Easterly WWTP – Dry and Wet Weather Treatment Strategies

OWEA 2017 Technical Conference & Expo
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Northeast Ohio Regional Sewer District

MWH®
now part of Stantec
Agenda

1. NEO RSD and Easterly WWTP
2. Operational Challenges
3. Dry and Wet Weather Flow Strategies
4. Case Examples
5. Future Activities
6. Questions
Combined and Separate Sewer Areas

Easterly

Lake Erie

Northeast Ohio Regional Sewer District

McMonagle Administration Building: 3900 Euclid Avenue
Environmental & Maintenance Services Center: 4747 E. 49th Street
Easterly Treatment Plant: 14021 Lakeshore Boulevard
Southerly Treatment Plant: 6000 Canal Road
Westerly Treatment Plant: 5800 W. Memorial Shoreway

Combined Sewer Area
Separate Sewer Area

EASTERLY WASTEWATER TREATMENT PLANT INTERCEPTOR SYSTEM
- E. 140th/E. 152nd-ivanhoe Interceptors
- Easterly Interceptor
- Doan Valley Interceptor
- Dugway Interceptor
- Heights-Hilltop Interceptors & ICRS
- Lakeshore-Nottingham interceptors

SOUTHERLY WASTEWATER TREATMENT PLANT INTERCEPTOR SYSTEM
- Big Creek Interceptor
- Cuyahoga Valley Interceptor
- Mill Creek Interceptor
- Southerly Interceptor
- Southwest, West Leg Interceptors & ICRS

WESTERLY WASTEWATER TREATMENT PLANT INTERCEPTOR SYSTEM
- Low Level Interceptor
- Northwest Interceptor
- Walworth Run Interceptor
- Westerly Interceptor
# Easterly WWTP Service Area

<table>
<thead>
<tr>
<th>INTERCEPTOR SYSTEM</th>
<th>SERVICE AREA (miles)²</th>
<th>LENGTH OF INTERCEPTORS AND ICRs (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easterly</td>
<td>38</td>
<td>48</td>
</tr>
<tr>
<td>Heights-Hilltop</td>
<td>38</td>
<td>46</td>
</tr>
<tr>
<td>Collinwood</td>
<td>13</td>
<td>16</td>
</tr>
</tbody>
</table>
Plant Wet Weather Capacity: 400 MGD
Secondary Treatment: 400 MGD
Wet Weather Flow: >1,000 MGD
Average Daily Flow: 65-85 MGD
## Easterly WWTP
### 2016 Highlights

<table>
<thead>
<tr>
<th>Accomplishments</th>
<th>Metric</th>
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<tbody>
<tr>
<td>Complete Treatment</td>
<td>26.26 Billion Gallons</td>
</tr>
<tr>
<td>Average Daily Flow</td>
<td>71.7 MGD</td>
</tr>
<tr>
<td>NPDES Permit</td>
<td>All Permit Requirements Met</td>
</tr>
<tr>
<td>Budget / Actual</td>
<td>$ 8.84 Million / $ 7.77 Million</td>
</tr>
<tr>
<td>Number of Employees</td>
<td>55</td>
</tr>
</tbody>
</table>
## Easterly WWTP
### NPDES PERMIT REQUIREMENTS

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(kg/day)</td>
<td>(kg/day)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Suspended Solids</td>
<td>mg/L</td>
<td>20</td>
<td>30</td>
<td>11,734</td>
<td>17,600</td>
</tr>
<tr>
<td>Oil and Grease</td>
<td>mg/L</td>
<td>≤ 10</td>
<td>grab 2x/month</td>
<td>year round</td>
<td></td>
</tr>
<tr>
<td>Total Phosphorus</td>
<td>mg/L</td>
<td>1.0</td>
<td>1.5</td>
<td>587</td>
<td>880</td>
</tr>
<tr>
<td>E-Coli (Summer)</td>
<td>#/100 mL</td>
<td>126</td>
<td>284</td>
<td>geometric mean</td>
<td></td>
</tr>
<tr>
<td>Total Chlorine Residual</td>
<td>mg/L</td>
<td>≤ 0.038</td>
<td>grab 3x/day</td>
<td>May 1 – Oct 31</td>
<td></td>
</tr>
<tr>
<td>Total Mercury</td>
<td>ng/L</td>
<td>4.5</td>
<td>-</td>
<td>0.00264</td>
<td>-</td>
</tr>
<tr>
<td>pH</td>
<td></td>
<td>between 6.0 and 9.0</td>
<td>continuous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CBOD5</td>
<td>mg/L</td>
<td>15</td>
<td>22.5</td>
<td>8,800</td>
<td>13,200</td>
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</tbody>
</table>
Influent Process Flow Diagram

Plant Influent
- Easterly Interceptor
- Heights-Hilltop Interceptor
- Collinwood Interceptor

Screening

Chemically Enhanced High Rate Treatment (CEHRT)
- 400 MGD

Influent Flow

Outfall to Lake Erie
- NPDES 002
- 800 MGD

Grit Removal
Primary Treatment
Secondary Treatment
- 400 MGD
Plant Process Flow Diagram

1. Plant Influent
2. Screening
3. Grit Removal
4. Settling Tanks
5. Aeration Tanks
6. Primary Treatment
7. Disinfection/Dechlorination
8. Screw Pumps
9. Effluent

[Logos: Northeast Ohio Regional Sewer District, MWH]
Operational Challenges

• Raw influent flow rates vary significantly due to storms/runoff in the combined sewer systems

• Average daily flow rates 65 – 85 MGD

• Wet weather flow rates can exceed 1,000 MGD (1 BGD)
Operational Challenges

• Maintain process performance at average daily flow rates using a select number of unit process tanks and accommodate sudden wet weather flow

• **Ten State Standards:**
  - Primary Settling Tanks SOR
    - 1,000 – 3,000 gal/ day-ft²
  - F:M ratio
    - 0.2 lb/lb-day
  - Final Settling Tanks SOR
    - 800 – 1,200 gal/ day-ft²
## Easterly WWTP
### 2016 Average Wastewater Concentrations

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>Raw Influent (mg/l)</th>
<th>Primary Effluent (mg/l)</th>
<th>Treated Effluent (mg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Suspended Solids</td>
<td>160</td>
<td>50</td>
<td>6</td>
</tr>
<tr>
<td>CBOD₅</td>
<td>80</td>
<td>47</td>
<td>4</td>
</tr>
<tr>
<td>Total Phosphorus</td>
<td>2.23</td>
<td>1.58</td>
<td>0.45</td>
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</tbody>
</table>
# Dry and Wet Weather Process Tanks

<table>
<thead>
<tr>
<th>PROCESS TANKS</th>
<th>TOTAL</th>
<th>DRY WEATHER</th>
<th>WET WEATHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>AERATED GRIT</td>
<td>4</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>PRIMARY SETTLING TANKS</td>
<td>12</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>AERATION TANKS</td>
<td>8</td>
<td>5</td>
<td>7 - 8</td>
</tr>
<tr>
<td>FINAL SETTLING TANKS</td>
<td>26</td>
<td>16 - 18</td>
<td>24 - 26</td>
</tr>
</tbody>
</table>
Dry Weather Strategies

Using 75 MGD

Primary Settling Tank SOR

- 4/12 PSTs = 1,974 gal/day-ft²
- Maintain higher Primary Effluent \( C_{BOD} \) F:M Ratio (MLSS = 1,200 mg/l)

Using 47 mg/l Primary Effluent \( C_{BOD} \)

- 5/8 ATs = 0.15 lb/lb-day

Final Settling Tank SOR

- 18/26 FSTs = 1,269 gal/day-ft²
During dry weather flow...

Aeration Tanks
Mixed Liquor Channel
During dry weather flow... FSTs
Dry to Wet Weather Flow Strategies

Tools available for increasing flow rates:

- Radar/Weather forecast
- Offsite control structure (LSRS)
- Three (3) Influent flow meters and channel levels inside the plant
- Future flow meters in two (2) upstream interceptors (1 mile from plant)
Moderate Increase in Flow Rate

327 MGD

106 MGD

Sustained High Flows

~1 hour
Dry to Wet Weather Flow Strategies

- During increasing flow rates - standby process tanks are used as equalization basins
- Filled slowly with wastewater to prevent damage to equipment inside the tanks
  - PSTs - inlet gates OPEN 3%
  - Aeration tanks - inlet gates OPEN 3%
- FSTs - inlet gates OPEN 100%
Aeration Tank Inlet Gates
Secondary System Improvements to increase hydraulic capacity

Aeration Tanks

48” Interconnect between East and West Mixed Liquor channels

Final Settling Tanks
Secondary System Improvements to increase hydraulic capacity

Aeration Tanks

Junction Chamber

Final Settling Tanks

Northeast Ohio Regional Sewer District

MWH

Stantec
Wet Weather Strategies
Improvements to existing 20 FSTs

- Density current baffles
- Polymer and ferric piping
- Effluent Gate Actuators
- Mixed liquor distribution chamber modifications (cut throat flumes)
Wet Weather Strategies – 6 new FSTs

- Flocculating Well (Allows solid particles to become larger)
- Drive Unit
- Center Column and Inlet Ports (Feeds and distributes solids into the clarifier)
- Energy Dissipating Inlet (Slows down solids entering the tank)
- Effluent Weirs with Square Notch Design
- Effluent Trough (Collects secondary effluent)
- Sludge Collection Arm (Designed to rapidly remove settled solids)
Sharp Increase in Flow Rate

155 MGD

325 MGD

〜30 mins
Dry to Wet Weather Flow Strategies

- Sharp increases in influent flow rates can result in the need to have more tanks in full operation before the empty tanks are filled
  - Primary Settling Tanks
  - Aeration Tanks
  - Final Settling Tanks
Dry to Wet Weather Flow Strategies

- At increasing flow rates, while PSTs are slowly filling - open two (2) gates to direct primary influent channel flow to the Settled Sewage channels leading to the Aeration Tanks

- Two (2) Primary Influent diversion gates to Primary Effluent (Settled Sewage) channels
Dry to Wet Weather Flow Strategies

Two Primary Influent diversion gates
Dry to Wet Weather Flow Strategies
Case Examples

• During construction, wet weather caused a sharp flow increase. The Primary Influent diversion gates were opened slightly to divert incoming flows as PSTs were filling.
Case Examples

Other construction activities:

• Two ML pipes non-operational
• Stop logs and bulkheads in ML channel
• ML interconnect between the west and east aeration systems being installed
What happened during a sudden increase in flow?
What happened during a sudden increase in flow?
Future Activities

- Design & install baffles at the PST inlet gates
- Automate the operation of the Primary Influent diversion gates (modulate gate based on channel levels)
- Design & install baffles at the Aeration tank inlet gate
Future Activities

- Activated Sludge Process
  - Each Aeration Tank has four passes
  - Pass 1 has two Settled Sewage gates
  - Passes 2, 3 and 4 each have one gate

- Dry weather flow (Conventional)
  - Settled Sewage into passes 1 & 2

- Wet weather flow >225 MGD (Contact Stabilization)
  - Open Settled Sewage gates into passes 3 & 4. Close gates into passes 1 & 2
**Operational Challenges**

**Wet Weather to Dry Weather** - Drain and clean tanks quickly between high flow events

**Odors** - Check wind direction before dewatering tanks
Final Effluent Screw Pumps