



MBBR Technologies

MBBR – What is it?

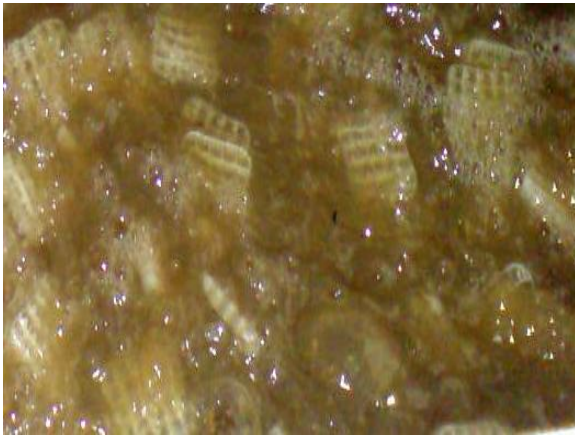
MBBR = Moving Bed Biofilm Reactor

- The process is based on the biofilm principle using the polyethylene carrier elements.
- The carrier elements, which are less dense than water, provide a large protected surface for bacteria culture.
- The MBBR provides advantages of Activated Sludge and Trickling Filter systems without the disadvantages of those systems.
- The MBBR is the most documented fixed film process with many technical publications and presentations.

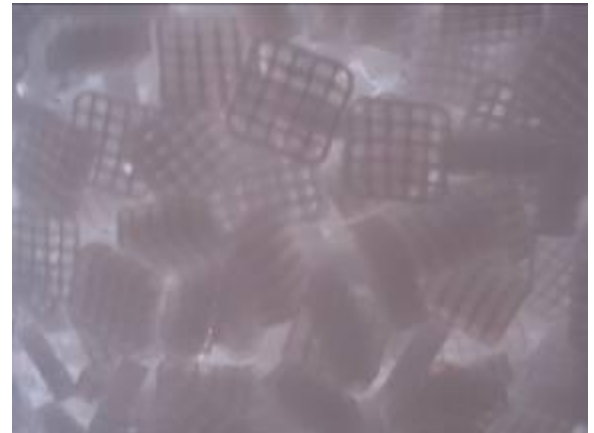




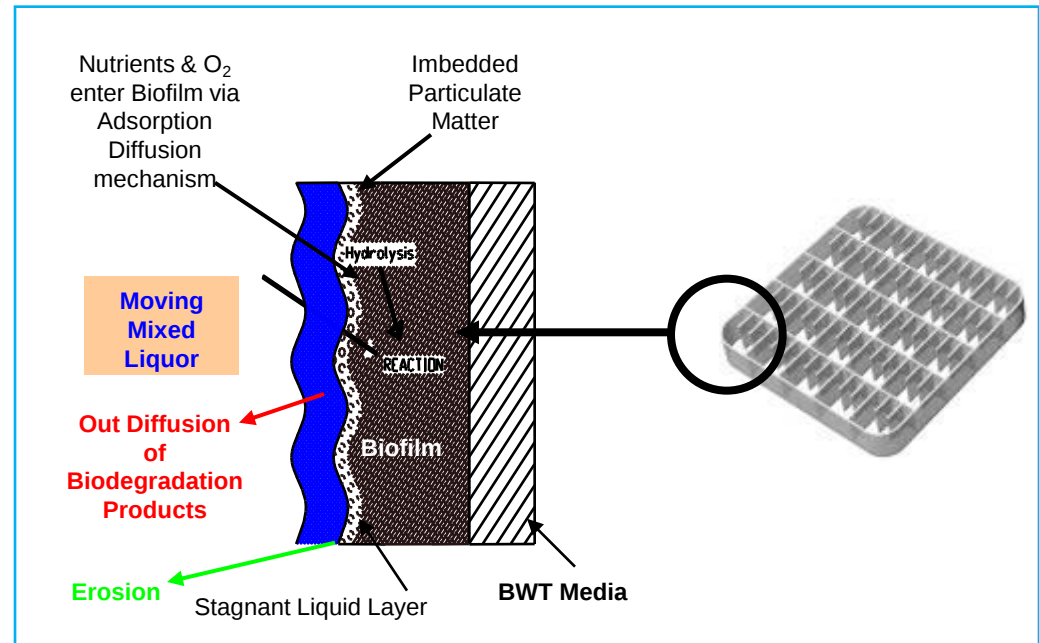
Trickling filters are a static, air phase fixed film treatment system.



MBBRs are dynamic, water phase fixed film treatment systems



- No problems with odors, snails or red-worms as in air phase fixed films.
- Easier transfer of contaminants and oxygen to the biomass.
- Thin biofilm controlled by constant movement created by the aeration.
- NO attrition of media – oldest plant is 20 years old and NO replacement of media has been required



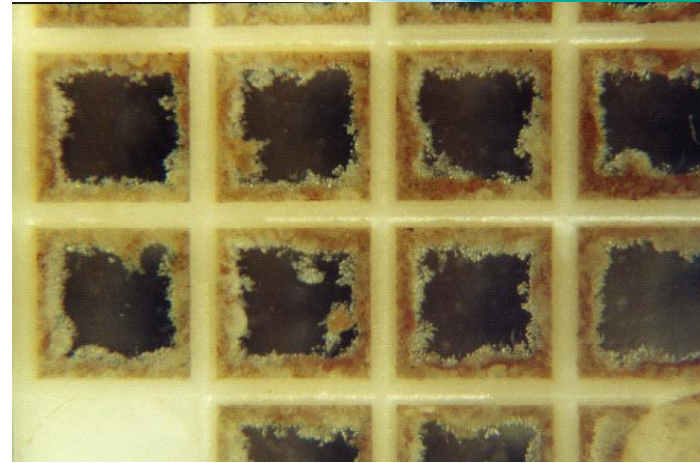
Biomedia Video in reactor

Biomedia Video in model

Mixing energy controls the biological thickness



BOD



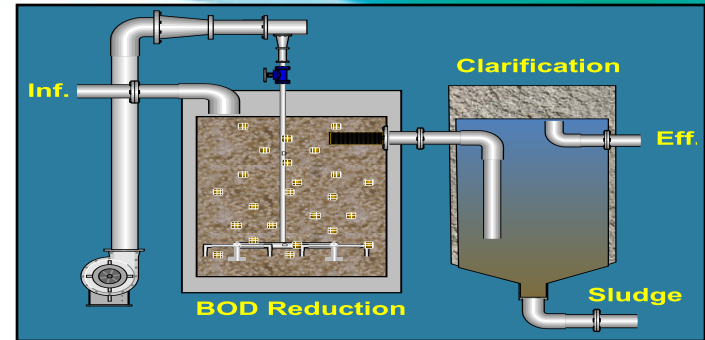
Nitrifiers



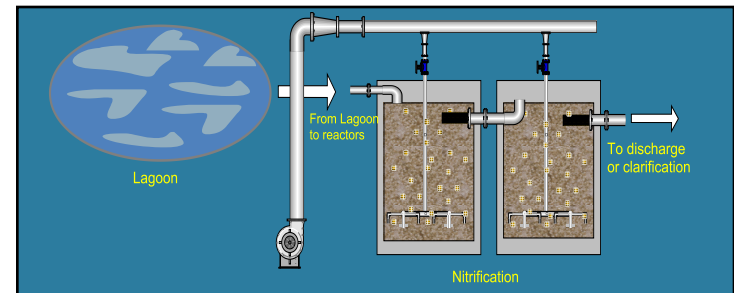
Features:

BOD Reduction

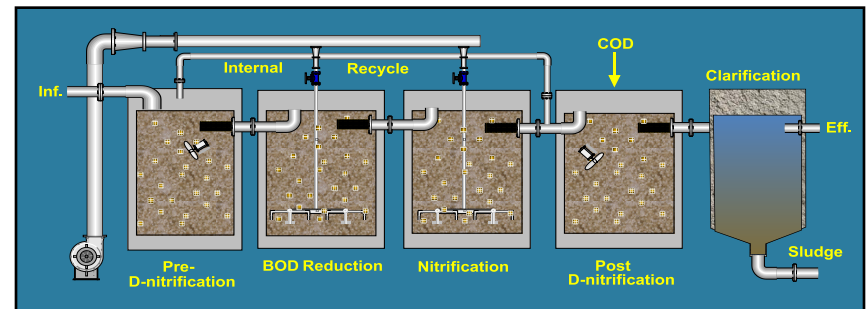
- Single pass treatment
- No operational adjustments
- Only equipment maintenance
- Self regulating biomass
- Small foot print
- Multiple applications



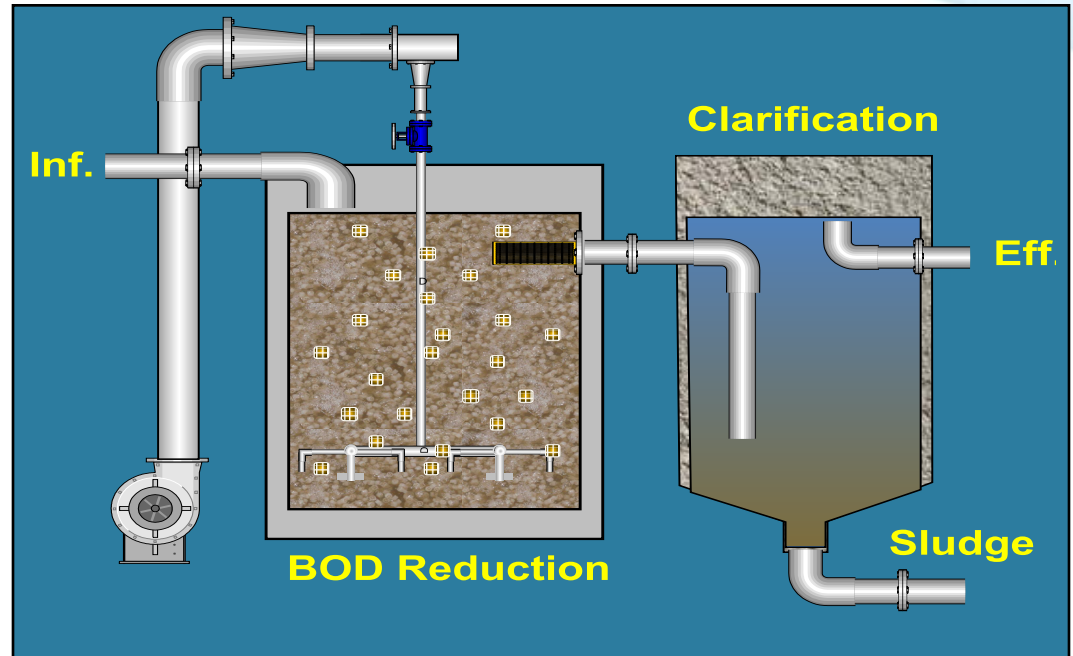
Nitrification



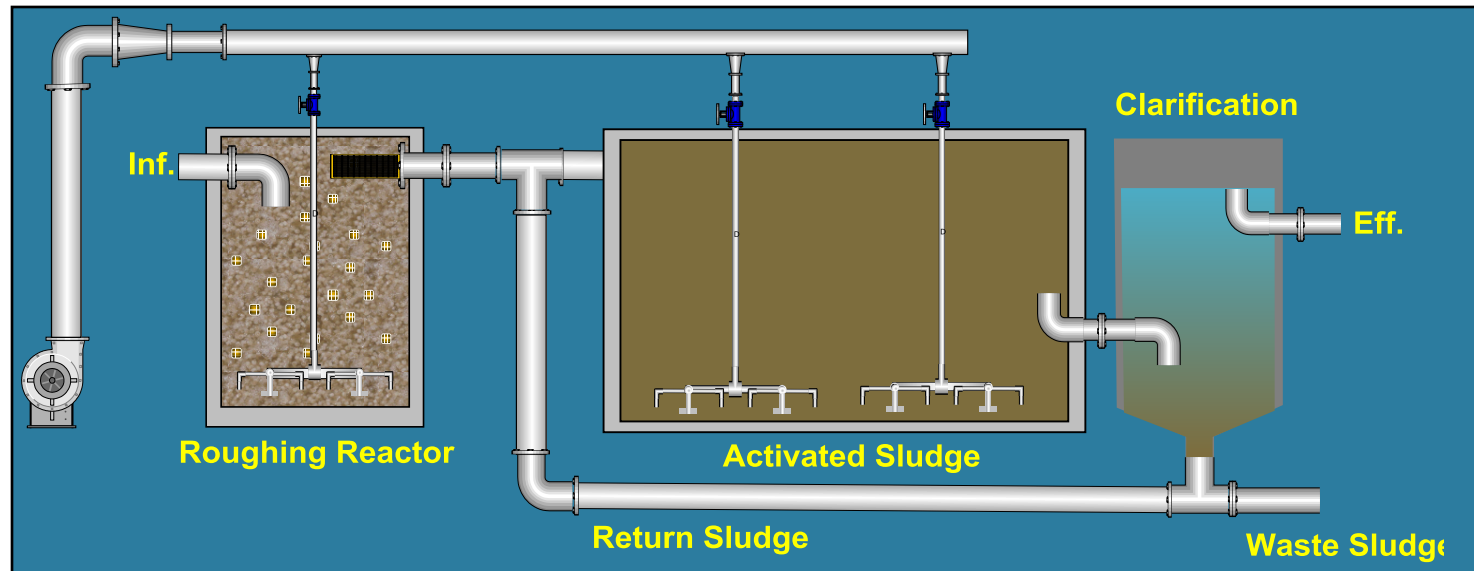
Denitrification



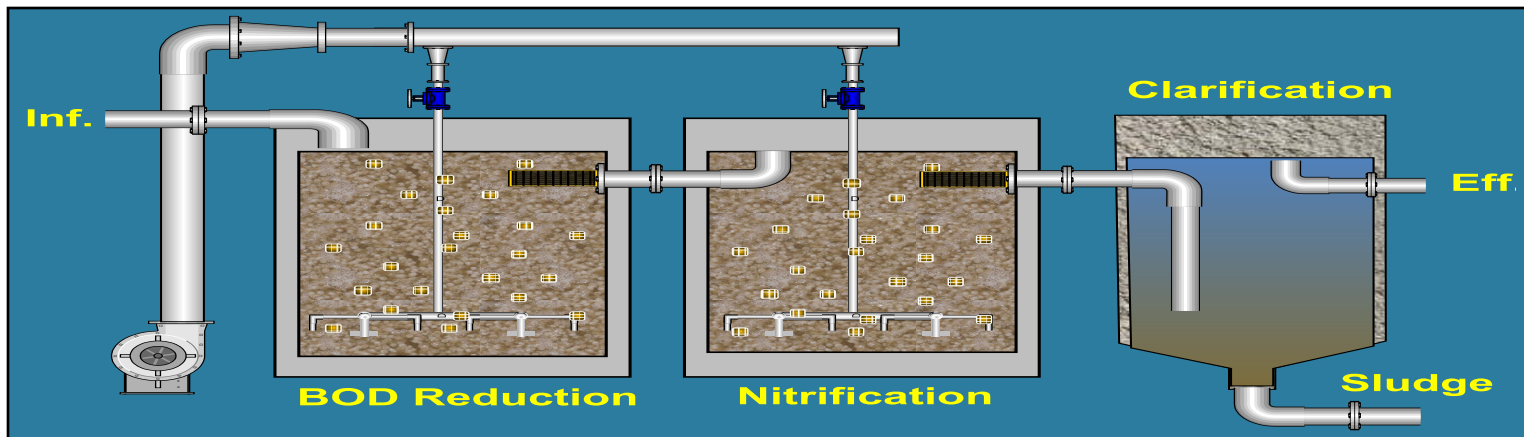
- High loads
- Up to 6000 mg/l
- Small foot print
- Single pass treatment
- No recycle
- No operator adjustments
- Biology self regulating
- Low BOD effluent
- 50% to 80 % reduction in 30 minutes
- < 10 mg/l BOD (after clarification)



- **Roughing Reactor**
 - Removes 50-80% of BOD prior to activated sludge.
 - Can increase treatment capacity with a small additional foot print.

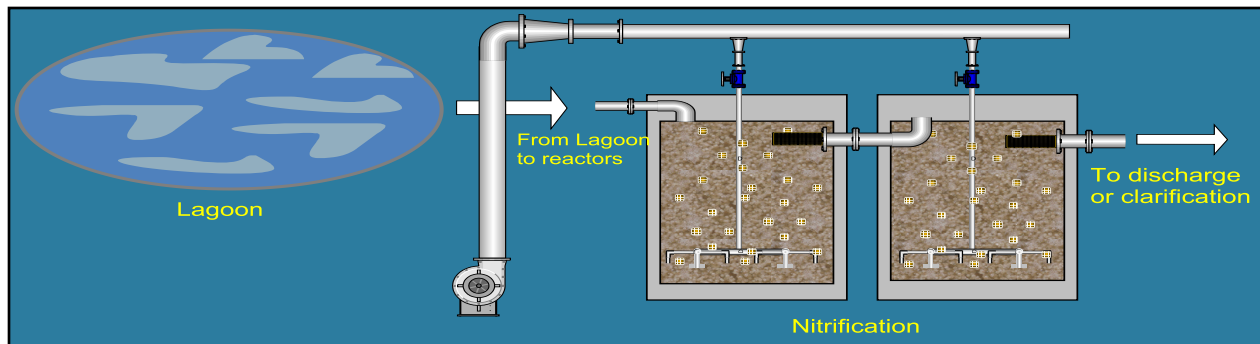
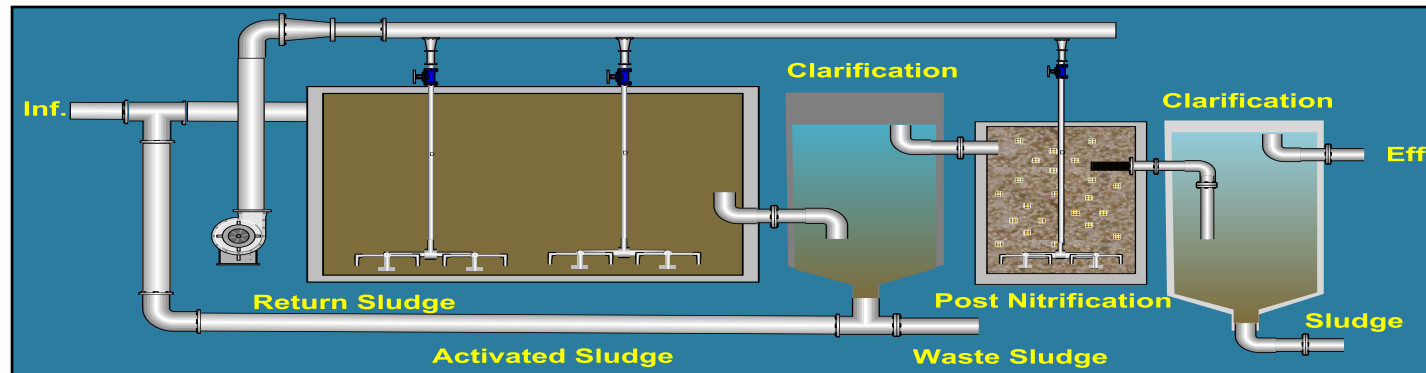


- Converting ammonia to nitrates and nitrites
- TKN changes to ammonia
- Works best when BOD is less than 10 mg/l
- Can achieve ammonia levels of $< 1\text{mg/l}$
- No wash out of nitrifiers during storm flows
- Nitrifiers mature on biofilm

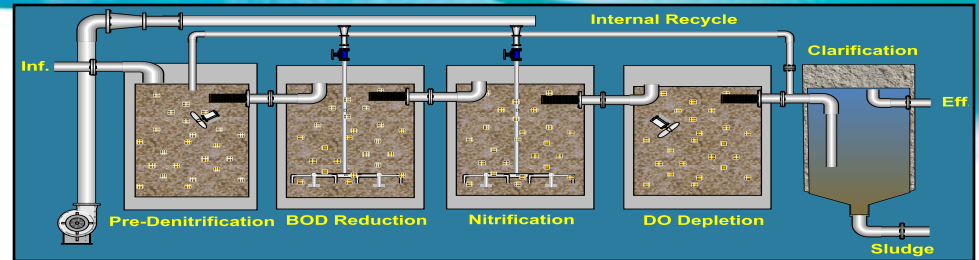


Post Nitrification

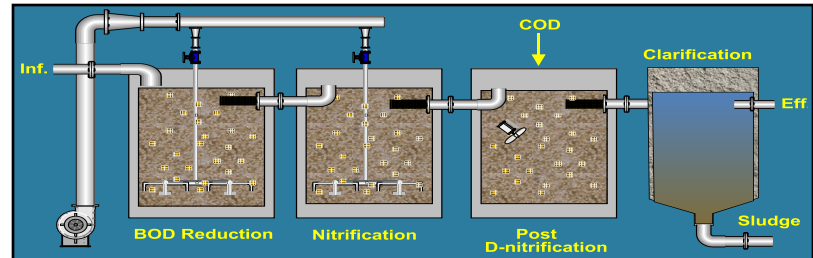
Adding nitrification after existing BOD treatment will achieve new ammonia limits, such as after activated sludge or a lagoon.



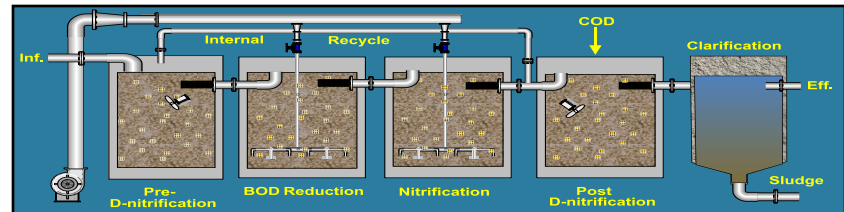
Pre-Denitrification



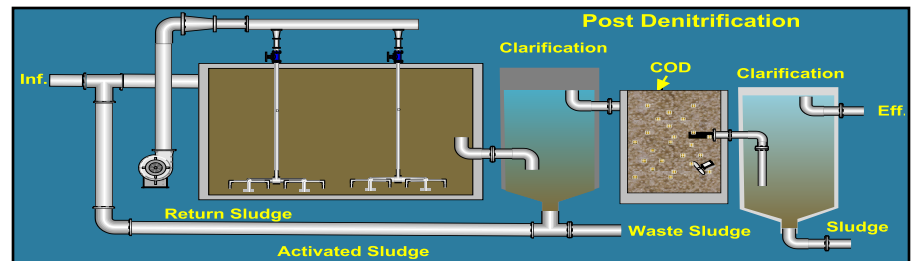
Post-Denitrification



Combination Pre & Post Denitrification



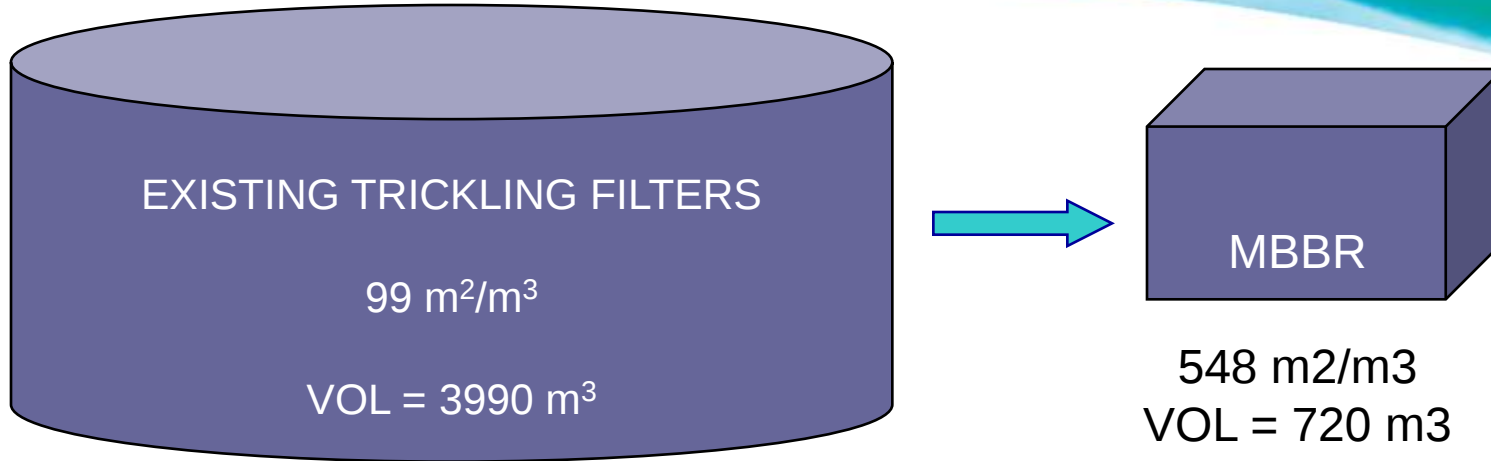
Post treatment-Denitrification



MBBR	Activated Sludge
Single Pass Process	Requires returning the sludge back to the head of the process
No Process Adjustments	Requires an operator experienced in measuring and balancing the biomass concentrations between the different process.
Smaller Foot Print	Larger volumes required for the same level of treatment.
Not affected by washout of biology	Surges in flow can wash out the biomass losing treatment capability
Less mechanical equipment	Requires return pumps and controls for waste pumps
More efficient nutrient removal	Takes up to 12 weeks to develop mature nitrifiers if they are lost or die out.

Foot Print Comparison

Trickling Filter vs. MBBR



AT EQUAL LEVELS OF BOD REMOVAL:

MBBR Provides Five times the Biofilm Surface Area in less than $\frac{1}{4}$ Reactor Volume as Trickling Filter

Kinetics = MBBR is More Active & Efficient than Trickling Filter

Activated Sludge Extended Air process is designed for 12 to 24 hours hydraulic retention time (HRT).

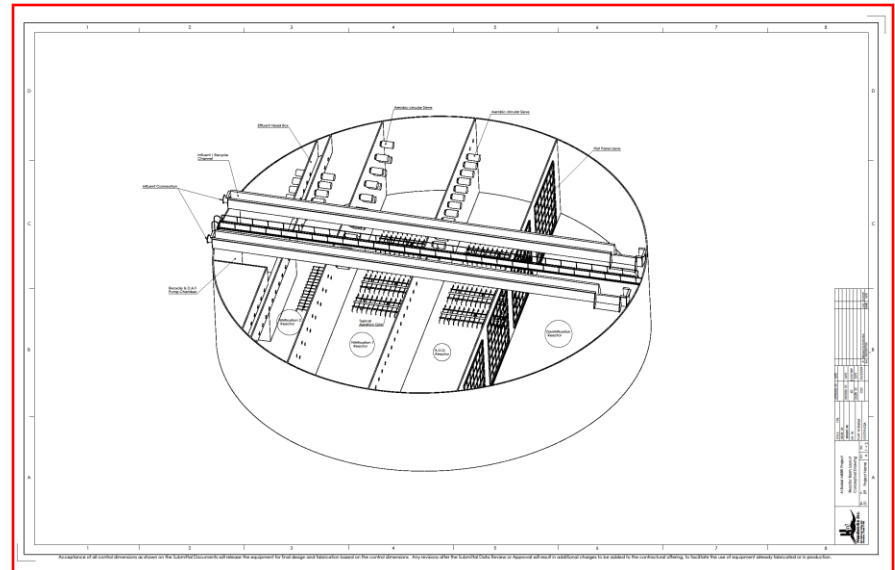
The MBBR need only 2 to 3 HRT to achieve the same level of nitrification.

This is less than or equal to $\frac{1}{4}$ the tank volume.

Typical biomass levels in activated sludge plants is between 2500 mg/l to 3500 mg/l of suspended solids.

Typical equivalent biomass in an MBBR is 6000 mg/l of attach growth.

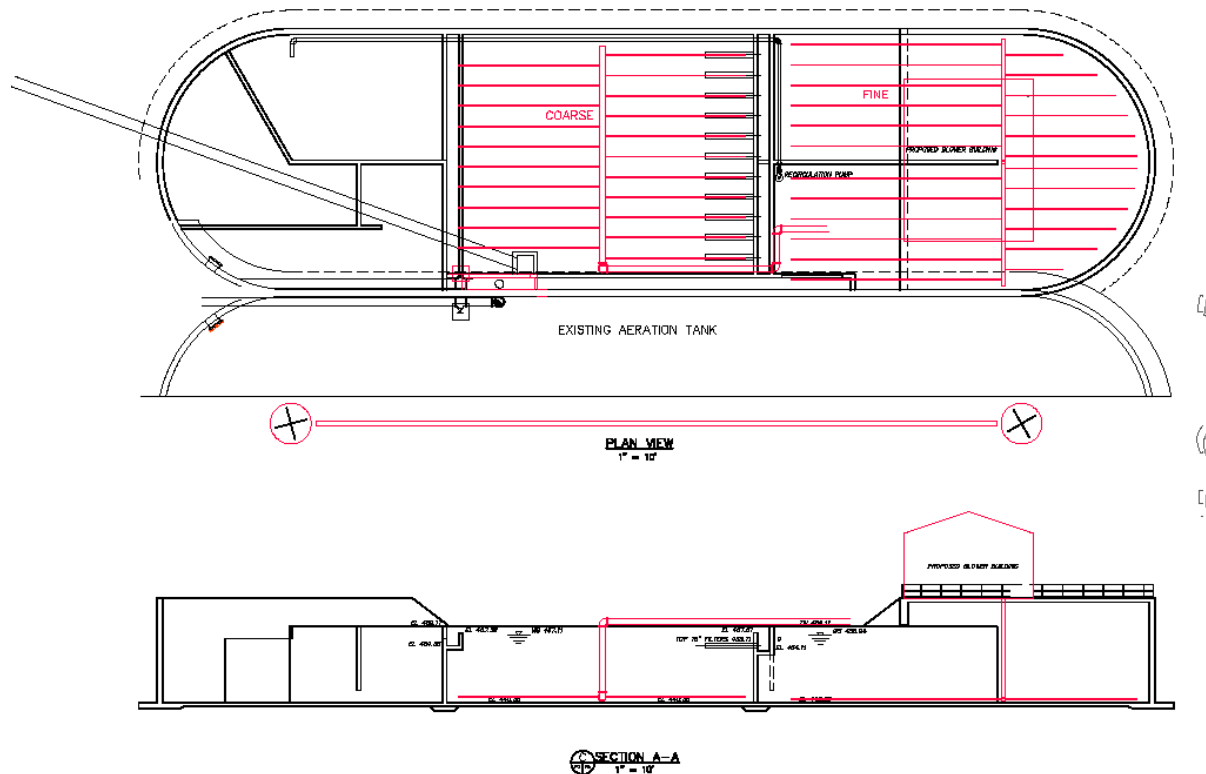
This is 2 times more available treatment mass.



Applications

Oxidation Ditch Conversion

Flow increased from 8328 m³/d to 15899 m³/d

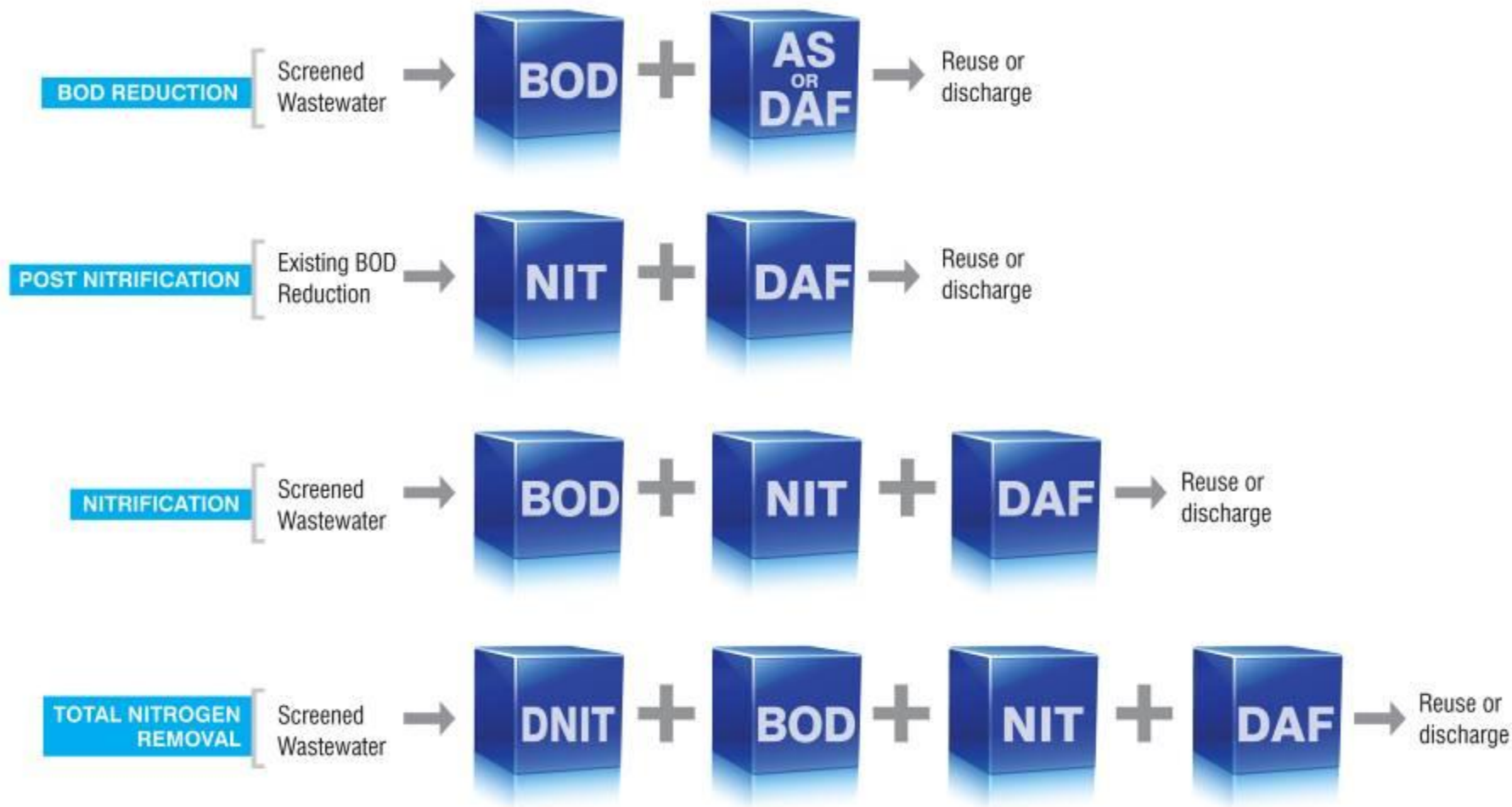




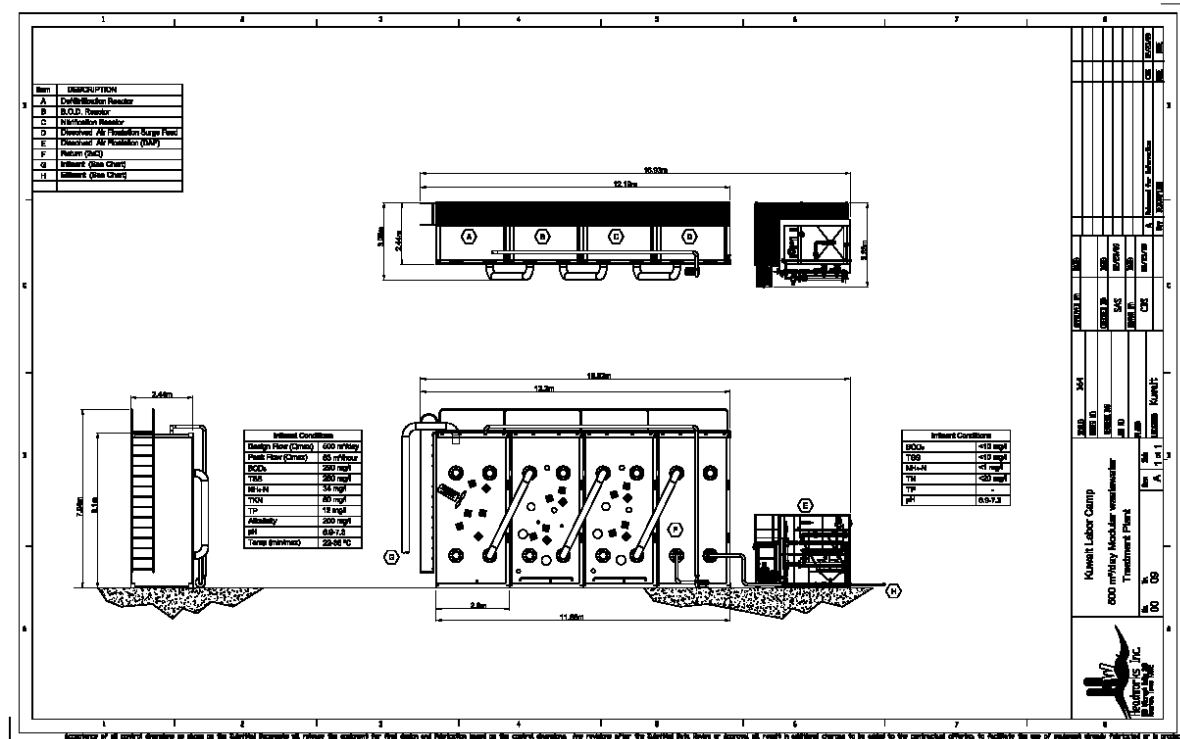
Highrises - Scenarios for total re-use

HIT System

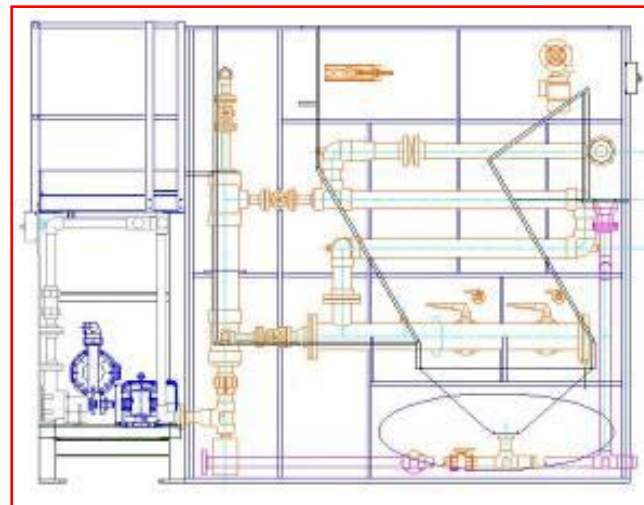




- Built to ISO Container specifications
- Ease of shipment
- Pre-assembled
- Heavy duty construction
- Weather resistant
- Easily upgradable modular system



- Small footprint
- Fully automatic
- Compact design
- High SS removal efficiency – 98%
- Highest available flux rate
- Low maintenance
- Low operational costs
- Air compressor not required

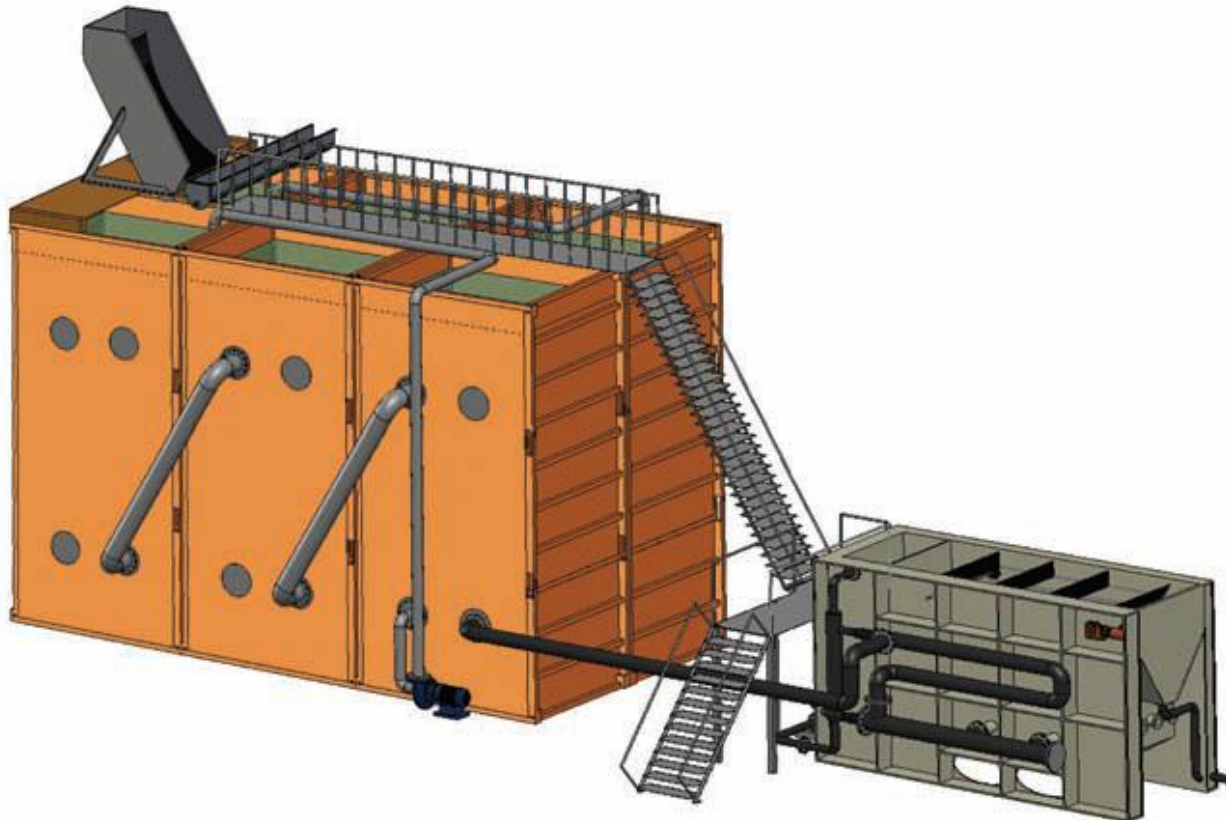


Single Train with DAF



Single Train, DN-BOD-Nitrification, 132,000 gpd, at 25 deg. C

- 500,000 gpd at 25 deg. C (77° F)
- Approximate price of \$1,000,000.
- Treatment tank foot print of 20 ft. by 30 ft.



Installations



Moorhead, MN

ActiveCell[®] Installation

INLAND EMPIRE PAPER, MILLWOOD, WA



ActiveCell® Installation

KEYSTONE LANDFILL, DUNMORE, PA





Container System



Oasis of the Sea

Royal Caribbean Cruises



8000 People



**Floor Module with
WWTP**

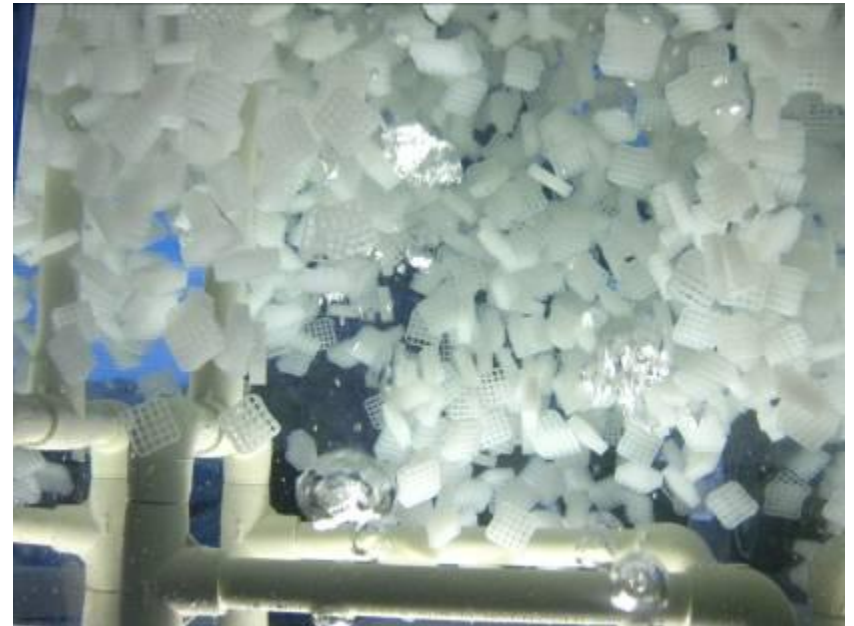


Complete MBBR System with DAF

What will have lesser maintenance?



Membrane Washing Machine



MBBR Media with air grid in tank

HIT™ System

Questions?



800 Wilcrest, Suite 340
Houston, Texas 77042
USA

+1 713.647.6667

www.headworksusa.com

