Irrigation scheduling: Recycled water management in public open spaces

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Recycled Water Scheme

Source water:
- STP
- Bore water

Treatment:
- AWRF
  - Disc filtration
  - [Membrane filtration]
  - UV
  - Chlorination
- Bore
  - Chlorination

Distribution and storage:
- Rising main
- End user storage
- Pre-AWRF storage
- Recycled water storage

End users:
- Golf club
- Racecourse
- Parks and gardens
- Sporting fields

Process:
Secondary Effluent → Disc Filtration → UV → Chlorine → Storage → Distribution
Recycled Water Scheme

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Key:
- Component
- Option
Recycled Water Scheme

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What could go wrong?
Hazard Identification

• Health hazard
  – Pathogens
    o Log reduction values (LRV) for municipal irrigation

<table>
<thead>
<tr>
<th>Process</th>
<th>Protozoa</th>
<th>Virus</th>
<th>Bacteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV disinfection</td>
<td>4.0</td>
<td>2.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Chlorination</td>
<td>0.5</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Design LRVs</td>
<td>4.5</td>
<td>6.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Municipal irrigation LRVs</td>
<td>3.7</td>
<td>5.2</td>
<td>4.0</td>
</tr>
</tbody>
</table>

– Chemicals

• Environmental hazard
  – Salt and nutrient
Controlled irrigation and scheduling
Scheduling Parameters

- Water quality
- Soil and plant
- Water demand
- Sprinkler precipitation rates
- Watering windows
Water quality

• Physicochemical
  – pH
  – Turbidity
  – Electrical conductivity (EC)

• Microbial

• Chemical
  – Sodium adsorption ratio (SAR)
  – Nutrients

• Metals
Soil moisture balance model

• **Inlet**
  – Rainfall
  – Irrigation

• **Outlet**
  – Plant Evapotranspiration (ET)
  – Soil holding capacity
  – Surface runoff
  – Deep drainage

*Source: BoM AWRA-L model description (2016)*
Demand model validation
Apply the right amount of water at the right time
Application rate

• Avoid plant water stress
• Avoid water logging and runoff

Infiltration rate (IR)

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>IR (mm/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>&gt;20</td>
</tr>
<tr>
<td>Sandy loam</td>
<td>10-18</td>
</tr>
<tr>
<td>Loam</td>
<td>10-15</td>
</tr>
<tr>
<td>Clay loam</td>
<td>5-10</td>
</tr>
</tbody>
</table>

Source: Effluent reuse management (2010)
Irrigation time

- Watering window 10:00 PM-7:00 AM
- No public access during irrigation
  - Non-treatment barrier
  - LRVs
- Smart control
  - Weather stations
  - Soil moisture sensors
Managing residual risk

• Operational control (E4)
• Continuous monitoring (E5)
  – Critical limits
  – Soil sampling
• Corrective actions (E6)
• Evaluation and audit (E11)
• Improvement plan (E12)

AGWR (2006)
What’s next?

• Central control system
  – Soil moisture model
  – BoM data
  – Alarm and shut down

• Soil testing and conditioning
• Continuous improvement
Acknowledgements
Questions?