

# SMART WATER & WASTE

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# 30 TOP

# MUNICIPAL CASE STUDIES

EDITOR'S CHOICE - 30 CASE STUDIES ON  
MUNICIPAL WATER, WASTEWATER, AND WASTE



# Marlay-Taylor Water Reclamation Facility Leverages Water Technology to Meet ENR Standards

The Marlay-Taylor Water Reclamation facility, located in Lexington Park, Maryland, underwent capacity and technology upgrades to bring the plant's treatment capabilities up to Enhanced Nutrient Removal (ENR) standards.

By Evoqua

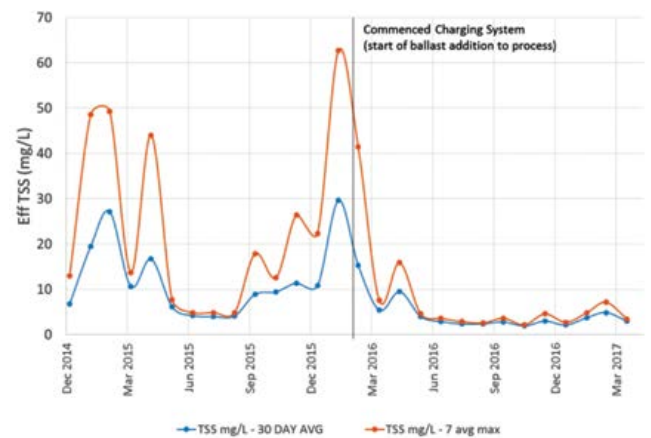


Figure 2: Full Scale BioMag System - Final Effluent TSS

## The Challenge

As part of the Chesapeake Bay Restoration Act's Enhanced Nutrient Removal (ENR) initiative, the Marlay-Taylor Water Reclamation facility, a regional wastewater treatment plant for the Lexington Park, Hollywood and Piney Point areas of St. Mary's County in Maryland, was faced with the need to find a cost-effective solution to achieve this initiative. The

requirements involved meeting future total nitrogen (TN) and total phosphorus (TP) limits, while maintaining the plant's 6 million gallons per day (MGD) rated capacity.

At the time, the Marlay-Taylor Water Reclamation facility treated an average flow of 4 MGD. The existing facility was designed to treat an annual average daily flow of 6 MGD, a max monthly flow of 8 MGD, a max daily flow of slightly

more than 15 MGD and a peak hourly flow of 20 MGD. The existing facility consisted of influent screening, grit removal,

primary clarification, two aeration tanks, four secondary clarifiers, and chlorine gas disinfection. The secondary treatment system was made up of two aeration trains. Each train

was configured as a four-stage Bardenpho with retrievable fine bubble tube diffusers in the first three aerobic zones and retrievable coarse bubble diffusers in the re-aeration

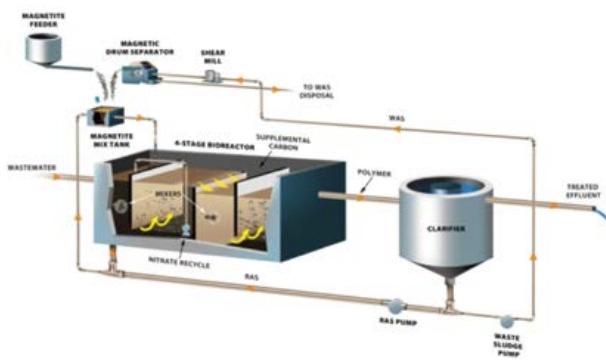


Figure 1: Typical Flow Diagram of 4 Stage Bardenpho with BioMag System



Influent		Effluent	
BOD <sub>5</sub>	130 mg/L	BOD <sub>5</sub>	5.0 mg/L
TSS	75 mg/L	TSS	5.0 mg/L
TKN	43 mg/L		
TN	43 mg/L	TN	3.0 mg/L
TP	5.0 mg/L	TP	0.3 mg/L
Average Daily Flow	6.0 MGD		
Average Temperature	20°C		
Minimum Temperature	12°C		

Table 1: Full-Scale BioMag System Design Conditions

zone.

### The Solution: More Treatment and Clarification

Through a collaborative ef-

BioMag® system, a ballasted activated sludge process, would be the ideal solution to allow for the stable operation across a wide range of flows and also remove phosphorus

Average Daily Flow	3.50 MGD
Average Daily Max Flow	9.31 MGD
Effluent TSS	2.9 mg/L
Effluent BOD <sub>5</sub>	2.7 mg/L
Effluent TN	2.69 mg/L
Effluent Ortho Phosphate	0.20 mg/L
MLSS (w/o Magnetite)	3,642 mg/L

Table 2: Full-Scale BioMag System Average Operating Conditions

fort between the utility operating the facility, MetCom, two consulting engineering firms, Dewberry, Brown and Caldwell, and Evoqua, a solution was developed to retrofit the existing single stage Bardenpho. It was concluded that Evoqua's

in the effluent.

The BioMag System enhances biological wastewater treatment processes by using magnetite to ballast biological floc. With a specific gravity of 5.2 and a strong affinity for biological solids, magnetite substantially increases the

	Total Rain (in.)	Total Flow (MG)	Average Day Effluent (mg/L)			
			BOD	TSS	TN	TP
March 03, 2015	0.8	4.47	106	105	30	0.2
March 15, 2017	3.3	7.17	12	10	7.2	0.47

Table 3: Peak Flow Before (2015) & After the BioMag System (2017)

	Total Rain (in.)	Total Flow (MG)	Monthly Avg Daily Flow	Monthly Average Effluent (mg/L)			
				BOD	TSS	TN	TP
March 2015	3.4	134.65	4.34	37	27	31.7	0.8
March 2017	4.6	117.17	3.78	4	5	3.3	0.37

settling rate of the biomass. Increasing the settling rates of the biological floc provides the opportunity to increase mixed liquor suspended solids (MLSS) concentration. Higher MLSS concentrations enable more treatment capacity, all within the same tankage. The BioMag system serves as the perfect application for activated sludge plants which need more treatment capacity or enhanced treatment removal capability.

### Design Basis

The full-scale BioMag system starts with waste pumped from either clarifier underflow or surface wasting that is sent to an intermediate thickener or holding tank. This tank allows for flexibility in wasting rates and allows for both a portion of underflow and surface waste to be utilized. This

tank can also be bypassed entirely if desired. The waste is then pumped by two of three double-disc diaphragm pumps to the four shear mills and four magnetic recovery drums. The operators have the option to send flow through any number and combination of the shear mills and drums. The recovered magnetite then slides down a chute where it is mixed with raw magnetite in a tank before being returned to aeration basins. The system typically uses ferric chloride with single point addition into the aeration tanks prior to the secondary clarifiers to meet its TP limit. Another available

conditions under wet weather spring flows, as the second train was taken offline and upgraded. Prior to the BioMag system, heavy rain events would have caused Biological Oxygen Demand (BOD) and Total Suspended Solids (TSS) values to surpass 100 mg/L, overwhelming the system. After leveraging Biomag, a rain of 3.3 inches caused flows to surpass 15 MGD, with a daily total of slightly over 7 MGD was observed. Due to the system, there was not a problem with high flows, and in turn, there was no need for an operator to remain on site after hours to manage issues stem-

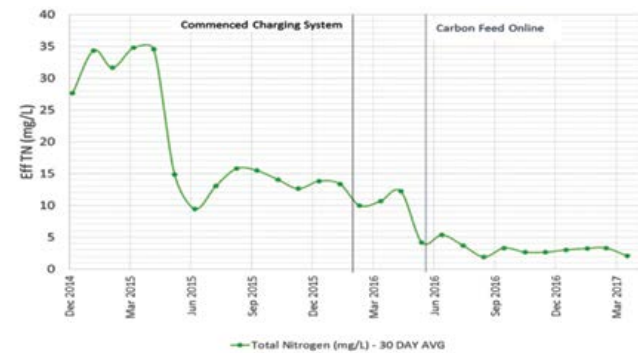


Figure 3: Full Scale BioMag System - Final Effluent TN

option is adding polymer into the clarifier splitter box, which the plant operates at an average dose of 0.68 mg/L active polymer.

### Operating Results

Since the full BioMag system by Evoqua Water Technologies came online in early 2016, it has had a successful run operating in overloaded

ming from the high flows.

Figure 2 shows the plant's effluent TSS concentrations since the BioMag system was operational. Effluent TSS concentrations have ranged from 1 to 7 mg/L TSS, with an average effluent TSS concentration of 2.9 mg/L, indicating excellent and consistent treatment overall. With the low TSS performance, the BOD<sub>5</sub> concen-





trations have also performed well with the BOD<sub>5</sub> concentration in TN with the commencement of the new system, TP in the effluent as shown in Figure 4.



tions ranging from 1 mg/L to 9 mg/L, with an average of 2.7 mg/L.

The TN removed is enhanced through carbon addition and has averaged 2.9 mg/L average daily effluent TN since this has come online. Figure 3 walks through the re-

charging the system with magnetite, and the addition of a glycerin-based carbon source.

While the main goal of implementing the BioMag system at the Marlay-Taylor Facility was to remove phosphorous, the reduction in TSS in effluent has also improved

Marlay-Taylor Water Reclamation facility's implementation of BioMag system was one of the first full-scale operating

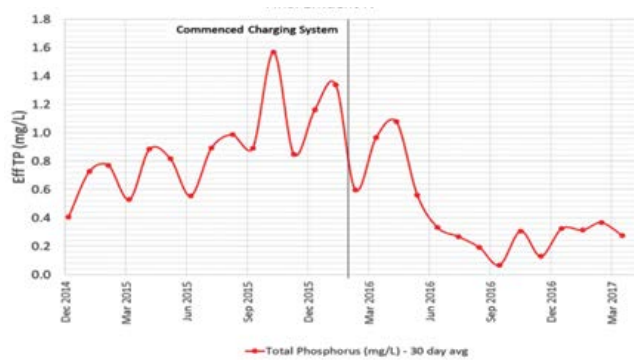


Figure 4: Full Scale BioMag System - Final Effluent TP

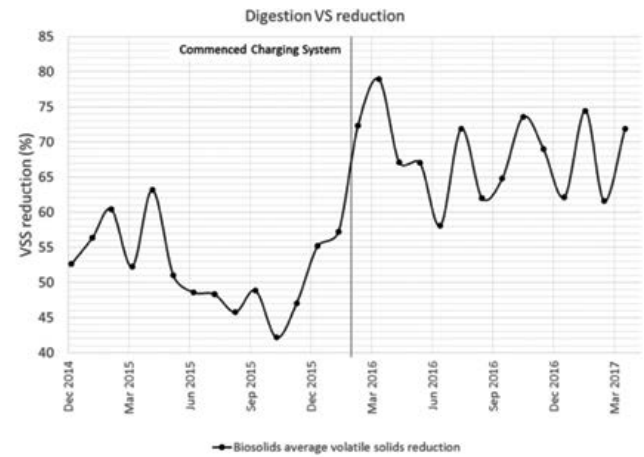


Figure 5: Full Scale BioMag System - Anaerobic Digestion Volatile Solids Reduction

BioMag systems with anaerobic digestion. As a result, there have been interesting findings around the destruction of volatile solids. While the majority of magnetite is returned back to the activated sludge process, there is a small fraction that makes its way past the recovery drums with the waste activated sludge. The plant has observed upwards of a 10% increase in volatile solids reduction, as shown in Figure 5 since the BioMag system came online.

The upgrade of the Marlay-Taylor Water Reclamation facility has allowed the plant to achieve ENR standards (the tighter 5 ppm BOD/ 5 ppm TSS/ 3 ppm TN/ 0.3 ppm TP effluent limits). In the past, storm flows would have created and led to deteriorating water quality. Since the BioMag®

system upgrade, the plant has pushed the average daily secondary clarifier surface overflow rate up to 1300 GPD/SF while maintaining effluent

### PROJECT FILE

**Customer:** Marlay-Taylor Water Reclamation Facility  
**Location:** St. Mary's County, Maryland, USA  
**Service Provider:** MetCom; Evoqua; Dewberry, Brown, and Caldwell  
**Products/Technology Involved:** BioMag® System (Ballasted Activated Sludge)

limits.

Additionally, the BioMag system has allowed for stable operation across the wide range of flows the plant encounters.

