IMPLEMENTING COMPRESSIBLE MEDIA FILTRATION FOR SPRINGFIELD’S WET WEATHER MANAGEMENT PROGRAM

BOB O’BRYAN, BLACK & VEATCH

TIM WEAVER, CITY OF SPRINGFIELD
AGENDA

- Project Background
- Compressible Media Filtration (CMF) Technology
- Pilot Testing
- Full Scale Design
- What’s Ahead
PROJECT BACKGROUND
PROJECT BACKGROUND

- Springfield’s LTCP submitted to Ohio EPA
  - Collection system conveyance improvements
  - 100- mgd HRT facility at WWTP
- Compliance schedules in NPDES permit
- Advanced facility planning
  - Define wet-weather event characteristics
  - Develop HRT alternatives
  - Develop process design criteria and technical selection criteria (economic and non-economic factors)
  - Select HRT technology prior to final design

HRT technology selected by evaluated bid process
Springfield chose WWETCO CMF for their situation

- Same life-cycle costs (±7%)
- Top 5 Differentiators
  - No need to increase staffing
  - Simplicity of process and operations
  - No chemicals required
  - Turndown capability
  - Dual function potential during dry weather
CMF TECHNOLOGY
EXAMPLE LAYOUT AND CROSS SECTION

Compressible Media Bed

Compressible Media

Influent Weirs

Top Perforated Plates and Backwash Troughs

Compression Bladder

Bottom Perforated Plate

Air Diffuser
Filtration process controlled by level and timers
PILOT TESTING
PILOT FACILITIES BEGAN OPERATING IN OCTOBER 2010

A Soggy Day at the Pilot Plant

View Down Into Filter Vessel

Typical Wet-Weather Samples

Influent

Effluent
PILOT TESTING

OBJECTIVES

<table>
<thead>
<tr>
<th>Process Design Criteria</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Hydraulic Loading Rate</td>
<td>gpm/ft$^2$</td>
<td>10</td>
</tr>
<tr>
<td>Maximum Backwash Air Rate</td>
<td>SCFM/ft$^2$</td>
<td>10</td>
</tr>
<tr>
<td>Maximum Backwash Flow Rate</td>
<td>gpm/ft$^2$</td>
<td>3</td>
</tr>
<tr>
<td>Event-Average Effluent TSS</td>
<td>mg/L</td>
<td>No measurements &gt;45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥80% of measurements ≤30 mg/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥60% of measurements ≤25 mg/L</td>
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</tbody>
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Confirm influent characterization and process design criteria
Wide variety of influent loading conditions were tested
OPERATOR OBSERVATIONS

- Operated jointly by City staff and local rep
- Automatic PLC control
  - Level and flow rate instruments
  - Timers
  - Valves, pumps and blower (Open/Close; On/Off)
- Monitoring, sampling and lab analyses were main tasks
  - 5-minute grabs (turbidity, headloss, flow rate)
  - Automatic influent and effluent composite samplers (10-minute aliquots)
  - Effluent disinfectant dose response tests

Simple mechanical process, automatic control, low O&M needs
Pilot testing confirmed influent characteristics and process design parameters

- 16 wet-weather events during study period
- Generally short durations of excess flows
- First-flush and dilution behavior

### WET-WEATHER TEST EVENTS

**Springfield, Ohio CMF Pilot**

**Wet-Weather Event**

16 Nov 2010

**Table: Event Average Effluent TSS**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>≤45mg/L</td>
</tr>
<tr>
<td>80th %ile</td>
<td>≤30 mg/L</td>
</tr>
<tr>
<td>60th %ile</td>
<td>≤25 mg/L</td>
</tr>
</tbody>
</table>

**Event-Average Effluent CBOD\(_5\)**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>-</td>
</tr>
</tbody>
</table>

**Example Event Hydrograph and Pollutograph**
PILOT DATA CONFIRMED 11-CELL DESIGN

Filter Operation for Peak CSO Event

- Flow To WWT
- Active Cells
- Backwashes per Hour
- Total Cells
- Cells in Backwash
- HLR, gpm/sq ft
- SLR, lbs/sq ft

CSO Flow Rate, MGD

Operating Filter Cells, HLR or SLR

CSO Event Duration, hrs

CSO Event Duration, hrs
SOME “ABNORMAL” TEST CONDITIONS

• Septage
  • Several test runs in 2011 impacted by septage haulers
  • Testing in 2012 avoided septage discharge periods
  • Full-scale flow intercept upstream of septage station

• Freezing Temperatures
  • System left on standby
  • Media appeared “frosted” before thawing
  • No adverse impacts observed, normal startup and operation
CMF effluent very amenable to chlorination, 10-minute contact time confirmed
CONTINUOUS OPERATIONS BEGAN MARCH 2011

Biofilm growth observed on filter media
SUN SETTING ON THE PILOT PLANT

Piloting testing continues...
FULL SCALE DESIGN
DESIGN PROGRESSES ON FULL-SCALE FACILITIES

- Existing Primary Settling
- Degritting
- New Influent Screening
- Trickling Filters
- Activated Sludge
- Existing and New Final Clarifiers
- Existing Dry and New Wet Weather Disinfection
- Intercept Up to 100 MGD of CSO Flow for HRT
- Backwash to Primary or Bio Treatment
- Future Tertiary Filtration of Dry Weather Flow
- New WWETCO FlexFilters
Footprint of new 100-mgd CMF will be similar to existing three primary clarifiers
DESIGN
CONSIDERATIONS
BACKWASH DESIGN

- Peak backwash return rate of 9 mgd
- 130,000 cf of backwash storage
- Backwash return to:
  - Primary effluent
  - CMAS basin influent
- Peak backwash return rate is solids based
INTERMITTENT OPERATION

- Freezing concerns
- Self draining
- Accessible for cleaning
- Disinfection for filter layup
TURNDOWN CAPABILITY

- Turndown only limited by minimum chlorine feed rates for chlorine contact basin
- Wet weather facilities typically limited by coagulation chemical feed system turndown
- Additional cells can be quickly brought on line
REMOTE OPERATION

• Fully automated PLC based control system
• Integrated into existing plant SCADA system
• Limited amount of equipment
  • Blowers
  • Electrically operated gates and valves
  • Sodium hypochlorite and sodium bisulfite feed systems
  • Effluent pumps
• No coagulation chemicals to optimize
WHAT’S AHEAD
MOVING FORWARD WITH CONSTRUCTION

- May 25, 2012: Bid Opening
- August, 2012: Begin Construction
- December 1, 2014: Complete Construction
- June 30, 2015: Meet Final Effluent Limits
INTO THE FUTURE

- Tertiary Filtration
- Bio-FlexFilter
THANK YOU VERY MUCH!

Bill Young
Jerry Ussher

Baker & Associates
Doug Borkosky

Mark Boner
Building a world of difference.

Together

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