SUPPLEMENTAL INFORMATION REPORT TO APPENDIX C.1
REGIONAL MUNICIPALITY OF DURHAM
CENTRAL PICKERING DEVELOPMENT PLAN
CLASS ENVIRONMENTAL ASSESSMENT REGIONAL SERVICES
STORMWATER MANAGEMENT REPORT

Prepared for The Regional Municipality of Durham
September 2014
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COLE ENGINEERING

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SABOURIN KIMBLE & ASSOCIATES LTD.
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1.0 INTRODUCTION AND BACKGROUND

This report has been prepared by Sabourin Kimble & Associates Ltd., Cole Engineering, R.J. Burnsides & Associates Limited and GHD Inc. on behalf of the Seaton Landowners Group (SLG) to provide additional information and guidance in support of the Stormwater Management Appendix C.1 of the Regional Municipality of Durham, Central Pickering Development Plan Class Environmental Assessment for Regional Services. The contents of this report have been prepared in consultation with the Region of Durham and through input provided by the Seaton Landowners Group (SLG) consulting engineers.

Portions of the stormwater management strategy contained in Appendix C.1 were based on information obtained from the Master Environmental Servicing Plan Amendment (MESPA) and Neighbourhood Functional Servicing and Stormwater Reports for the Seaton Community, prepared by the SLG consultants. Since publication of those reports some of that information has either been updated or revised. This report has been prepared to update any outdated information originally prepared by the SLG consultants and to provide additional information in support of and relating to, stormwater management works for Regional Roads considered within this Class EA. This report forms an integral component of, and should be read in conjunction with, the Class EA Study including Appendix C.1. In the event of any technical conflict between this report and the Class EA or Appendix C.1, the content and findings of this report shall govern.
2.0 STORMWATER MANAGEMENT STRATEGY

The stormwater management strategy has been revised and updated for Regional roads that contribute drainage to stormwater management facilities (SWMF’s) located within the Seaton Community, for roads within the community that are unable to drain to those SWMF’s and for roads located outside of the Seaton Community boundary but within the Class EA study area. That additional information and guidance is contained within the following sections.

2.1 Stormwater Management Design Criteria

Stormwater management design criteria will be specific to the watercourse to which each section of roadway drains. For the roads internal to the Seaton Community that drain to SWMF’s, the stormwater management criteria will be satisfied as part of the design of that facility and as such, does not require repeating within this document. All internal SWMF’s have been located and designed according to extensive criteria outlined in the City of Pickering Official Plan Amendment 22 as well as, the Seaton MESPA.

All roads which do not drain to SWMF’s will be subject to water quality controls, erosion controls and depending on the watershed, water quantity controls. At the time of construction of any road improvement or new road within the Seaton Master Environmental Servicing Plan (MESP) boundary, the applicable stormwater management criteria will apply to the entire road right-of-way (ROW) with no pre-development flow consideration for existing coverage. This approach was developed as part of the overall watershed modelling assessment and SWMF designs for the Seaton Community. For existing roadways outside of the Seaton MESP boundary, the applicable stormwater management criteria will only apply to that section of roadway being constructed beyond the existing limits.

Figure REG-1 shows the limits of roadway within the Seaton MESP boundary which are not tributary to a SWMF internal to the development plan. Control of the storm runoff from these roads will be subject to the requirements of the Duffins Creek Hydrology Update (Aquafor Beech Limited, February 2013) plus any additional requirements placed upon those lands as per the Seaton Master Environmental Servicing Plan Amendment (MESPA, The Sernas Group et. Al., June 2014). Table 1 provides a summary of those sections of road within the Seaton MESP boundary which are not tributary to a SWMF.
<table>
<thead>
<tr>
<th>Watershed</th>
<th>Contributing Roads</th>
<th>Duffin Creek SWM Criteria</th>
</tr>
</thead>
</table>
| West Duffins Creek     | • Taunton Road from West Duffins Creek to 120m west of proposed Sideline 26,  
                           • Whitesvale Bypass from West Duffins Creek to 150m east of Golf Club Road,  
                           • Rossland Road from the southern MESP boundary limit to 400m north of the Canadian Pacific railway  
                           • Whites Road from 330m south of Taunton Road to south MESP boundary limit | • Water quality control to enhanced level of protection  
                           • Erosion control based on the extended detention of the runoff from a 25mm storm over 120 hours |
| Ganatsekiagon Creek    | • Taunton Road from 270m west of Sideline 24 to 450m west of Brock Road,  
                           • Whitesvale Road from Sideline 22 to 300m east of Sideline 22,  
                           • Rossland Road/Sideline 22 from Whitesvale Road to 210m north of Sideline 22 | • Water quality control to enhanced level of protection  
                           • Erosion control based on the extended detention of the runoff from a 25mm storm over 120 hours  
                           • Control of 2 year through 100 year storm flows to unit flows from Table 2 Appendix B5-1 of the final MESPA |
<table>
<thead>
<tr>
<th>Watershed</th>
<th>Contributing Roads</th>
<th>Duffin Creek SWM Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urfe Creek</td>
<td>• Taunton Road from 450m west of Brock Road to the eastern Study Area limit,</td>
<td>• Water quality control to enhanced level of protection</td>
</tr>
<tr>
<td></td>
<td>• Brock Road from Whitevale Road to the southern MESP Boundary limit</td>
<td>• Erosion control based on the extended detention of the runoff from a 25mm storm over 120 hours</td>
</tr>
<tr>
<td></td>
<td>• Whitevale Road from Brock Road to the eastern Study Area limit</td>
<td>• Control of 2 year through 100 year storm flows to unit flows from Table 2 Appendix B5-1 of the final MESPA</td>
</tr>
</tbody>
</table>

Figure EXT-1 shows the limit of roadways outside of the Seaton MESP boundary but within the Class EA study limits which will require the provision of stormwater management controls. The level of control will be dependent on the specific watershed criteria. Table 2 summarizes the watersheds receiving drainage from Regional roads outside of the Seaton MESP boundary.
<table>
<thead>
<tr>
<th>Watershed</th>
<th>Contributing Roads</th>
<th>SWM Criteria Document</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Duffins Creek</td>
<td>• Brock Road from the south study limit to 580m north (Major Oaks Road),</td>
<td>Water quality and erosion controls based on Duffins Creek Hydrology Update Study (2013)</td>
</tr>
<tr>
<td></td>
<td>• Rossland Road from CNR to 885m southeast.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Taunton Road from the west MESP boundary to 580m west.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Whitevale Bypass from west MESP boundary to 1580m west</td>
<td></td>
</tr>
<tr>
<td>West Duffins Creek Tributary</td>
<td>• Whites Road from south MESP boundary to 1830m south</td>
<td>Water quality, erosion and water quantity controls based on Duffins Creek Hydrology Update Study (2013)</td>
</tr>
<tr>
<td>Ganatsekiagon Creek</td>
<td>• Rossland Road from Brock Road to 1325m west,</td>
<td>Water quality, erosion and water quantity controls based on Duffins Creek Hydrology Update Study (2013)</td>
</tr>
<tr>
<td></td>
<td>• Brock Road south of Rossland Road to Major Oaks Road</td>
<td></td>
</tr>
<tr>
<td>Urfe Creek</td>
<td>• Brock Road from south MESP boundary to 305m south.</td>
<td>Water quality, erosion and water quantity controls based on Duffins Creek Hydrology Update Study (2013)</td>
</tr>
<tr>
<td>Watershed</td>
<td>Contributing Roads</td>
<td>SWM Criteria Document</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Petticoat Creek</td>
<td>• Taunton Road from the west study area limit to 3070m east,</td>
<td>Water quality, erosion and water quantity controls based on Petticoat Creek Hydrology Study (2006)</td>
</tr>
<tr>
<td></td>
<td>• Whitevale Bypass from west study limit to 550m east</td>
<td></td>
</tr>
<tr>
<td>Dunbarton Creek</td>
<td>• Whites Road from south study limit to 1570m north.</td>
<td>Water quality, erosion and water controls based on Hydrology Study, Stormwater Management Master Plan, Frenchmans Bay (April 2009)</td>
</tr>
</tbody>
</table>

As well as the documented stormwater management criteria, certain watersheds may have property or existing infrastructure constraints which warrant additional consideration. Specifically, the City of Pickering has identified an outlet location on Brock Road south of Dellbrook Avenue and private properties within the Dunbarton Creek watershed that will require specific assessment. At these locations, the Region will determine the capacity of the existing system and determine if additional controls are required to the satisfaction of the private landowner or existing storm drainage infrastructure owner. These specific locations may not constitute all of the locations where additional study is required. All locations and the extent of additional consideration required should be determined through consultation with the Region of Durham, City of Pickering and the TRCA.

Figure EXT-1 also shows a section of Brock Road which is tributary to a previously designed SWMF known as Duffins Heights Pond 4. This facility was previously designed and will be built as part of that development with sufficient capacity to accept drainage from Brock Road to the limits shown. The details of the facility and the limits of the Brock Road drainage area are summarized in the Stormwater Management Design Brief,
2.2 Regional Roads Draining to SWMF’s Internal to the Seaton Lands

Appendix C.1 identified the extent of Regional roads draining to SWMF’s internal to the Seaton development lands based on existing reports prepared by the SLG consultants and proposed Regional road profiles prepared as part of this EA process. The results of this work were shown graphically in figure 2 of Appendix C.1. Since the publication of the Class EA, the SLG consultants have reviewed and updated the drainage areas based on the following approach:

- a review of the proposed road profiles to determine if more drainage may be directed to a specific SWMF,
- examination of specific SWMF’s to determine if over-control for erosion and/or water quantity is possible for sections of road that cannot drain to a SWMF and/or,
- proposed revisions to specific profiles to direct more drainage to specific SWMF’s.

Figure REG-1 reflects the updated information and shows the extent of Regional roads which can be accommodated by SWMF’s either through direct discharge and control or through over-control. With respect to over-control, it is assumed that the road drainage will be directly conveyed to the watercourse, and that over-control for erosion and/or water quantity will be provided in a SWMF discharging to the same watercourse. The resultant total discharge from the SWMF plus the uncontrolled portion of the road must still meet the allowable discharge as specified in the DCHU (2013). Appropriate water quality controls must still be provided for the road drainage in-situ, through a treatment train approach to obtain an “Enhanced” level of quality control as per the MESPA.

With respect to erosion control, if the extended detention of the 25mm rainfall event for 120 hours is not feasible as over-control in an adjacent SWMF, then it is recommended that infiltration, detention or retention of the first 5mm of runoff be provided in-situ to meet the requirements for erosion control for the road drainage. This is subject to further discussion with TRCA.
Table 3 summarizes the road profiles that were reviewed and determined that they could drain to a specific SWMF, over-controlled for in a specific SWMF or modified to increase the amount of road drainage to that SWMF.

<table>
<thead>
<tr>
<th>Road &amp; Chainage</th>
<th>Reviewed &amp; Determined to Drain to SWMF</th>
<th>Over-control in SWMF</th>
<th>Profile Modified to Drain to SWMF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rossland Road Extension Sta 13+800 to 13+880</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Rossland Road Extension Sta 13+937 to 14+200</td>
<td></td>
<td></td>
<td>13</td>
</tr>
<tr>
<td>Rossland Road Extension Sta 15+025 to 15+380</td>
<td></td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Rossland Road Extension' Sta 15+380 to 15+575</td>
<td></td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Rossland Road Extension Sta 16+320 to Sta 16+440</td>
<td></td>
<td></td>
<td>41</td>
</tr>
<tr>
<td>Rossland Road Extension Sta 16+950 to Sta 17+050</td>
<td></td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>Rossland Road Extension' Sta 17+050 to Sta 17+355</td>
<td></td>
<td></td>
<td>43</td>
</tr>
<tr>
<td>Whitevale Bypass Sta 12+360 to Sta 12+952</td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>Whitevale Bypass Sta 13+300 to 13+380</td>
<td></td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Road &amp; Chainage</td>
<td>Reviewed &amp; Determined to Drain to SWMF</td>
<td>Over-control in SWMF</td>
<td>Profile Modified to Drain to SWMF</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>----------------------------------------</td>
<td>----------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>Whitevale Bypass Sta 13+380 to 13+590</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whitevale Bypass Sta 15+785 to Sta 15+840</td>
<td></td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Whitevale Bypass Sta 16+180 to Sta 16+240</td>
<td></td>
<td></td>
<td>26</td>
</tr>
<tr>
<td>Whitevale Bypass Sta 16+240 to Sta 16+420</td>
<td></td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Whitevale Bypass Sta 16+420 to Sta 16+790</td>
<td></td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Whitevale Road west of Brock Road Sta 16+790 to 17+340</td>
<td></td>
<td>Split 46a/46b</td>
<td></td>
</tr>
<tr>
<td>Brock Road north of Whitevale Road Sta 15+850 to Sta 16+550</td>
<td></td>
<td>46a</td>
<td></td>
</tr>
<tr>
<td>Brock Road north of Whitevale Road Sta 16+550 to Sta 16+680</td>
<td></td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>Brock Road north of Whitevale Road Sta 16+680 to Sta 17+160</td>
<td></td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>Taunton Road Sta 13+940 to 14+750</td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Taunton Road east of Brock Road Sta 17+575 to 17+775</td>
<td></td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>
Draft Plans are not approved for lands owned by Infrastructure Ontario in Neighbourhoods 17, 19 and 20. There is the potential to provide over-control for quantity and erosion in SWMF #15, 25, 29, 46a, 46b and 47 for portions of the Regional Roads as indicated above, subject to further review as part of the on-going NFSSR study.

2.3 Regional Roads Not Draining to SWMF’s Internal to Seaton Lands

There are a number of roads internal to the Seaton MESP boundary plus the majority of the roads external to that boundary which are not tributary to a SWMF. Appendix C.1 identified that appropriate stormwater management controls for these roads could be provided by either the over-control of flows from facilities within the Seaton MESP boundary and/or by the provision of enhanced swales in lieu of roadside ditches or oil/grit separators (OGS) for urban or steep sections of road. Review of this approach has resulted in the following observations:

1. The possibility of over-control within proposed SWMF’s internal to the Seaton MESP boundary is limited based on the restrictive nature of the allowable discharge rates within the Duffins Creek watershed. Effectively, over-control becomes impractical to achieve in many locations when the area of uncontrolled drainage is sufficiently large and the contributing drainage area to the SWMF is sufficiently small that the flow rate of uncontrolled drainage becomes larger than the target release rate from the SWMF.

2. The provision of enhanced swales and OGS units did not fully satisfy the stormwater management requirements for each watershed area.

As a result, the Region of Durham in consultation with the TRCA, City of Pickering and the SLG consultants has determined that a suite of stormwater management measures within the affected Regional road right-of-ways must be considered.

Table 4 outlines the sections of road, plus the type of road within the Class EA study area which will require the examination of alternative stormwater management measures to meet the applicable stormwater management criteria. Urban sections consist of curb and gutter on both sides with a boulevard and storm sewers, semi-urban sections provide a multi-use path on one side with a ditch and catchbasins and a ditch on the opposite side (resulting in ditches on both sides), and rural sections have ditches on both sides.
### TABLE 4
REGIONAL ROADS WITHIN THE CLASS EA STUDY AREA
THAT REQUIRE ON-SITE STORMWATER MANAGEMENT ASSESSMENT

<table>
<thead>
<tr>
<th>Road &amp; Chainage</th>
<th>Road Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taunton Road</td>
<td></td>
</tr>
<tr>
<td>Sta 14 + 750 to Sta 15 + 520</td>
<td>Urban</td>
</tr>
<tr>
<td>Sta 13 + 400 to Sta 13 + 950</td>
<td>Urban</td>
</tr>
<tr>
<td>Sta 9 + 791 to Sta 13 + 400</td>
<td>Semi-Urban</td>
</tr>
<tr>
<td>Sta 15 + 520 to Sta 18 + 320</td>
<td>Semi-Urban</td>
</tr>
<tr>
<td>Whitevale Road</td>
<td></td>
</tr>
<tr>
<td>Sta 10 + 000 to Sta 12 + 230</td>
<td>Rural</td>
</tr>
<tr>
<td>Sta 15 + 640 to Sta 15 + 785</td>
<td>Urban</td>
</tr>
<tr>
<td>Sta 15 + 840 to Sta 15 + 980</td>
<td>Urban</td>
</tr>
<tr>
<td>Sta 17 + 360 to Sta 18 + 480</td>
<td>Urban</td>
</tr>
<tr>
<td>Whites Road</td>
<td></td>
</tr>
<tr>
<td>Sta 10 + 000 to Sta 13 + 860</td>
<td>Semi-Urban</td>
</tr>
<tr>
<td>Rossland Road/Sideline 22</td>
<td></td>
</tr>
<tr>
<td>Sta 9 + 900 to Sta 10 + 920</td>
<td>Semi-Urban</td>
</tr>
<tr>
<td>Sta 10 + 920 to Sta 12 + 840</td>
<td>Urban</td>
</tr>
<tr>
<td>Sta 16 + 110 to Sta 16 + 320</td>
<td>Urban</td>
</tr>
<tr>
<td>Brock Road</td>
<td></td>
</tr>
<tr>
<td>Sta 9 + 900 to Sta 12 + 060</td>
<td>Urban</td>
</tr>
<tr>
<td>Sta 13 + 540 to Sta 14 + 340</td>
<td>Urban</td>
</tr>
<tr>
<td>Sta 14 + 340 to Sta 16 + 060</td>
<td>Semi-Urban</td>
</tr>
</tbody>
</table>

#### 2.3.1 Stormwater Management Options

Each section of roadway will be unique based on the road cross section, design constraints and the watershed receiving the road runoff. Therefore, as part of the preliminary design of each respective section of road, a complete stormwater management assessment should be carried out to consider and identify various options to provide the necessary level of control. This assessment should examine a suite of controls that will satisfy the requirements for water quality, erosion and water quantity (if required) specific to each respective watershed. Table 5 contains a list of various
stormwater management control options, the type of control they provide and the type of road section that they may be applicable to.

<table>
<thead>
<tr>
<th>SWM Control Option</th>
<th>Type of Control Provided</th>
<th>Type of Road Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetated Buffer Strip</td>
<td>Quality (Partial)</td>
<td>Rural Semi-Urban</td>
</tr>
<tr>
<td>Enhanced Swale</td>
<td>Quality (Partial)</td>
<td>Rural Semi-Urban</td>
</tr>
<tr>
<td>Infiltration Facilities</td>
<td>Quality, Erosion, Quantity</td>
<td>ALL</td>
</tr>
<tr>
<td>Oil/Grit Separators</td>
<td>Quality (Partial)</td>
<td>Urban Semi-Urban</td>
</tr>
<tr>
<td>Bioretention/Dry Swales</td>
<td>Quality, Erosion, Quantity</td>
<td>Semi-Urban Rural</td>
</tr>
<tr>
<td>Permeable Pavement</td>
<td>Quality, Erosion, Quantity</td>
<td>ALL</td>
</tr>
<tr>
<td>Centralized Dry SWMF</td>
<td>Quantity</td>
<td>ALL</td>
</tr>
<tr>
<td>In-line Underground Storage</td>
<td>Erosion, Quantity</td>
<td>Urban Semi-Urban</td>
</tr>
<tr>
<td>Underground Open Bottom Storage</td>
<td>Quality, Erosion, Quantity</td>
<td>ALL</td>
</tr>
<tr>
<td>Centralized Wet SWMF</td>
<td>Quality, Erosion, Quantity</td>
<td>ALL</td>
</tr>
</tbody>
</table>

A complete description and design template for many of these options is contained in the MOE Stormwater Management Planning and Design Manual (March 2003) and TRCA Low Impact Development Stormwater Planning and Design Guide (2010).

The assessment of each suite of options should also include an examination of site constraints such as property limitations, soil type, groundwater levels, conflicts with other underground and above ground services as well as a complete cost analysis.
2.3.2 Sample SWM Assessment for an Urban Road Section

Cole Engineering Group Ltd. examined the possible stormwater management facilities that may be provided within the urban section of Taunton Road between stations 14+750 and 15+520. This section of road is within the MESP boundary and is located completely within the Ganatsekiagon Creek watershed. As such, the stormwater management criteria requires the provision of enhanced water quality control, the extended detention of the runoff from a 25mm storm plus quantity control to the unit rates specified in the Duffins Creek Hydrology Update Study.

Two possible SWM options were examined as follows:

Option 1U- Underground Storage within Boulevards

This option contemplates the provision of water quality through the use of street catchbasins combined with OGS systems, such as Inlet Stormceptor or Jellyfish Filter Catchbasins to provide enhanced level TSS removal before the storm water is directed to underground storage facilities which will provide extended detention for the 25mm storm event plus quantity storage sufficient to meet the unit flow rates for the Ganatsekiagon Creek watershed. This required storage can be accomplished through many commercially available systems for underground storage. In this example a crate system 4.0m wide by 1.2m high was considered to demonstrate that such a system can fit within the urban cross-section under landscaped areas without impacting sidewalk or multiuse path functionality. These storage systems are also versatile since they allow utility crossing where necessary by either cutting holes as needed through the systems or simply by not installing one of the crates where utility crossing may be required. Infiltration is also possible where ground water levels permit it, by wrapping the storage crates in filter fabric. Where the ground water levels are too high and infiltration is not desirable these systems can be wrapped with impervious liner to avoid interaction with groundwater so as to maintain the storage volumes.

The drainage area between station 14+750 and 15+520 is 4.47ha and the proposed imperviousness is approximately 66%. At 250m³/imp-ha the storage required to meet the erosion target for the Ganatsekiagon Creek watershed is 738m³. The quantity storage volume to meet the unit flow targets for the Ganatsekiagon Creek watershed for the 2-year through the 100-year storms is 573m³/ha, resulting in a storage requirement of 2,561m³. Thus the total storage requirements to meet the erosion and quantity unit
flow target for this section of urban road section is 3,299m$^3$ which equates to 4.28m$^3$/m of urban road section. The example investigated and shown in Figure A1 in Appendix A of this report, consists of a section 4.0m wide by 1.2m high of crates can provide up to 4.8m$^3$/m, thus satisfying the erosion and quantity control requirements for the Ganatsekiagon Creek watershed.

Although one row of crates on average is capable of providing sufficient storage to treat the flow for the urban section of Taunton Road on a meter of road basis, the use of crates or other underground storage systems is not recommended under intersections making it necessary to utilized both boulevards for underground storage in between intersections to provide the total amount of storage required.

**Option 2U- Underground Storage & Bioswales within Boulevards**

Similar to Option 1U, this option contemplates the use of underground storage to provide erosion and quantity controls capable of meeting the unit flow targets for the Ganatsekiagon Creek watershed, but where desirable due to streetscaping considerations, it incorporates the use of Bioswales within (see Figure A2 in Appendix A) to achieve water quality in lieu of OGS/jellyfish filter systems (Inlet Stormceptor or Jellyfish Filter Catchbasins). The road section allows the construction of landscaped bioswales with inverts up to 2.0m below the centre line of road without impacting the functionality of sidewalks and multiuse path. The bioswale can be used to collect flows from regular street catchbasins and provide water quality treatment through the use of engineered soil and landscaping allowing the road drainage to be filtered before interaction with groundwater. When the flows exceed the capacity of the bioswale engineered soil to percolate, by-pass drains at set elevations (below road granular level) can provide relief and direct the flows to the underground storage crates. In comparison with Option 1U, under this option the total volume of the underground storage crates can be reduced by the amount of storage that the bioswales provide before the activation of the by-pass drains. It is estimated that the bioswales can provide as much as 1.5m$^3$ of storage per meter of road, which would satisfy the erosion storage requirements for this section of road and would reduce the underground storage requirement using crates from 4.28m$^3$/m to 2.78m$^3$/m. An underground storage crate configuration consisting of 2.6m wide by 1.2m high would provide 3.12m$^3$/m.
Although the above options were calculated specifically for Taunton Road between station 14+750 and 15+520, similar measures can be employed to meet watershed specific targets in similar urban sections outside the Seaton MESP boundary, where drainage to SWMF is not feasible.

2.3.3 Sample SWM Assessment for a Semi-Urban Road Section

Sabourin Kimble & Associates Ltd. examined possible stormwater management facilities that may be provided within the semi-urban section of Taunton Road between stations 15+550 and 16+600. This section of road is within the Seaton MESP boundary and is located completely within the Ganatsekiagon Creek watershed. As such, the stormwater management criteria requires the provision of enhanced water quality control, the extended detention of the runoff from a 25mm storm plus quantity control to the unit rates specified in the Duffins Creek Hydrology Update Study.

Two possible SWM options were examined as outlined below:

**Option 1 – Bio-retention Swales and Centralized Quantity Facility**

This option contemplates the provision of water quality and erosion controls within bio-retention swales constructed within the roadside ditch with a centralized dry water quantity facility located adjacent to the ROW. The general location of these facilities is shown in Figure B1 in Appendix B.

The bio-retention swale consists of plantings within the ditch to provide filtration of suspended solids, a layer of engineered soil (topsoil and sand mixture) to pass flow into the subsurface and a granular layer to provide storage of stormwater within the voids of the stone. The granular layer will contain a perforated pipe which will allow for extended drain down of stormwater from the granular layer. Sufficient permanent storage volume will be provided below the perforated pipe to address the enhanced water quality control requirements. This will also provide a volume of water which is permanently available for infiltration. The 25mm water quality volume will be stored above the invert of the perforated pipe. Extended detention of the flow may be provided by flow controls placed on the perforated pipe if necessary. A cross section at station 16+200 is provided in Figure B2 in Appendix B.
At the bottom end of the system, a dry centralized water quantity facility is proposed on lands currently owned by the Province. The Region would acquire these lands to construct the facility. The general location and approximate area of the facility is shown in Figure B1 in Appendix B. A complete design memo and calculations in support of these facilities are included in the appendix.

**Option 2 – Bio-retention Swales to Include Water Quantity**

This option provides the same approach to water quality and erosion controls as option 1. However, the granular cistern portion of the bio-retention swale has been increased in size to accommodate the water quantity storage requirements. This option does not require a centralized water quantity facility. A cross section showing this option at station 16+200 is provided in Figure B2 in Appendix B. A complete design memo and calculations in support of these facilities are included in the appendix.

The design memo provided in Appendix B expands the assessment to include two (2) more options where the required storage volumes for the urban section of Taunton Road outlined previously in Section 2.3.2 are accommodated in the bio-retention facilities identified for this semi-urban section. The net result is similar for Options 1 and 2, however, the granular cistern portions of the facilities are larger in size. While this is a unique situation restricted to this section of Taunton Road, similar design opportunities may arise in the consideration of other rural and semi-urban roads within the study area.

**2.3.4 Summary of Sample SWM Assessments**

These sample design assessments have been provided to demonstrate that various options may be available to any given section of regional road within the study area. The Ganatsekiagon watershed was specifically chosen as it has very restrictive criteria for water quantity control. If these criteria can be met within or adjacent to Regional road right-of-ways, then the criteria can also be met within other similar or less restrictive watersheds. However, it must also be recognized that all of the possible site constraints (such as ground water levels) in these options have not been examined. Such site constraints may require changes or modifications to the options provided. Similarly, a complete cost assessment of these options has not been provided.
2.3.5 Regional Commitment to Future Studies

For each section of Regional Road, both internal and external to the Seaton Lands, which do not receive treatment through an internal SWMF, the Region commits to preparing a pre-design Stormwater Management Report and a detailed design which address the specific quality, erosion and quantity control criteria for the given watershed, to the satisfaction of the TRCA.
3.0 OVERLAND FLOW TO REGIONAL ROADS

Appendix C.1 clearly states that the provision of major system overland flow from development lands onto a Regional road ROW should be avoided. However, the provision of transverse or longitudinal storm piping of the major system flows may be considered, provided specific design criteria are satisfied.

In the interim since the Class EA was filed, the SLG consultants have been working with the Region of Durham to further refine the requirements for major system conveyance within the Regional road ROW and to identify those areas where transverse and longitudinal piping will be acceptable. The Region of Durham has acknowledged and agreed to major system conveyance in the locations shown in Figure MAJ-1 subject to the following additional and refined design criteria:

- Prepare a dual drainage model (PCSWMM or approved equivalent model) for the complete storm drainage system draining to the Regional Road.
- Design the capture and conveyance system for the piping across/along the Regional Road using a 1:100 year storm 1 hour AES storm and assume all inlets are 50% blocked. This design must not cause any overland flow on to the surface of the Regional Road.
- Re-analyse the system for “Failure” using the greater of the 1:100 year storm or the Regional storm and assume the continuous grade road inlets are 50% blocked and the sag inlets are 100% blocked.
- The maximum lateral spread criteria outlined in MTO’s Highway Drainage Design Standards, SD-3 be applied and satisfied in the “Failure” analyses.

The locations shown in Figure MAJ-1 do not preclude the requirement to provide the technical design support as outlined above and in Appendix C.1 during the detailed design process.
4.0 **SWMF’s LOCATED NEXT TO REGIONAL ROADS**

Section 4.2 of Appendix C.1 addresses a number of issues related to the provision of neighbourhood stormwater management facilities including locating these facilities next to Regional Roads. The requirements for locating SWMF’s next to a Regional road are outlined in Appendix C.1 as follows:

*Wherever possible the Regional right of way grading should not be used as the SWMF embankment, however, should this be required the following conditions will need to be satisfied:*

- *The active operating zone of the SWMF is located sufficiently below the road sub-base and related utilities;*
- *An adequate geotechnical and technical design is provided to the satisfaction of the City of Pickering and the Region;*
- *Suitable setbacks and buffers are provided to protect the Regional road and related utilities and provide the required level of safety.*

During detailed design of any SWMF, the design consultant will consider and address the first two requirements as outlined above. The last requirement is vague and subject to interpretation and as such it has been agreed to with the Region of Durham to revise the wording as follows;

5.0 PHASING CONSIDERATIONS

As part of the first phase of development within the Seaton land area, extensive Regional road construction and improvements will be undertaken. In many areas the road works will be constructed well in advance of development on the adjacent lands. In this situation, the Region has indicated that adequate stormwater management facilities must be available for control of flow from the roads.

The SLG has committed to the provision of adequate conveyance and stormwater management facilities to support the construction of Regional roads, whether in conjunction with, or in advance of development. In areas where road works are constructed in conjunction with development lands, adequate stormwater management will be provided in the ultimate facility servicing the development area. In areas where the road works are constructed in advance of the subdivision works, adequate stormwater management facilities will be constructed either in the ultimate location or in a location where a temporary facility makes good design and economic sense.
6.0 CONCLUSIONS

Based on the findings of this Supplemental Information Report, the following conclusions may be reached:

1. Based on a technical review by the Seaton Landowners Group (SLG) Consultants and the Region of Durham, the extent of storm drainage from Regional roads reaching stormwater management facilities (SWMF) within the Seaton development lands has been refined as outlined in Figure REG-1 and Table 3 of this report.

2. Based on a technical review by the SLG Consultants and the Region of Durham, the limits of Regional roads that have stormwater controls provided through over-control within SWMF’s located internal to the Seaton development lands has been refined as shown in Figure REG-1 and Table 3 of this report.

3. For the over-controlled areas, it is assumed that the road drainage will be directly conveyed to the watercourse, and that over-control for erosion and/or water quantity will be provided in a SWMF discharging to the same watercourse. As such, water quality controls must be provided for the road drainage in-situ through a treatment train approach to obtain an “Enhanced” level of quality control as per the MESPA.

4. The limits of Regional roads located internal to the Seaton development lands that are not tributary to a SWMF and require stormwater management controls are shown in Figure REG-1 and Tables 1 and 4 of this report.

5. The limits of Regional roads located external to the Seaton development lands and within the Class EA boundary which will require stormwater management controls are shown in Figure EXT-1 and Tables 2 and 4 of this report.

6. Sample assessments for various types of Regional road geometries have been provided to demonstrate that effective stormwater management controls are possible within the road right-of-way and/or adjacent areas.

7. The Region of Durham has committed to the provision of a pre-design stormwater management analysis and associated detailed design for any
Regional road within the Class EA study area which is not tributary to a SWMF.

8. Through cooperation between the Region of Durham and the SLG Consultants specific design criteria have been developed for the conveyance of major system flows from the development lands onto Regional road rights-of-way. Furthermore, the anticipated extent of the conveyance of major system flows from the development lands onto Regional roads is shown in Figure MAJ-1.

9. The design criteria for locating SWMF’s next to regional road rights-of-way have been refined.

10. A commitment from the SLG and the Region of Durham has been provided to ensure adequate stormwater management facilities are in place (whether in a permanent or temporary location) to service the provision of all new Regional roads and/or Regional road improvements at the time of construction.
DATE: September 11, 2014
TO: Paul Gillespie
FROM: Adam Ribeiro, P.Eng., Cole Engineering
CC: Lloyd Cherniak, Lebovic Enterprises
     Marilee Gadzovski, M.Sc., P.Eng., City of Pickering
     Gerry Lynch, P.Eng., Cole Engineering
     Geoff Masoti, P.Eng, Cole Engineering
OUR REF.#: LD12-0605
SUBJECT: Options for Stormwater Management for Taunton Road between station 14+750 and 15+520

Further to our meeting regarding the options for Stormwater Management (SWM) for Taunton Road, between the proposed Sideline 24 and the proposed Sideline 22, we have summarized our analysis which would allow flow to be maintained to the existing ditches east of the proposed urbanization, as shown on Figure 1 attached. As discussed in the meeting with staff from the Region of Durham on Wednesday, July 30th, 2014, the two (2) Seaton ponds located near this section of Taunton Road (Pond 2 and Pond 13) can not accommodate the additional drainage from Taunton Road due to site constraints. The solutions summarized below would allow Taunton Road to provide on-site quality, quantity and erosion control and maintain the existing drainage patterns within the Ganatsekiagon Creek Watershed.

Option 1U- Underground Storage within Boulevards

This option contemplates the provision of water quality through the use of street catchbasins combined with OGS systems, such as Inlet Stormceptor or Jellyfish Filter Catchbasins to provide enhanced level TSS removal before the storm water is directed to underground storage facilities which will provide extended detention for the 25mm storm event plus quantity storage sufficient to meet the unit flow rates for the Ganatsekiagon Creek watershed. This required storage can be accomplished through many commercially available systems for underground storage. In this example a crate system 4.0m wide by 1.2m high was considered to demonstrate that such a system can fit within the urban cross-section under landscaped areas without impacting sidewalk or multiuse path functionality. These storage systems are also versatile since they allow utility crossing where necessary by either cutting holes as needed through the systems or simply by not installing one of the crates where utility crossing may be required. Infiltration is also possible where ground water levels permit it, by wrapping the storage crates in filter fabric. Where the ground water levels are too high and infiltration is not desirable these systems can be wrapped with impervious liner to avoid interaction with groundwater so as to maintain the storage volumes.
Using the unit storage requirements establish in the MESP applied to the drainage area between station 14+750 and 15+520 of 4.47ha and the proposed imperviousness is approximately 66%, at 250$m^3$/imp-ha the storage required to meet the erosion target for the Ganatsekiagon Creek watershed is $738m^3$. The quantity storage volume to meet the unit flow targets for the Ganatsekiagon Creek watershed for the 2-year through the 100-year storms is $573m^3$/ha, resulting in a storage requirement of $2,561m^3$. Thus the total storage requirements to meet the erosion and quantity unit flow target for this section of urban road section is $3,299m^3$ which equates to $4.28m^3$/m of urban road section base on unit storage requirements. The example investigated and shown in Figure A1, consists of a section 4.0m wide by 1.2m high of crates can provide up to $4.8m^3$/m, thus satisfying the erosion and quantity control requirements for the Ganatsekiagon Creek watershed. In order to meet the extended detention time of 120hr for the 25mm event a Hydrovex Vertical Vortex system or equivalent may be required given the small footprints typical of underground storage systems.

Using a series of $4.0m \times 1.2m$ crates as underground storage within the Taunton Road boulevards for a total length of 728m the erosion and quality control requirements for Taunton Road can be met while maintaining the existing drainage patterns and discharge location within the watershed. Figure A1 shows how this storage can be provided with an urban cross-section boulevard.

**Option 2U- Underground Storage & Bioswales within Boulevards**

Similar to Option 1U, this option contemplates the use of underground storage to provide erosion and quantity controls capable of meeting the unit flow targets for the Ganatsekiagon Creek watershed, but where desirable due to streetscaping considerations, it incorporates the use of Bioswales within (see Figure A2) to achieve water quality in lieu of OGS systems (Inlet Stormceptor or Jellyfish Filter Catchbasins). The road section allows the construction of landscaped bioswales with inverts up to 2.0m below the centre line of road without impacting the functionality of sidewalks and multiuse path. The bioswale can be used to collect flows from regular street catchbasins and provide water quality treatment through the use of engineered soil and landscaping allowing the road drainage to be filtered before interaction with groundwater. When the flows exceed the capacity of the bioswale engineered soil to percolate, by-pass drains at set elevations (below road granular level) can provide relief and direct the flows to the underground storage crates. In comparison with Option 1U, under this option the total volume of the underground storage crates can be reduced by the amount of storage that the bioswales provide before the activation of the by-pass drains. It is estimated that the bioswales can provide as much as $1.5m^3$ of storage per meter of road, which would satisfy the erosion storage requirements for this section of road and would reduce the underground storage requirement using crates from $4.28m^3$/m to $2.78m^3$/m. An underground storage crate configuration consisting of $2.6m$ wide by $1.2m$ high would provide $3.12m^3$/m.

**Encls.**  
Figure 1  
Figure A1  
Figure A2  
Audrain EnviroModule 2  
Documentation on Hydrovex Vertical Vortex Flow Regulator  
Inlet Stormceptor  
Jellyfish Filter Catchbasin
656m LONG 4m x 1.3m STORAGE CRATES TO PROVIDE SUPPLEMENTAL STORAGE FOR EROSION MITIGATION AND QUANTITY CONTROL.

FLOW FROM UNDERGROUND STORAGE CRATES TO BE CONTROLLED PRIOR TO OUTLETTING TO ROADSIDE DITCH ON TAUNTON ROAD.
EnviroModule™ 2
modular underground tank systems

rainwater harvesting
infiltration
on-site detention
bio-remediation
filtration
Our mission

AUSDRAIN™ recognises that water is one of our most precious natural resources, an asset to be conserved and re-used wherever possible.

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|               | • Sub-surface  
|               | • Modular  
|               | • High compressive strength  
|               | • High durability  
|               | • High void storage  
|               | • Open structure  
|               | • Lightweight  
|               | • Low maintenance  
|               | • Connectors  
|               | • Flat-pack form  
|               | • Slide and lock assembly  
|               | • 100% recycled  | • More useable land area  
|               |                                           | • Design flexibility  
|               |                                           | • Trafficable  
|               |                                           | • Long life expectancy  
|               |                                           | • Cost-effective  
|               |                                           | • High flow rate  
|               |                                           | • Install by hand  
|               |                                           | • No cleaning required  
|               |                                           | • Makes installation easy  
|               |                                           | • Economical to transport  
|               |                                           | • Quick to assemble  
|               |                                           | • Environmentally friendly  |

Our water resources are limited and at present the world's consumption of this resource far exceeds its natural replenishment. Too much of our stormwater is wasted, escaping via stormwater channels out to sea.

Systems for stormwater infiltration, rainwater harvesting and bio-remediation contribute towards better management of this precious resource.

AUSDRAIN™ products have been designed and developed to fit with the principles and best management practices for Water Sensitive Urban Design. Conservation and re-use of stormwater is making an important contribution to the challenges facing mankind over the coming decades.

AUSDRAIN™ has made a commitment towards improving the methods of stormwater conservation to assist in creating a more sustainable future for us all.
EnviroModule™ 2
product specifications

technical data

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Compressive strength
- Standard duty module - 3 braces: 27.5 tonnes/m²
- Extra duty module - 4 braces: 37.5 tonnes/m²

Minimum cover recommended
- Standard duty module: 400mm
- Extra duty module: 400mm

Maximum cover recommended
- Standard duty module: 1200mm
- Extra duty module: 1800mm

Overall maximum depth
- Standard duty module: 2400mm
- Extra duty module: 3000mm

Maximum height of modules
- Standard duty module - 4 high: 1800mm
- Extra duty module - 5 high: 2250mm
- Service temperature: -30°C + 120°C
- Module material: Recycled polypropylene

important design information

1. EnviroModules must be installed with the 450mm side as the height to ensure maximum strength.
2. Standard duty modules are suitable for landscaped areas only.
3. Extra duty modules are required for trafficable areas such as driveways and carparks and where greater depth of cover is needed. A suitable pavement designed by a certified engineer is required over the surface of the tank.
4. Compressive strength tests were conducted by a certified testing authority and represent the maximum strength in a controlled environment that replicates the case when soil is uniformly distributed under a short term static load.
5. Safety factors should be employed to the compressive strength results. This is to allow for actual site conditions, possible variations in recycled material and any potential creep factors.
The AUSDRAIN EnviroModule Rainwater Harvesting Tank offers a cost-effective and flexible alternative when installing an underground rainwater tank. Our tanks are extremely robust and can be installed in landscaped areas or under driveways, thus optimizing valuable land area for the home owner and avoiding the visual impact created by above ground water storage devices.

AUSDRAIN EnviroModule Rainwater Harvesting Tanks are supplied as a complete package including EnviroModules, an EnviroSump filtration unit, a factory welded waterproof liner to suit tank dimensions and geotextile protection fabric. The tank is delivered in flat-pack form minimizing transportation costs.

AUSDRAIN tanks can be supplied according to the required dimensions and capacity that best suits the available land space. Each tank connects to an above ground pump via a suction line inside the tank. The reticulation of stored water for household purposes such as toilets, laundry and irrigation can provide potential water saving benefits of up to 40%.

The AUSDRAIN EnviroModule Rainwater Harvesting Tank has been specifically designed to be quickly and easily installed by any licensed plumber or contractor. AUSDRAIN EnviroModules are manufactured from 100% recycled plastic so choosing to install an AUSDRAIN tank is not only reducing the demand on our water supply but also the demand on our natural resources.
EnviroModule™

rainwater harvesting tank

1. Downpipe
2. Inlet pipe
3. EnviroSump
4. Dual filter
5. EnviroModules
6. Welded tank liner
7. Protection fabric
8. Coarse sand backfill
9. Suction line
10. Overflow pipe
11. Tank outlet
12. Above ground pump

system components

- EnviroModules – 9.6 modules per 1000 litres
- Connector pins (optional)
- EnviroSump filtration unit
- Factory welded tank liner
- Geotextile fabric
The high compressive strength and durability of AUSDRAIN EnviroModules makes them suitable for installation under driveway and carpark areas, thus making the most of valuable and often limited land area.

The AUSDRAIN EnviroModule Rainwater Harvesting Tank provides a cost-effective and flexible solution to underground water storage requirements. The modular flexibility of the system offers enormous scope to maximize the amount of water storage and design a tank that best suits each individual project.

AUSDRAIN tanks can be installed in landscaped areas and under trafficable areas such as a driveway or carpark where external space is limited. When installed in a trafficable area, a pavement consisting of stabilised road base and asphalt or a reinforced concrete slab is required over the surface of the tank according to engineer's specification.

The AUSDRAIN tank is recommended for car and light commercial vehicle traffic. The tank can be designed for heavy vehicle traffic in certain situations. This will require consultation with Ausdrain and approval by a certified engineer.

The AUSDRAIN EnviroModule tank is surrounded in a durable, high tensile strength factory welded waterproof liner. The liner is supplied as a base and cap and is made to order according to specific tank dimensions. The cap overlaps the base and does not require joining or sealing on site ensuring that each tank is completely watertight.

Inlets and outlets connect to a pre-cast pit that sits within the liner of the tank. This pit acts as a maintenance and inspection chamber for the tank and houses either a suction line connected to an above ground pump or a submersable pump.

It is essential that water entering the tank is pre-filtered to avoid long term and costly maintenance of the tank. Either an AUSDRAIN EnviroSump(s) or a suitable Gross Pollutant Trap (GPT) should be installed to prevent sediment and gross pollutants from reaching the tank. In the event that the tank surcharges, excess water is discharged through an overflow pipe to a designated stormwater outlet.
EnviroModule™

rainwater harvesting tank

system components

- EnviroModules – 9.6 modules per 1000 litres
- Connector pins (optional)
- 150mm pipe connector (optional)
- EnviroSump filtration unit or GPT
- Factory welded tank liner - made to size
- Protection fabric
The continued development of our cities and greenfields has resulted in the requirement to provide on-site water management systems. This enables the replenishment of underground aquifers and prevents stormwater discharge that may result in downstream flooding.

The AUSDRAIN EnviroModule Infiltration Tank has proven to be one of the most efficient and cost-effective solutions to the environmental issues of stormwater management that have resulted in local authority requirements for on-site infiltration and retention.

The EnviroModule Tank is constructed from high strength EnviroModules that have been engineered to allow stormwater to be captured and efficiently discharged inside a structural void surrounded in geotextile fabric. Water entering the tank is stored temporarily and naturally dissipates back into the surrounding ground at a rate depending on soil type.

The AUSDRAIN EnviroModule tank can be installed in a variety of soil types due to the remarkable infiltration rates proven to be up to six times greater than gravel filled systems. The high compressive strength of the modules enables tank installations under trafficable areas such as car parks and driveways.

Pre-filtering of stormwater is essential for a well designed system. Combined with the AUSDRAIN EnviroSump or a suitable Gross Pollutant Trap (GPT), this system provides a complete stormwater management solution.
EnviroModule™ infiltration tank

system components

- EnviroModules – 9.25 modules/cubic metre
- EnviroSump filtration unit
- Connector pins (optional)
- 150mm pipe connector (optional)
- Geotextile fabric

1. Downpipe
2. Inlet pipe
3. EnviroSump or GPT
4. EnviroModules
5. Geotextile fabric
6. Discharge pipe
7. Overflow pit
8. Coarse washed river sand
AUSDRAIN EnviroModule Detention Tanks are easily installed on any project saving valuable time and money. Compared to a concrete tank there are no footings, slabs, blockwork or reinforcement required. Each tank is sealed with a strong and durable waterproof liner.

AUSDRAIN EnviroModules create the required void storage allowing stormwater to be temporarily stored inside the tank before discharging to a designated outlet. AUSDRAIN EnviroModules are available in standard duty suitable for installation under landscaped areas or extra duty for trafficable situations. The modular nature of the tank allows greater scope for design flexibility and tank sizing.

Stormwater is pre-filtered via an EnviroSump or GPT. This provides valuable at source water quality benefits and reduces the need for long-term tank maintenance. The water then enters a pre-cast pit that is fitted with an orifice plate to reduce the rate of discharge from the tank to the designated stormwater outlet.
EnviroModule™
detention tank

system components
- EnviroModules – 9.25 modules/cubic metre
- Connector pins (optional)
- 150mm pipe connector (optional)
- EnviroSump filtration unit
- Pre-cast discharge control pit
- Tank liner
- Geotextile fabric

1. Downpipe
2. Inlet pipe
3. Discharge control pit
4. Lockable lid/grate
5. EnviroModules
6. Tank liner
7. Protection fabric
8. Geogrid under carpark
9. Coarse river sand backfill
10. Maximesh screen
11. Orifice plate
12. Outlet to stormwater
technologies such as constructed wetlands, sand filters and bio-retention systems. AUSDRAIN™ EnviroModules can be effectively used to create a secondary treatment system. This system has proven to be extremely effective in the treatment of stormwater run-off. During light to medium rainfall all stormwater is directed to the system for treatment. During large storms the system adequately treats the initial “first flush” runoff containing the major concentration of pollutants.

Other stormwater pollutants include nutrients from decaying organic matter, detergents and pathogens from animal waste. Without proper management this polluted water will end up in our oceans and waterways seriously impacting aquatic ecosystems.

Gross Pollutant Traps (GPT’s) are effective in capturing solids such as litter, sediment and organic waste. However, in most cases it is not possible to treat stormwater for nutrients and heavy metals using such systems. A secondary stage of filtration is required based on treatment techniques used by other

Stormwater flowing from roadways, car parks and pavements contain toxic and gross pollutants. Heavy metals such as zinc, copper and lead are deposited on our roadways and are washed into the stormwater drains with each rainfall.
EnviroModule™
treatment system

system components
• EnviroModules – 9.25 modules/cubic metre
• Connector pins (optional)
• 150mm pipe connector (optional)
• EnviroSump filtration unit and/or GPT
• Geotextile fabric

1 Vegetation
2 Untreated stormwater
3 Inspection points
4 Coarse washed river sand
5 Clean 7mm gravel
6 EnviroModules
7 Geotextile fabric
8 Clean stormwater
The AUSDRAIN EnviroSump has been developed as a low cost, effective and easy to maintain stormwater filtration unit.

Stormwater flowing from roof areas and pavements is directed into the EnviroSump via downpipes or a surface grate. The AUSDRAIN EnviroSump traps sediment and gross pollutants allowing clean water to flow through the filter.

Each unit consists of a 600x600x700mm polyethylene pit and a removable filter bag on stainless steel rim with handles. The filter bag has a 200 micron base section and a 400 micron overflow. The filter bag is easily removed for maintenance. This involves discarding the contents of the bag as compost and washing the bag before replacing.

The EnviroSump is available with a solid plastic lid or galvanized grate. When required a 600x600x300mm riser is also available allowing flexibility for required pipe invert levels.

The EnviroSump is suitable for residential and smaller size projects and is recommended for installation in landscaped areas only.

### technical data

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<td>Colour:</td>
<td>Mist green</td>
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AUSDRAIN EnviroModule

<table>
<thead>
<tr>
<th>Code</th>
<th>Product Description</th>
<th>Dimensions</th>
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<tbody>
<tr>
<td>100212</td>
<td>Standard duty module - 4 sides / 3 braces</td>
<td>600 x 400 x 450mm (9.25 per cubic metre)</td>
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<tr>
<td>100214</td>
<td>Extra duty module - 4 sides / 4 braces</td>
<td>600 x 400 x 450mm (9.25 per cubic metre)</td>
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<tr>
<td>100216</td>
<td>Double module - standard or extra duty</td>
<td>600 x 400 x 900mm (4.6 per cubic metre)</td>
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<tr>
<td>100218</td>
<td>Triple module - standard or extra duty</td>
<td>600 x 400 x 1350mm (3.1 per cubic metre)</td>
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AUSDRAIN EnviroModule Connectors

<table>
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<th>Dimensions</th>
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<tbody>
<tr>
<td>100210</td>
<td>EnviroModule connector pin</td>
<td>4 per double module/8 per triple module</td>
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<td>100215</td>
<td>EnviroModule 150mm pipe connector</td>
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AUSDRAIN Filtration Systems

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<th>Code</th>
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<tr>
<td>102060</td>
<td>EnviroSump filtration unit</td>
<td>600 x 600 x 700mm</td>
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<tr>
<td>102075</td>
<td>EnviroSump riser</td>
<td>600 x 600 x 300mm</td>
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<tr>
<td>102065</td>
<td>EnviroSump filter bag</td>
<td>440 x 440 x 300mm</td>
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<tr>
<td>102070</td>
<td>Light-duty galvanised grate</td>
<td>540 x 540mm</td>
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AUSDRAIN Tank Liners

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<tr>
<th>Code</th>
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<tr>
<td>101010</td>
<td>Geotextile fabric</td>
<td>2 x 25m/ 2 x 50m/ 4 x 50m</td>
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<tr>
<td>101020</td>
<td>Detention tank flat sheet liner</td>
<td>Made to suit tank dimensions</td>
</tr>
<tr>
<td>101030</td>
<td>Rainwater harvesting tank flat sheet liner</td>
<td>Made to suit tank dimensions</td>
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<tr>
<td>101040</td>
<td>Rainwater harvesting tank fitted liner</td>
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AUSDRAIN EnviroModule Rainwater Harvesting Tanks

<table>
<thead>
<tr>
<th>Code</th>
<th>Product Description</th>
<th>Dimensions</th>
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<tbody>
<tr>
<td>R2500</td>
<td>2500 litre rainwater harvesting tank</td>
<td>1200 x 1600 x 1350mm</td>
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<tr>
<td>R5000</td>
<td>5000 litre rainwater harvesting tank</td>
<td>2400 x 1600 x 1350mm</td>
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<tr>
<td>R10000</td>
<td>10000 litre rainwater harvesting tank</td>
<td>2400 x 3200 x 1350mm</td>
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<tr>
<td>R20000</td>
<td>20000 litre rainwater harvesting tank</td>
<td>4800 x 3200 x 1350mm</td>
</tr>
</tbody>
</table>

Please note: AUSDRAIN rainwater harvesting tanks can be supplied to any dimension/capacity required
Manufactured from 100% environmentally friendly recycled plastics

For more in-depth information about AUSDRAIN™ and the products the company provides contact:

T 61 2 9929 7650
F 61 2 9929 7655
E enquiries@ausdrain.com

PO Box 164
Cammeray NSW 2062
Australia

1300 AUSDRAIN (1300 287 372)
(Toll free within Australia)

or visit
www.ausdrain.com

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Australian Drainage Modules Pty Ltd
Trading as AUSDRAIN™
One of the major problems of urban wet weather flow management is the runoff generated after a heavy rainfall. During a storm event, uncontrolled flows may overload the drainage system and cause flooding. Sewer pipe wear and network deterioration are increased dramatically as a result of increased flow velocities. In a combined sewer system, the wastewater treatment plant will experience a significant increase in flows during storms, thereby losing its treatment efficiency.

A simple means of managing excessive water runoff is to control excessive flows at their point of origin, the manhole. John Meunier Inc. manufactures the HYDROVEX® VHV / SVHV line of vortex flow regulators for point source control of stormwater flows in sewer networks, as well as manholes, catch basins and other retention structures.

The HYDROVEX® VHV / SVHV design is based on the fluid mechanics principle of the forced vortex. The discharge is controlled by an air-filled vortex which reduces the effective water passage area without physically reducing orifice size. This effect grants precise flow regulation without the use of moving parts or electricity, thus minimizing maintenance. Although the concept is quite simple, over 12 years of research and testing have been invested in our vortex technology design in order to optimize its performance.

The HYDROVEX® VHV / SVHV Vertical Vortex Flow Regulators (refer to Figure 1) are manufactured entirely of stainless steel, and consist of a hollow body (1) (in which flow control takes place) and an outlet orifice (7). Two rubber "O" rings (3) seal and retain the unit inside the outlet pipe. Two stainless steel retaining rings (4) are welded on the outlet sleeve to ensure that there is no shifting of the "O" rings during installation and operation.

As a result of the air-filled vortex, a HYDROVEX® VHV / SVHV flow regulator will typically have an opening 4 to 6 times larger than an orifice plate. Larger opening sizes decrease the chance of blockage caused by sediments and debris found in stormwater flows. Figure 2 shows the discharge curve of a vortex regulator compared to an equally sized orifice plate. One can see that for the same height of water and same opening size, the vortex regulator controls a flow approximately four times smaller than the orifice plate.

- Having no moving parts, they require minimal maintenance.
- Submerged inlet for floatables control.
- The HYDROVEX® VHV / SVHV line of flow regulators are manufactured entirely of stainless steel, making them durable and corrosion resistant.
- Installation of the HYDROVEX® VHV / SVHV flow regulators is quick and straightforward and is performed after all civil works are completed.
- Installation requires no assembly, special tools or equipment and may be carried out by any contractor.
Selecting a VHV or SVHV regulator is easily achieved using the selection chart found at the end of this brochure (refer to Figure 3). Each selection is made using the maximum allowable discharge rate and the maximum allowable water pressure (head) retained upstream from the regulator. The area in which the design point falls will designate the required VHV/SVHV model. The maximum design head is calculated as the difference between the maximum upstream water level and the invert of the outlet pipe. All selections should be verified by a John Meunier Inc. representative prior to fabrication.

Example:

✓ Maximum discharge 6 L/s (0.2 cfs)**
✓ Maximum design head 2m (6.56 ft.)
✓ Using Figure 3 model required is a 75 VHV-1

** It is important to verify the capacity of the manhole/catch basin outlet pipe. Should the outlet pipe be >80% full at design flow, the use of an air vent is required.

**HYDROVEX® VHV / SVHV flow regulators can be installed in circular or square manholes. Figure 4 lists the minimum dimensions required for each regulator model. It is imperative to respect the minimum clearances shown to ensure ease of installation and proper functioning of the regulator.**
In order to specify a **HYDROVEX® VHV/SVHV** flow regulator, the following parameters must be clearly indicated:

- The model number (ex: 75-VHV-1)
- The diameter and type of outlet pipe (ex: Ø 6", SDR 35)
- The maximum discharge rate (ex: 6.0 L/s [0.21 CFS])
- The maximum upstream head (ex: 2.0 m [6.56 ft]) *
- The manhole diameter (ex: Ø 900 mm [Ø 36"])
- The minimum clearance "H" (ex: 150 mm [6 in]) as indicated in Figure 4
- The material type (ex: 304 stainless steel, standard)

* Upstream head is defined as the difference in elevation between the maximum upstream water level and the invert of the outlet pipe where the HYDROVEX® flow regulator is to be installed.

**PLEASE NOTE THAT WHEN REQUESTING A PROPOSAL, WE SIMPLY REQUIRE THAT YOU PROVIDE US WITH THE FOLLOWING INFORMATION:**

- project design flow rate
- pressure head
- chamber’s outlet pipe diameter and type

*Typical HYDROVEX® VHV model*
OPTIONS

**VHV-1-O**
(extended inlet for odor control)

**FV–VHV**
(mounted on sliding plate for emergency bypass)

**VHV with Gooseneck assembly**
(manhole without clearance below regulator)

**FV–VHV-O**
(sliding plate with extended inlet)

**VHV with upstream air vent**
(applications where outlet pipe is > 80% full at peak flow)
### Typical Installation of a Vortex Flow Regulator in a Circular or Square/Rectangular Manhole

**Figure 4**

<table>
<thead>
<tr>
<th>Model</th>
<th>Regulator Diameter A (mm) [in]</th>
<th>Minimum Manhole Diameter B (mm) [in]</th>
<th>Minimum Chamber Width B (mm) [in]</th>
<th>Minimum Outlet Pipe Diameter C (mm) [in]</th>
<th>Minimum Clearance H (mm) [in]</th>
</tr>
</thead>
</table>

**Circular Manhole**

**Square / Rectangular Manhole**

**Note:** In the case of a square manhole, the outlet pipe must be centered on the wall to ensure that there is enough clearance for installation of the regulator.
The installation of a HYDROVEX® regulator may begin once the manhole and piping are in place. Installation consists of simply sliding the regulator into the outlet pipe of the manhole and securing it to the wall with an anchor (supplied). John Meunier Inc. recommends applying a lubricant on the inner surface of the outlet pipe, in order to facilitate the insertion and the manipulation of the flow controller.

HYDROVEX® regulators are designed and manufactured to minimize maintenance requirements. We recommend a periodic visual inspection every 3-6 months (depending on local flow and sediment conditions) in order to ensure that neither the inlet nor the outlet has become blocked with debris. The manhole housing the vortex regulator should be inspected and cleaned with a vacuum truck periodically, especially after major storm events.

The HYDROVEX® line of VHV / SVHV regulators are guaranteed against both design and manufacturing defects for a period of 5 years after sale. Should a flow regulator be found to be defective within the guarantee period, John Meunier Inc. will modify or replace the defective unit.
FIGURE 3

JOHN MEUNIER
Jellyfish® Filter Catchbasin

**Features and Benefits**

- Pretreatment and filtration in one compact structure
- TARP Field Tested / Verified Performance
- Treats flow up to 1.0 cfs (28 Lps)
- Available in curb inlet and grated inlet configurations
- On-line or off-line configurations available
- Ideal for shallow excavations
- Works well with shallow pipe networks
- Accepts in-line pipe flow
- Easy inspection and maintenance
- Lightweight rinseable/reuseable filter cartridges
- Low life-cycle cost
Figure 2. Inlet Stormceptor

Adam Ribeiro, P.Eng.
Project Manager, Urban Development

Cole Engineering Group Ltd.
70 Valleywood Dr., Markham, ON L3R 4T5
Tel: 416-467-6161, Ext. 242 Phone: 905-940-6161 Mobile: 416-277-3234, Fax: 905-940-2064
Email: aribeiro@coleengineering.ca
Website: www.ColeEngineering.ca

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From: Paul Gillespie [mailto:Paul.Gillespie@Durham.ca]
Sent: August-22-14 15:23 PM
To: akimbled@skwengineer.com; Adam Ribeiro
Cc: ‘Geoff Nicholson’; Peter Castellan; Paul Gee

Subject: yesterday’s meeting notes

Alan and Adam,

Thank you very much for yesterday’s meeting. I think it was very productive.
I have made some notes from our meeting, including some of my own commentary. Please review. If I have misstated anything particularly about the actions/next steps, please let me know. Thanks.

11/09/2014
DATE: September 15, 2014
FILE: 08:178
TO: Mr. Paul Gillespie
FROM: Alan Kimble
SUBJECT: Taunton Road LID/SWM Works

In support of our recent discussions with respect to proposed stormwater management works for Regional roads, we have developed a proposed stormwater management system for the Taunton Road corridor from station 14+750 to 16+680. We have developed four (4) distinct options which provide varying levels of SWM controls within the Taunton Road ROW. Each option contains various Low Impact Development (LID) measures that may be implemented within the right-of-way. A brief outline of each option is provided as follows:

**Option 1 – Sta. 15+550 to Sta. 16+680**

This option focuses on the semi-urban section of Taunton Road and contemplates the provision of water quality and erosion controls within bio-retention swales constructed within the roadside ditch with a centralized dry water quantity facility located adjacent to the ROW. The general location of these facilities is shown in Figure B1.

The bio-retention swale consists of the plantings within the ditch to provide filtration of suspended solids, a layer of engineered soil (topsoil and sand mixture) to pass flow into the subsurface and a granular layer to provide storage of stormwater within the voids of the stone. The granular layer will contain a perforated pipe which will allow for extended drain down of stormwater from the granular layer. The water quality control volume (per MOEE SWMPP Manual Table 3.2) will be provided below the perforated pipe and will provide a volume of water which is permanently available for infiltration. The 25mm erosion control volume will be stored above the invert of the perforated pipe. Extended detention of the flow may be provided by flow controls placed on the perforated pipe if necessary. A cross section at station 16+200 is provided in Figure B2 plus typical details of the bio-retention swales are shown in Figure B4.
At the bottom end of the system, a centralized water quantity facility is proposed for lands currently owned by the Province. The Region would acquire these lands to construct the facility. The general location and approximate area of the facility is shown in Figure 1. Calculations in support of these facilities are included in the attached Appendix.

**Option 2 – Sta. 15+550 to Sta. 16+680**

This option provides the same approach to water quality and erosion controls as option 1. However, the granular cistern portion of the bio-retention swale has been increased in size to accommodate the water quantity storage requirements above the erosion control volume. This option does not require a centralized water quantity facility. A cross section showing this option at station 16+200 is provided in Figure B2 and a typical cross section is provided in Figure B5. Calculations in support of these facilities are included in the attached appendix.

**Option 3 – Sta. 14+750 to Sta. 16+680**

This option is identical to Option 1 except the volume calculations as determined for the section of road from stations 14+750 to 15+550 by Cole Engineering have been added to the volumes for stations 15+550 to 16+680. The bio-retention swales will be provided in the same locations as option 1 and as a result the granular storage layers and the centralized facility are larger in size. A cross section showing this option at station 16+200 is provided in Figure B3 and a typical cross section is provided in Figure B6. Calculations in support of these facilities are included in the attached appendix.

**Option 4 – Sta. 14+750 to Sta. 16+680**

This option is identical to Option 2 except the volume calculations as determined for the section of road from stations 14+750 to 15+550 by Cole Engineering have been added to the volumes for stations 15+550 to 16+680. The bio-retention swales will be provided in the same locations as option 2 and as a result the granular storage layers are larger in size. A cross section showing this option at station 16+200 is provided in Figure B3 and a typical cross section is provided in Figure B7. Calculations in support of these facilities are included in the attached appendix.

If you should have any questions with respect to the enclosed information, please contact the undersigned at your convenience.

Yours Truly

A.B. Kimble P. Eng.
Region of Durham EA  
Taunton Road Drainage Calculations

SEMI-URBAN SECTION OF TAUNTON ROAD

Taunton Road Drainage from Stn 15+550 (east of Rossland Road) to Stn 16+680 (Ganatsekiagon Creek Crossing) 1130m of Road (Average ROW width of approx. 60m)

Given the semi-urban design of the ROW (i.e. curbs on south side, gravel shoulder on north side) the drainage area shall be broken up using the centerline of road (refer to Figure 1).

A) North Drainage Area = 3.54ha @ an average of 44% imp
B) South Drainage Area = 3.29ha @ an average of 58% imp

North Side of Taunton Road

Required drainage volumes per TRCA/MOEE:

Option 1 – Quality and Erosion Volume in ditches, Quantity in central facility

1) Water Quality Storage – (MOE Table 3.2 - 2.725mm) = 3.54ha x 0.002725mm x 10,000=96.5m³ or  
   (96.5m³/1130m)=0.085m³/m of ROW
   
   Granulars required @ a porosity of 0.4 is 0.085/0.4=0.212m³/m
   Provide a 1.3m wide by 0.16m deep trench to accommodate

2) 25mm Erosion Storage = 3.54ha x 0.025mm x 0.44 x 10,000=389m³ or  
   (389m³ /1130m)=0.344m³/m of ROW
   
   Granulars required @ a porosity of 0.4 is 0.344/0.4=0.860m³/m
   Provide a 1.3m wide by 0.66m deep trench to accommodate

Option 2 – Quality, Erosion and Quantity Volume in ditches (Quantity volume stacked above erosion volume)

3) 100yr storage = 3.54ha x 0.44 x 719m³/imp.ha = 1112m³ + erosion volume above (389 m³) or  
   (1501m³/1130m)=1.328 m³/m of ROW
   
   Granulars required @ a porosity of 0.4 is 1.328/0.4=3.320m³/m
In order to minimize depth a widened geometry was assumed for the upper portion of the granular area as shown in Figure B5.

South side of Taunton Road

Required drainage volumes per TRCA/MOE:

Option 1— Quality and Erosion Volume in ditches, Quantity in central facility

1) Water Quality Storage – (MOE Table 3.2 - 3.1mm) = 3.29ha x 0.0031mm x 10,000=102m³ or (102m³/1130m)=0.090m³/m of ROW

Granulars required @ a porosity of 0.4 is 0.090/0.4=0.225m³/m
Provide a 1.2m wide by 0.19m deep trench to accommodate

2) 25mm Erosion Storage = 3.29ha x 0.025mm x 0.58 x 10,000=477m³ or (477m³/1130m)=0.422m³/m of ROW

Granulars required @ a porosity of 0.4 is 0.422/0.4=1.06m³/m
Provide a 1.2m wide by 0.88m deep trench to accommodate

Option 2— Quality, Erosion and Quantity Volume in ditches

1) 100yr storage = 3.29ha x 0.58 x 719m³/imp.ha = 1373m³ + erosion volume (477m³)or (1850m³/1130m)=1.637m³/m of ROW

Granulars required @ a porosity of 0.4 is 1.637/0.4=4.092m³/m
In order to minimize depth a widened geometry was assumed for the upper portion of the granular area as shown in Figure B5.

Centralized Quantity Pond Sizing for Option 1

Required “Dry” SWM Pond Volumes assuming Water Quality and 25mm storage within ROW. Therefore apply same 100 yr unit rate volumes above for both the north and south portions of the road (1112m³ + 1373m³ = 2485 m³). A block size of approximately 0.20ha in size at 2.5m deep will provide adequate volume; however, a grading exercise would need to be completed to verify. Refer to Figure B1 for approximate area and conceptual location of the facility.
ANALYZING ALL OF TAUNTON

Taunton Road Drainage from Stn 14+750 (East of Street 16AO) to Stn 16+680 (Ganatsekiagon Creek Crossing) 1930m of Road (Average ROW width of approx. 60m)

Drainage Area from Cole Engineering is 4.74ha @ 66% impervious

Assume the north and south ROW’s drain to the North and south Ditch at Rossland Road – therefore Split drainage in half and simple add requirements to Options 1 & 2 above.

North side of Taunton Road

Required drainage volumes per TRCA/MOEE:

Option 3– Quality and Erosion Volume in ditches, Quantity in central facility

1) Water Quality Storage – (MOE Table 3.2 - 2.95mm) = 3.54ha + 2.37ha x 0.00295mm x 10,000=174m³ or (174m³/1130m)=0.154m³/m of ROW
   Granulars required @ a porosity of 0.4 is 0.154/0.4=0.385m³/m
   Provide a 2.18m wide by 0.18m deep trench to accommodate

2) 25mm Erosion Storage = (3.54ha x 0.44) + (2.37 x 0.66) x 0.025mm x 10,000=780m³ or (780m³/1130m)=0.691m³/m of ROW
   Granulars required @ a porosity of 0.4 is 0.691/0.4=1.73m³/m
   Provide a 2.18m wide by 0.79m deep trench to accommodate

Option 4– Quality, Erosion and Quantity Volume in ditches

3) 100yr storage = (3.54ha x 0.44) + (2.37 x 0.66) x 719m³/imp.ha = 2245m³ + erosion volume (780m³)or (3025m³/1130m)=2.677m³/m of ROW
   Granulars required @ a porosity of 0.4 is 2.677/0.4=6.692m³/m
   In order to minimize depth a widened geometry was assumed for the upper portion of the granular area as shown in Figure B7.
South side of Taunton Road

Required drainage volumes per TRCA/MOEE:

Option 3– Quality and Erosion Volume in ditches, Quantity in central facility

1) Water Quality Storage – (MOE Table 3.2 - 3.2mm) = 3.29ha + 2.37ha x 0.0032mm x 10,000=181m³ or (181m³/1130m)=0.160m³/m of ROW

   Granulars required @ a porosity of 0.4 is 0.160/0.4=0.400m³/m
   Provide a 3.0m wide by 0.13m deep trench to accommodate

2) 25mm Erosion Storage = (3.29ha x 0.58) + (2.37 x 0.66) x 0.025mm x 10,000=868m³ or (868m³/1130m)=0.768m³/m of ROW

   Granulars required @ a porosity of 0.4 is 768/0.4=1.92m³/m
   Provide a 3.0m wide by 0.64m deep trench to accommodate

Option 4– Quality, Erosion and Quantity Volume in ditches

1) 100yr storage = (3.29ha x 0.58) + (2.37 x 0.66) x 719m³/imp.ha = 2497m³ + erosion volume (868m³)or (3365m³/1130m)=2.978m³/m of ROW

   Granulars required @ a porosity of 0.4 is 2.978/0.4=7.445m³/m
   In order to minimize depth a widened geometry was assumed for the upper portion of the granular area as shown in Figure B7.

Centralized Quantity Pond Sizing for Option 3

Required “Dry” SWM Pond Volumes for the entire Taunton Road from chainage assuming Water Quality and 25mm storage within ROW. Therefore apply same 100 yr unit rate volumes above for both the north and south portions of the road (2245m³ + 2497m³ = 4742 m³). A block size of approximately 0.35ha in size at 2.5m deep will provide adequate volume; however, a grading exercise would need to be completed to verify. Refer to Figure B1 for approximate area and conceptual location of the facility.
OPTION #1

NORTH HALF TAUNTON ROAD
RURAL CROSS SECTION
SCALE 1:25

SOUTH HALF TAUNTON ROAD
SEMI-URBAN CROSS SECTION
SCALE 1:25

ENGINEERED SOIL
(TOPSOIL/SAND MIX)
FILTER CLOTH
50mm CLEAR STONE
300mm PERFORATED PIPE
FILTER CLOTH
NATIVE SOIL

ENGINEERED SOIL
(TOPSOIL/SAND MIX)
FILTER CLOTH
50mm CLEAR STONE
300mm PERFORATED PIPE
FILTER CLOTH
NATIVE SOIL

REGIONAL MUNICIPALITY OF DURHAM
CROP CLASS EA
TAUNTON ROAD - STA, 15+550 TO STA, 16+68D
TYPICAL BIO-SWALE/SWM TREATMENT SYSTEM
QUALITY AND 25mm STORAGE VOLUMES

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS