Direct Non-Potable Water Reuse in the Northeastern US – A Resource for Campus Energy Facilities

Presented by: Bruce Douglas, PE
Issue Statement

- Campus use large amounts of water for non-potable purposes
- Campus energy facilities typically are the single largest user of non-potable water
- Campus cooling water is often constrained by either:
  - Cost of Municipal Water
  - Availability of Water
- Building-scale uses of reclaimed water can enable broader acceptance of water reuse on campus
The Case for Water Reuse

💧 Water Supply & Demand

🔄 Sustainability & Resiliency

💰 Rising Costs

🛠️ Aging Infrastructure

🌲 Going Green
How Do Local Water & Sewer Rates Relate to Cities with High Water & Sewer Rates?

Top Tier Water & Sewer Rates

Rate / 1,000 gal.

- New York City, NY
- Foxborough, MA
- Boston, MA
- Cambridge, MA
- Atlanta, GA
- Pittsburgh, PA
- San Francisco, CA
- Seattle, WA

Municipalities
Campus-Scale Reuse in Foxborough, MA

2002- Present

**Onsite** water use
- 50% of wastewater reused onsite
- 900,000 gallons buffer capacity
- 20 MGY potable use savings

**Gillette Stadium**
- 68,000 seats + 5,000 employees

2007 - Present

**Patriot Place**
- 250,000 GPD water reuse facility
- **Landscape Irrigation** using reclaimed water
- 0.5 MG reclaimed water Storage
- 1,300,000 sq. feet retail, restaurants & commercial
Massachusetts Direct/Onsite Water Reuse Regulatory Requirements and Uses

**MADEP 314 CMR 20 Class A Reuse Limits**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Class A Requirements</th>
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<tbody>
<tr>
<td>pH</td>
<td>6.5 – 8.5</td>
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<tr>
<td>Biochemical Oxygen Demand</td>
<td>&lt;10 mg/L</td>
</tr>
<tr>
<td>Total Suspended Solids (TSS)</td>
<td>&lt;5 mg/L</td>
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<tr>
<td>Total Nitrogen</td>
<td>&lt;10 mg/L</td>
</tr>
<tr>
<td>Turbidity</td>
<td>2 NTU*</td>
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<tr>
<td>Fecal Coliform</td>
<td>Not Detectable**</td>
</tr>
<tr>
<td>Other Parameters specified by the DEP</td>
<td>To be determined</td>
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</table>

**Notes:**
- * Less than average of 2 NTU within a 24-hour period, cannot exceed 5 NTU more than 5% of the time within a 24 hour period, and cannot exceed 10 NTU at any time.
- **Median of no detectable fecal coliform/100 ml over continuous seven-day sampling periods, not to exceed 14 /100 ml in any one sample

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**Allowed Uses for Class A Water in MA**

- Irrigation
- Cooling Water
- Toilet and Urinal Flushing
- Agricultural Use
- Industrial Process Water
- Commercial Laundries and Carwashes
- Snowmaking
- Fire Protection
- Creation of Wetlands & Recreational Impoundments
Gillette Stadium Water Reclamation Facility
Membrane Bioreactor (MBR)
Secure Remote Access at Gillette Stadium/Patriot Place

Programmable Logic Control (PLC) & Supervisory Control and Data Acquisition (SCADA)

Computerized Maintenance Management System (CMMS)

Digitized Daily Rounds (LogCheck)
Lessons Learned

- Source water
  - Equalization is effective in handling peak flow rates
  - Influent quality required a plant expansion in 2007

- Reclaimed water
  - Significant non-potable water storage volume is necessary to handle peak demands
  - High quality of reclaimed water enabled a permit amendment to meet new regulatory requirements and add landscape irrigation as a use for reclaimed water
One Water NYC: 2018 Water Demand Management Plan
The New School University

- Downtown Manhattan
- 100 years old
- 10,000 students

Source: Google Earth

http://www.newschoolfreepress.com/2013/04/29/the-war-for-space/
Long-Term Goals

Target for 2030, vs 2015 (baseline)

Aligned with NYC Carbon Challenge

- Energy: 40% Reduction
- CO₂: 40% Reduction

Internal TNS Goals

- Water: 20% Reduction
- Waste Diversion: 10% Increase
The New School University’s University Center

- 365,000 sq. ft.
- Classrooms
- Library-research center
- Auditorium
- Cafeteria
- Event café
- 600-bed student residence
The New School University Center Water Balance

Total Building Domestic Potable Water Input = 21,600 GPD

NON-POTABLE REUSE (gpd)
- Cooling Towers = 14,000
- Toilet Flushing = 19,500
- Laundry = 4,500
- Irrigation = 300
- Total = 38,300

Discharge to Sewers = 7,300 gpd
The New School University Center
Onsite Water Treatment and Reuse
Schematic Diagram

Sanitary Drains in Building

Primary Treatment

Secondary Treatment

Tertiary Treatment

Disinfection

Reuse Storage

Toilet Flushing & Laundry

Cooling Tower

Municipal Sewer

RO Polishing

Cooling Tower
New School Onsite Water Reuse System

Construction/System Photographs
<table>
<thead>
<tr>
<th>System Location/Criteria</th>
<th>BOD (mg/l)</th>
<th>TSS (mg/l)</th>
<th>Turbidity (NTU)</th>
<th>Fecal Coliform (#/100 ml)</th>
<th>E. Coli (#/100 ml)</th>
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<tbody>
<tr>
<td>NYC Limit</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;2</td>
<td>&lt;100</td>
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<td>MBR Specification</td>
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<td>The New School</td>
<td>&lt;6</td>
<td>&lt;1</td>
<td>&lt;0.2</td>
<td>&lt;1</td>
<td>&lt;1</td>
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<tr>
<td>The Solaire</td>
<td>&lt;6</td>
<td>&lt;1</td>
<td>0.05 – 0.25</td>
<td>&lt;1</td>
<td>1</td>
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<td>Millennium</td>
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<td>0.15 – 0.45</td>
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<tr>
<td>The Visionaire</td>
<td>&lt;6</td>
<td>&lt;1</td>
<td>0.15 – 0.45</td>
<td>&lt;1 (Total coliform)</td>
<td>&lt;1</td>
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<tr>
<td>The Helena</td>
<td>&lt;6</td>
<td>&lt;1</td>
<td>0.05 -0.20</td>
<td>&lt;1</td>
<td>1</td>
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</table>
New School University, NYC

Outcomes:
• 74% Water Use Reduction
• 89% Sewer Discharge Reduction

Lessons Learned:
• High strength influent due to water conserving fixtures
• Multiple barrier approach provides resiliency
• Need for reverse osmosis treatment prior to cooling tower use
The Case for Onsite Non-Potable Reuse

- Imbalance of Water Supply & Demand
- Sustainability, Resiliency & Resource Recovery
- Aging Infrastructure
- Rising Costs

Sustainability, Resiliency & Resource Recovery

Aging Infrastructure

Rising Costs

Imbalance of Water Supply & Demand
Questions?
Contact Natural Systems Utilities:

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