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New Erosion and Sediment Control Guidance for the Greater Golden Horseshoe Area

Presented by: Lisa Rocha
lrocha@trca.on.ca
ESC Guideline Update

Why is the update needed?

• *GGHA Conservation Authorities ESC Guideline for Urban Construction* published over 10 years ago

• ESC knowledge has expanded & practice has evolved

• Key changes this past decade:
  - Availability of professional training
  - Legislative changes
  - Changes to BMPs
  - Expanded knowledge and understanding of key ESC issues
  - Turbidity monitoring requirements for SAR habitat (e.g. Silt Smart Protocol)
Guide Contributors

• Authors:
  - TRCA and CVC staff in planning ecology, water resources engineering, STEP, and restoration services.

• External advisory group including representatives from:
  - Provincial ministries (MOECC, MNRF, MTO)
  - Environment Canada
  - Municipalities
  - Construction and development industry (i.e. consultants, developers, contractors)
  - Ten conservation authorities in southern Ontario (TRCA, CVC, GRCA, LSRCA, CLOCA, UTCA, RVCA, HRCA, HCA, NVCA)
Highlights

• Qualitative erosion risk assessment methodology
• Updated information on protecting natural features during in-water works
• Guidance on ESC effectiveness and turbidity monitoring
• Recommendations for protecting LID features during construction
• Clarification of approvals process, including flowcharts
• Inclusion of new BMPs and adoption of generic BMP names
Primary Sources

• Guide draws on information from several key locally applicable guidelines, standards and policies

• Additional sources:
  - Federal and provincial legislation
  - Research papers and studies
  - ESC guidance from other jurisdictions in Canada and the U.S.
Erosion Risk Assessment

• New addition to the guide


• Part of preliminary site assessment – done prior to the start of construction
Erosion Risk Assessment

• Qualitative assessment of erosion risk based on the following factors:
  ➢ Soil Characteristics
  ➢ Topography
  ➢ Rainfall and Climate Variations
  ➢ Soil Cover
  ➢ Duration and Extent of Disturbance

• Larger development sites divided into polygons of like erosion potential

• Erosion risk assessment is carried out for each polygon

• Outcome of erosion risk assessment informs decisions about appropriate BMP selection
Erosion Risk Assessment

• **STEP 1:** Collect site information
  - Data related to erosion risk (e.g. soil type, slopes)
  - Requires onsite investigation and desktop analysis

• **STEP 2:** Divide site into polygons (for larger sites)
  - Areas of like erosion risk
  - Based on site data collected and use of GIS
  - See MTO guideline for examples

• **STEP 3:** Rate erosion risk for all factors
  - Use tables provided to classify erosion risk as low, moderate or high
  - Repeat for each polygon

# Erosion Risk Assessment

## Soil Characteristics

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Erodibility Classification</th>
<th>Soil Erodibility Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well Graded Gravel</td>
<td>Least</td>
<td>Low</td>
</tr>
<tr>
<td>Poorly Graded Gravel</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Sand</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Loamy Sand</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Heavy Clay</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Clay</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Silty Clay</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Silty Clay</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Sandy Clay Loam</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Silty Clay Loam</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Sandy Loam</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Silty Sand</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Loam</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Silt Loam</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Silt</td>
<td>Most</td>
<td>High</td>
</tr>
</tbody>
</table>
# Erosion Risk Assessment

## Topography

<table>
<thead>
<tr>
<th>Slope gradient</th>
<th>Soil erodibility</th>
<th>Erosion Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>slope length &lt;30 m</td>
</tr>
<tr>
<td>&lt;2%</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>Moderate</td>
</tr>
<tr>
<td>2-10%</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>&gt;10%</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>
# Erosion Risk Assessment

## Soil Cover

<table>
<thead>
<tr>
<th>Cover Management</th>
<th>Erodibility Classification</th>
<th>Soil Erodibility Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Densely vegetated areas</td>
<td>Least</td>
<td>Low</td>
</tr>
<tr>
<td>Sodded/Established Vegetated Areas</td>
<td>Least</td>
<td>Low</td>
</tr>
<tr>
<td>Soil Sealant and Rolled Erosion Controls</td>
<td>Low</td>
<td>Moderate to Low</td>
</tr>
<tr>
<td>Hydroseeded/Hydromulch Areas Prior to Significant Vegetation Growth</td>
<td>Low</td>
<td>Moderate to Low</td>
</tr>
<tr>
<td>Established temporary crop covered/vegetated lands</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Seeded lands prior to significant vegetation growth</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Sparsely vegetated lands</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Bare lands (exposed soil) following topsoil stripping and/or grading</td>
<td>Most</td>
<td>High</td>
</tr>
</tbody>
</table>
Erosion Risk Assessment

• **STEP 4:** Determine overall erosion risk for each polygon
  - Use table provided to assign values according to the risk level for each factor
  - Total points to determine if erosion risk is low, moderate or high

• **STEP 5:** Apply overall erosion risk assessment to determine best practices
  - Use table provided to consider which structural and non-structural best practices are appropriate in each polygon
## Erosion Risk Assessment

*Overall risk determination (in each polygon)*

<table>
<thead>
<tr>
<th>Erosion Risk Factors</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Characteristics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil Cover</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extent of Disturbance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Topography</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration of Disturbance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rainfall and Climate</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Values weighted based on relative importance of each risk factor

### Overall Erosion Risk

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Range of values based on totals above
## Applying the erosion risk assessment

<table>
<thead>
<tr>
<th>Minimum best practices recommended</th>
<th>Low risk</th>
<th>Moderate risk</th>
<th>High risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedural ESC Measures</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>ESC Plan</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Routine inspection of ESC effectiveness</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Flow/Runoff Diversion</td>
<td>optional</td>
<td>where possible</td>
<td>yes</td>
</tr>
<tr>
<td>Staged Construction and Progressive Rehabilitation</td>
<td>optional</td>
<td>where possible</td>
<td>yes</td>
</tr>
<tr>
<td>More intensive ESC measures</td>
<td>optional</td>
<td>optional</td>
<td>Yes</td>
</tr>
<tr>
<td>Turbidity monitoring</td>
<td>optional</td>
<td>After significant rainfall/snowmelt</td>
<td>Continuous</td>
</tr>
</tbody>
</table>
The turbidity monitoring spectrum

<table>
<thead>
<tr>
<th>Method</th>
<th>Location</th>
<th>Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handheld turbidity measurement of grab samples</td>
<td>Site discharge points</td>
<td>• Straightforward&lt;br&gt;• Low equipment cost&lt;br&gt;• Direct measurement of site runoff = greater accountability&lt;br&gt;• Problem areas can be pinpointed&lt;br&gt;• Can be carried out even in the winter</td>
</tr>
<tr>
<td></td>
<td>Receiving water D/s and U/s of site</td>
<td>• Low equipment cost&lt;br&gt;• More readily comparable to existing CWQG for aquatic life&lt;br&gt;• Can be carried out even in the winter</td>
</tr>
<tr>
<td>Continuous online turbidity measurement</td>
<td>Outlet of sediment control pond</td>
<td>• Concentration &amp; duration = more accurate assessment&lt;br&gt;• Convenience - data logged at all times of day and night&lt;br&gt;• Set location means higher precision and comparability</td>
</tr>
<tr>
<td></td>
<td>Receiving water D/s and U/s of site</td>
<td>• Concentration &amp; duration = more accurate assessment&lt;br&gt;• Convenience - data logged at all times of day and night&lt;br&gt;• Set location means higher precision and comparability&lt;br&gt;• Readily comparable to existing CWQG for aquatic life</td>
</tr>
<tr>
<td>Continuous online turbidity measurement</td>
<td>Outlet of sediment control pond</td>
<td>In addition to those listed above:&lt;br&gt;• Convenience of remote access&lt;br&gt;• Opportunity for faster problem response</td>
</tr>
<tr>
<td>with remote real-time access to data</td>
<td>Receiving water D/s and U/s of site</td>
<td>In addition to those listed above:&lt;br&gt;• Convenience of remote access&lt;br&gt;• Opportunity for faster problem response</td>
</tr>
</tbody>
</table>
# The turbidity monitoring spectrum

<table>
<thead>
<tr>
<th>Method</th>
<th>Location</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| Handheld turbidity measurement of grab samples | Site discharge points          | • Staff costs for sampling  
• Limited to locations where grab sampling is possible  
• Potential for error due to poor sampling technique  
• Duration is not assessed |
|                                             | Receiving water D/s and U/s of site | • Need to determine pre-construction background turbidity  
• Staff cost for pre-and during construction sampling |
| Continuous online turbidity measurement     | Outlet of sediment control pond | • Higher equipment cost  
• Staff costs for data QA/QC  
• Site visits required to retrieve data – delays problem response  
• Only pond effluent is assessed  
• Not operational during winter |
|                                             | Receiving water D/s and U/s of site | • Higher equipment cost  
• Staff costs for data QA/QC  
• Site visits required to retrieve data – delays problem response  
• Need to determine pre-construction background turbidity  
• Staff cost for pre-and during construction sampling  
• Not operational during winter |
| Continuous online turbidity measurement with remote real-time access to data | Outlet of sediment control pond | • Highest equipment cost  
• Staff costs for data QA/QC  
• Only pond effluent is assessed  
• Not operational during winter |
|                                             | Receiving water D/s and U/s of site | • Highest equipment cost  
• Staff costs for data QA/QC  
• Need to determine pre-construction background turbidity  
• Staff cost for pre-construction sampling  
• Not operational during winter |
Turbidity monitoring in the Silt Smart Protocol

• **Silt Smart - Erosion and Sediment Control Effectiveness Monitoring and Rapid Response Protocol for High Risk Construction Projects**

• Requirement for continuous in-stream turbidity monitoring with remote real-time data access

• Eligible sites are:
  - >25 ha and/or high risk; and
  - Discharging to sensitive streams including those that support species at risk and coldwater species
Turbidity monitoring in the Silt Smart Protocol

- Trigger levels are determined for each site based on pre-development background turbidity.
- The configuration of the equipment allows contact groups to receive alerts when turbidity exceeds triggers.
- Protocol focuses on prevention, encouraging rapid response to ESC deficiencies on high risk projects.
- Response and reporting requirements:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem response</td>
<td>All deficiencies in ESC design and maintenance as identified through inspection will be rectified as soon as possible and not later than 24 hours of notice.</td>
</tr>
<tr>
<td>Preliminary assessment report</td>
<td>Required within 10 hours after first light</td>
</tr>
<tr>
<td>Final assessment report</td>
<td>Report, stamped by a qualified professional, is required within 48 hours of the end of the occurrence.</td>
</tr>
</tbody>
</table>
Protecting LID during construction

• What types of LID need protection during construction?

*Practices applied at or below ground level to infiltrate or filter stormwater*
Protecting LID during construction

• Impacts to LID during construction, where inadequate protection is in place:
  ➢ Clogging with sediment
  ➢ Erosion of inlets and beds (for planted areas)
  ➢ Subgrade compaction by heavy machinery
  ➢ Contamination by substances in construction runoff

• Lack of understanding of the system can also result in damage to components

• Protection required until:
  ➢ construction is complete
  ➢ contributing drainage area is stabilized
  ➢ construction vehicle mud tracking has ceased
Protecting LID during construction

• Diverting flows around LID areas provides best protection

• Benefits:
  - Less erosion risk, clogging
  - Opportunity for seeded/planted LID areas to become established
  - Easier access to carry out additional construction, repairs or maintenance of the LID area
Protecting surface infiltration LIDs
*When flows can be diverted*

- LID is built but not planted
- A layer of growing media (≥10 cm) or sand (≥5 cm) and geotextile is added on top of the final post construction grade of the BMP
- This sacrificial protective layer is removed once construction is complete and BMP starts receiving flow
- Enhanced protection - compost biofilter socks surrounding the area and stabilization of the sand/growing media
Protecting surface infiltration LIDs

*When LID area serves as temporary detention basin*

- When flows cannot be routed around LID during construction
- Bioretention example shown
- Retain ≥75 cm native soil between the base of the detention basin and the final base of the LID when complete.
- Sediment accumulation in detention basin removed during excavation to construct LID.
- Once LID is built, protect until construction and stabilization are complete.
Protecting surface filtration LIDs

*When LID area serves as temporary detention basin*

- When flows cannot be routed around LID during construction
- Grass swale example shown
- Retain ≥30 cm native soil between the base of the detention basin and the final base of the LID when complete.
- Once LID is built, protect until construction and stabilization are complete.
Protecting LID during construction

- LID installations that are below ground (e.g. infiltration chambers), can be constructed early (e.g. during cut/fill)

- Barrier (e.g. plug, bulkhead) must be installed during construction to prevent facility clogging

- Facility only begins to receive runoff when construction is complete, drainage area stabilized, vehicle mud tracking has ceased.
Protecting LID during construction

General guidance

• Ensure LID areas are properly identified and sectioned off, and that staff are aware of best practices
• Maintain LID perimeter controls throughout construction
• Avoid heavy equipment on intended infiltration sites to avoid native soil compaction
• Regular ESC site inspections to include LID areas
• For detailed guidance → CVC’s *LID Construction Guide* (2012) and full day course (www.sustainabletechnologies.ca/events)
THANK YOU!

Have any burning questions? Want to get involved?

Contact:

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Toronto and Region Conservation
416-661-6600 ext. 5786
Lrocha@trca.on.ca

Project updates and information on other STEP ESC research and training:

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