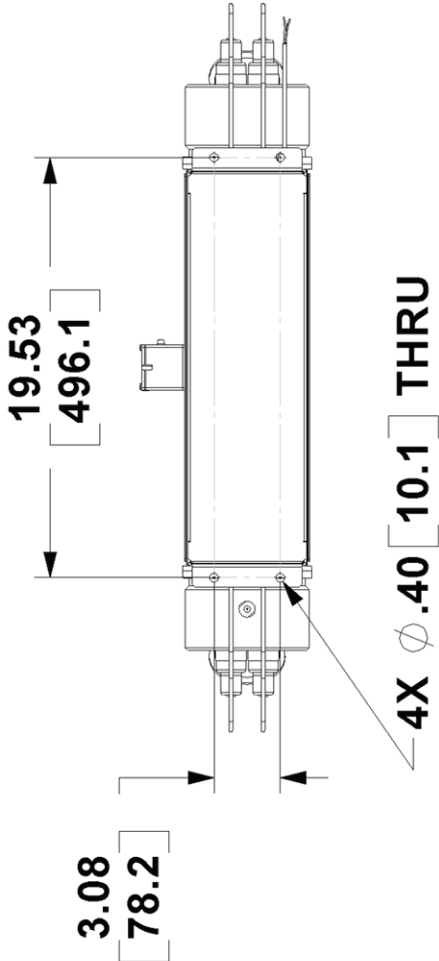
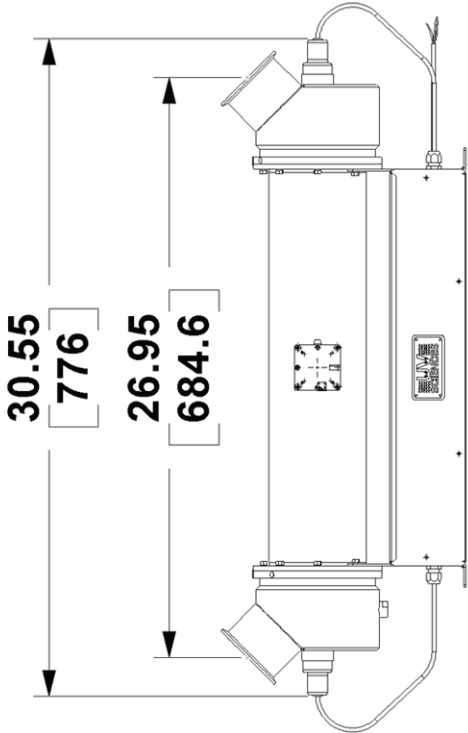
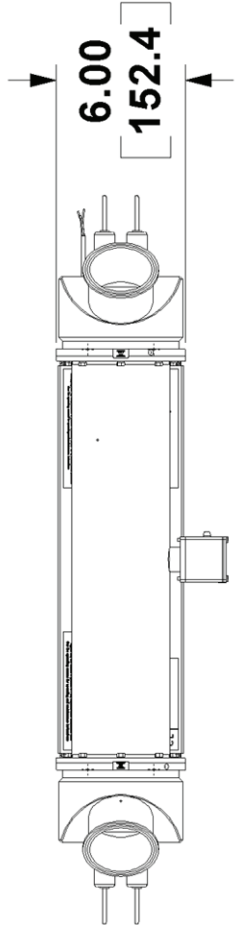
MINIMAL MAINTENANCE AND SERVICE

The service and maintenance requirements for the NeoTech D428™ are limited to three basic requirements:

- Lamp Replacement: No Tools Required
- UV Monitor: May be changed with a single screwdriver while the system is operating
- Cleaning: May be cleaned as needed in a CIP loop or manually brushed.

UNPARALLELED EFFICIENCY

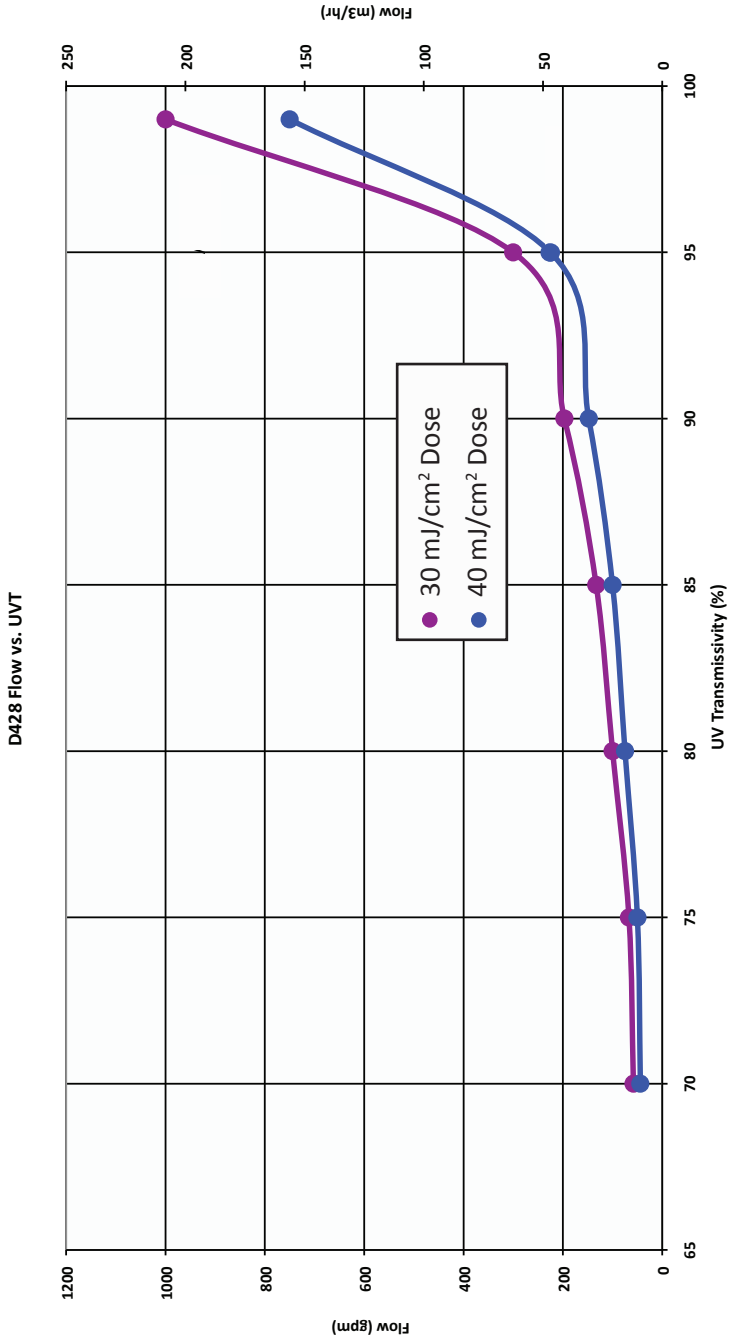
The NeoTech D428™ boasts the smallest footprint in its class. With as few as one-tenth as many bulbs compared to standard UV systems, it has the lowest operating cost and maintenance schedule in the field.



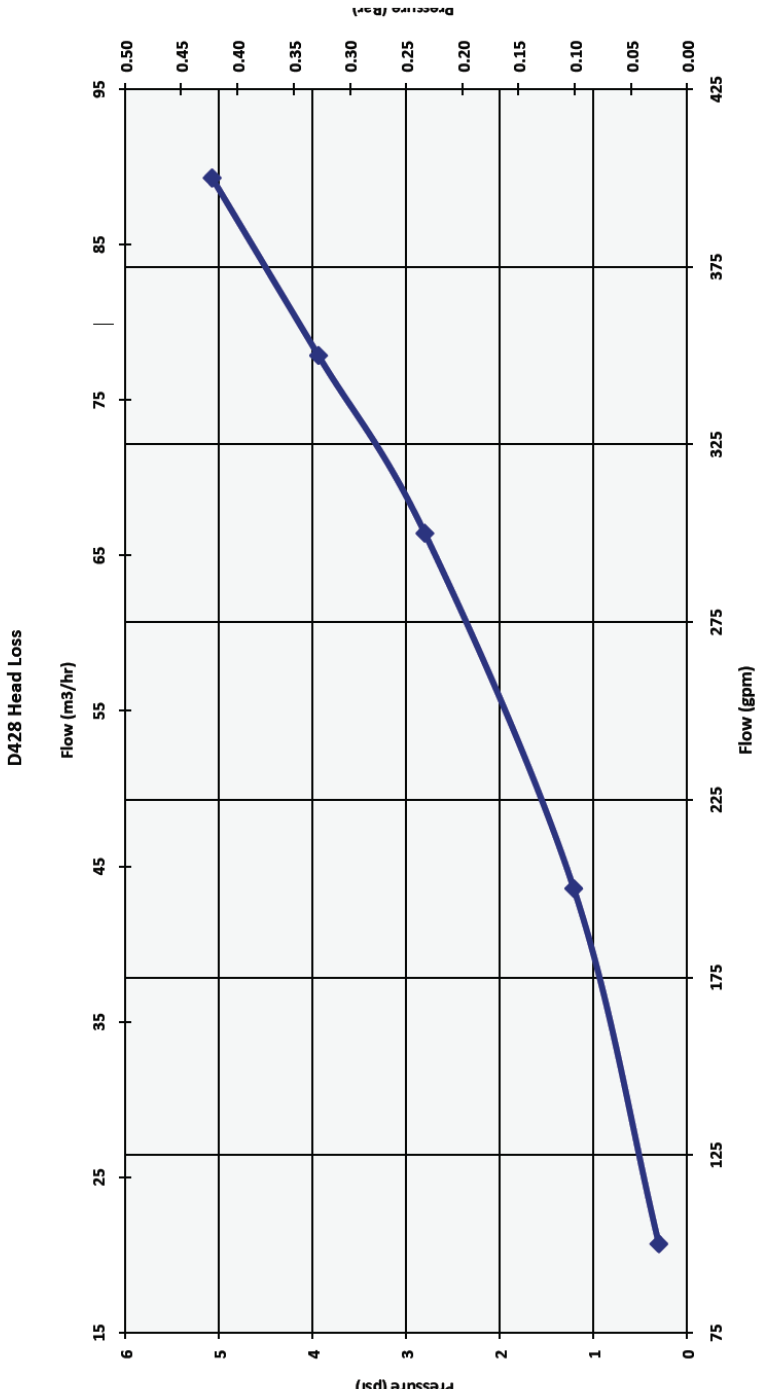
OPTIONS AND SPARES

Description	Part Number
*Light Trap Kit	UVLTk-4
Cleaning Kit	CK-4-1
Amalgam Lamp Kit	LK-28
Lamp Sleeve Kit	OSK-28
UV Monitor Calibration	UVIM-CAL
Ballast Kit, 120V	BK-120
Ballast Kit, 230V	BK-230

* Reflected UV light may be harmful to nonmetallic surfaces, such as PPL, PVC, and other plastics. Therefore, it is recommended that a light trap be installed on your unit.



The UV transmissivity (UVT) of the treated water, combined with the flow rate through the unit, determine the UV dosage applied to the water. Particles in water typically absorb or reflect UV light which affects the water's UV transmissivity. NeoTech Aqua's units are rated based on a UVT of 95%. The above graph illustrates the appropriate rating for the D428 based on varying UVT levels. The NeoTech Aqua Solutions technical team provides complimentary UVT analysis on customer-supplied water samples to ensure proper UV equipment sizing. Please contact your NeoTech Aqua representative for assistance.





PRODUCT BENEFITS

- Dual lamp efficiency processes up to 500 gallons per minute
- 75% smaller footprint compared to standard UV systems
- May be mounted vertically or horizontally
- Up to four units may be controlled with a single micro-control box
- Built for 120V or 230V single phase power providing maximum flexibility
- No flow, no problem – guaranteed 60 minutes
- Water contact finish – Ra-15
- Controller- Remote
- Alarms, Remote Control, 4-20 mA output
- Real time dosimetry, 100% dosage assurance – with constant flow
- UV monitor is NIST traceable
- Sanitization in place – hot water or steam
- No-tool lamp change
- NSF Standard 50 certified
- Warranty one year parts and labor

SPECIFICATIONS

Flow Rate - gpm (m³/hr.) - 99% UVT @ 40mJ/cm²^A	500 (90.8)
Flow Rate - gpm (m³/hr.) - 99% UVT @ 30mJ/cm²^A	500 (90.8)
Flow Rate - gpm (m³/hr.) - 95% UVT @ 40mJ/cm²^A	329 (74.7)
Flow Rate - gpm (m³/hr.) - 95% UVT @ 30mJ/cm²^A	500 (90.8)
Number of High Output Amalgam Lamps	2
Lamp Life - Hours*	9000
Operating Power - watts	303
Operating Pressure - psi (bar)	150 (13)
Operating Temperature - °F (°C)	36 - 104 (2 - 40)
Pressure Drop at rated flow - psi (bar)	10.9 (0.95)
Dry Weight - pounds (kg)	63 (28.6)
Dimensions (L x H x D) - inches	40.6 x 7.9 x 11.4
Dimensions (L x H x D) - millimeters	1030 x 201 x 290
Sanitary Fittings - Standard*	3 in.

^ At rated pressure drop.

* Lamp life is based on a maximum of one on-off cycle per day and room temperature water.

+ All units come standard with sanitary tri-clamp fittings for improved reliability, sanitation, and ease of installation. Alternative connections are available upon request.

NeoTech D438™

The NeoTech D438™ is specially designed to disinfect water and is an essential component in advanced oxidation processes.

This high-efficiency UV system utilizes NeoTech Aqua's patented ReFlex™ chamber technology, reflecting over 99% of the 254nm UV generated. It is the highest efficiency, smallest footprint, and lowest operating cost UV system in the water treatment industry.

With only two thirty-eight inch lamps, the D438™ provides users the most convenient and lowest cost service schedule of any low pressure or medium pressure UV system today.

MAXIMUM UV PENETRATION

The NeoTech D438™ provides users an unparalleled level of engineering sophistication by maximizing UV distribution in a patented 99% reflective chamber. This unique technical advantage also reduces the number of lamps and power requirements by up to 90% compared to standard UV systems.

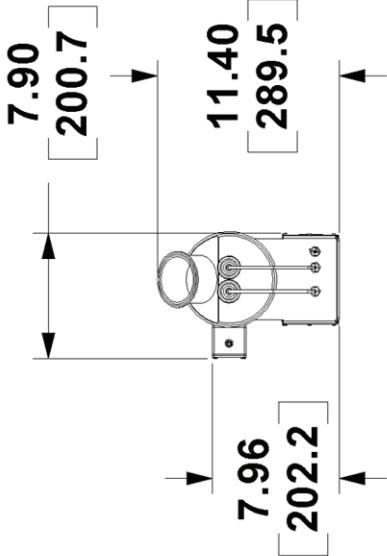
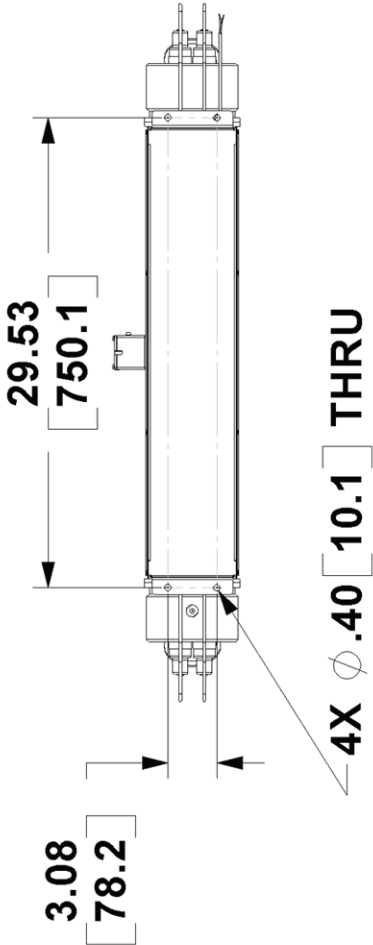
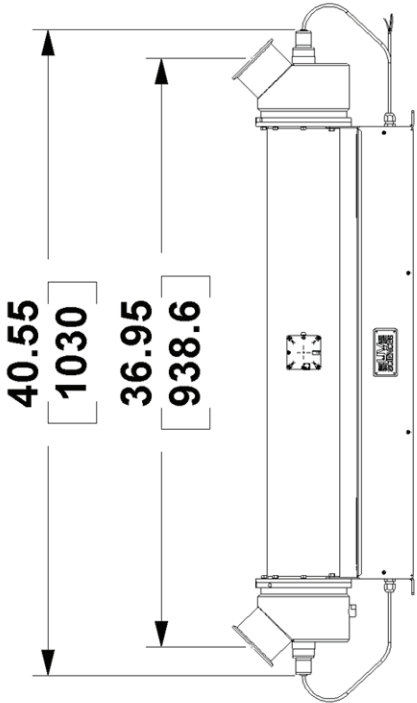
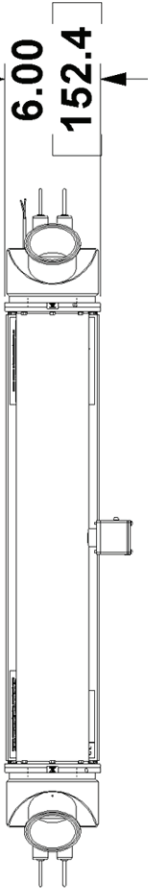
MINIMAL MAINTENANCE AND SERVICE

The service and maintenance requirements for the NeoTech D438™ are limited to three basic requirements:

- Lamp Replacement: No Tools Required
- UV Monitor: May be changed with a single screwdriver while the system is operating
- Cleaning: May be cleaned as needed in a CIP loop or manually brushed.

UNPARALLELED EFFICIENCY

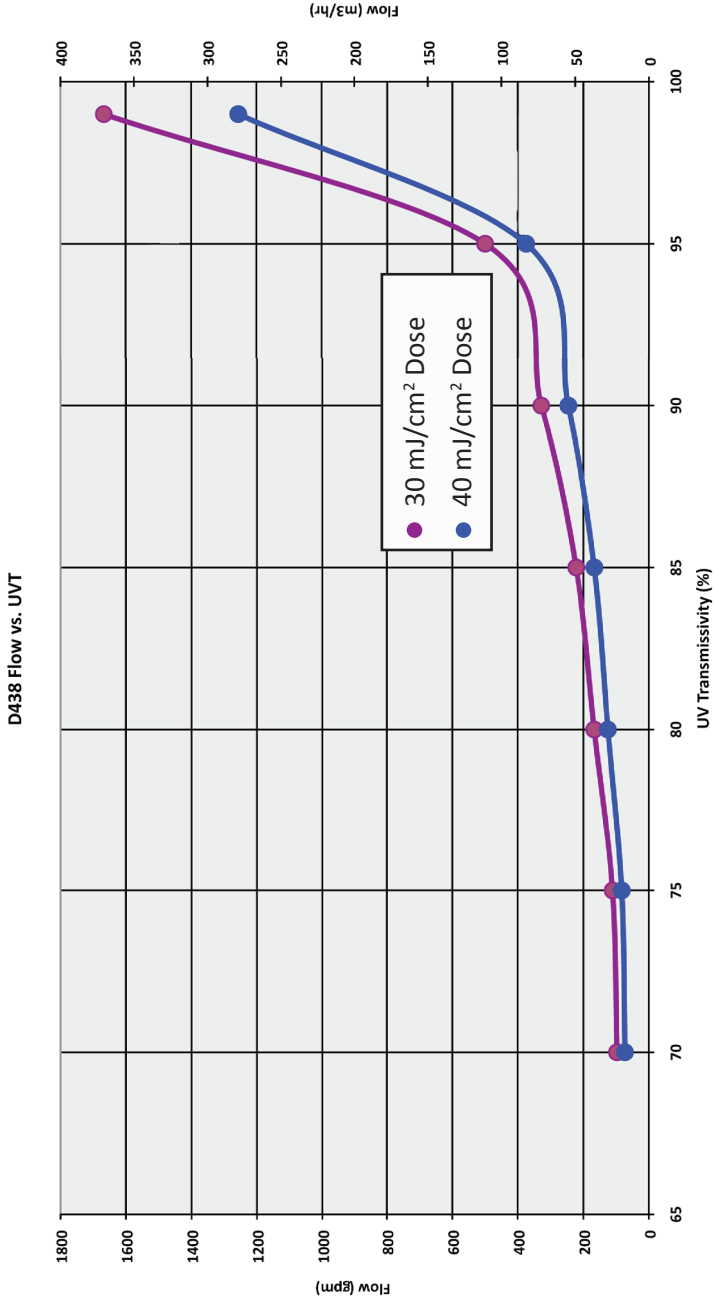
The NeoTech D438™ boasts the smallest footprint in its class. With as few as one-tenth as many bulbs compared to standard UV systems, it has the lowest operating cost and maintenance schedule in the field.



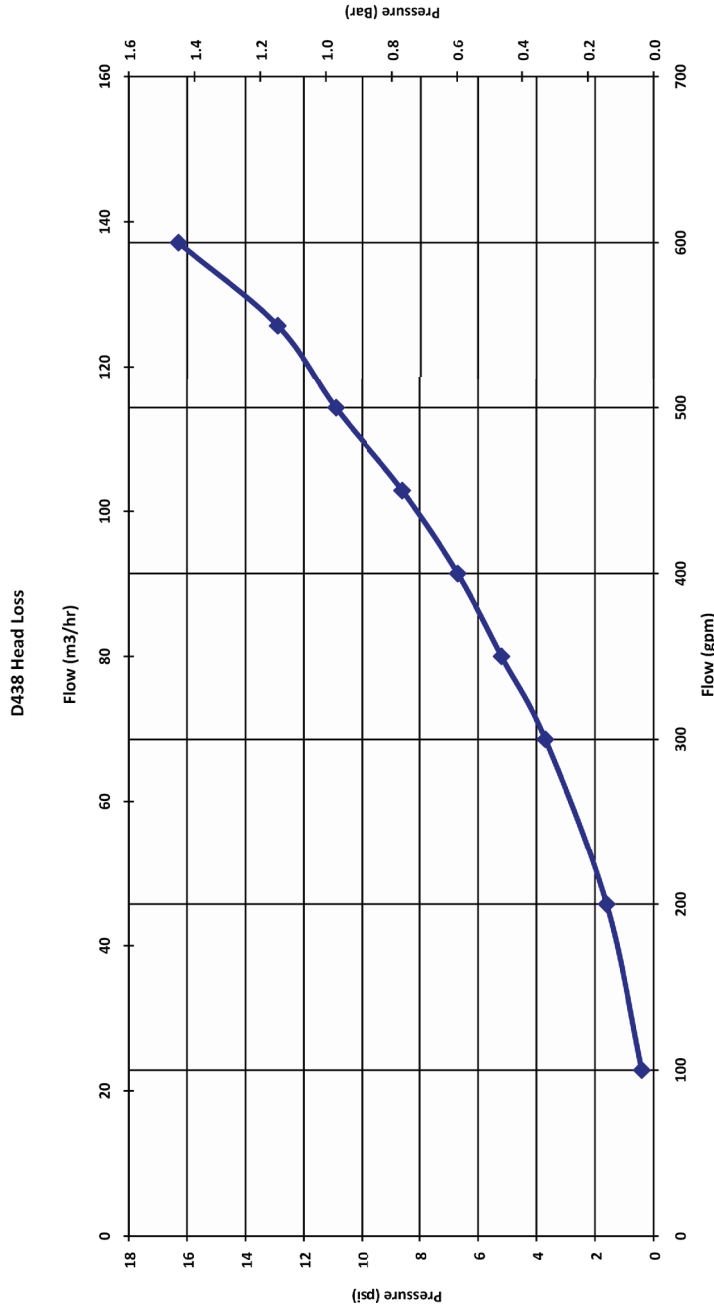
OPTIONS AND SPARES

Description	Part Number
Light Trap Kit*	UVLTk-4
Cleaning Kit	CK-4-1
Amalgam Lamp Kit	LK-38
Lamp Sleeve Kit	OSK-38
UV Monitor Calibration	UVIM-CAL
Ballast Kit, 120V	BK-120
Ballast Kit, 230V	BK-230

* Reflected UV light may be harmful to nonmetallic surfaces, such as PPL, PVC, and other plastics. Therefore, it is recommended that a light trap be installed on your unit.



The UV transmissivity (UVT) of the treated water, combined with the flow rate through the unit, determine the UV dosage applied to the water. Particles in water typically absorb or reflect UV light which affects the water's UV transmissivity. NeoTech Aqua's units are rated based on a UVT of 95%. The above graph illustrates the appropriate rating for the D438 based on varying UVT levels. The NeoTech Aqua Solutions technical team provides complimentary UVT analysis on customer-supplied water samples to ensure proper UV equipment sizing. Please contact your NeoTech Aqua representative for assistance.



APPENDIX C.6

TERTIARY FILTRATION

PHOSPHORUS REMOVAL

Advanced Phosphorus Removal

Blue Water Technologies, Inc. is the industry leader in the development of technologies for phosphorus removal from wastewater. With advanced control techniques and patented nutrient removal systems, Blue Water can provide you with a cost effective solution to meet your phosphorus level needs.

The Blue PRO® system provides a unique approach to chemical dosing, with significantly lower chemical use across the entire wastewater treatment plant than competitors. No other chemical dosing is required in the plant to achieve the lowest phosphorus discharge requirements. Current Blue PRO® installations are meeting permit limits as low as 0.05 mg/L with a chemical dose of only 10 mg/L as Fe. Blue Water's unique chemical control system provides an advantage due to its cost efficiency and ability to seamlessly integrate into and respond to the needs of existing wastewater treatment systems. The chemical dose used with Blue PRO® methods is so much lower than the competition that the comparative savings represent a return on the capital investment in less than three years.

The Blue PRO® process is the leading technology for phosphorus reduction to any level. Whether the targeted phosphorus discharge limit is 10 mg/L P or as low as 0.01 mg/L P, Blue PRO® methods provide reductions in chemical usage, equipment footprint, and associated operations and maintenance costs over alternative technologies. The Blue PRO® platform is the most effective and most inexpensive tertiary treatment solution where additional considerations are needed, such as denitrification or metals removal.



A Blue PRO® installation in Grangeville, Idaho for 0.05 mg/L phosphorus

Blue PRO®

The Blue PRO® System

How does the Blue PRO® process work? Using Blue Water's Centra-flo® continuous backwash gravity sand filters, a unique control system, and the patented Blue PRO® process for reactive filtration, phosphorus is removed from wastewater streams through an array of mechanisms. Most importantly, Blue PRO® systems optimize adsorption.

Blue Water's reactive filtration process overcomes a critical obstacle to achieving efficient phosphorus removal in bulk aqueous solutions by providing reactive surface sites within the media bed, resulting in forced contact of chemical species with high adsorptive capacity. The adsorptive surface in Blue PRO® filters is a continuously regenerated hydrous ferric oxide (HFO) coating that forms on the surface of the sand media. Coagulation followed by filtration simply cannot compare to the efficiency of adsorptive phosphorus removal.

Waste HFO, phosphorus, and solids are removed from the filter through the backwash or reject stream. Recycling this reject upstream provides the added benefit of removing phosphorus in plant clarification systems, further guaranteeing the achievement of the discharge phosphorus target as well as lowering the chemical dose. The phosphorus is chemically bound, leaving the plant with the sludge, rather than releasing in effluent streams or digestion. Integration of Blue Water's phosphorus removal technology does not require change in the plant's sludge handling system. The Blue PRO® system uses over 30% less chemical than other technologies, therefore producing less sludge. The waste HFO also helps with odor control and can reduce water content in biosolids.

Blue PRO® Applications:

- Advanced total phosphorus removal
- Metals removal, including mercury
- Combined denitrification
- Algae mitigation

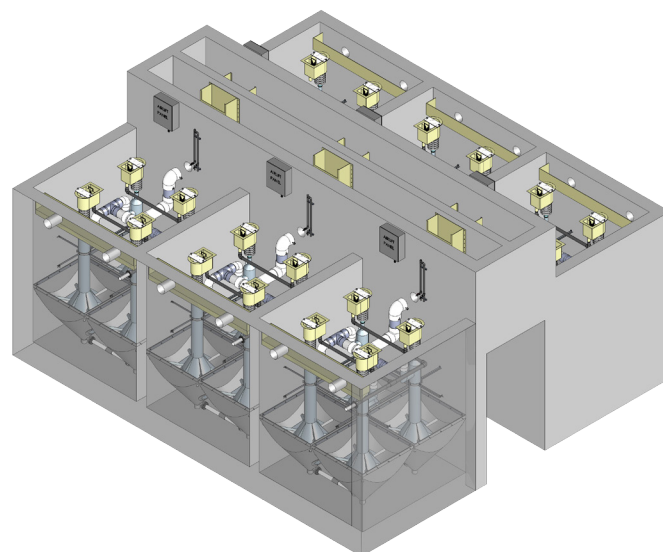


The Blue PRO® system is available in several models and configurations. The modular nature of the filters allows for easy system expansion. The filters are available as freestanding fiberglass or stainless steel units or as in-ground concrete cells. Control systems and smaller filters may be skid mounted for mobility or ease of commissioning.

Additional Features

Since many plants requiring phosphorus mitigation also require nitrogen control, Blue Water provides the option to simultaneously denitrify in the same vessel with the Blue PRO® process. With slight modifications, Blue Water can provide a unique and efficient system for total nutrient reduction.

Besides phosphorus, Blue PRO® methods are effective at removing many other contaminants, such as mercury, arsenic, chromium, and uranium. Minor adjustments in water chemistry may be implemented for the removal of metals and other contaminants, including zinc, lead, copper, iron, and manganese. Blue Water has installations for removal of these contaminants in wastewater plants as well as groundwater systems, including self-contained package treatment systems.



4.3 MGD Blue PRO® system design for 0.07 mg/L TP in a Massachusetts WWTP

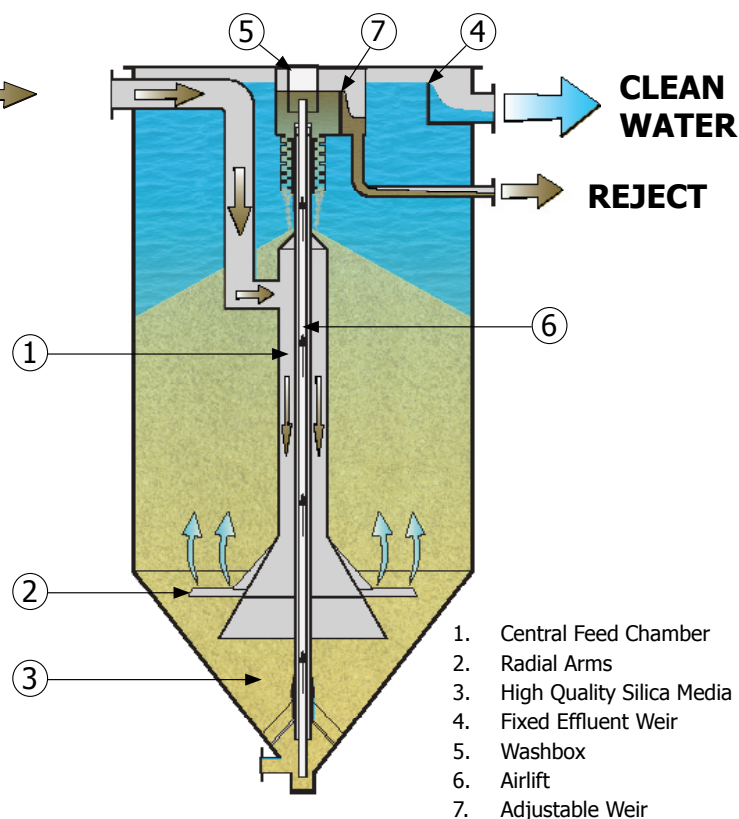
INFLUENT → **+ CHEMICAL** →

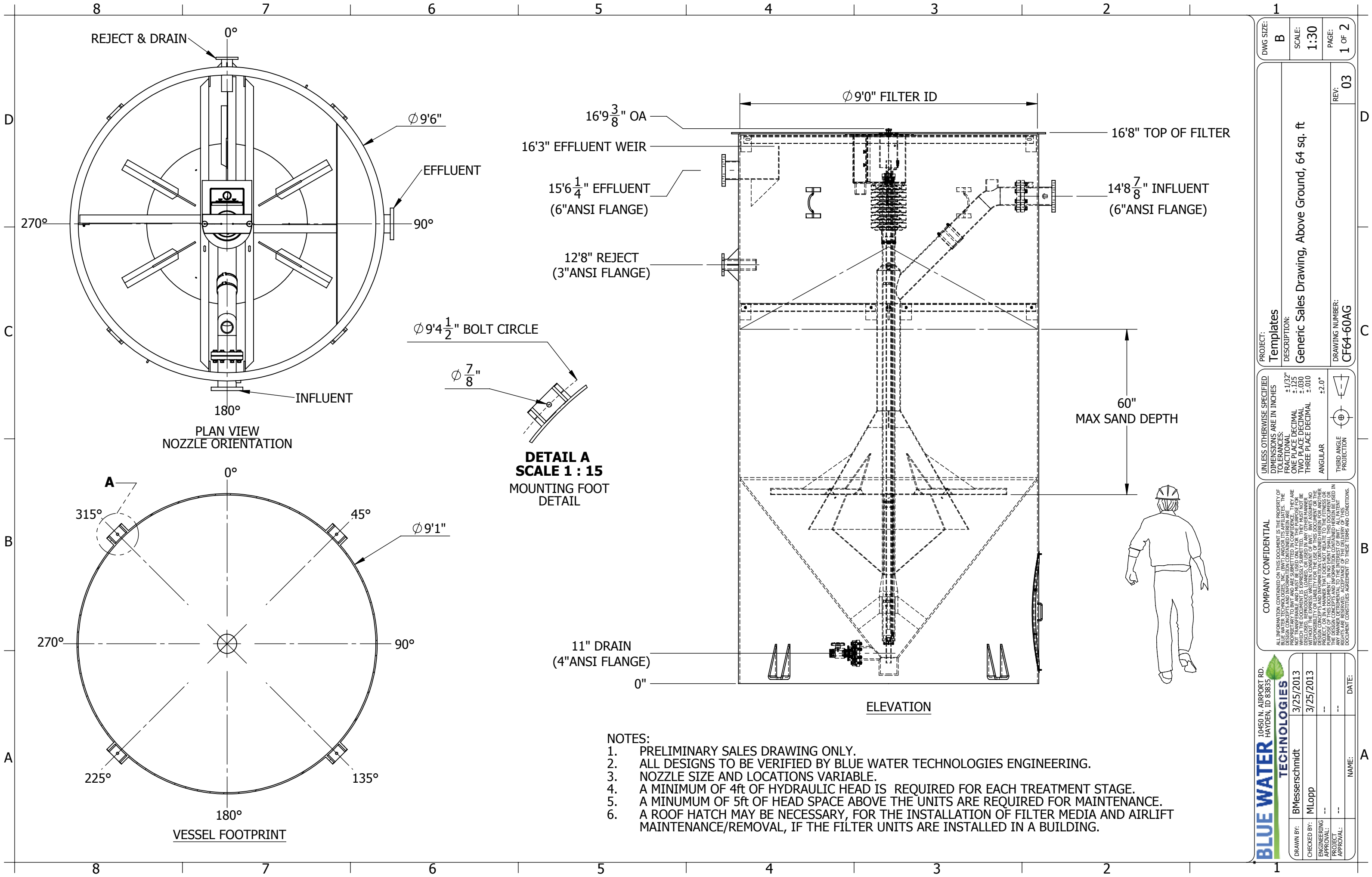
Blue PRO®

Blue Water's Blue PRO® technology is covered by multiple patents and patents pending.

The Blue PRO® Advantages:

- Low capital and O&M costs
- Continuous flow – no interruption for backwash or changing media
- Modular design easily handles capacity increases
- Simple operation & low chemical use





- NOTES:
1. PRELIMINARY SALES DRAWING ONLY.
 2. ALL DESIGNS TO BE VERIFIED BY BLUE WATER TECHNOLOGIES ENGINEERING.
 3. NOZZLE SIZE AND LOCATIONS VARIABLE.
 4. A MINIMUM OF 4ft OF HYDRAULIC HEAD IS REQUIRED FOR EACH TREATMENT STAGE.
 5. A MINIMUM OF 5ft OF HEAD SPACE ABOVE THE UNITS ARE REQUIRED FOR MAINTENANCE.
 6. A ROOF HATCH MAY BE NECESSARY, FOR THE INSTALLATION OF FILTER MEDIA AND AIRLIFT MAINTENANCE/REMOVAL, IF THE FILTER UNITS ARE INSTALLED IN A BUILDING.

DWG SIZE: B

SCALE: 1:30

PAGE: 1 OF 2

PROJECT: Templates

DESCRIPTION: Generic Sales Drawing, Above Ground, 64 sq. ft

DRAWING NUMBER: CF64-60AG

REV: 03

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES: ±1/32" FOR DIMENSIONS ±1/16" FOR DIMENSIONS ±1/32" FOR DIMENSIONS ±1/16" FOR DIMENSIONS

ONE PLACE DECIMAL ±0.10

TWO PLACE DECIMAL ±0.05

THREE PLACE DECIMAL ±0.010

ANGULAR ±2.0°

THIRD ANGLE PROJECTION

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10450 N. AIRPORT RD. HAYDEN, ID 83835

BLUE WATER TECHNOLOGIES

DRAWN BY: BMesserschmidt

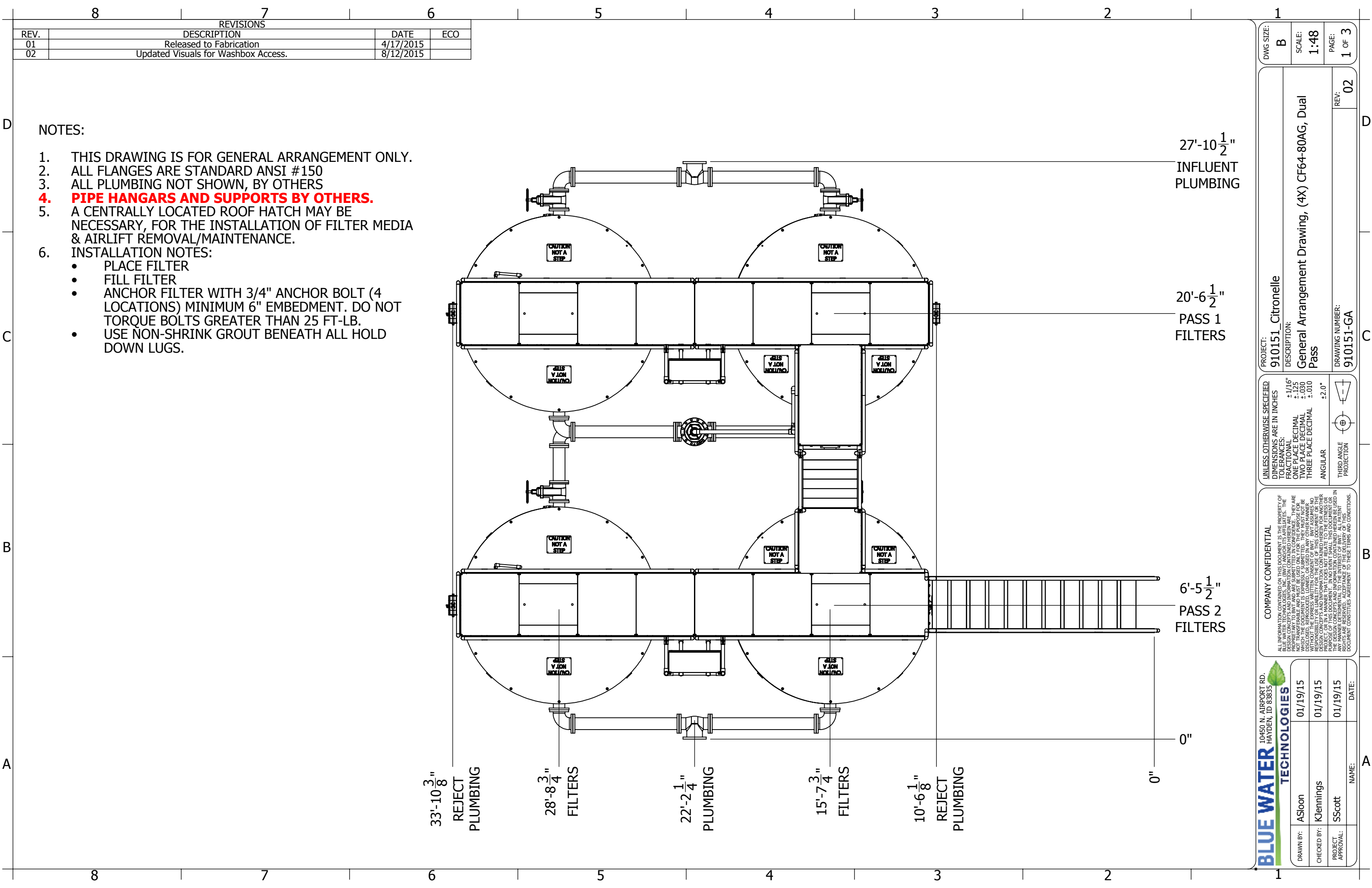
CHECKED BY: MLopp

ENGINEERING APPROVAL: --

PROJECT APPROVAL: --

DATE: --

NAME: --



REVISIONS			
REV.	DESCRIPTION	DATE	ECO
01	Released to Fabrication	4/17/2015	
02	Updated Visuals for Washbox Access.	8/12/2015	

DWG SIZE: B		SCALE: 1:48	PAGE: 1 OF 3
PROJECT: 910151_Citronelle		REV: 02	
DESCRIPTION: General Arrangement Drawing, (4X) CF64-80AG, Dual Pass		DRAWING NUMBER: 910151-GA	

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. TOLERANCES: FINISH: ±1/16" ONE PLACE DECIMAL ±.010 TWO PLACE DECIMAL ±.010 THREE PLACE DECIMAL ±.010 ANGULAR ±2.0° THIRD ANGLE PROJECTION

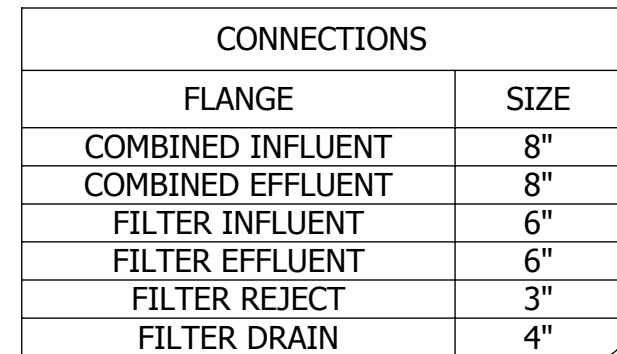
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BLUE WATER TECHNOLOGIES

10450 N. AIRPORT RD.
HAYDEN, ID 83835

DRAWN BY: ASloan	01/19/15	DATE:
CHECKED BY: Klenings	01/19/15	
PROJECT APPROVAL: SScott	01/19/15	
NAME:		

1. ALL ELEVATIONS ARE BASED OFF 1-1/2" NON-SHRINK GROUT.



DRAWN BY:	ASloon	01/19/15
CHECKED BY:	KJennings	01/19/15
PROJECT APPROVAL:	SScott	01/19/15
NAME:		DATE:

PROJECT: 910151_Citronelle	
DESCRIPTION: General Arrangement Drawing, (4X) CF64-80AG, Dual Pass	
DRAWING NUMBER: 910151-GA	REV: 02



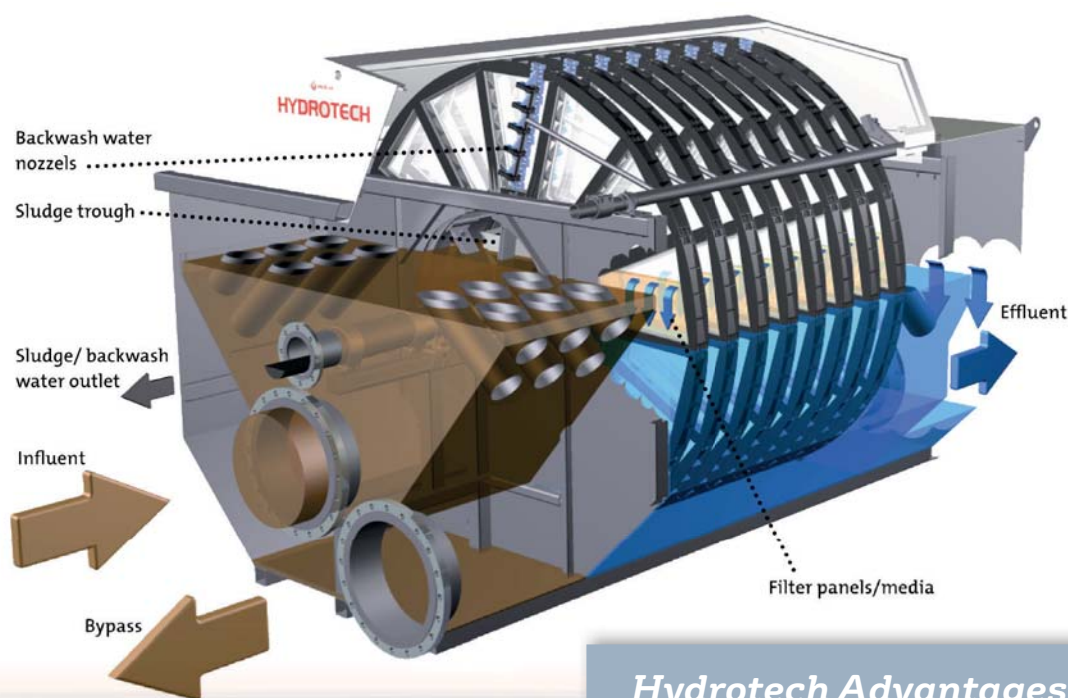
Hydrotech Discfilter Pure Performance

WATER TECHNOLOGIES

The Discfilter Process

The Hydrotech Discfilter provides proven experience for today's demanding wastewater treatment applications through an efficient, yet easy-to-operate design. Influent flows by gravity into the center drum and then passes through the filter media mounted on both sides of the discs. The solids are retained on the media within the discs. Only purified water flows to the collection tank. The inside-out flow path prevents solids accumulation in the tank.

As solids collect on the inside of the media the influent water level rises. Maximum head loss through the media is <12 inches. The inlet water level is measured and the control system automatically initiates backwashing. The filtered effluent is pumped to the backwash spray nozzles, washing solids into the sludge trough as the discs rotate. The backwash water is typically 1% to 2% of the total flow to the filter, while the sludge return is typically <1%. Filtration is continuously maintained, even during backwash.



Hydrotech Advantages

- Unmatched experience and performance
- Innovation: patented designs offer real savings
- Robust construction with 304 or 316 SSTL
- Proven media: durable and chemically resistant
- Meets or exceeds Title 22 requirements at hydraulic loading rates up to and above 6 gpm/ft²
- Consistently produces high quality effluent despite high-solids loadings and upset conditions
- Ideal for "retro-fit" projects in existing basins
- Compact design requires far less space
- Simplified control system and lower installation costs than other filtration technologies
- Improved backwash efficiency reduces operating costs and carbon footprint

Progressive Innovation

The Hydrotech Discfilter utilizes many patented designs including the oscillating backwash spray header, which provides efficient media cleaning while reducing water consumption by 20 percent. Ongoing research ensures the most cost effective filtration methods available.

The Hydrotech Discfilter is available in a variety of models:

1700 series

- Up to 8 discs
- Up to 1 MGD per unit in effluent polishing
- Ideal for small scale projects



2200 series

- Up to 24 discs
- Up to 9 MGD per unit in effluent polishing
- Excellent for a wide range of project sizes

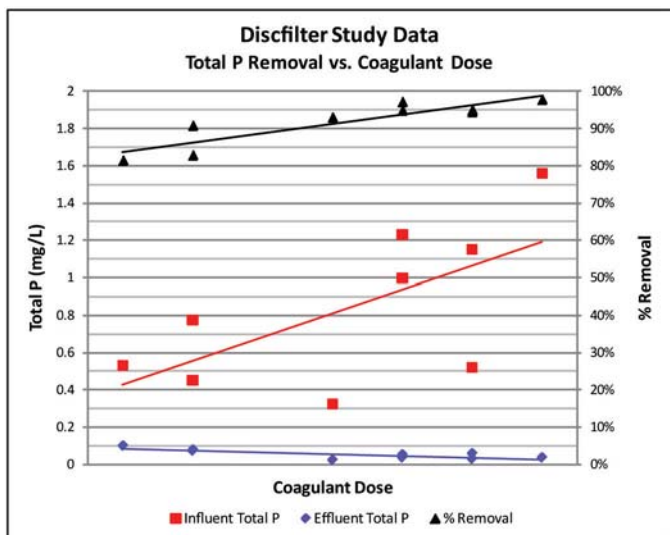


2600 series

- Up to 30 discs for 15 MGD per unit in effluent polishing
- Provides highest filtration area and most compact footprint
- High flow rates maximize treatment in a given footprint
- Energy reduced 15% and footprint by 25%
- User-friendly design for minimal maintenance



Advanced Treatment



The Hydrotech Discfilter enables facilities to meet stringent performance requirements.

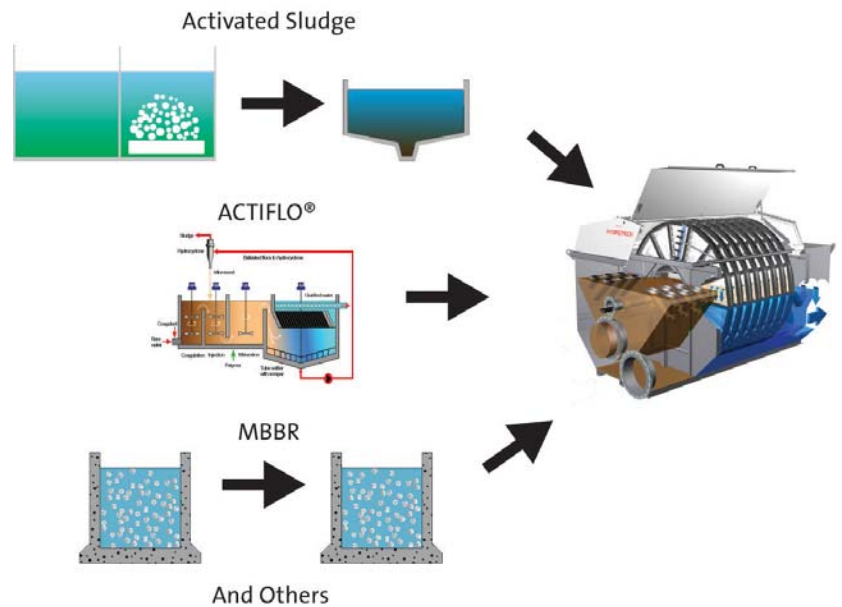
Veolia has pioneered use of the discfilter in combination with coagulation/ flocculation as a cost effective means to reduce effluent phosphorus to < 0.1 mg/L.

Proven Performance

The compact Hydrotech Discfilter is used in a wide range of applications:

- Effluent polishing of wastewater
- Phosphorus removal
- Water reuse (Title 22 approved)
- Retrofit/replacement of existing systems
- CSO, SSO, and primary treatment
- Process water filtration
- Membrane pre-treatment

The Hydrotech Discfilter is ideal for treating effluent from a variety of processes (e.g., activated sludge, fixed film, etc.). Veolia offers full-scale pilots to demonstrate performance.



Designed To Save

Hydrotech systems enable customers to achieve performance with lower cost and straight-forward maintenance. Hydrotech Discfilters provide a large filter area in a small footprint; up to 75% smaller than sand filters and up to 20% smaller than other cloth filters.

The discfilter is delivered as an assembled unit. Other cloth filters require substantial labor for site assembly and a larger footprint for backwash pumps and valves. The discfilter eliminates these concerns and costs. Installation is as simple as off-loading from a trailer, anchoring the unit, and completing mechanical and electrical connections.

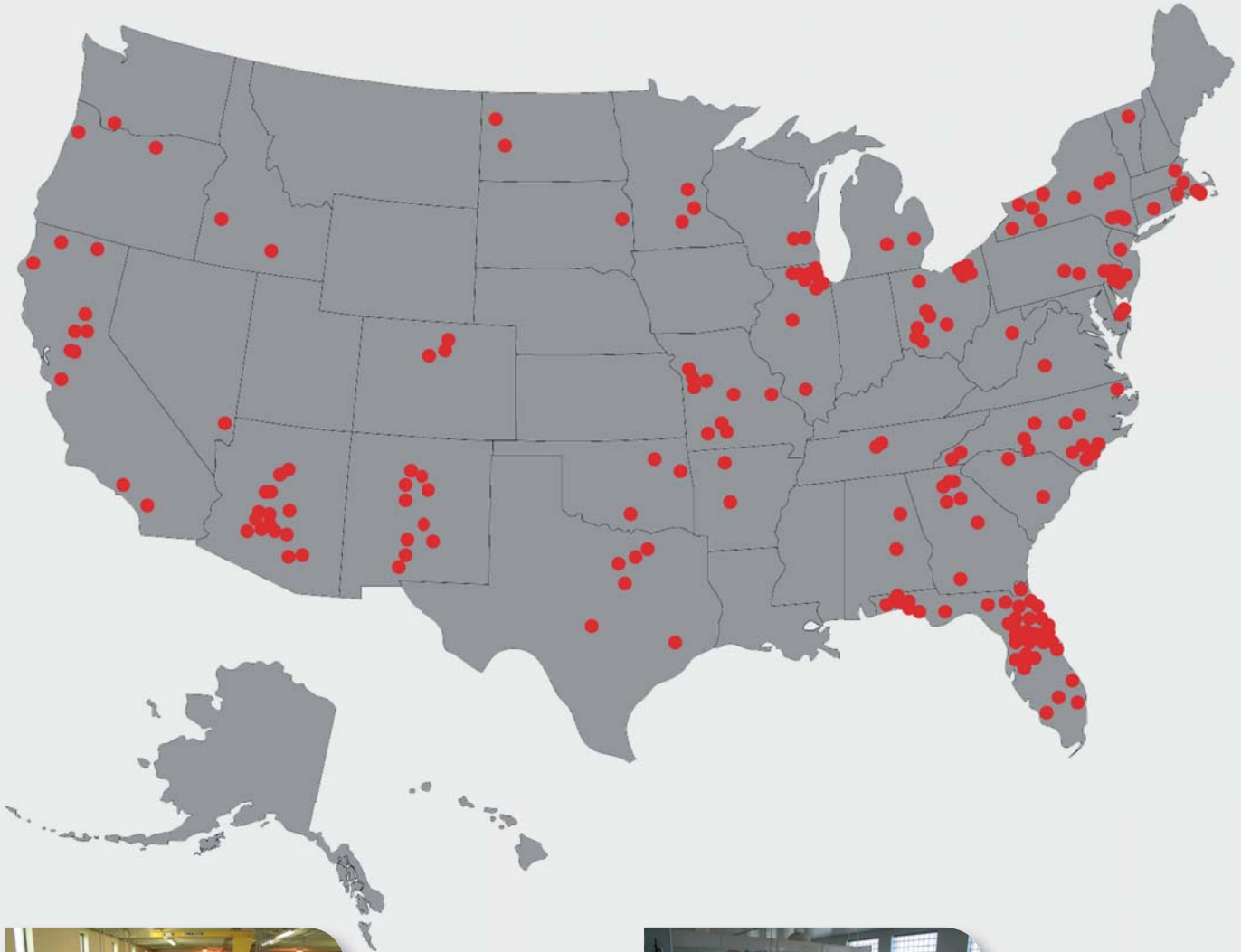
O&M is simple and reduces operating costs. Fabrication is in 304 or 316 SSTL for trouble-free operation in the toughest conditions. Durable filter media provides long life without frequent and costly replacement. The efficient backwash process reduces energy costs.



Hydrotech Discfilters are easy to inspect and maintain, saving time and money.

Experience You Can Trust

Today's demanding applications require proven experience. Hydrotech Discfilters lead the market with over 400 installed units in the United States and over 1,900 worldwide.



Oconomowoc, WI

Retrofit of tertiary
sand filters
12 MGD



Fox Lake, IL

Retrofit of tertiary
sand filters
30 MGD



Mesquite, TX

Effluent polishing
48 MGD



Holly Springs, NC

Water reclaim and
phosphorus removal
15 MGD

