How to Participate Today

- Audio Modes
  - Listen using Mic & Speakers
  - Or, select “Use Telephone” and dial the conference (please remember long distance phone charges apply).

Submit your questions using the Questions pane.

- A recording will be available for replay shortly after this webcast.
Webinar Speakers

Jim Goodwin – Evoqua UK Applications Manager
A chemical engineering graduate (Aston University) with over 30 years experience in a wide range of industrial and municipal water and waste water treatment technologies. Latterly leading the process design function at Evoqua Water Technologies, concentrating on ultrafiltration processes and ballasted settlement technologies.

Simon Radford – Evoqua UK Sales Manager
A chemical engineering graduate (Leeds University) with over 30 years experience in water treatment with experience in ion exchange, reverse osmosis, ultrafiltration, membrane bioreactors and wastewater treatment. Currently responsible for the portfolio of unique process technologies that Evoqua supply to the municipal market place.

Evoqua Serving Markets Around the World

Evoqua’s Global Locations
Operates 170+ offices, plants, and factories throughout Australia, Canada, China, Germany, Italy, Singapore, the UK and US with 4,000+ employees worldwide.
WHAT'S THE PROBLEM?
SOLID/LIQUID SEPARATION WITH A FILTRATION BARRIER

What if we could remove the physical barrier and maintain or improve effluent quality?

What's the problem? Low specific gravity of the flocs

What if we could increase the specific gravity of flocs?

BioMag®/CoMag®
BALLASTED WASTEWATER TREATMENT PROCESSES
**BioMag® and CoMag® System Technologies**

Accomplish More… with Less

These systems can:

- Increase capacity
- Improve final effluent quality
- Improve stability
- Reduce footprint
- Reduce capital costs
Magnetite as a Ballast

Magnetite: \( \text{Fe}_3\text{O}_4 \)
- Fully oxidized iron ore
- Mined
- Wide range of applications
- Readily available from multiple sources

Six compelling properties
- Completely inert
- Specific Gravity: 5.2
- Readily embeds in floc
- Magnetically retrievable
- Non-abrasive
- Inexpensive

Introduction to the CoMag® System

Embrace Gravity. Defy Convention

TRANSFORMING WATER. ENRICHING LIFE.
CoMag® System – What can it remove?

- Phosphorus
- Particulate solids
- Colloidal suspensions
- Heavy metals
- Colour
- Pathogens
- Algae

CoMag® System Applications

- Tertiary Treatment
- Fixed-film secondary clarification
- Ultra-low phosphorus treatment (<0.05 mg/l)
- Various industrial applications

Also
- Storm water treatment
- Drinking water treatment
CoMag® System – How is it applied?

- Clarifiers 90+% smaller
- Increase capacity up to 10X
- Quality of tertiary filtration

- Reduces chemicals
- Promotes solids-contact

99.5% magnetite recovery from waste stream

CoMag® Process Flow Diagram
CoMag® System Video

Severn Trent Finham STW - CoMag® Plant in Numbers

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flow</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td>43,200</td>
<td>m³/day</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>139,057</td>
<td>m³/day</td>
<td>Including returns</td>
</tr>
<tr>
<td>Maximum</td>
<td>250,714</td>
<td>m³/day</td>
<td>Including returns</td>
</tr>
<tr>
<td><strong>Inlet Quality</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TSS (95%ile)</td>
<td>14</td>
<td>mg/l</td>
<td></td>
</tr>
<tr>
<td>Ortho P (95%ile)</td>
<td>1.3</td>
<td>mg/l</td>
<td></td>
</tr>
<tr>
<td><strong>Effluent Quality Guarantee</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP (average)</td>
<td>&lt; 0.18</td>
<td>mg/l</td>
<td></td>
</tr>
<tr>
<td>Fe (average)</td>
<td>&lt; 2</td>
<td>mg/l</td>
<td></td>
</tr>
<tr>
<td>TSS (average)</td>
<td>&lt; 7</td>
<td>mg/l</td>
<td></td>
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<tr>
<td><strong>Chemical dose</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coagulant (Ferric Sulphate)</td>
<td>5</td>
<td>ppm</td>
<td>Subject to jar test</td>
</tr>
<tr>
<td>Polymer</td>
<td>0.6</td>
<td>ppm</td>
<td>Subject to jar test</td>
</tr>
</tbody>
</table>
Severn Trent Finham STW – Overview

CoMag® Plant

Final Settlement Tanks

Activated Sludge Plant

10 Standard Clarifiers

1 CoMag® Clarifier

Treating more… with less
### CoMag ‘Low P’ Schemes - Numbers

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Site A</th>
<th>Site B</th>
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<tbody>
<tr>
<td>Minimum Flow</td>
<td>m$^3$/day</td>
<td>8994</td>
<td>2059</td>
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<tr>
<td>Average Flow</td>
<td>m$^3$/day</td>
<td>14420</td>
<td>2947</td>
</tr>
<tr>
<td>Maximum Flow</td>
<td>m$^3$/day</td>
<td>18525</td>
<td>4967</td>
</tr>
<tr>
<td>Average Feed TSS</td>
<td>mg/l</td>
<td>35</td>
<td>45</td>
</tr>
<tr>
<td>95% Feed TSS</td>
<td>mg/l</td>
<td>65</td>
<td>75</td>
</tr>
<tr>
<td>Average Feed T-P</td>
<td>mg/l</td>
<td>1.5</td>
<td>1.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Site A</th>
<th>Site B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average T-P Permit</td>
<td>mg/l</td>
<td>0.5</td>
<td>0.25</td>
</tr>
<tr>
<td>95% Effluent TSS</td>
<td>mg/l</td>
<td>8.0</td>
<td>5.0</td>
</tr>
<tr>
<td>95% Effluent Fe (as Fe)</td>
<td>mg/l</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Average Effluent TSS</td>
<td>mg/l</td>
<td>5.0</td>
<td>2.5</td>
</tr>
</tbody>
</table>
CoMag ‘Low P’ Schemes using the existing site infrastructure

- PSTs
- Trickling Filters
- Humus Tanks
- Duty Standby
- Clarifiers
- To River
- Feed
- Screens
- Fe Dosing
- CoMag®

CoMag® System Summary

- High rate ballasted clarification process
- No physical barrier to “clog”, much more robust under stress than filters
- Achieve TP < 0.05 mg/l
- For P removal, can be applied as 2° or 3° system
- Very small footprint
Introduction to the BioMag® System

Embrace Gravity. Defy Convention

TRANSFORMING WATER. ENRICHING LIFE.

BioMag® Systems – Applications for Activated Sludge Processes

- Conventional ASP
- High Rate
- Extended Air
- Oxidation Ditch
- Multistage
- SBR
Clarifiers are the Limiting Factor in ASP Process

BioMag® system:
- Relieves bottlenecks
- Enhancing clarifier performance

BioMag® Mixed Liquor Comparison

Settling determines the capacity of a WWTP
BioMag® System - More out of Existing Tanks

- Improved Effluent Quality – No Tertiary Treatment Required
- Settlement rate (m/hr): 2-4
- MLSS: 6,000+
- Q: 2xQ
- SAS: 2xQ

Severn Trent Rugby WWTW

- Improved Effluent Quality – No Tertiary Treatment Required
- Settlement rate (m/hr): 2-4
- MLSS: 6,000+
- Q: 2xQ
- SAS: 2xQ
Severn Trent Rugby BioMag® - Plant in Numbers

<table>
<thead>
<tr>
<th>Item</th>
<th>Parameter</th>
<th>Value</th>
<th>Units</th>
<th>Notes</th>
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<tbody>
<tr>
<td>PE</td>
<td>2020</td>
<td>107,975</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2028</td>
<td>122,682</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>14% Increase in Load</strong></td>
</tr>
<tr>
<td>Flow</td>
<td>DWF</td>
<td>21,761</td>
<td>m³/day</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>28,324</td>
<td>m³/day</td>
<td><strong>12% Increase in Av Flow</strong></td>
</tr>
<tr>
<td></td>
<td>Maximum (FFT)</td>
<td>59,962</td>
<td>m³/day</td>
<td><strong>25% Increase in FFT</strong></td>
</tr>
<tr>
<td>Effluent Quality</td>
<td>TP (average)</td>
<td>&lt; 0.32</td>
<td>mg/l</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TSS (95%ile)</td>
<td>&lt; 11.2</td>
<td>mg/l</td>
<td></td>
</tr>
<tr>
<td>Chemical dose</td>
<td>Coagulant (Ferric Sulphate)</td>
<td>10 + 5</td>
<td>ppm</td>
<td>2 point dosing (subject to trial)</td>
</tr>
<tr>
<td></td>
<td>Polymer</td>
<td>0.5 – 1.0</td>
<td>ppm</td>
<td>Subject to jar test</td>
</tr>
</tbody>
</table>

Rugby State Point Analysis

**FLUX CURVES**

- Rugby BioMag
- Pitman and White
- Overflow
- Influent
- Underflow

**FFT Condition**

- Enhanced BioMag Settling Flux Curve
- Existing Settling Flux Curve
Rugby STW: Process Flow

BioMag®

Waste Sludge

SAS with Magnetite

Recovered Magnetite

BioMag® System

Final Effluent

BioMag® System Layout at Rugby WWTW
Rugby – BioMag® System Footprint vs FST’s

BioMag Footprint Area of 252 M2 Versus 1385 M2
≈ 20% of Conventional Footprint

Where to Use BioMag® System

• Capacity expansions
• Achieve tight nutrient limits without Tertiary Treatment
• Improve storm flow capacity
• Improve process reliability by overcoming poor settling sludge
• Sites with footprint constraints
• Upgrades with budget constraints
• New plant Construction
Magnetite Recovery Drum – How it works

- Drum Rotation
- Stationary Magnetic Array
- Recovered Magnetite
- Ballasted Waste Sludge
- Waste Sludge