Moving from Secondary to Tertiary Wastewater Treatment

Chris Howorth P.Eng.
Why Tertiary?

- Regulations
  - Phosphorous
  - Emerging Contaminants
- Sensitive Receiving Waters
- Reuse
- Climate Change
- Public Pressure
What Technologies are Used?

- Filtration (Discfilters, Membranes)
  - Phosphorous
  - Reuse
  - Emerging Contaminants
    - Particles or Molecules?
- Ballasted Flocculation (Actiflo™)
  - Phosphorous
- Oxidation (Ozone, Advanced Oxidation)
  - Emerging Contaminants
- Other (e.g. activated carbon)
How Do Filtration Technologies Compare?

- **Disc Filters**
- **Sand Filters**
- **MF/UF Membranes**
- **RO Membranes**

**Metrics:**
- Effluent Quality
- Cost & Complexity
What Can Discfilters Achieve?

- **Tertiary Filtration (10 µm cloth)**
  - Guaranteed Effluent TSS 3 to 5 mg/L
  - Effluent TP ~0.1 mg/L
  - BC MoE MWR “Greater Exposure Potential”
    - <2 NTU monthly average
    - <5 mg/L TSS
Do Discfilters Need Chemicals Upstream?

- It Depends....
  - Particle Size Distribution
  - Dissolved Constituents
  - Treatment Objectives
How Does It Work?

Continuous Filtration
Discfilter Operation – Automatic Backwash

Backwash
Moving Backwashing Spraybar
Moving Backwashing Spraybar
Simple Solution

Influent

Effluent

Waste

Cleaning Chemicals
Discfilter Components

- BW Pump
- BW Strainer (optional)
- Influent Box
- Filter Media
- Backwash Collection Trough
Discfilter Components

Drive Motor (cover removed)
Filter Media

- Woven polyester media (since 1984!)
- Filtration range 10-1000µm
- Fouling and chemical resistant
- Easily cleaned
- Very Durable
Configuration Options
O&M Overview

- High level of operator safety
- All components easily accessible
- Basin draining/entry very rarely required
- Inside out design - everything on the “clean side”
  - Better for staff
  - Less wear
  - More reliable

“I LOVE my Hydrotech filters… [they] far exceed design and sales promises”

CJ Wowk, Assistant Superintendent
O&M Routine Inspection

- Backwash sequence
- Level sensor
- Backwash Nozzles
- Filter media
## O&M Overview – Mechanical Maintenance

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Maintenance Requirement</th>
<th>Typical Interval</th>
<th># People</th>
<th>Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drum bearing</td>
<td>Grease bearings</td>
<td>1 months</td>
<td>1</td>
<td>5</td>
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<tr>
<td>Drum drive</td>
<td>Check oil</td>
<td>6 months</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Pump bearings</td>
<td>Grease bearings</td>
<td>6 months</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Drum bearing</td>
<td>Inspect bearing</td>
<td>6 months</td>
<td>1</td>
<td>15</td>
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<tr>
<td>Drum drive</td>
<td>Change oil in gear box</td>
<td>3 years</td>
<td>1</td>
<td>60</td>
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<tr>
<td>Lip seal on drum</td>
<td>Replace lip seal</td>
<td>~10 years</td>
<td>1</td>
<td>120</td>
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<tr>
<td>Backwash pump</td>
<td>Replace shaft seal</td>
<td>~10 years</td>
<td>1</td>
<td>240</td>
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<tr>
<td>Drum bearing</td>
<td>Replace bearing</td>
<td>~10 years</td>
<td>1</td>
<td>240</td>
</tr>
<tr>
<td>Backwash nozzles</td>
<td>Replace nozzles</td>
<td>~15 years</td>
<td>1</td>
<td>1 (each)</td>
</tr>
<tr>
<td>Drive chain</td>
<td>Replace drive chain</td>
<td>~20 years</td>
<td>2</td>
<td>240</td>
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</table>
Chemical Cleaning
World’s Leading Cloth Media Filter Supplier

- Over 10,000 units installed worldwide
- Over 750 sites in US & Canada
- World’s largest Discfilter installations
Canadian Municipal References

- Okotoks, AB, 2004, 25 MLD
- Simcoe, ON, 2008, 40 MLD
- Sunshine Village, AB, 2009, 0.4 MLD
- Fort Macleod, AB, 2010, 10 MLD
- Okanagan Falls, BC, 2013, 2.2 MLD
- Calgary, AB, 2018, 240 MLD
- Banff, AB, 2018, 25 MLD
- Cultus Lake, BC, 0.6 MLD
Project Example - Banff

- Retrofit of existing sand filter
- 2 X 12.7 MLD
- Parks Canada Leadership Targets and AEP
- Effluent targets:
  - 3 mg/L TSS annual average (15 mg/L influent)
  - 8 mg/L TSS daily average (25 mg/L influent)
- Design Builder - Tritech
- Handed over June 2018
Banff’s Sand Filters
# Performance Test Results

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Influent</th>
<th>Effluent</th>
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<tbody>
<tr>
<td><strong>Grab Sample Results:</strong></td>
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<td></td>
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<tr>
<td>Turbidity</td>
<td>NTU</td>
<td>10.7</td>
<td>0.99</td>
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<tr>
<td>TSS</td>
<td>mg/L</td>
<td>23.7</td>
<td>2.1</td>
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<td><strong>Auto-Sampler Results:</strong></td>
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<tr>
<td>TSS</td>
<td>mg/L</td>
<td>33.5</td>
<td>&lt;1.0</td>
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Results
Ballasted Flocculation

- Extremely compact
- More robust than filtration
- Flexible (e.g. wet weather/dry weather)
- Very low phosphorous targets
  - Effluent TP <0.07 mg/L
- >300 Canadian projects
High Rate Clarification - Actiflo™

Stable particles in water → Unstable Coagulated Particles → Flocculated Particles

Metal Salt → Microsand

Polymer
Microsand Ballast

Flocculated Solids

Microsand
Actiflo Process Configuration

- **COAGULATION TANK**
- **FLOCCULATION TANK WITH TURBOMIX™**
- **SETTLING TANK WITH LAMELLA AND SCRAPER**

Flow Diagram:
- Raw Water enters the system.
- Coagulant is added to the raw water.
- Microsand is added to the raw water.
- Polymer is added to the raw water.
- The mixture goes through the COAGULATION TANK.
- The mixture then goes through the FLOCCULATION TANK WITH TURBOMIX™.
- The mixture then goes through the SETTLING TANK WITH LAMELLA AND SCRAPER.
- Clarified Water is produced.
- Sludge and Microsand Ballasted Flocs are removed and directed to the Hydrocyclone.
- The clarified water is then recycled back into the system.
ACTIFLO® Stability During Variable Events

INFLUENT

EFFLUENT

TSS (mg/l)

Date


(100 - 130 m/h) (160 m/h) (100 – 120 m/h) (190 m/h)
THANKS! Questions?

chris.howorth@veolia.com
604 562 0301