Three Innovative Stormwater Treatment Approaches for Three Linked Industrial Sites
Discussion Topics

- Three Industrial Sites
- WA Industrial Stormwater General Permit
- Stormwater Characteristics
- Treatment Evaluation and Selection
- Hydrologic and Hydraulic Evaluation
- Performance and Costs
Three Linked Industrial Sites

- General Peninsula Project
- Olympic Container Terminal (OCT)
- North Intermodal Yard (NIM)
- South Intermodal Yard (SIM)
- Heavy Industrial Maritime Property
- Containerized Cargo
- Difficult Meeting ISGP Benchmarks
Olympic Container Terminal (OCT)

- 56 acres
- Ship to Rail or Truck and Back
- 5 Drainage Basins
- Outfalls Under Pier
North Intermodal Yard (NIM)

- 12 acres
- Containers moved between terminals
- Efficient means of ship to inland or inland to ship transport
- 24 hour operations
- Small strip of unpaved land available
South Intermodal Yard (SIM)

- 22 acres
- Operating rail facility
- 2 drainage basins
- Long rectangular configuration
- Perforated storm drain piping underneath track ballast
Stormwater Characteristics

- Zinc – Main pollutant of concern
- Occasional turbidity exceedances Throughout
- Copper at SIM
- Larger particulate at SIM (perforated storm drains along tracks)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Turbidity</th>
<th>pH</th>
<th>Zinc</th>
<th>Copper</th>
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<tbody>
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<td>OCT Average</td>
<td>23.0</td>
<td>7.0</td>
<td>150.0</td>
<td>5.0</td>
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<td>OCT Maximum</td>
<td><strong>74.0</strong></td>
<td>7.9</td>
<td><strong>275.0</strong></td>
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<td>NIM Average</td>
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<td>NIM Maximum</td>
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<tr>
<td>SIM Average</td>
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<td>7.0</td>
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<tr>
<td>SIM Maximum</td>
<td><strong>44.3</strong></td>
<td>7.8</td>
<td><strong>281.0</strong></td>
<td><strong>17.6</strong></td>
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**Note:**
Bold red text indicates exceedance of the parameter benchmark.
Treatment Alternatives Selected

- 2 up-flow type
- 1 lateral flow
Upward Flow Media Filtration

- Subsurface Manhole or Vault
- Fluidized Media Filtration Technology
- Bags of Media Inside Filter Modules
Lateral Flow Media Filtration

- At-Grade System
- Front End Settling
- Pre-Filtration Cartridges
- Media Filtration
- Perforated Collection Piping
Upward Flow Cartridge Filtration

- Subsurface Manhole
- Up-flow configuration
- Membrane Filters
- Passive Backwash
Draining by Gravity

- In-depth Hydraulic Modeling
- Tidal Influence
- Check Valves
- Bypassing Flows Greater Than Water Quality Flowrate
OCT Final Design

- 5 Subsurface Vaults
- From 8’ x 12’ to 16’ x 17’
- 15 feet deep
- Accommodates 125 Kip Wheel Loads
NIM Final Design

- 2 At-Grade Systems
- Each 10’ x 20’
- 1 Flow Splitter and Collection MH
- Located clear of container traffic, on strip of unpaved area
SIM Final Design

► 2 Subsurface 6” ID Filter Systems.
► Upstream Flow Splitter MH and Downstream Collection MH for each
► Accommodates 125 Kip Wheel Loads
SIM – Cost & Performance

► ~70% reduction of turbidity and zinc for 2 qtrs
► Below all benchmark levels through 1st qtr 2016
► Very little O&M

Project Costs:
Final Construction Cost: $418,603
Cost per acre treated: $11,674
NIM – Cost & Performance

► ~70% reduction of turbidity and zinc for 2 qtrs
► Below all benchmark levels through 1st qtr 2016
► Very little O&M

Project Costs

Final Construction Cost: $301,104
Cost per acre treated: $25,092
OCT – Cost & Performance

► Not so lucky
► Leaks
► Retrofit
► Still working on it

Project Costs:
Final Construction Cost: $1,033,614
Cost per acre treated: $18,457
Don’t be afraid to try new things