evoqua
WATER TECHNOLOGIES

THE BIOMAG™ SYSTEM FOR ENHANCED SECONDARY TREATMENT

PROVEN TO MAXIMISE EFFICIENCY AND CAPACITY BY DRAMATICALLY INCREASING BIOLOGICAL SETTLING RATES

ABOUT EVOQUA WATER TECHNOLOGIES

Evoqua Water Technologies is committed to ensuring uninterrupted quantity and quality of water and a more sustainable future for communities and industries around the globe. By combining our process knowledge and industry expertise, we're addressing the world's water treatment needs — integrating systems, developing more automated technologies and working together to be one reliable source for answers that last.

THE BIOMAG™ SYSTEM — MAXIMUM PERFORMANCE AND UP TO TRIPLE THE CAPACITY

Simple, reliable and proven, the innovative BioMag™ System from Evoqua uses magnetite to ballast conventional biological floc, enhancing settling rates and increasing the performance of wastewater and water treatment facilities, while substantially reducing life-cycle costs. Primarily used to improve secondary wastewater treatment, the BioMag System easily integrates with planned or existing facilities, making it easier than ever to solve today's operational and environmental challenges.

Key benefits of the CoMag™ System:

- Simplicity and reliability
  Ballasting biological floc with magnetite increases secondary settling rates while providing reliable control over the depth of secondary sludge blankets to minimize the risk of upsets.
- Up to 300% increase in capacity
  Rapid and reliable settling enables a 2 – 3x increase in mixed liquor suspended solids (MLSS) concentrations and an equivalent increase in treatment capacity all within existing bioreactors and clarifiers.
- Enhanced nutrient removal (ENR) at lower costs
  Increased capacity and superior solids removal enable existing activated sludge systems to free up reactor capacity for multi-stage treatment processes, thereby enabling the removal of nitrogen to ≤ 3.0 mg/L and phosphorus to ≤ 0.2 mg/L.

Magnetite: The little compound that pulls a lot of weight.

Magnetite is a readily available, fully inert form of iron ore (Fe_3O_4), and the ballast that powers the BioMag System.

Benefits of Magnetite

- Hydrophobic
  - Shuns water and naturally bonds with chemical floc and biological solids
- Dense
  - Specific gravity of 5.2 means increased floc density, faster settling and higher surface overflow rates (SOR) and solids loading rates (SLR)
- Fully oxidized and insoluble
  - Will not rust, degrade or easily disolve like some ballasting agents
- Non-abrasive
  - Will not erode components while incorporated with floc
- Inexpensive
  - A readily-available commodity that helps keep operational costs low
- Reusable
  - Attracted to magnets, not components, allowing for easy recovery and reuse

MAGNETITE RECOVERY DRUM

BIOREACTOR TANK

INSIDE MAGNETITE BALLASTED TECHNOLOGY

A. THE BIOREACTOR™: BALLASTING THE FLOC TO INCREASE CAPACITY AND REDUCE COSTS

The BioMag System enhances the performance of nearly all activated sludge configurations and technologies. The first step is the addition of magnetite to the bioreactor. From various storage systems, magnetite is blended into a side stream of MLSS, fed directly into the bioreactor, gently mixed and fully infused in the biological floc.

With the resulting increase in the specific gravity of the floc:

- Biological solids settle faster and more reliably.
- MLSS concentration can be increased up to 3x without the risk of upset.
- Clarifier SLR can be increased up to 4x.
- Operators gain more control over sludge blankets (especially for storm flows).
- Tankage capacity is freed up for nutrient removal.

The increased density can be employed to process greater loads, or flows or both — all within the existing bioreactor tanks, for substantially reduced costs.

B. THE CLARIFIER: WHERE THE BIOMAG™ SYSTEM SETTLES A CONVENTIONAL PROBLEM

Clarifiers are the choke point of every water and wastewater treatment plant. But magnetite ballasted floc from the BioMag System eliminates bottlenecks, enabling:

- Rapid settling and short hydraulic retention times (HRT)
- 2 – 3x SOR and up to 4x SLR
- Low and stable sludge blankets with reduced risk of solids loss
- The ability to manage wide swings in loads and flows
- High contaminant removal

C. RECOVERY AND REUSE: A SUSTAINABLE PROCESS FOR LOWER OPEX

In addition to enabling rapid and reliable settling, the BioMag System offers the cost-effective ability to continuously recycle and reuse magnetite.

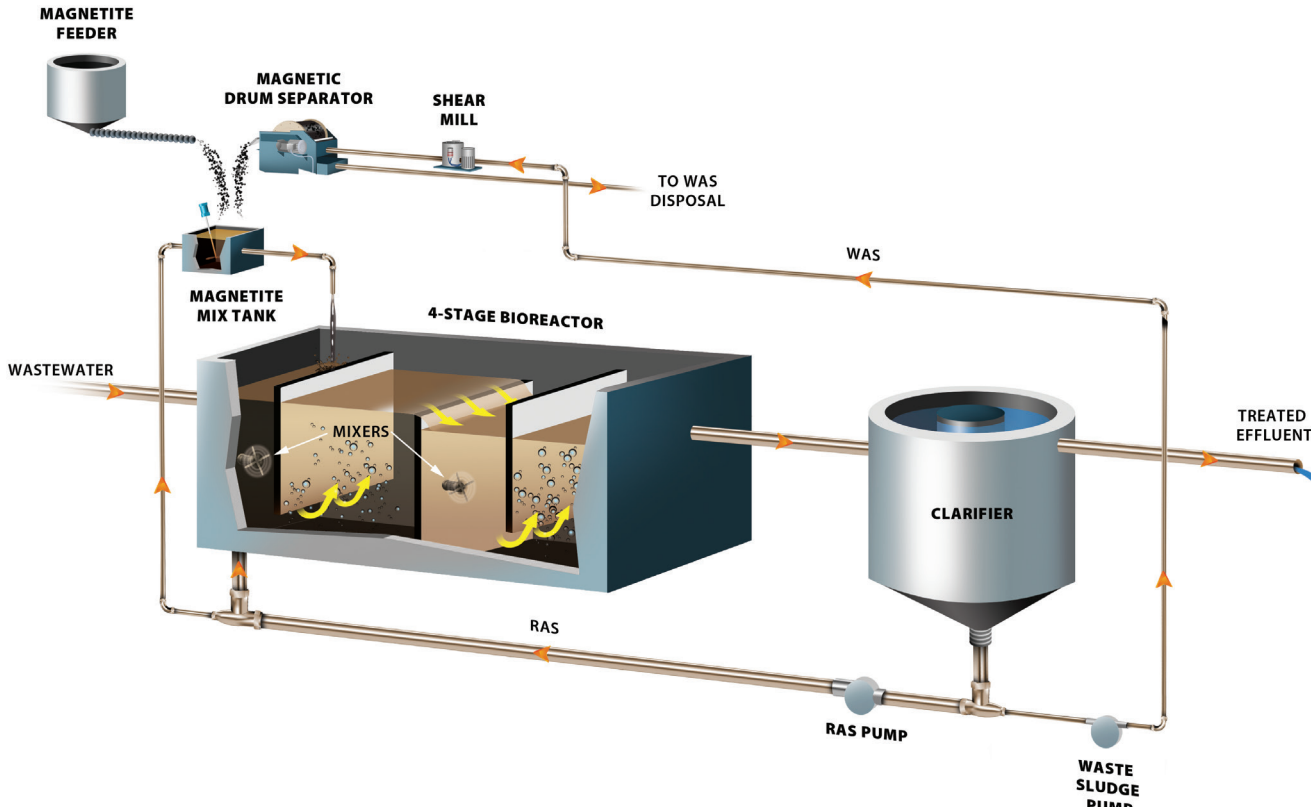
Here's how it works:

- Sludge moves from the clarifier via a waste activated sludge (WAS) line to an inline high-speed sheer mill where magnetite is liberated from biological floc.
- The resulting two-part slurry is then passed under a recovery drum.
- Permanent and stationary magnets inside the drum help capture 95+% of the magnetite, then release it back into the system.
- Sheered sludge, minus magnetite, then flows to a gravity thickener where it thickens to 3 – 6% solids.

Practical uses for the BioMag System

Municipal and industrial wastewater treatment facilities rely on the proven technology of the BioMag System to:

- Enable capacity increases up to 300% without new tankage
- Manage wet weather flows without bypassing the biological process
- Free up existing tankage to meet tougher ENR standards
- Manage high organic industrial waste
- Enable the conversion of single-stage bioreactors to higher performing multi-stage systems
- Find a cost effective alternative to MBR, MBBR, IFAS technologies and conventional clarifier expansion solutions



THE BIOMAG™ SYSTEM AS PART OF A TRADITIONAL SECONDARY TREATMENT CONFIGURATION

SOLID PROOF. THE DEMONSTRATED PERFORMANCE OF THE BIOMAG™ SYSTEM

PROCESS CONTROLS

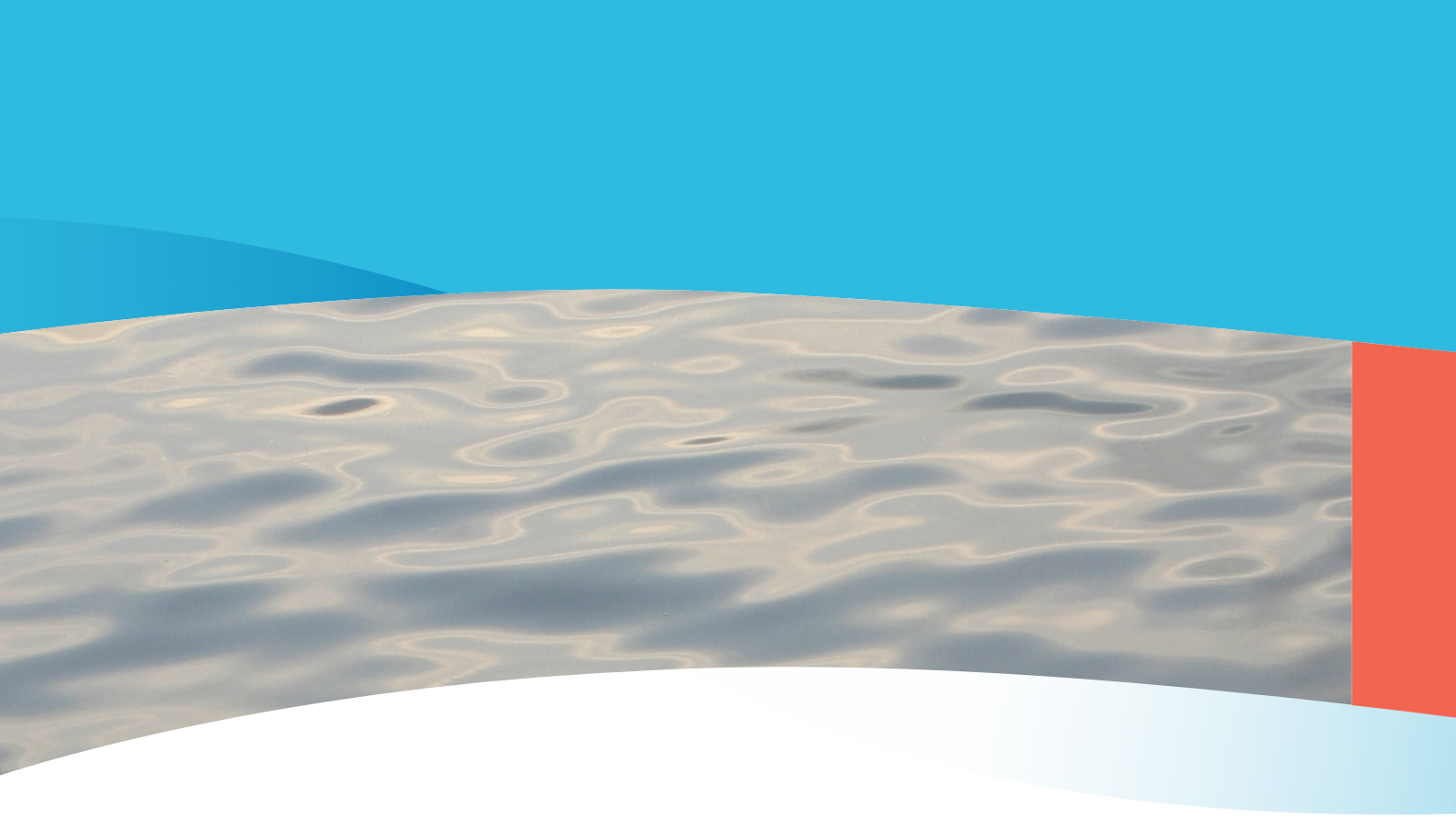
The BioMag System can double if not triple a plant's existing biological treatment capacity and achieve enhanced nutrient removal limits — all within existing tankage — and has been proven at multiple industrial and municipal facilities to deliver the following results:

- $BOD_5 \leq 5.0$ mg/L
- TSS ≤ 5.0 mg/L
- NH_3-N ≤ 0.2 mg/L
- TP ≤ 0.2 mg/L
- TN ≤ 3.0 mg/L
- SVI ≤ 70 mL/gram
- Clarifier SLR up to 100 lb/day-ft^2
- Clarifier SOR up to 2,500 gpd/ft^2
- MLSS up to 10,000 mg/L
- MLVSS up to 8,000 mg/L

Access our complete library of multimedia resources including performance videos, case studies and FAQs.

All the answers you need to meet your water management objectives, today and into the future, are at

www.evoqua.com



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