CVCA - LID Infrastructure Performance and Risk Assessment (IPRA) program

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CVC Infrastructure Performance Monitoring Program

- 61 LID Sites
- 12 Demonstration Sites
  - Road Right of Ways
  - Residential sites
  - Public Land sites
  - industrial/commercial
Stormwater Management Monitoring Strategy

- Highlight the importance of SWM monitoring in the design, construction, assumption, operation and maintenance of stormwater infrastructure to ensure long-term performance;

- Provide an overview of how CVC’s stormwater monitoring program fits within our watershed stakeholders priorities (Region of Peel and member municipalities, Ministry of Environment, Ministry of Natural Resources, Development Community);

- Defined 18 objectives for CVC’s overall SWM monitoring program.
Top Five Performance Monitoring Priorities

• Water quality and quantity performance of LID design in low infiltration soils;

• How multiple LID treats and manages stormwater;

• Performance of flood control, erosion control, water quality and natural heritage protection.

• Long term maintenance needs and impact on performance;

• Lifecycle costs (asset management);
Importance of Performance Monitoring

- Provide information on LID performance
- Meet compliance requirements
- Inform design standards
- Inform municipal resolutions for LID implementation
- Provide solutions and procedures for maintenance
- Inform life-cycle costing
Monitoring LID: Why?

Compliance Monitoring

- Environmental Compliance Approval (MOECC’s requirement)
- SWM design standards

Performance Monitoring

- To feed into future designs based off performance of existing sites
Monitoring LID: Why?

Adaptive Monitoring

- Adapt to new questions, requirements and designs
- New needs with changing climate
- Develop new criteria and changes to current standards; demonstrate duty of care of our infrastructure

Assumption Monitoring

- Monitoring to ensure site functionality prior to assumption
Elm Elm Drive – Demonstration Site
Elm Drive: Demonstration Site
Demonstration Site Implementation

• Ward councillor and School Board Trustee provided direction from top down;

• Key project partners included:
  – the City of Mississauga Transportation & Works Department
  – School principal
  – PDSB Maintenance Manager
  – CVC staff
Integration between Departments

• Within the City of Mississauga all departments were engaged to ensure integration;

• Ensured that the people responsible for planning, constructing and maintenance are all involved in the process from the beginning.
School Board and City agreed to terms for granting the city the use of school board property for SWM purposes;

The right for the city to enter the school board property for construction and maintenance of the LID practices;

The city assumed responsibility for the bioretention planters.
Monitoring Data Collection

- Precipitation: Heated rain gauge
- Outflows: V-notch weirs
- Water levels: observational wells
- Water Quality
  - flow-proportioned composite samples
  - 15 events/year
  - general chemistry, TSS, nutrients, metals, temperature
Qualitative Observation:

- Observing a site during precipitation events is critical to identifying how the site is functioning/performing.
- These observations can assist in the interpretation of monitoring data, and add to the overall information record of a site.

Lesson Learned: Observing precipitation events can provide insight into the functionality of the site that may not become apparent even with detailed monitoring.
Inflow and Outflow Hydrographs

Total Rainfall = 27mm
Volume Reduction = 79%
Peakflow Reduction = ~87%

B.A.U

Elm LID
Volume Reduction

![Graph showing volume reduction for different event sizes.](image)

- **<10 mm**: 105, 99%
- **10-20 mm**: 36, 81%
- **20-30 mm**: 13, 84%
- **>30 mm**: 16, 65%
- **<25 mm**: 147, 97%

*Uncontrolled Urban Runoff (Estimated) vs. LID Treated Effluent (Measured)*
## Water Quality Performance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Total Estimated Influent Load (g)</th>
<th>Total Estimated Effluent Load (g)</th>
<th>Estimated Load Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO₃</td>
<td>5,255</td>
<td>1,386</td>
<td>74%</td>
</tr>
<tr>
<td>OP</td>
<td>976</td>
<td>44</td>
<td>95%</td>
</tr>
<tr>
<td>Cd</td>
<td>0.21</td>
<td>0.11</td>
<td>48%</td>
</tr>
<tr>
<td>Cu</td>
<td>83</td>
<td>7</td>
<td>92%</td>
</tr>
<tr>
<td>Fe</td>
<td>11,823</td>
<td>353</td>
<td>97%</td>
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<tr>
<td>TKN</td>
<td>9,683</td>
<td>762</td>
<td>92%</td>
</tr>
<tr>
<td>Pb</td>
<td>39</td>
<td>2.2</td>
<td>94%</td>
</tr>
<tr>
<td>Ni</td>
<td>22</td>
<td>0.9</td>
<td>96%</td>
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<tr>
<td>TP</td>
<td>2,027</td>
<td>76</td>
<td>96%</td>
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<tr>
<td>TSS</td>
<td>457,899</td>
<td>30,235</td>
<td>93%</td>
</tr>
<tr>
<td>Zn</td>
<td>548</td>
<td>18</td>
<td>97%</td>
</tr>
</tbody>
</table>
Water Quality and Treatment Train Performance in Low Infiltration Soils

- 90% of all rainfall events are filtered by LID
- 69% of all rainfall is detained and infiltrated
- Only 3-8 rainfall events produce runoff where 93% of Total Suspended Solids and 96% Total Phosphorus is removed
Temperature Performance

EMT = Event Mean Concentration
## Operational Level of Service

<table>
<thead>
<tr>
<th>Metric</th>
<th>Criteria</th>
<th>Performance at Elm</th>
<th>Criteria Met?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Flow Reduction</td>
<td>100-Year Post equal to Pre</td>
<td>60% Reduction</td>
<td>N/A</td>
</tr>
<tr>
<td>Runoff Volume Reduction</td>
<td>15 mm</td>
<td>21 mm</td>
<td>✔️</td>
</tr>
<tr>
<td>TSS Removal</td>
<td>80%</td>
<td>93%</td>
<td>✔️</td>
</tr>
<tr>
<td>Phosphorous Removal</td>
<td>80%</td>
<td>96%</td>
<td>✔️</td>
</tr>
<tr>
<td>Effluent Cd Concentration</td>
<td>0.2 μg/L</td>
<td>0.10</td>
<td>✔️</td>
</tr>
<tr>
<td>Effluent Ni Concentration</td>
<td>25 μg/L</td>
<td>0.70</td>
<td>✔️</td>
</tr>
</tbody>
</table>
Operation & Maintenance
Issues & Challenges

• Excess salt clogging permeable pavement
• Garbage and debris collecting in bioretention cells
TRCA Inspection & Maintenance Guide

LOW IMPACT DEVELOPMENT
STORMWATER PRACTICE
INSPECTION AND MAINTENANCE GUIDE

DRAFT
JUNE 2015
O&M Design Considerations
O&M Contracts and Agreements

- Subdivision and site plan agreement
- Warranty period
- Assumption / Final Acceptance
- Long term maintenance
Inspection of site condition and Photo logs
Common issues are erosion, inlet blockage, sediment accumulation, water ponding, and vegetation death.

- Maintenance issues can be tracked over time to see if they are design or site related
- Maintenance schedules will provide insight as to when issues are addressed, how frequently, and if they are resolved
- Routine maintenance will be more cost efficient in the long-term if small issues are addressed more frequently than leaving them to develop into larger problems
Visual issues are just as important as structural issues as the public wants to see an attractive feature. This is why it is important to both inspect structural features to ensure functionality as well as visual feature to ensure an attractive site is well maintained.
O&M Tasks
Asset Management
Education & Outreach
Lessons Learned: CVC Stormwater Management and LID Monitoring and Performance Assessment Guide

Lessons Learned

• Championing the project with municipal, school board and school staff works best when direction comes from top down.

• Demonstration site Water quantity and quality performance is meeting design criteria

• O& M is critical for the long term success and performance of green infrastructure

• O&M needs to be considered in the design and plan review stage

• Resources and guidance is available for O&M and performance monitoring of green infrastructure
Questions