Wet Weather Flow Management

Guidelines

TORONTO

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Letter to Readers

Background

In September 2003, Toronto City Council adopted a Wet Weather Flow Management Policy, which provides direction on how to manage wet weather flow on a watershed basis. Since that time, all new developments in the City have had to comply with the policy. It was determined that a set of Wet Weather Flow Management Guidelines would be developed as a companion document to:

1. guide the design and implementation of stormwater management measures at source necessary to achieve the long-term goal and objectives of the Wet Weather Flow Management Plan;

2. harmonize stormwater management policies and practices of former municipalities; and

3. provide guidance on stormwater management practices and approval requirements to City staff, development industry and property owners.

Status

The Wet Weather Flow Management Guidelines provides a practical working aid in the review and approval of stormwater management plans for new development or redevelopment. As well, the guidelines document identifies performance objectives for runoff from new development sites with respect to controls in peak flows, flood management, water quality and water balance (or annual runoff volume).

Although it is intended to further refine the guidelines, the City's plan reviewers will apply these Guidelines now for the review and approval of stormwater management plans for new development/redevelopment applications. This provides valuable opportunities for the City to receive feedback and input as to the effectiveness of the guidelines through actual practice so that future version of the Guidelines can be improved.

While the Guidelines presents a general framework of the City's expectations of approval requirements on water balance, water quality and quantity targets for on-site stormwater management, the City also recognizes that flexibility is important to certain site-specific conditions. As a result, the City may consider any innovative approach if it can be demonstrated that there are better ways of achieving the same performance objectives.

Further Studies / Outstanding Issues

Certain technical studies, protocols and by-laws have yet to be developed and included in the Guidelines. These are:

- Numerical criteria applicable to the various innovative and Low Impact Development technologies available – available in summer 2007
- Cash-in-Lieu process/mechanism – available in summer 2007 (need stakeholders consultation)
- Erosion and Sediment Control Bylaw – available in fall 2007 (need stakeholders consultation)
- Long-term review process, monitoring and test protocols for oil-grit separators (OGS) devices – available in summer 2007 (need stakeholders consultation)
- Long-term review process, monitoring and test protocols for other BMPs (on-going)

Next Steps

The guidelines document is a "living" document. Therefore, there will be technical refinements and updates to the Guidelines over time.

Revised guidelines, technical studies for new guidelines and any proposed by-laws to enforce new or existing guidelines will be published for a public and stakeholder review when they are completed and before being sent for approval by City Council.

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Wet Weather Flow Management Guidelines

1. PURPOSE OF THIS DOCUMENT

The Wet Weather Flow Master Plan (WWFMP) and the Wet Weather Flow Management Policy were adopted, in principle, by Toronto City Council in October 2002 and confirmed in September 2003, upon completion of the public consultation processes.

The Wet Weather Flow Management Policy provides direction on how to manage wet weather flow on a watershed basis and in a manner that recognizes rainwater and snowmelt as a resource. The primary goal of the Wet Weather Flow Management Policy is to reduce the quantity, and to improve the quality of stormwater runoff, consistent with overall objectives and principles of WWFMP. To support and implement the City Council approved Wet Weather Flow Master Plan (WWFMP) and its Policy; the City is developing a set of Management Guidelines. The Guidelines are intended to document the technical requirements for on-site stormwater quantity and quality control for all new development, including infill and redevelopment projects.

The primary goals of the Guidelines are to:

(1) guide the design and implementation of stormwater management measures at source necessary to achieve the long-term goal and objectives of the Wet Weather Flow Management Plan;

(2) harmonize stormwater management policies and practices of former municipalities; and

(3) provide guidance on stormwater management practices and approval requirements to City staff, development industry and property owners.

The Wet Weather Flow Management Guidelines provides a practical working aid in the review and approval of stormwater management plans for new development or redevelopment. As well, the guidelines document identifies performance objectives for runoff from new development sites with respect to controls in peak flows, flood management, water quality and water balance (or annual runoff volume). It will also form a basis for the City (through all relevant stakeholders; such as: Development Engineering, City Planning, Parks, Forestry & Recreation, District Operations, Legal Services, Financial Planning, etc.) to review wet weather flow management requirements and other water management issues for new development and redevelopment projects.

Certain technical studies, protocols and by-laws have yet to be developed and included in the Guidelines. These are:

- Numerical criteria applicable to the various innovative and Low Impact Development technologies available – available in summer 2007
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Although it is intended to further refine the guidelines, the City's plan reviewers will apply the Guidelines now for the review and approval of stormwater management plans for new development/redevelopment applications. This provides valuable opportunities for the City to receive feedback and input as to the effectiveness of the guidelines through actual practice prior to the document being revised and finalized.

In essence, the guidelines document is a "living" document. Therefore, there will be technical refinements and updates to the Guidelines over time.

2. WET WEATHER FLOW MANAGEMENT TARGETS AND CRITERIA

Ideally, water management targets for all new development and redevelopment should be based on what is required to achieve the long-term receiving water quality targets and objectives. In the WWFMP Study, the management objectives were intended for the "lands" of the watersheds in order to meet the established receiving water quality targets. In the study, HSPF (Hydrologic Simulation Program – FORTRAN), a continuous hydrologic computer model was used to simulate the hydrologic and water quality processes under the various strategies. The modeling results were used to evaluate and determine what source controls, conveyance controls and end-of-pipe solutions must be implemented on the "lands" in order to achieve the receiving water targets. Due to the size and complexity of the hydrologic model coupled with a large number of development types and control scenarios, continuous efforts are being applied by City Staff and through consulting assignments in establishing land-based stormwater management criteria and their linkage to receiving water quality targets and objectives.

While the Guidelines presents a general framework of the City's expectations of approval requirements on water balance, water quality and quantity targets for on-site stormwater management, the City also recognizes that flexibility is important to certain site-specific conditions. As a result, the City may consider any innovative approach if it can be demonstrated that there are better ways of achieving the same performance objectives.

In the interim, the stormwater management criteria and requirements for new and in-fill development are provided in this document, which will be updated when new information and experience is gained.

2.1 Hierarchical Principles

The Hierarchy Approach was adopted as part of the Guiding Principles used in establishing the Objectives for the Wet Weather Flow Master Plan (see Appendix A).

The Principles are:

1. As a priority, rainwater (including snowmelt) should be managed where it falls on the lots and streets of our City, particularly before it enters a sewer.
2. Wet weather flow will be managed on a watershed basis with a natural systems approach being applied to stormwater management as a priority.
3. A hierarchy of wet weather flow solutions will be implemented – starting with "at source", then "conveyance", and finally "end-of-pipe".
4. Toronto's communities need to be made aware of wet weather flow issues and involved in the solutions.

The proponent shall demonstrate that the Stormwater Management Plan/Report for the proposed development implement, to the maximum extent practicable, the hierarchy of Wet Weather Flow practices as described below:

1. Source Control - Source controls at the lot level are the preferred method for controlling the impacts of wet weather flow. Examples of source control measures are set out in the "Blue Book" report entitled, "List of CSO/Stormwater Control Alternatives – Final Report, March 2002" (http://www.toronto.ca/involved/projects/archived/wwfmmp_archive/pdf/cso/complete_report.pdf.), prepared as part of the WWFMP study.

2. Conveyance Control – Conveyance controls, such as roadside ditch/swale and/or infiltration systems, shall be implemented, where new roads are built, to the maximum practicable extent site conditions and soil conditions permit.

3. End-of-Pipe Control – End-of-pipe controls shall be implemented after source controls and conveyance controls are unable to achieve the necessary level of stormwater quality and quantity control targets.

The hierarchical approach is similar to the familiar "treatment train approach", which is premised on providing control at the lot level and in conveyance followed by end-of-pipe controls. A treatment train is normally required to meet the multiple objectives of water balance, water quality, erosion and flood control in an overall stormwater management strategy. Typically, lot level and conveyance controls can reduce end-of-pipe storage requirements for erosion control and are the best means of achieving water balance objectives. They also provide benefits for stormwater quality improvement and quantity control for small storm events.

Table 1 provides examples of on-site stormwater management practices (SWMPs) that are applicable to various types of developments. On-site stormwater management is generally preferred. However, in certain situations it may be ineffective or impractical because of physical constraints. In these cases, off-site systems (OSS) or City-wide facilities may be considered for all residential infill beyond a single lot through Off-Site Compensation/Cash-in-Lieu option (see Section 2.4). For general guidance, a table that summarizes the potential and effectiveness of the various SWMPs and control measures is available in the MOEE Stormwater Management Practices Planning and Design Manual (June 1994) and is presented in Table 2.

2.2 Water Management (Land-Based) Targets and Criteria

The City's ultimate goal of water management targets in water quality is to "Achieve PWQOs (Provincial Water Quality Objectives) in receiving waters over the long term". Under the WWFMP Study, an

extensive watershed based analysis of the performance and efficiencies in wet weather flow management under various strategies was completed including recommendations of action plans in both short term (25-year) and long term (100-year). In general, the developer is not required to demonstrate through modeling the achievement of PWQOs as long as they can demonstrate the compliance with the Guidelines (Interim) and Criteria contained in this document or its future updates.

Consistent with the WWFMP, the Guidelines (Interim) require all new development including areas of infill development implement, to the extent practicable, the combinations of source controls and conveyance controls, which would put the City in the right direction and position to achieve the receiving water quality targets and objectives over the long term.

In general, the three key WWF Management Targets (Interim) are:

1. Water Balance (or annual runoff volume) - for erosion control, groundwater recharge and downstream habitat protection;
2. Water Quality - for protection of downstream water resources; and
3. Water Quantity - peak flow control for flood management, and both peak flow and runoff volume controls to mitigate erosion impacts.

Each of the targets/criteria is described in the following sections.

2.2.1. Water Balance Management

The primary objective of the Water Balance Targets/Criteria is to capture and manage annual rainfall on the development site itself to preserve the pre-development hydrology (or "water balance", which typically consists of three components: runoff, infiltration and evapotranspiration) through a combination of infiltration, evapotranspiration, landscaping, rainwater reuse and/or other low impact development practices. The performance efficiencies shall be measured in terms of runoff volume reduction (m^3) on an annual basis.

Table 1 Examples of On-Site Stormwater Management Practices (SWMPs) Applicable to Various Types of Land Use

Land Use	Source Control Options	Conveyance Options
Residential low rise properties	■ Roof leader disconnection ■ Rain barrels ■ Minor lot grading to enable roof disconnection ■ Plant trees/bushes ■ Reduce fertilizer/pesticide use ■ Foundation drain disconnection ■ Major lot grading to slow runoff and enhance infiltration ■ Pervious driveways ■ Infiltration trench ■ Absorbent landscaping	■ Pervious technologies (i.e. Etobicoke exfiltration system, pervious catchbasin) ■ Enhanced ditches/swales ■ Enhanced catchbasin cleaning.
Residential high rise and institutional properties	■ Plant trees/bushes ■ Route roof drainage to pocket wetland/cisterns ■ Green roof technologies ■ Use of filters/bio-retention (i.e. islands, parking areas, etc.) ■ Pervious pavement in parking areas/driveways ■ Absorbent landscaping ■ Oil/grit separators	■ Pervious technologies (i.e. Etobicoke exfiltration system, pervious catchbasin) ■ Enhanced ditches/swales
Commercial properties	■ Rooftop restrictors ■ Catchbasin restrictors in parking lots ■ Plant trees/bushes ■ Pervious pavement in parking lots ■ Infiltrate roof runoff ■ Underground storage ■ Rainwater harvesting (i.e. re-use in toilet flushing and irrigation, etc.) ■ Green roof technologies ■ Use of filters/bio-retention (i.e. islands, parking areas, etc.) ■ Absorbent landscaping ■ Oil/grit separators	■ Pervious technologies (i.e. Etobicoke exfiltration system, pervious catchbasin)
Industrial Properties	■ Rooftop restrictors ■ Route parking lot runoff to grassed areas (where possible) ■ Catchbasin restrictors in parking lots ■ Plant trees/bushes ■ Pervious pavement in parking lots ■ Infiltrate roof runoff ■ Underground storage ■ Rainwater harvesting (i.e. re-use in toilet flushing and irrigation, etc.) ■ Green roof technologies ■ Use of filters/bio-retention (i.e. islands, parking areas, etc.) ■ Absorbent landscaping ■ Oil/grit separators	■ Pervious technologies (i.e. Etobicoke exfiltration system, pervious catchbasin)
Open space	■ Route parking lot runoff to grassed areas (where possible) ■ Add trees/bushes ■ Reduce fertilizer/pesticide use	■ Pervious technologies (i.e. Etobicoke exfiltration system, pervious catchbasin) ■ Enhanced ditches/swales
Highways/local Roads	■ Plant trees ■ Reduce fertilizer/pesticide use ■ Previous technologies (i.e. Etobicoke exfiltration system) ■ Enhanced ditches/swales ■ Oil/grit separators	■ Pervious technologies (i.e. Etobicoke exfiltration system, pervious catchbasin) ■ Enhanced ditches/swales

Table 2 Stormwater Management Practice Potential
(Excerpted from MOE SWMP Planning & Design Manual, June 1994)

Stormwater Management Practice	Water Quality Control	Flooding	Erosion	Groundwater Recharge	Other	
					Temp.	Spills
Lot grading	▲	▲	▲	■	▲	□
Roof Leader Ponding	▲	▲	▲	■	▲	□
Roof Leader Soakaway Pits	▲	▲	▲	■	■	□
Pervious Pipes	■*	▲	▲	■	■	*
Pervious Catch-basins	■*	▲	▲	■	■	*
Wet Pond	■	■	■	□	*	■
Dry Pond	▲	□	■	□	□	■
Dry Pond with forebay	■	■	■	□	□	■
Wetland	■	▲	■	□	*	■
Wetland with forebay	■	▲	■	□	*	■
Sand Filter	■	▲	▲	□	□	▲
Infiltration Trench	▲**	▲	▲	■	■	*
Infiltration Basin	▲**	▲	▲	■	■	*
Vegetated Filter Strip	■	□	▲	▲	▲	□
Buffer Strip	▲	□	▲	▲	▲	□
Oil/Grit Separator (offline or bypass)	▲	□	□	□	□	■

■ highly effective (primary control)
▲ limited effectiveness (secondary control)
□ not effective
* may have adverse effects
** effective pollutant removal (TSS, nutrients, metals, bacteria) but suspended solids removal reduces their longevity and hence effectiveness.

2.2.1.1 Water Balance Targets

(b) Retain stormwater on-site, to the extent practicable, to achieve the same level of annual volume of overland runoff (see Table 3 & Figure 2) allowable from the development site under pre-development (i.e. presently existing site conditions before the new proposed development) conditions.

(c) If the allowable annual runoff volume (see Table 3 & Figure 2) from the development site under post-development conditions is less than the pre-development conditions, then the more stringent runoff volume requirement becomes the governing target for the development site. The maximum allowable annual runoff volume from any development site is 50% of the total average annual rainfall depth.

(d) In most cases, the minimum on-site runoff retention requires the proponent to retain all runoff from a small design rainfall event [(1)] - typically 5 mm (In Toronto, storms with 24-hour volumes of 5 mm or less contribute about 50% of the total average annual rainfall volume) through infiltration, evapotranspiration and rainwater reuse.

(e) Table 7 provides further details regarding the application of water balance targets for the various types of development.

[(1)] As part of the WWFMP Study, 23 years (1975 - 1997) of the total (annual/monthly/seasonal) rainfall data from Pearson International Airport were reviewed / analyzed; and the WWFMP consultant teams concluded that the year 1991 should be considered as the most representative of long-term average annual precipitation patterns. A subsequent analysis of the daily precipitation data at 16 rainfall gauge stations across Toronto for the year 1991 was conducted by Toronto Water staff, and the average results of the % of total annual rainfall depth vs. the daily rainfall amounts and the total average annual occurrences vs daily precipitation are plotted in Figure 1(a) and Figure 1(b). As indicated in Figure 1(a), storms with 24-hour volumes of 5 mm or less and 20 mm or less contribute about 50% and 90% of the total average annual rainfall volumes, respectively, based on the analysis of the 1991 rainfall data from 16 rain gauge stations in Toronto. Similarly, they also represent about 50% and 90% of the total average annual rainfall events in Toronto. The results in Figure 1(a) are almost identical to the results of a previous analysis of 20 years daily precipitation record from the Atmospheric Environment Service (AES) rainfall gauge at Yonge and Bloor Street (Figure C.2 - Annual Capture Rate for Daily Capture Amounts in Appendix C of the MOE SWMP Planning & Design Manual, June 1994).

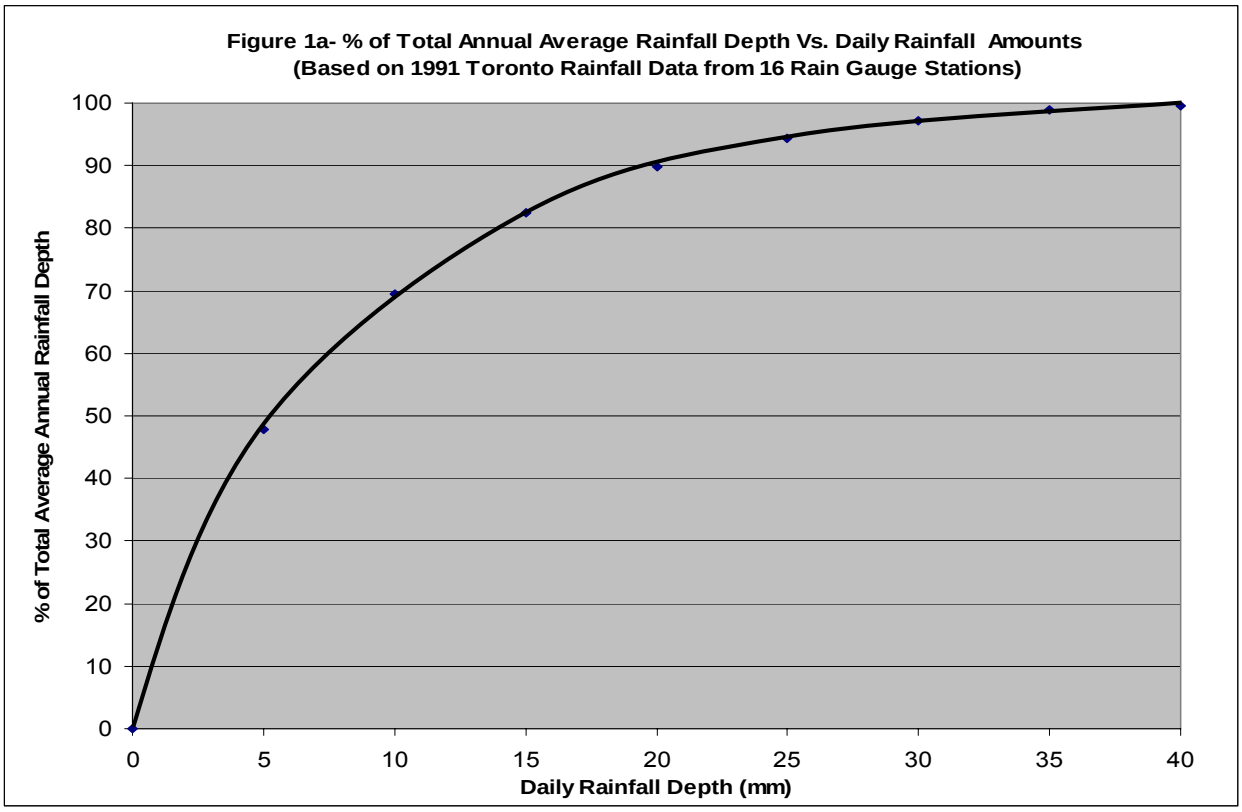
Figure 1a- % of Total Annual Average Rainfall Depth Vs. Daily Rainfall Amounts
(Based on 1991 Toronto Rainfall Data from 16 Rain Gauge Stations)
% of Total Average Annual Rainfall Depth
100
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
35
40
Daily Rainfall Depth (mm)

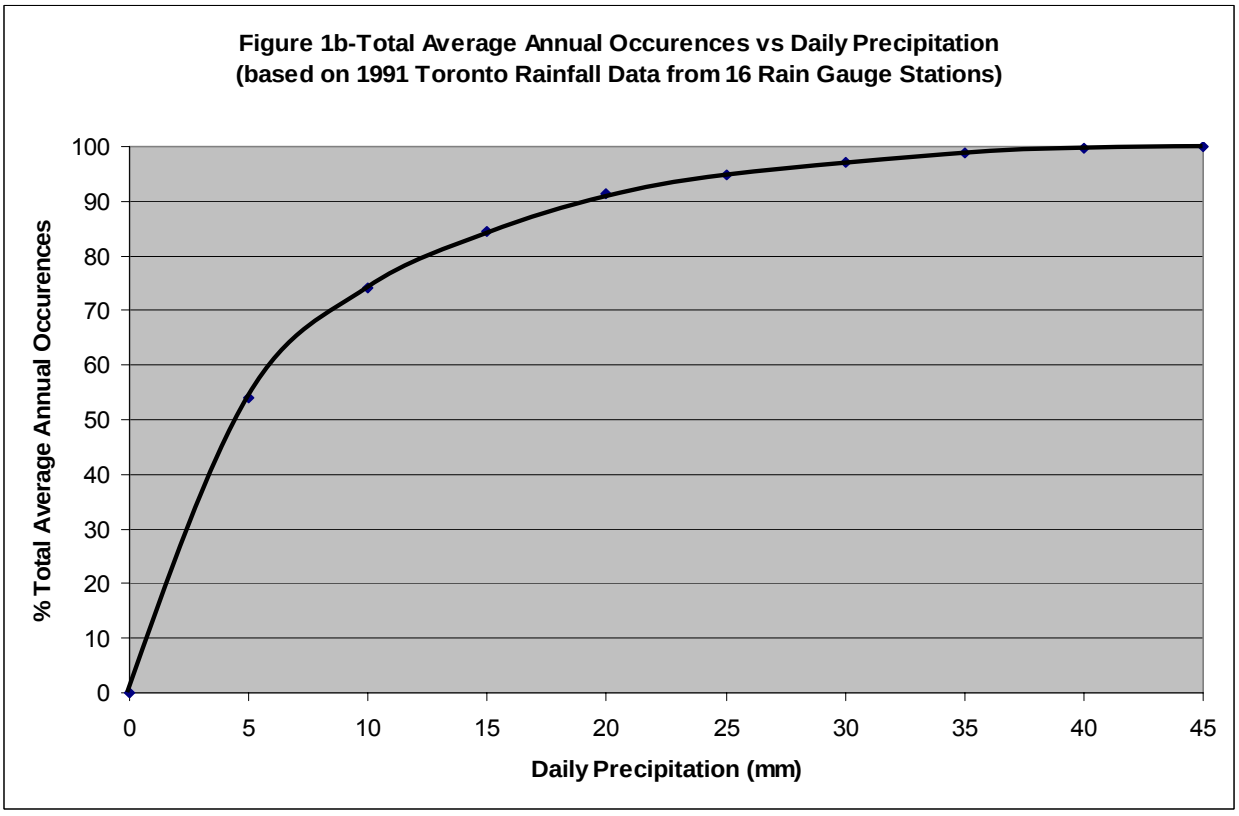
Figure 1b-Total Average Annual Occurences vs Daily Precipitation
(based on 1991 Toronto Rainfall Data from 16 Rain Gauge Stations)
% Total Average Annual Occurences
100
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
35
40
45
Daily Precipitation (mm)

2.2.1.2 General Guidelines

(1) The methodology of summarizing the water balance targets or requirements for different types of land use/development density, soil conditions and connectivity options was developed based on the URFs (unit response functions) applied in the WWFMP HSPF (Hydrologic Simulation Program – Fortran) modeling. Table 3 and Figure 2 provide examples of some default values of the water balance requirements (i.e., annual runoff volume in terms of % of total annual precipitation) for the various types of land uses and hydrologic soil groups as general guidance; but the City may accept the use of other innovative approaches, including modeling in establishing on-site water balance quantities.

(2) The proponent shall demonstrate in the Stormwater Management Report/Plan (see Section 3.3 for submission requirements) that the proposed stormwater management practices for the new development will satisfy the Water Balance Targets. If the proponent can demonstrate to the City's satisfaction that there is no need and/or practical means of satisfying the Water Balance Targets due to physical site constraints (i.e., unfavorable underground conditions for stormwater infiltration, small lot sizes for in-fill development sites, etc.), the City may accept the less stringent requirements for on-site water balance, which may include an off-site compensatory option (see Section 2.4) in terms of financial contribution, to the extent the proponent is not able to achieve the level of control required under the governing criterion. Despite the off-site compensatory option, in most cases, the minimum runoff retention target still requires the proponent to capture all runoff from a small design rainfall event [(1)] (typically 5 mm) and retain it on-site to infiltrate or evaporate. Where soils permit, roof drainage to soakaway pits, infiltration trenches or cisterns, and flatter lot grading should be considered. Roof leader discharge to pervious areas should be applied even to single lots unless physically not feasible.

(3) Physical factors may suggest the use of some stormwater management practices (SWMPs) and preclude the use of others, or they may point to special design considerations. Table 4 summarizes the physical constraints, which could limit the use of some SWMPs (Excerpted from Table 4.1 of MOE SWM Planning and Design Manual – March 2003).

(4) Some of the SWMPs require pre-treatment to ensure proper operation and longevity. In general, pre-treatment is required for infiltrating SWMPs to reduce the potential for clogging and to avoid the deterioration of groundwater quality. In the case of surface end-of-pipe stormwater management facilities, forebays can be considered pre-treatment. In general, the need for pre-treatment may be eliminated if infiltration practices are used for "clean" runoff from landscaped areas.

(5) Volumes of stormwater which have been retained on-site to natural pathways (through infiltration, evapotranspiration and rainwater reuse, etc.) would also provide benefits towards water quality (e.g. TSS loading reduction) and water quantity (e.g. peak flow reduction) improvements. Therefore, the total water quality volume to be treated and water quantity volume to be controlled can be reduced by the amount of stormwater runoff that is sent to natural pathways.

Table 3 Examples of water balance (estimated annual runoff) requirements for various types of development and soil group based on WWFMP (2003) Study.

Connectivity Condition – No Roof Leader Connection to Storm Sewers			Estimated Allowable Annual Runoff (% of Total Annual Precipitation)
Class	Category	Soil Group (HSG)	
High Density Residential (70% Imperviousness)	RHD	AB	31
	RHD	BC	38
	RHD	CD	49
Medium Density Residential (50% Imperviousness)	RMD	AB	23
	RMD	BC	28
	RMD	CD	37
Low Density Residential (30% Imperviousness)	RLD	AB	15
	RLD	BC	17
	RLD	CD	25
Agricultural (Tilled) (0% Imperviousness)	AGT	AB	2
	AGT	BC	3
	AGT	CD	10

Code	Description
RHD	Residential lots characterized by > 60% imperviousness
RMD	Residential lots characterized by 40- 60% imperviousness
RLD	Residential lots characterized by < 40 % imperviousness
AGT	Agricultural lands used for crops.

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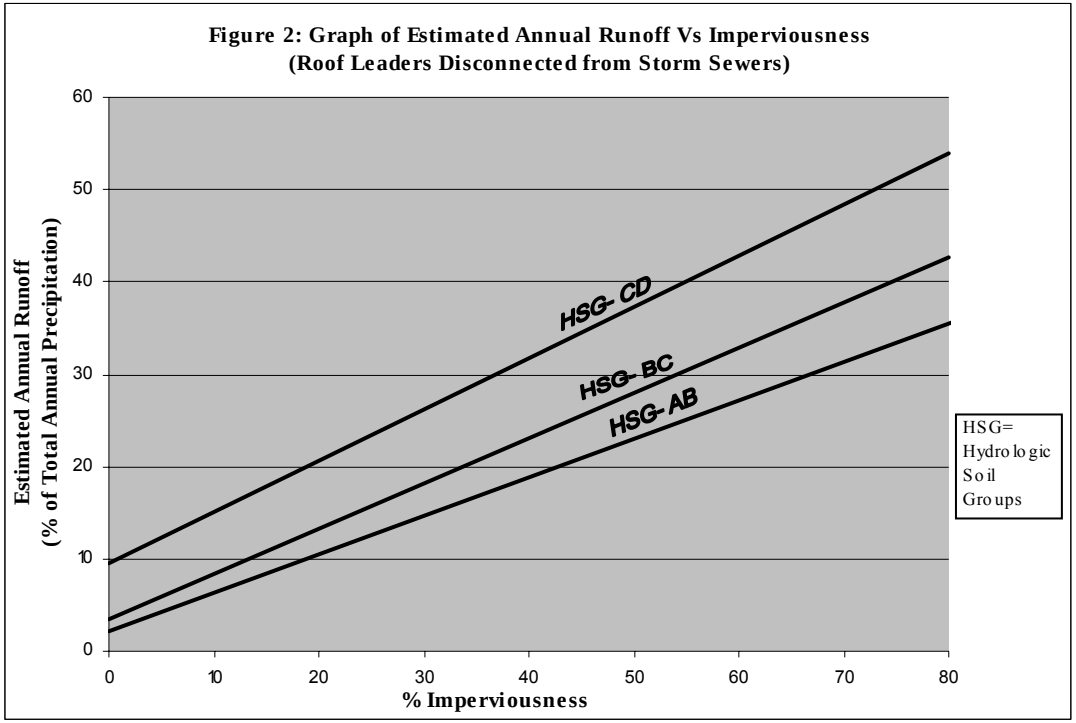
HSG - Hydrologic Soil Groups
AB - Sandy loams and gravels (very pervious)
BC - Medium textured loams (pervious)
CD - Clay loams & silty clay loams (impervious)



LEGEND

HSG=Hydrologic Soil Groups
AB- Sandy loams and gravels (very pervious)
BC- Medium textured loams (pervious)
CD- Clay loams & silty clay loams (impervious)

Table 4 Physical Constraints for Stormwater Management Practices Types
(Excerpted & modified from Table 4.1 of MOE SWM Planning and Design Manual- March 2003)

SWMP	Topography	Soils	Bedrock	Groundwater	Area
wet pond	none	none	none	none	> 5 ha
dry pond	none	none	none	none	> 5 ha
Wetland	none	none	none	none	> 5 ha
infiltration basin	none	sandy loam or better (min. inf. rate ≥60 mm/h)	> 1 m below bottom	> 1 m below bottom	< 5 ha
infiltration trench	none	loam or better (min. inf. rate ≥15 mm/h)	> 1 m below bottom	> 1 m below bottom	< 2 ha
reduced lot grading	< 5%	loam or better (min. inf. rate ≥15 mm/h)	none	none	none
soakaway pit	none	loam or better (min. inf. rate ≥15 mm/h)	> 1 m below bottom	> 1 m below bottom	< 0.5 ha
rear yard ponding	< 2%	loam or better (min. inf. rate ≥15 mm/h)	> 1 m below bottom	> 1 m below bottom	< 0.5 ha
grassed swales	< 5%	none	none	none	< 2 ha
pervious pipes	none	loam or better (min. inf. rate ≥15 mm/h)	> 1 m below bottom	> 1 m below bottom	none
vegetated filter strips	< 10%	none	none	> 0.5 m below bottom	< 2 ha
sand filters	none	none	none	> 0.5 m below bottom	< 5 ha
oil/grit separators	none	none	none	none	< 2 ha

Note:

The above MOE criteria (minimum infiltration rate $\geq$ 15 mm/h) shall be calculated based on percolation tests conducted on-site. The percolation rates and the hydraulic conductivity are related soil parameters, but their relationship is not simply a unit conversion from mm/h to cm/s. They are measured by different field tests under different conditions. The approximate relationship of soil types to permeability and percolation rate is provided in Table 2 of the Supplementary Guidelines, SG-6 Percolation Time and Soil Descriptions, Ontario Building Code 1997. On that table, for example, the guideline indicates that clayey sands (sand-clay mixtures) with hydraulic conductivity of 10^{-4} to 10^{-6} cm/s would have a percolation rate between 12 - 50 min/cm (or 12 - 50 mm/h). If one were to take the same hydraulic conductivity range of 10^{-4} to 10^{-6} cm/s and convert them directly to an hourly rate, then the results would be much lower - only 0.04 to 4 mm/h. Therefore, if the MOE had intended that the criteria (i.e. 15 mm/h) in Table 4 are based on percolation rates, this would suggest that the 2003 MOE SWMP Planning & Design Manual explicitly indicates that **soils with hydraulic conductivity as low as 10^{-6} cm/s (or 10^{-8} m/s) may be acceptable for infiltration practices.** There are other factors which must also be assessed in the evaluation of the physical feasibility of any infiltration practices by qualified geotechnical professionals/consultants based on investigation and soil tests on site. These factors include impacts on stability of nearby slopes, potential groundwater contamination (e.g. MOE Reasonable Use Guideline), effect on groundwater table, subsurface erosion & seepage, etc. For the purposes of site suitability, where the tested soil infiltration rate is low (i.e. less than 15 mm/h), infiltration may still be possible although the surface area required

could be large, and other volume reduction methods may be warranted. Typically, the design must be sufficient to fully drain the stormwater quality design storm runoff volume within 72 hours. The above MOE criteria are provided for general guidance and/or planning purposes and successful infiltration is dependent on careful consideration of site conditions, careful design , and careful construction.

The use of lab testing alone to establish infiltration rates for detailed designs of any infiltration BMPs is not acceptable. Past observations on infiltration practices also suggested that the hydraulic conductivity for clay or silt loams as determined by in-situ tests is typically an order of magnitude higher than the values determined by grain size analysis probably due to anisotropy. Therefore, the City require that in-situ tests (i.e. borehole percolation tests and/or falling head tests) must be performed by a qualified geotechnical professional/consultant to confirm the infiltration rates and/or the hydraulic conductivity of the underlying soil's suitability for any lot-level infiltration techniques if there is dispute or uncertainty of the soil's suitability for infiltration practices.

(6) Consistent with the WWFMP long-term objectives and hierarchical principles, all new development and re-development projects are strongly encouraged to apply low impact development strategy and design techniques that are suitable and applicable to individual site conditions. A variety of lot level control measures and techniques (non-structural and structural) were evaluated in the WWFMMP study (see Table 1). Some of the Low Impact Development (LID) strategies and techniques we recommend for considerations include the following:

- Site Planning
- Source Separation of Runoff
- Green Roof Technologies
- Rainwater Harvesting (Re-use)
- Absorbent Landscaping

A general discussion on the Low Impact Development Practices Initiatives and the above lot-level control techniques are provided in Appendix F as general guidance for applications to achieve specific wet weather flow management targets.

(7) Stormwater modeling for sizing end-of-pipe flooding controls should also recognize and incorporate end-of-pipe storage provided for quality and erosion controls. Table 4.11 of MOE SWM Planning and Design Manual – March 2003 provides general guidance in terms of modeling techniques to achieve the benefits and reductions in the volumetric requirements for various SWMPs. It should be noted that any change in storage requirements with respect to Table 3.2 of MOE SWM Planning and Design Manual – March 2003, represents a reduction in the volume of required active storage (not permanent pool). **Quantitative guidelines for the various SWMPs and LID practices will be provided when further URF analysis is completed.**

2.2.2 Water Quality Management

Under the Toronto WWFMP, the long-term goal is to achieve federal, provincial and municipal water and sediment quality objectives and guidelines in area watercourses and along the Waterfront. The acceptable removal efficiencies applied in the modeling analysis for different types of stormwater management facilities are presented in Table 6 (excerpt from Toronto WWFMP, Appendix 5-5). On an interim basis, two primary water quality constituents need to be controlled, dependent on the location of the development site within the City of Toronto and they are:

- Total Suspended Solids (TSS)
- E. coli (Escherichia Coli)

In addition, there are many other water quality parameters of concern, such as nutrients (total phosphorus, nitrates, TKN), trace metals (cooper, zinc, lead) and toxic chemicals (pesticides), etc. TSS has been selected by the City of Toronto as a surrogate for these other water quality parameters because sediment is also an efficient carrier of toxicants and trace metals, which are often associated with the particulate phase. Once deposited, pollutants in these enriched sediments can be remobilized under suitable environmental conditions posing a risk to benthic life. Removal of TSS also removes a large portion of these other pollutants and contaminants. This is similar to the rationale used by the Ontario Ministry of the Environment (MOE) in selecting the TSS for establishing its water quality storage requirements.

Table 5 Removal Efficiencies for Stormwater Management Facilities
(Excerpted from Toronto WWFMMP - Appendix 5-5)

Water Quality Group	Water Quality Parameter	% of Removal									
		Source Controls	Conveyance Controls			Dry Ponds	Wet Ponds Level II / I	Constructed Wetlands	Hybrid Wet Ponds/Wetlands Level II / I	End-of-Pipe Sand Filters	Dunkers Flow Balancing System
		Oil/Grit Separators	In-line Filter System	Roadside Ditches	Grassed Swales						
Nutrients	Total Phosphorus	30	30	0	34	20	57 / 65	40	57 / 65	33	57
	Nitrates + Nitrite	0	0	20	31	0	31 / 36	40	31 / 36	0	31
	TKN	35	20	0	34	30	22 / 26	30	22 / 26	45	22
Heavy Metals	Copper	50	35	10	50	30	57 / 65	40	57 / 65	45	57
	Zinc	50	35	10	70	30	63 / 72	40	63 / 72	45	63
	Lead	50	35	10	70	50	54 / 62	60	54 / 62	45	54
Bacteria	E. Coli	35	30	10	60	40	57 / 65	60	57 / 65	70	57
General Chemistry	Total Suspended Solids	50 [(2)]	40	30	80	60	70 / 80	70	70 / 80	70	70
PAH	Benzo (G,H,I) Perylene	60	40	30	80	60	70 / 80	70	70 / 80	70	70
Pesticide	Dieldrin	0	0	20	30	0	31 / 36	40	31 / 36	0	31

[(2)] In the interim, the City of Toronto is prepared to accept, based on the US TARP (The Technology Acceptance and Reciprocity Partnership) Tier I Interim Approval by NJDEP (New Jersey Department of Environmental Protection) that OGS devices, operating alone (see Appendix B.2 for NJDEP Conditional Interim Certification Letter for OGS Devices), are capable of achieving a TSS removal efficiency of 50%. The types of OGS certified (interim) by NJDEP include: VortSentry, Vortechs, High Efficiency CDS, Baysaver Separator System, Downstream Defender, Stormceptor, etc. (see Appendix B- Oil/Grit Separators Guideline).

2.2.2.1. Water Quality Targets – Total Suspended Solids (TSS)

(a) The wet weather flow (WWF) water quality target is the long-term average removal of 80 % of Total Suspended Solids (TSS) on an annual loading basis from all runoff leaving the proposed development site based on the post-development level of imperviousness.

(b) Table 7 provides further details regarding the application of water quality targets for the various types of development.

2.2.2.2. General Guidelines

(1) This long-term average of removal of 80% of TSS requirements is consistent with the "enhanced protection" recommended in the current MOE SWM Planning & Design Manual (March 2003). As defined in the current guidelines from the MOE SWM Planning & Design Manual, "enhanced protection" corresponds to the end-of-pipe storage volumes required for the long-term average of 80% of suspended solids. The use of a long-term average (defined as %) is to account for the variability in characteristics of rainfall events. The efficiency of any proposed SWMP should be judged by its long-term sustainability and on an annual basis, instead of on an event or seasonal basis.

(2) The requirement of achieving, on-site, the long-term average removal of 80% TSS on an annual loading basis from all runoff leaving the site is not applicable for residential infill or intensification situations with site area less than 0.1 ha.

(3) In order to comply with the water quality objectives, very often, developers and/or their engineers are proposing that oil/grit separators (OGS) be installed on the development site. In most cases, the OGS specified is purported to be capable of removing 80% of total suspended solids from the runoff stream and therefore satisfies the criteria for quality control. Most of the OGS devices are proprietary designs. Often, the Professional Engineer responsible for preparing the Stormwater Management Report, does not certify the performance of the device, but is instead relying on the manufacturer to specify an appropriate make and model. It is difficult for an approving agency to assess independently whether the device is adequate. The reported removal rates of sediments, floatables, and oil and grease differ depending on the vendors. Literature review of independent performance testing suggests that these removal efficiencies are only attainable under very specific circumstances, which are highly dependent on study design, specific site conditions, particle size distribution and the varying flow conditions under which the tests were conducted. To provide a level playing field for all OGS vendors, the City has developed a new Oil/Grit Separators Guideline (Interim), which is included in Appendix B. This guideline represents the City's current position regarding the use and approval of the OGS devices for stormwater management in development applications and on City projects. The Guideline will be updated when the City completes the development of its review program and monitoring/test protocols for the evaluation of new stormwater treatment technologies including the OGS devices. .

The main points of the guideline are as follows:

- For stormwater quality control, oil/grit separators (OGS) may be applied as one element of a multi-component approach unless it is determined that it can achieve the desired water quality as a stand-alone device on a site-specific basis.

- **OGS devices, operating alone at their original design capacities (see Appendix B.2 for NJDEP Conditional Interim Certification Letters), are capable of achieving a TSS removal efficiency of 50%.** When used as a stand-alone stormwater management/control device, it must also be sized to capture and treat a minimum 90% volume of the annual runoff on a long-term average basis (i.e., shall be designed in accordance with the Toronto 1991 continuous rainfall data) without bypass (this is not required for pretreatment or spill control functions).

- City staff may consider higher removal efficiency if field performance data verified by an independent source is deemed satisfactorily to the City staff consistent with the City's performance standards.

- The specifications of any OGS models proposed for a development must be signed and sealed by a Professional Engineer (i.e., Registered Engineer of Ontario). The required submission of information for review and approval by the City staff must include design computations documenting the estimated performance, supported with well-documented sizing (computer modeling) program, CADD details and maintenance requirements.

- The OGS make and model specified on the approved Stormwater Management Report cannot be substituted with an "equivalent" model later, without the approval of City staff. Requests for substitution must be accompanied by certification of equivalency by the Professional Engineer who prepared the approved Stormwater Management Report.

2.2.2.3 Water Quality Target - E. Coli

For discharges directly to the Lake or Toronto Waterfront:

(a) Wet Weather Periods: E. coli < 1000/100 mL during swimming season (June 1 to September 30)

(b) Dry Weather Periods: E. coli < 100/100 mL during swimming season.

(c) Table 7 provides further details regarding the application of water quality targets for the various types of development.

2.2.2.4 General Guidelines

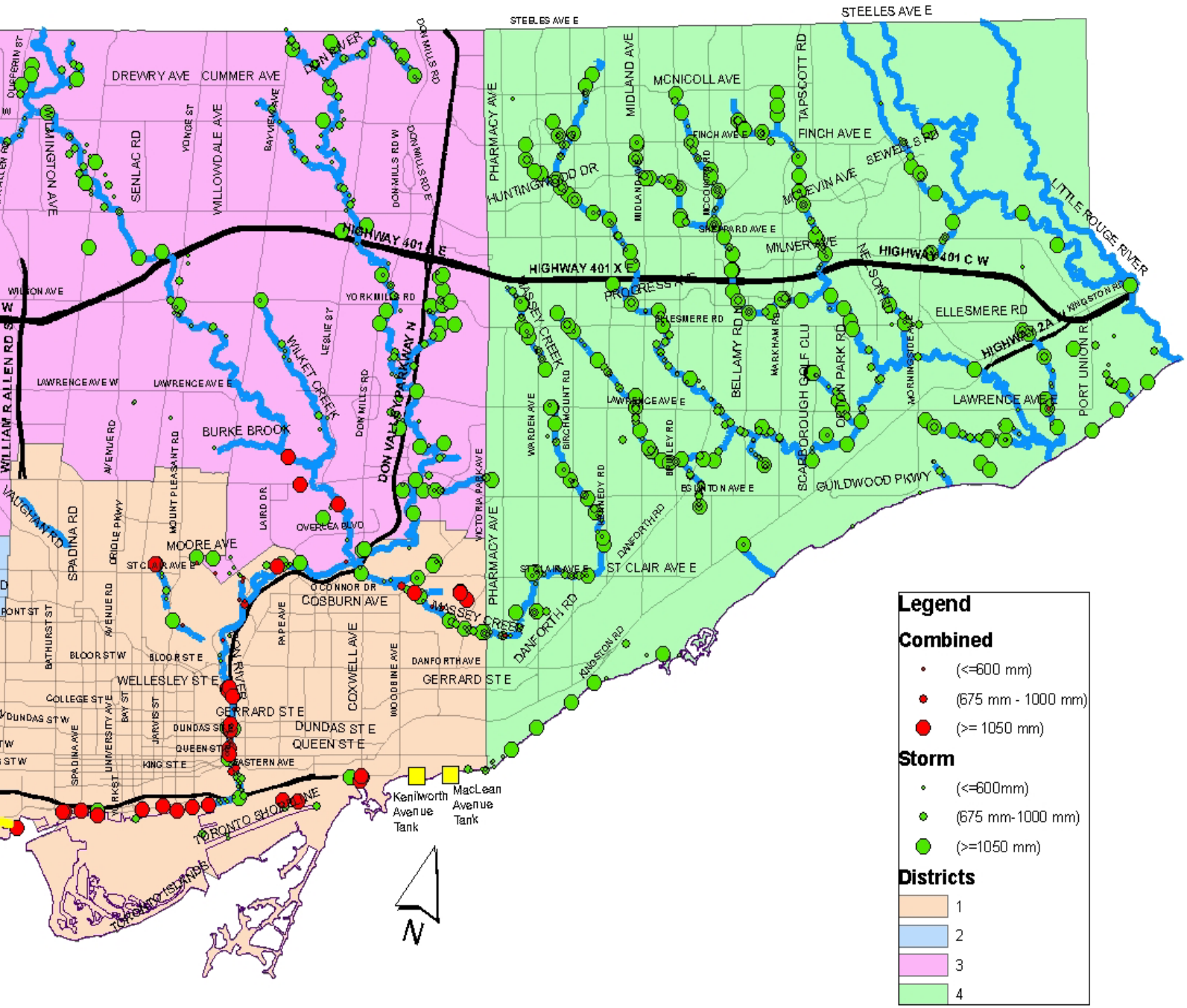
(1) Provide disinfection treatment (i.e., ultraviolet light radiation or equivalent) for storm runoff from the development site, which discharges through either a new or an existing outfall (see Figure 3) directly to the Lake or Waterfront areas. (e.g., City of Ottawa has had experience with the use of UV disinfection for stormwater runoff treatment in their Clarke Bellinger Stormwater Facility, constructed in 1990/1991.)

(2) For development areas, where storm runoff discharge from the sites is currently intercepted and treated by the Eastern Beaches Tanks and Western Beaches Tunnel, there will be no requirement for further disinfection treatment.

(3) For discharges within watersheds and outside the combined sewer service areas, the design and physical provision for a future disinfection treatment system shall be provided within all City-owned end-of-pipe facilities constructed during the first 25-year implementation period of the WWFMMP. For example, when the design and construction of any City-owned end-of-pipe facilities is undertaken by the private sector developers (see Section 2.4 – Off-Site Compensation/Cash-in-Lieu for details), the proponent may be required to allow provision and design considerations for future installation of disinfection treatment systems (i.e., ultraviolet light radiation) at these facilities.

City of Toronto

Exisiting Outfall Locations by Type and Size



2.2.3 Water Quantity Management

Water Quantity targets focus primarily on flood flow management and erosion control aimed to minimize the impacts on downstream flooding, stream bank erosion, and overflows of infrastructure. Typically, controls include peak flow control for flood control and both peak flow and runoff volume controls to mitigate erosion impacts.

2.2.3.1 Flood Flow Management Criteria

(a) The required level of peak flow control from a development site contributing flow to a specific watercourse at the point of discharge, shall follow Toronto and Region Conservation Authority (TRCA) Flood Flow Criteria Map (see Appendix C.1).

(b) For development sites within the City's chronic basement flooding areas (see City of Toronto Basement Flooding Relief Work Program Location Map & Schedule in Appendix D), the proponent shall consult Toronto Water - Sewer Asset Planning Section for details of requirements, where applicable.

(c) The City of Toronto has adopted the 100-year storm as the level of protection for properties, where feasible, against surface flooding from ponding on streets, particularly, in areas of the City experiencing chronic basement flooding and/or when a proper major overland flow stormwater drainage system does not exist (see Section 2.2.3.8 for overland flow drainage system requirements).

(d) For development sites < 2 ha, the proponent may use a simplified approach such as the Rational Method / IDF curves to compute peak flows.

(e) Table 7 provides further details regarding the application of flood control criteria for the various types of development.

2.2.3.2 General Guidelines

(1) The TRCA Flood Flow Criteria shall be applied to any new development site contributing flow to a specific watercourse at the point of discharge. For example, if the development site is located within the Highland Creek watershed, the requirement is to control post-development peak flows to pre-development levels for all storms up to and including the 100 year storm (i.e. 2, 5, 10, 25, 50 and 100 year storms). For locations within Humber River Watersheds in the City of Toronto, post-development peak flows controlled to **Unit Flow Rates** [(3)] for pre-development conditions are required, and the details of these Unit Flow Rates are presented in Appendix C.2 (obtained from TRCA). Don River **Unit Flow Rates** are only available for the 905 areas, north of Toronto (i.e., north of Steeles Avenue).

[(3)] The Unit Flow Rates were introduced by TRCA to ensure local target flows for developers are consistent with the watershed wide target flows. The unit flow methodology was used to develop generic unit flow rate targets for each return period. These unit flow targets can then be applied directly to proposed development in the watershed.

(2) The same design storm distribution as used in the approved hydrology model for the specific watershed shall be used when addressing flood flow management criteria, which are summarized as follows:

Watershed	Design Storm	Hydrologic Model
Don River	12 hour SCS	Visual OTTHYMO
Humber River	6 & 12 hour AES	SWMHYMO
Rouge River	12 hour AES	Visual OTTHYMO
Highland Creek	6 hour AES	Visual OTTHYMO
Mimico Creek	24 hour SCS	Visual OTTHYMO
Etobicoke Creek	24 hour SCS	Visual OTTHYMO

(3) Further background information on the hydraulics and hydrology studies for specific watersheds are available from the following TRCA web link:
http://www.trca.on.ca/water_protection/hydrology/stormwater_management/

2.2.3.3 Erosion Control Criteria

(a) For Rouge River watershed (within City of Toronto), follow TRCA (Toronto and Region Conservation Authority) erosion control criteria for individual sites, which discharge directly to and/or are in proximity of natural watercourses.

- ***Detain the post-development rainfall runoff from a 30 mm storm for a minimum of 24 hours for Tributary "B" of the little Rouge Creek (south of Steeles Ave. – see map on Appendix C.4)***
- ***Detain the post-development rainfall runoff from a 33 mm storm for a minimum of 48 hours for the Morningside Tributary of the Rouge River (south of Steeles Ave. – see map on Appendix C.4)***

(b) For all other watersheds where new large development blocks (site area > 5 ha) discharge directly and/or in proximity (within 100 m) of natural watercourses, the proponents are required to complete an Erosion Analysis Report to determine the erosion control criteria for the sites (see Appendix E.2 for the Terms of Reference for such study analysis – or obtain the latest edition from TRCA).

(c) For sites where it is not feasible [(4)](this condition must be reviewed and agreed by City staff) to complete an Erosion Analysis Report, we typically require that runoff from a 25 mm design storm be detained on-site and released over a minimum of 24 hours.

(d) For small infill/redevelopment sites < 2 ha, erosion control in the form of stormwater detention is normally not required, provided the on-site minimum runoff retention from a small design rainfall event (typically 5 mm) is achieved under the Water Balance Criteria.

(e) New developments shall be designed to minimize the number of new storm outfalls in the valley and all new outfalls shall be designed to minimize potential erosion (see Appendix E.3 for Storm Outfall & Outfall Channel Design Criteria - obtained from TRCA).

(f) Table 7 provides further details regarding the application of erosion control criteria for the various types of development.

(4) Physical site conditions may be considered "not feasible", such as proposed development is negligible with respect to the total drainage area of the receiving watercourse and/or watercourse (e.g., less than 1%) and/or the watercourse is not sensitive to development – concrete channel, etc. - this condition must be reviewed and agreed by City staff.

2.2.3.4 General Guidelines

(1) In addition to the above site-specific erosion control criteria, any localized existing erosion problems, sewer infrastructure capacity constraints and flooding issues must be addressed and mitigated in the Stormwater Management Plan or Report.

(2) Regardless of size for all development sites, temporary erosion and sediment control is required on-site (see Section 2.2.3.5 for details).

(3) Under Ontario Regulation 166/06, the Toronto and Region Conservation Authority regulates and may prohibit work taking place within valley and stream corridors, wetlands and associated areas of interference and the Lake Ontario waterfront. TRCA screening maps identify areas where there is a flood risk and/or specific natural feature of interest to the TRCA. Most of the lands regulated by the Conservation Authority have been mapped in detail. The Regulation Limit mapping, which shows the Authority's Regulated Areas, is available through TRCA's head office. If the property is regulated, the proponent must apply for a permit from the Conservation Authority in order to do any of the following works:

a) Straightening, changing, diverting or interfering in any way with the existing channel of a river, creek, stream or watercourse, or for changing or interfering in any way with a wetland;

b) Development, if in the opinion of the authority, the control of flooding, erosion, dynamic beaches or pollution or the conservation of land may be affected by the development.

Where Development is defined as:

a) The construction, reconstruction, erection or placing of a building or structure of any kind,
b) Any change to a building or structure that would have the effect of altering the use or potential use of the building or structure, increasing the size of the building or structure or increasing the number of dwelling units in the building or structure,
c) Site grading,
d) The temporary or permanent placing, dumping or removal of any material, originating on the site or elsewhere.

2.2.3.5 Erosion & Sediment Control during Construction

(a) Regardless of size for all development sites, temporary erosion and sediment control for construction must be provided on-site.

(b) All erosion and sediment control BMPs shall be designed, constructed and maintained in all development sites in accordance with the GTA CA's Erosion & Sediment Control Guidelines for Urban Construction (2006) and/or other City of Toronto requirements on a site-by-site basis.

2.2.3.6 General Guidelines

(1) In accordance with the City of Toronto Erosion and Sediment Control BY-law No.xxxxx (being developed - led by Toronto Water and is expected to be available by summer 2007), an Erosion and Sediment Control Permit must be obtained prior to undertaking any land disturbing activities on development sites greater than 0.5 hectares in size or on development sites of any size that is adjacent to a body of water. Details of the by-law and implementation procedures are to be provided in the near future.

(2) All sedimentation basins and other control measures necessary to meet the requirements of the City Bylaw (being developed) shall be in place prior to any land disturbance of the site unless otherwise approved by the City. These measures shall be maintained by the Sediment and Erosion Control Permit holder or subsequent landowners during the period of land disturbance in a manner satisfactory to the City to insure adequate compliance with the requirements of the Bylaw and to prevent damage occurring because of erosion, sedimentation or flooding.

(3) City staff (and/or in conjunction with TRCA staff) shall inspect sites for which Sediment and Erosion Control Permits have been issues for compliance with the approved Sediment and Erosion Control Plan. No work authorized under the Sediment and Erosion Control Permit shall be carried out without at least a 48-hour notice being given.

(4) The issuance of a Sediment and Erosion Control Permit by the City does not preclude the applicant's responsibility to obtain all other approvals, which may be required by any level of government and agencies or authorities.

2.2.3.7 Discharge Criteria to Municipal Infrastructure

(a) The allowable release rate to the municipal storm sewer system (minor system) from the development site during a 2 year design storm event must not exceed the peak runoff rate from the site under pre-development conditions during the same storm event, or existing capacity of the receiving storm sewer, whichever is less.

(b) See Sections 3.1 (Storm Sewers) & 3.2 (Connections to Sewers) for more details.

2.2.3.8 General Guidelines

(1) Unless directed by City staff, the consultant shall demonstrate that existing downstream system has capacity to accommodate design flows from point of connection of the development site to an existing outfall or municipal trunk sewer (confirm existing capacity and/or original design parameters and contributing drainage areas with local district staff). An assessment of the existing storm sewer system draining the proposed infill/redevelopment site to the receiving stream may be required depending upon capacity constraints, the proposed release rate of flows from the infill site and the potential for basement flooding in areas within the sewershed. Accommodation of overland (major system) flow must also be accounted for.

(2) When the % imperviousness of a development site under pre-development condition is higher than 50% (regardless of what the post-development condition is), the maximum value of C (Runoff Coefficient) used in calculating the pre-development peak runoff rate is limited to 0.5.

(3) In all cases, the proponent of a development site shall investigate and determine the direction and hydraulic capacity of the conveyance path for the existing major system flow from the site through any adjacent properties, existing right-of-ways, or overland flow routes within City lands/easement, etc. to an existing watercourse. The purpose of this investigation is to determine if a suitable overland flow route of sufficient hydraulic capacities (up to a 100-year return period storm) exists, which is acceptable to the City. If the major overland flow route is accepted by the City, storm runoff, which exceeds the allowable release rate defined above but complying with all other requirements (i.e. water balance, water quality, flood flow and erosion controls) is allowed to discharge off-site via the overland flow route. If no approved or adequate overland flow route exists, then all flow from the 2-year up to the 100-year return period storms shall be stored on site and released at the allowable release rate defined above or the capacity of the existing minor system, whichever is less. Rooftop storage, oversized sewer pipe storage and paved area storage will be permitted and the depth of ponding within a paved parking area shall not exceed 0.3 m (greater depths may be permitted in loading dock areas). Storage within depressed landscaping or grassed areas will be permitted and the maximum depth of ponding shall not exceed 0.9 m.

(4) The overland flow (major) system including flood protection works, where applicable, within the subject development shall be designed to accommodate and/or convey the major storm flow, that is, the rainfall runoff resulting from the subject site and any external tributary areas using the City's 100 year design storm, without causing flood damage to proposed and adjacent public and private properties. Overland flow shall only be conveyed through walkways, easements and within the road allowance. Continuity of overland flow routes between adjacent developments shall be maintained. Determination of the allowable flow for the major system is based on allowable depth and inundated area, and the reduced allowable flow due to velocity considerations. In sump areas, overflow outlets (to parking or other graded areas) should be provided to prevent water in sumps, particularly when the sump is clogged, from entering adjoining buildings. Residential dwellings, public, commercial and industrial buildings shall not be inundated at the ground level, unless buildings are flood-proofed.

(5) Velocities in overland flow channels should be minimized as the force of moving water on objects in its path increases with the square of velocity. If the public has access to the flow routes, the velocities and depths of flow for the major overland flow systems should not exceeded the combinations outlined in the table below. The table lists the approximated flow depths that a child (20 kg) would be able to withstand while standing in a concrete-lined channel or gutter flow at the selected velocities. Values outside of these limits must be approved by Toronto Water.

Permissible Depths for Submerged Objects	
Water Velocity (m/s)	**Permissible Depth (m)**
0.5	0.80
1.0	0.32
2.0	0.21
3.0	0.09
Note: The above values are based on a 20-kg child and concrete-lined channels. Source: Stormwater Management Guidelines for the Province of Alberta (1999)	

(6) For convenience and safety, the maximum pavement encroachment by ponding on streets during the 1 in 2 year storm (minor) are as follows:

(a) Local roads – No curb overtopping and flow may spread to crown of street.
(b) Collector roads - No curb overtopping and flow spread must leave at least one lane free of water.
(c) Arterial roads - No curb overtopping and flow spread must leave at least one lane free of water in each direction.
(d) Freeway – No encroachment is allowed on any traffic lanes.

(7) Road grading must direct flows from the right-of-way to a safe outlet at specified low points. Outlets can be walkways or open sections of roads leading to open spaces or river valleys. Roads may be used for major system overland flow conveyance during the 100 year storm subject to the following depth constraints and minimum flood protection:

Level of Protection During the 100 Year Storm	
Location	**Maximum Depth of Ponding**
Open Spaces	▪ As required for overland flow outlets
Local Roads	▪ Maximum depth of ponding shall be the lesser of 0.15 m above the crown of road or the water level up to the right-of-way limit.
Collector and Industrial Roads	▪ Maximum depth of ponding shall be the lesser of 0.1 m above the crown of road or the water level up to the right-of-way limit.
Arterial Roads	▪ Maximum depth of ponding is to the crown of the road
Location	**Minimum Flood Protection**
Private Properties	▪ No structural damage ▪ No basement flooding
Public Properties, Schools and Parklands	▪ No structural damage ▪ No basement flooding ▪ Positive overland flow to outlets ▪ No erosion

(8) Flow across road intersections shall not be permitted for minor storms (generally 1 in 2 year). To meet the criteria for major storm runoff, low points in roads cannot be permitted unless adequate provision is made for safe overland flow at the low points.

2.3 Maintenance of SWMPs and Verification of Performance

2.3.1 Maintenance

In subdivisions, where a stormwater management facility is required, it shall be located on lands conveyed to the City by the landowner free of charge and encumbrances. A detailed maintenance plan including a monitoring program for assessing the performance of the facility must be fully described in the Stormwater Management Report/Plan as required by the Ministry of the Environment (MOE) Certificate of Approval (C of A). When a C of A condition is issued for a facility from the MOE, it typically contains terms and conditions of approval, which includes owner's responsibilities.

If the facility is on public property and the proponent requires Toronto Water to review and approve the final design, the Toronto Water's District Operations staff will be responsible for the operations and maintenance and/or performance monitoring of the facility with assistance from the Water Infrastructure Management staff. For stormwater management facilities serving subdivisions, maintenance remains the responsibility of the developer/landowner until the works are assumed by the City of Toronto. During this period, the monitoring results should be sent to Toronto Water and Development Engineering Services.

On-site stormwater management facilities on private property (i.e., facilities that manage runoff from only one property) should be located within the property and the property owner will be responsible for the operation and maintenance of the facilities. In this case, the owner will typically commit to the City (through some form of agreement) to carry out the required maintenance, monitoring and record keeping activities, etc., under the MOE Certificate of Approval conditions and/or City of Toronto's standards and practices. This agreement will also give the City the right to enter the private property and conduct the necessary maintenance activities for the facility with reimbursements from the owner when the condition of the agreement is breached. Typically, the owner shall maintain a logbook to record the results of the required inspections and any cleaning and maintenance operations undertaken, and shall keep the logbook updated and ready for inspection by the MOE and/or City of Toronto. Typically, the logbook shall include the following:

(a) the name of the Works, including site locations and municipal address;

(b) the date and results of each inspection, maintenance and cleaning, including an estimate of the quantity of any materials removed and the method of disposal; and

(c) the inspection, cleaning and maintenance records shall be signed and sealed annually by a Professional Engineer (i.e., Registered Engineer of Ontario) certifying the records are kept accurate and current and the facility is properly operated and maintained in compliance with the approval conditions by the MOE (C. of A) and/or the City of Toronto (e.g. Toronto Sewer Use Bylaw, site plan/subdivision agreement).

It is important that SWMP planners and designers consider maintenance activities in their design and provide specific details in the SWM Reports. There are many factors, which affect sedimentation rates and maintenance requirements including: types of SWMP, land use, upstream development, and wildlife. Typically, sediment removal is the main maintenance consideration for wet or dry ponds and for infiltration devices. Accumulated sediment at pre-treatment inlets or within the facilities should be removed. Infiltration devices should also be cleaned when the infiltration rate drops significantly. Other activities are periodic removal of debris, control of vegetation (grass cutting, weed control, etc.) and replanting, where necessary. Proper access must be provided for maintenance purposes. Many

maintenance aspects have been discussed in the MOE SWM Planning and Design Manual (March 2003). In the future, the City will develop specific maintenance requirements and protocols for each type of SWMPs.

2.3.2 Verification of Performance

Once a stormwater management facility is assumed by the City, the City will be responsible for its maintenance and monitoring activities. Prior to assuming the facility, the City may require the developer of any large-scale development project/subdivision, under the site plan/subdivision agreement, to be responsible for a post-construction monitoring program for a period of time (e.g. 2 to 3 years) to ensure the proposed stormwater management facility will perform as designed and approved. This post-construction monitoring requirement for any new stormwater management facility to be assumed by the City of Toronto will provide the City an opportunity of assessing the performance and/or deficiencies of the facility. At the end of the monitoring period, a monitoring report must be prepared by a Professional Engineer (i.e., Registered Engineer of Ontario), on behalf of the developer/owner. The report shall include all site observations, monitoring and test results, assessments of removal efficiencies, system performance, conclusions and recommendations, including a remedial plan to improve the efficiency and system performance to the level that it was designed and approved under the MOE's Certificate of Approval conditions. If the City and the developer agree, the City could also take over the post-construction monitoring program with funds provided by the developer/owner. This is important to the City from its risk management perspective because once the stormwater management facility is assumed by the City; the City will be responsible for ensuring the facility will be in compliance with the MOE's Certificate of Approval conditions.

Since the approval of the subdivision / development project is based on the designed performance of the facility, the developer/owner shall also be liable for the costs of improving the facility to its designed performance and in compliance with the MOE Certificate of Approval conditions and/or approval conditions of other relevant agencies. The City may consider some forms of reserved funding for the retrofit works under the subdivision agreement, if necessary.

Monitoring of hydraulic conditions and operation and maintenance inspections are typically required for most stormwater management facilities. However, the need for monitoring specific pollutants, the nature of pollutants to be sampled and the sampling duration and frequency may vary with the importance of the facility and the sensitivity of the site and its impact on downstream receiving waters, and will be subject to the City's approval. The monitoring program report shall typically include specifics, such as the monitoring location, equipment and methods of sampling, the data (parameters) to be collected, and how the results should be presented and interpreted, etc. While a decision has to be taken in conjunction with other approval agencies on a case-by-case basis, the City of Toronto considers that more comprehensive monitoring should be conducted mainly for large-scale projects. The City is developing and will provide protocols in the future for the post-construction monitoring programs for new stormwater management facilities which will be assumed by the City. In the interim, the designer of such new stormwater management facility is advised to consult the City and/or MOE staff regarding site-specific requirements.

2.4 Off-Site Compensation/Cash-in-Lieu

Under the WWFMMP, the type of stormwater management measures that are proposed for areas of intensification must be consistent with the measures required in the Plan. In summary, the proposed type of stormwater management measures would include: (1) enhanced level of source control; (2)

exfiltration/filtration and evaporation systems; and (3) end-of-pipe facilities with nutrient and bacteria removal technology.

On-site stormwater management is generally preferred; however, it is recognized that site conditions and types of development (e.g. small infill/redevelopment) may preclude the feasibility of achieving all of the WWFMP requirements. There is a need to consider options, if agreed by the proponent, for allowing off-site systems and/or off-site compensatory options to the extent the proponent is not able to achieve the level of control consistent with the WWFMP Long-Term Preferred Strategy. A number of municipalities have used the approach of requesting a financial contribution toward the development of stormwater management at another location elsewhere in the watershed and have used various formulas to calculate the required financial contribution. In the interim, the City is considering cash-in-lieu, at the discretion of the General Manager of Toronto Water, to the extent the proponent is not able to achieve the level of control after exhausting all reasonable on-site methods to achieve all of the WWFMP requirements. Cash-in-lieu funding collected by the City will be used to implement projects contained within the WWFMP for the corresponding watershed or waterfront drainage basin in which they are collected. Until further analysis and implementation process are finalized, off-site compensation options, including the cash-in-lieu contribution will be considered on a site-by-site basis.

In order to qualify for consideration of the cash-in-lieu option, a proposed development site must meet certain criteria, which are primarily intended for small infill housing/developments where storm sewer infrastructure exists and/or small developments (total site area less than 5 ha) where end-of-pipe controls may not be feasible. For large developments (total site area greater than 5 ha), the City requires the proponent do "whatever it takes" to provide stormwater management controls at source necessary to achieve the long-term goal and objectives of the WWFMP. No categorization can cover all eventualities and any request for exceptions to all and/or part of WWFMP requirements under special conditions using cash-in-lieu contribution would be assessed on an individual basis in an equitable manner.

The intention of cash-in-lieu contribution is to establish a means of securing funds to provide stormwater quality/quantity/erosion controls and treatment to address impacts caused by development, where implementing controls at source is not feasible. In all cases, new developments within Toronto must be designed to provide adequate flood protection for property protection and safety reasons. Typically, the most dominant impact from development is the degradation of water quality in the receiving watercourse resulting from the increase in runoff and pollutant export from the development site. For calculating the runoff volume in cash-in-lieu contribution, we select the level of stormwater quality control for a 20 mm daily rainfall, which covers all storms with 24-hour volumes of 20 mm or less. This event size represents the rainfall depth of about 90% of the total average annual rainfall volume (see footnote [1] in Section 2.2.1.1) which occur over a typical rainfall year in the City and it also represents the "first flush" period of larger rainfall events where most of the contaminants are expected to be washed off.

The cash-in-lieu contribution shall be calculated as follows:

(**Site Area**) X (**Runoff Coefficient**) **X** (**Average Rainfall Control**) **X** (**Capital Cost /m^3 of Capacity**)
(A) **(B)** **(C)** **(D)**

Where:

A = Gross area of development site in m^2 (10,000 m^2 per hectare)

B = Runoff Coefficient:

Single Family Residential	= 0.5
Semi-detached Residential	= 0.6
Townhouses	= 0.65
Apartments	= 0.75
Parkland	= 0.25
Commercial	= 0.90
Industrial	= 0.85
Institutional	= 0.75
Asphalt, concrete and roof areas	= 0.95

The above coefficients are provided for general guidance. When the development consists of a mix of land uses, a weighted-average value of the runoff coefficients should be calculated based on the ratios in areas and their corresponding % of imperviousness.

C = Average amount of rain per rainfall event that require control = 0.020 m

D = Capital cost per m^3 of capacity
= \$1,000/m^3 (This cost represents the underground storage option – concrete tanks, including construction cost + 35% allowance for engineering, contingency and GST, but excluding land costs based on the WWFMP Study. We have learnt that some municipalities' retrofit studies could not be implemented because their cash-in-lieu rates did not include the cost of acquisition of private land where some of the best retrofit opportunities were situated. This cost figure is chosen as it is independent of the availability of land in view of the high land costs in Toronto.

Incentives: The cash-in-lieu contribution shall be reduced by a percentage proportionate to the effectiveness of the overall on-site (source + conveyance controls) SWMPs. For example, if the overall on-site controls reduce the uncontrolled runoff volume by 20%, the cash-in-lieu contribution shall be reduced by 20% in calculating the required storage.

Example

The cash-in-lieu contribution for a 1.5 hectare residential development of townhouses, including a 0.15 hectare park, would be calculated as follows:

A = 15,000 m^2

B = (1.35 ha/ 1.5 ha) x 0.65 + (0.15 ha/ 1.5 ha) x 0.25 = 0.61

C = 0.015 m (assuming the minimum runoff capture requirement (5 mm rainfall event) is achieved, i.e., 0.020 m - 0.005 m)

D = \$1,000/m^3

Therefore, cash-in-lieu contribution = A x B x C x D = \$137,250

(These capital costs shall be reviewed and adjusted annually based on the increase in the Southam Construction Cost Index, which is a reflection of the trend in the general cost of construction within Ontario.)

When an end-of-pipe facility is identified as part of the stormwater treatment necessary to support a proposed development (i.e., small developments of total site area from 0.1 to 5 ha), application for an exemption from on-site stormwater management and the use of cash-in-lieu for an off-site system SWMP will be considered based on the following principles:

1. A development site where there is no nearby City-wide facility planned under the WWFMP

   (a) Identify and evaluate the need for a new SWM facility in the area

   - if there is enough development interest in the area to warrant the construction of a new facility to service the affected area;
   - conduct a subwatershed study to review the need for a new SWM facility in the area according to the terms of reference provided by Toronto Water or provide a cash contribution to a subwatershed study for the area conducted by Toronto Water
   - depending on the need and justification for a new SWM facility in the area, the developer may be allowed to design and construct the facility

   (b) Consider an off-site system SWMP, which could be used in combination with on-site runoff retention (minimum) and a conveyance control-treatment approach.

   (c) Accept a cash-in-lieu contribution for improvements elsewhere in the same watershed

2. A development site where there is a nearby City-wide facility planned under the WWFMP

   (a) If the scheduled construction of the stormwater management facility is within 3-5 years

   - cash-in-lieu contribution towards the costs of the design and construction of the facility by the City of Toronto

   (b) If the scheduled construction of a stormwater management facility is beyond 5 years

   - cash-in-lieu contribution towards the costs of the design and construction of the facility by the City of Toronto
   - the City may consider to accelerate the construction of the facility if there is enough development interest in the area to warrant such
   - adjusting the 25-Year Implementation Plan to meet/match development progress
   - if agreed by the City, the developer may choose to design and construct the planned facility under the WWFMP or initiate the study of a new (smaller) City-wide facility

   (c) Accept cash-in-lieu contribution for improvements elsewhere in the same watershed

3. OTHER GUIDELINES AND POLICIES FOR LOT LEVEL SOURCE CONTROL PRACTICES

3.1 Storm sewers (Minor System)

The design storm frequency to be adopted for the planning and design of minor storm drainage facilities shall be 1 in 2 years for all sewers under normal circumstances. Under special situations such as flood protection and/or the design of trunk sewer capacities, higher design storm frequencies may be required as directed by the City staff (Toronto Water, Sewer Asset Planning Section). The following Intensity-Duration-Frequency (IDF) curves shall be applied to all districts across the City.

Equation of IDF curves [(5)] is:

$$I = AT^C$$

Where:

I = Rainfall Intensity (mm/hr)
T = Time of Concentration (hour) - use 10 minutes inlet time (or initial time of concentration)

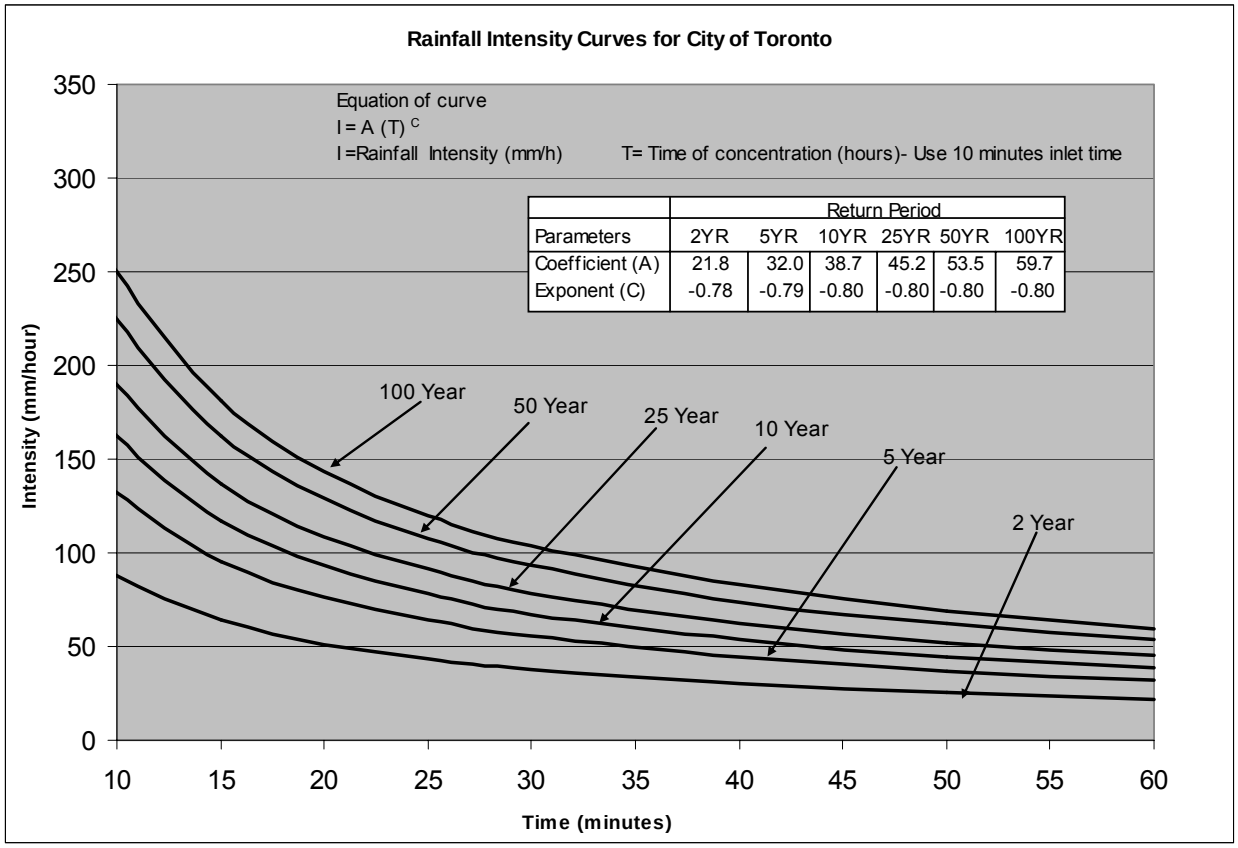
Parameters of A and C are shown as follows:

Return Period (Year)	A	C
2	21.8	-0.78
5	32	-0.79
10	38.7	-0.80
25	45.2	-0.80
50	53.5	-0.80
100	59.7	-0.80

Rainfall intensity curves for the 2-year, 5-year, 10-year, 25-year, 50-year and 100-year return periods are presented in Figure 4.

[(5)] The updated IDF curves were derived based on the rainfall statistic analysis from three Toronto Gauges: Toronto Bloor Street (Gauge# 6158350 – 24 years record), Ellesmere (Gauge# 6158520 – 21 years record) and Pearson Airport (Gauge# 6158733 – 24 years record), as part of the WWFMP Study. (Reference: Technical Memorandum of October 16, 2000 – Regional Rainfall Analysis: Summary Plots/ Tables, prepared by XCG Consultants Ltd.) The Parameter C is of negative value because the equation is written in a "multiplication" instead of "reciprocal" format. It can also be written in the familiar format as: $I = a/(t + b)^c$, where, for a 2 year storm, a = 21.8, b = 0 and c = 0.78.

Figure 4: Rainfall Intensity Curves for City of Toronto



3.2 Connections to Sewers

In accordance with the Wet Weather Flow Policy and the City of Toronto Sewer Use By-law (available on the City's website http://www.toronto.ca/legdocs/municode/index.htm) and its latest amendments, Table 6 provides a summary of Sewer Use By-law sections/clauses relevant to storm sewers (see Appendix G for excerpts from the Toronto Municipal Code document). Highlight of the Guidelines for sewer connections include the following:

1. New Private Sewer Connections

   (a) The direct connection of any new private storm sewer to the municipal storm sewer system is prohibited for any new or reconstructed residential, industrial, commercial or institutional buildings. Application for an exemption must be supported by a Stormwater Management Report identifying the storm water quantity and quality control measures being proposed for the site, and may be approved for any proposed direct connection to the municipal storm sewer system, where the report successfully demonstrates that there is no practical alternative means of drainage available on site and the proposed method is satisfied by the City staff.

For example, situations where infiltrating stormwater runoff may not be feasible and/or desirable, such as:

- where soil and groundwater regimes are not suitable for infiltration
- where soil is contaminated and does not meet the Ontario Ministry of Environment Guidelines
- where industrial/commercial processes on private property may contaminate stormwater runoff from the site

2. Roof Water Leaders / Downspouts

(a) No new connections to sanitary, combined and storm sewers will be permitted for roof water leaders or downspouts.

(b) Existing roof/downspout connections to the combined sewer systems shall be eliminated except under exceptional circumstances. If necessary due to site constraints, existing roof/downspout connections to the combined sewer systems may be permitted to reconnect to the storm sewer systems, where road sewer separation from the combined sewer systems has been implemented.

(c) Storm water collected from roof water leaders / downspouts shall be directed to pervious areas for infiltration or other areas for re-use on site. Storm water collected by a down-pipe from the eavestrough shall be discharged at grade with provisions to prevent soil erosion and shall be conducted away from the building in such a manner that the storm water will not accumulate at or near the building and will not adversely affect adjacent properties.

3. Foundation Drains

(a) All new foundation drains shall be pumped to the grade, wherever possible, subject to soil conditions with respect to environmental impacts and soil permeability. Any application for an exemption must be approved by the General Manager of Toronto Water.

(b) Weeping tiles / foundation drains shall not be connected be to any municipal sewers. If necessary due to site constraints, foundation drains may be permitted, at discretion of the General Manager of Toronto Water, to reconnect to the storm sewer systems, where road sewer separation from the combined sewer systems has been implemented.

(c) Where no practical alternative means of drainage is available, staff would review the application for an exemption on a case-by-case basis and approve the direct connection to the municipal sewer systems with set conditions on proper safeguard to protect the City from any liability in the event of basement flooding.

For example, when foundation drains are connected to the storm sewer system, the elevation of the basement floor shall be at least 1.0 meter above the elevation of the storm sewer obvert at that point and preferably 150 mm above the hydraulic grade line generated by the 1 in 100-year storm. For building connections located close to the point where the storm sewer discharges into the major system, there is, the additional requirement that the basement floor elevation must be above the 1 in 100-year flood elevation at the point of discharge.

Table 6 Summary of [(6)] Sewer Use By-Law Sections Relevant to Storm Sewers

Category	Relevant Sections/ Clauses/Tables
1. Definitions	§ 681-1
2. Prohibition of dilution	§ 681-3
3. Storm sewer requirements	§ 681-4: A, B, C, D, E, F, G, H, I, J, Table 2
4. Spills	§ 681-9 A, B,C,D
5. General • Maintenance access hole • Grease/oil interceptors • Sediment interceptors • Garbage Grinders • Right of entry • Protection from damage • Damage to the sewage works • Unauthorized entry to sewage works • Dental waste amalgam separator	§ 681-10 A B, C D E F G H I J
6. Sewer Connections • Restrictions • Existing sub-standard municipal sewer connection • Reconstructed buildings • Existing sewer connections in contravention of Article I. • Application for a sewer connection • Sewer connections on public or private property • Methods and materials used in construction of sewer connections. • Roof water leaders/downspouts • Catchbasins installed on private driveways • Groundwater drainage system • Private swimming pool water	§ 681-11 A, B, J C D E, F G H I, L M, Q, S O, P R T, U
7. Confidential Information	§ 681-12 A, B
8. Self-monitoring, sampling and reporting requirements for industrial premises	§ 681-13 A, B, C
9. Offences	§ 681-14 A, A1, B, B1, C, D
10. Repealer; impact on existing agreements; effective dates	§ 681-15 A, B, C, D, E
11. Appendix 2; Subject Pollutants	Appendix 2

Note: See Appendix G for excerpts from the Toronto Municipal Code document.

[(6)] Summary table was referenced to the Amendments to the Toronto Municipal Code Chapter 681- Sewers, Article I, Sewage and Land Drainage (Sewer Use By-Law No. 457- 2000), approved by the Works Committee (October 11, 2005) and by City Council (October 26,27,28,31, 2005)

3.3 General Procedures & Requirements for Design and Submission

1. The design shall follow all applicable design, construction and restoration guidelines established by the Ontario Ministry of Environment, Toronto and Region Conservation Authority, Department of Fisheries and Oceans and Ontario Ministry of Natural Resources, etc., including the City of Toronto policies regarding the storm drainage procedures for private properties.

2. Approval of the design must be obtained from Toronto Water and agents prior to remittance of fees for municipal connections.

3. Submission of the following documentation is required for review and approval by the Executive Director of Technical Services under the terms and conditions of the Servicing Agreement with Toronto Water:

   (a) Servicing, grading and drainage plans detailing existing & proposed grades of the site as well as abutting properties with details of the proposed drainage facilities (including catch basin/area drain inverts and details);

   (b) A Storm Water Management Report identifying the storm water quantity and quality control measures.

   (c) A geotechnical soil analysis report in circumstances of storm water infiltration.

4. A Stormwater Management Report is required for the following application types:

   (a) Plans of Subdivision
   (b) Site Plan Control Applications
   (c) Severance Consent Applications (where there are new right-of-way and the installation of storm services, site alterations that may affect nearby ravines, watercourse and/or overland drainage paths, etc.)
   (d) Drainage Alterations (i.e., seeking connections to the municipal storm sewer system, installation of storm sewer system, etc.)
   (e) Alteration of Stormwater Management Works

   Note: The level of detail for the Stormwater Management Report depends on the type of application, the size of the development and the types of stormwater management schemes proposed. For example, a report for a Plan of Subdivision will typically be more complex than a report in support of a Site Plan Control application.

5. A Stormwater Management Report must be based on established stormwater management principles, best management practices and the most current versions of the Wet Weather Flow Management Guidelines, the Ministry of the Environment Policies, and the Wet Weather Flow Management Policy. The information, fees and other requirements needed when seeking planning approvals from the City including detailed contents and requirements of the Stormwater Management Report are documented in the Toronto Development Guide (May 2004) – included in Appendix E.1 (Stormwater Management Report – Terms of Reference)

6. Stormwater Management Report, in general, shall document how a proposed development achieves WWF Management Targets, which include:

(a) Water balance targets
(b) Water quality targets
(c) Applicable flood flow management and erosion control targets
(d) Addresses other policies and guidelines
(e) The Stormwater Management Report shall demonstrate how the Hierarchy Principle for WWF management has been followed
(f) Temporary erosion and sediment control plan during construction including implementation (staging), inspection, and maintenance/repair requirements.

7. Where all of the wet weather flow management (WWFM) targets cannot be achieved on-site and the developer is proposing off-site systems and/or off-site compensatory options, an assessment of "to what degree the WWFM targets are achieved" by the proposed development shall be provided at the conceptual planning stage for review and consideration. The degree of achievement of each target shall be described and confirmed in the Stormwater Management Report, together with details of all proposed works addressing all other requirements.

8. An Erosion and Sediment Control Plan shall be submitted, following the City Erosion and Sediment Control Code (to be developed in the near future). All erosion and sediment control BMPs shall be designed, constructed and maintained in all development sites in accordance with the GTA CA's Erosion & Sediment Control Guidelines for Urban Construction (2006) and/or other City of Toronto requirements on a site-by-site basis, where applicable.

9. A Professional Engineer (i.e., a Registered Engineer of Ontario) qualified for stormwater management work, must approve and stamp the submitted Stormwater Management Report, Erosion and Sediment Control Plan and the associated design drawings, etc. Upon completion of works, certification of compliance including as-built surveys, confirmation of designed volumetric storage volumes including rooftops and safety measures according to the approved stormwater management works.

10. In cases where changes or adjustments are required during construction due to unpredictable site conditions and/or non-homogeneous soil conditions, the Stormwater Management Report must be updated and re-submitted to the City, with those change information to ensure compliance with the MOE Certificate of Approval conditions and approval conditions of other relevant agencies.

Table 7 provides a quick reference, which summarizes all relevant stormwater management requirements for various types of development.

Note:

The mention of trade names or commercial products in this document is for illustration purposes only and does not constitute either an endorsement or a recommendation by Toronto Water.

Table 7 Summary of Stormwater Management Requirements for Various Types of Development (November 2006)

Types of Development	Water Balance	Water Quality		Water Quantity		Erosion & Sediment Control During Construction	Discharge Criteria to Municipal Infrastructure	Sewer Connections
		TSS Removal	Disinfection	Flood Flow Management	Erosion Control			
References to WWFM (interim) Guidelines	**Sections 2.2.1.1 & 2.2.1.2**	**Sections 2.2.2.1& 2.2.2.2**	**Sections 2.2.2.3 & 2.2.2.4**	**Sections 2.2.3.1 & 2.2.3.2**	**Sections 2.2.3.3 & 2.2.3.4**	**Sections 2.2.3.5 & 2.2.3.6**	**Sections 2.2.3.7, 2.2.3.8 & 3.1**	**Sections 3.2.1, 3.2.2 & 3.2.3**
1. Large new developments (residential & non-residential) - total site area > 5.0 ha	▪ Retain stormwater on-site, to the extent practicable, to achieve the same level of annual volume of overland runoff allowable from the development site under pre-development conditions (see Table 3 & Figure 2). ▪ If the allowable annual runoff volume (see Table 3 & Figure 2) from the development site under post-development conditions is less than the pre-development conditions, then the more stringent runoff control requirement becomes the governing target for the development site. The maximum allowable annual runoff volume from any development site is 50% of the total average annual rainfall depth. ▪ In all cases, the minimum on-site runoff retention requires the proponent to retain all runoff from a small design rainfall event - typically 5 mm (In Toronto, storms with 24-hour volumes of 5 mm or less contribute about 50% of the total average annual rainfall volume) through infiltration, evapotranspiration & rainwater reuse.	▪ Require long-term average removal of 80% of TSS on an annual loading basis from all runoff leaving the site. (Suspended solids removal efficiency is to be calculated based on 100% of the total runoff volume resulted from all storm events that occur in an average year.) ▪ Overall efficiency in TSS removal can be considered in combination with minimum on-site runoff retention and other conveyance & end-of-pipe controls (i.e. the treatment train approach).	▪ Provide disinfection treatment for storm runoff from the development site, which discharges directly to the Lake or Waterfront areas.	▪ The required level of peak flow control from a development site contributing flow to a specific watercourse at the point of discharge shall follow Toronto and Region Conservation Authority (TRCA) Flood Flow Criteria Map (see Appendix C.1). ▪ For development sites within the City's chronic basement flooding areas (see Basement Flooding Relief Work Program Location Map & Schedule in Appendix D), the proponent shall consult Toronto Water – Sewer Asset Planning Section for details of requirements, where applicable ▪ The City of Toronto has adopted the 100-year storm as the level of protection for properties, where feasible, against surface flooding from ponding on streets, particularly, in areas of the City experiencing chronic basement flooding and/or when a proper major (overland flow) stormwater drainage system does not exist (see Section 2.2.3.8 for overland flow drainage system requirements).	▪ For Rouge River watershed (within City of Toronto), follow TRCA (Toronto and Region Conservation Authority) erosion control criteria for individual sites, which discharge directly to and/or are in proximity of natural watercourses. (a) Detain the post-development rainfall runoff from a 30 mm storm for a minimum of 24 hours for Tributary "B" of the little Rouge Creek (south of Steeles Ave. – see map on Appendix C.4) (b) Detain the post-development rainfall runoff from a 33 mm storm for a minimum of 48 hours for the Morningside Tributary of the Rouge River (south of Steeles Ave. – see map on Appendix C.4) ▪ For all other watersheds where new large development blocks (site area > 5 ha) discharge directly and/or in proximity (within 100 m) of natural watercourses, the proponents are required to complete an Erosion Analysis Report to determine the erosion control criteria for the sites (see Appendix E.2 for the terms of reference for such study analysis – obtained from TRCA). ▪ For sites where it is not feasible ** (this condition must be reviewed and agreed by City staff) to complete an erosion analysis study report, we typically require that runoff	▪ Regardless of size for all development sites, temporary erosion and sediment control for construction must be provided on-site. ▪ All erosion and sediment control BMPs shall be designed, constructed and maintained in all development sites in accordance with the GTA CA's Erosion & Sediment Control Guidelines for Urban Construction (2006) and/or other City of Toronto requirements on a site-by-site basis, where applicable.	▪ The allowable release rate to the municipal storm sewer system from the development site during a 2-year design storm event must not exceed the peak runoff rate from the site under pre-development conditions during the same storm event, or existing capacity of the receiving storm sewer, whichever is less. ▪ Unless directed by City staff, the consultant shall demonstrate that existing downstream system has capacity to accommodate design flows from point of connection of the development site to an existing outfall or municipal trunk sewer (confirm existing capacity and/or original design parameters and contributing drainage areas with local district staff). ▪ When the % imperviousness of a development site under pre-development condition is higher than 50% (regardless of what the post-development condition is), the maximum value of C (Runoff Coefficient) used in calculating the pre-development peak runoff rate is limited to 0.5. ▪ Unless directed by City staff, the minor storm sewer system shall be designed to a 1 in 2 years design storm frequency based on City of Toronto Intensity-Duration-Frequency (IDF) curves and a 10-minute inlet time (or initial time of concentration). The following IDF curve shall be applied to all districts across the City: $I = AT^C$, where **I** = Rainfall Intensity (mm/hr) **T** = Time of Concentration (hour) Parameters of **A** and **C**: Return Period (Year) / A / C 2 / 21.8 / -0.78 5 / 32 / -0.79 10 / 38.7 / -0.80 25 / 45.2 / -0.80 50 / 53.5 / -0.80 100 / 59.7 / -0.80	▪ New Private Sewer Connections The direct connection of any new private storm sewer to the municipal storm sewer system is prohibited for any new or reconstructed residential, industrial, commercial or institutional buildings. Application for an exemption must be supported by a Stormwater Management Report identifying the storm water quantity and quality control measures being proposed for the site, and may be approved for any proposed direct connection to the municipal storm sewer system, where the report successfully demonstrates that there is no practical alternative means of drainage available on site and the proposed method is satisfied by the City staff. ▪ Roof Water Leaders / Downspouts (a) No new connections to sanitary, combined and storm sewers will be permitted for roof water leaders or downspouts. (b) Existing roof/downspout connections to the combined sewer systems shall be eliminated except under exceptional circumstances. If necessary due to site constraints, existing roof/downspout connections to the combined sewer systems may be permitted to reconnect to the storm sewer systems, where road sewer separation from the combined sewer systems has been implemented. (c) Storm water collected from roof water leaders / downspouts shall be directed to pervious areas for infiltration or other areas for re-use on site. Storm water collected by a down-pipe from the eavestrough shall be discharged at grade with provisions to prevent soil erosion and shall be conducted away from the building in such a manner that the storm water will not accumulate at or near the building and will not adversely affect adjacent properties.

Types of Development	Water Balance	Water Quality		Water Quantity		Erosion & Sediment Control During Construction	Discharge Criteria to Municipal Infrastructure	Sewer Connections
		TSS Removal	Disinfection	Flood Flow Management	Erosion Control			
References to WWFM (interim) Guidelines	**Sections 2.2.1.1 & 2.2.1.2**	**Sections 2.2.2.1& 2.2.2.2**	**Sections 2.2.2.3 & 2.2.2.4**	**Sections 2.2.3.1 & 2.2.3.2**	**Sections 2.2.3.3 & 2.2.3.4**	**Sections 2.2.3.5 & 2.2.3.6**	**Sections 2.2.3.7, 2.2.3.8 & 3.1**	**Sections 3.2.1, 3.2.2 & 3.2.3**
					from a 25 mm design storm shall be detained on-site and released over a minimum of 24 hours. ▪ New developments shall be designed to minimize the number of new storm outfalls in the valley and all new outfalls shall be designed to minimize potential erosion (see Appendix E.3 for Storm Outfall & Outfall Channel Design Criteria - obtained from TRCA). ¨ Physical site conditions may be considered "not feasible", such as proposed development is negligible with respect to the total drainage area of the receiving watercourse (e.g., less than 1%) and/or watercourse is not sensitive to development – concrete channel, etc.		▪ Storm runoff, which exceeds the allowable release rate defined above but complies with all other requirements (i.e. water balance, water quality, flood flow and erosion controls) is allowed to discharge off-site via overland flow routes (major system) of sufficient capacities (up to a 100 year design storm). If no approved or adequate overland flow route exists, then all flow from the 2 year up to the 100-year return event storms shall be stored on site and released at the allowable release rate defined above or the capacity of the existing minor system, whichever is less.	▪ <u>Foundation Drains</u> (a) All new foundation drains shall be pumped to the grade, wherever possible, subject to soil conditions with respect to environmental impacts and soil permeability. (b) Weeping tiles / foundation drains shall not be connected to any municipal sewers. If necessary due to site constraints, foundation drains may be permitted by City staff, to reconnect to the storm sewer systems, where road sewer separation from the combined sewer systems has been implemented. (c) Where no practical alternative means of drainage is available; staff would review the application for an exemption on a case-by-case basis and may approve the direct connection to the municipal sewer systems with set conditions on proper safeguard to protect the City from any liability in the event of basement flooding.
2. Small new developments (residential & non-residential) - total site area < 5.0 ha	▪ Same as (1) above ▪ In all cases, the minimum on-site runoff retention requires the proponent to retain all runoff from a small design rainfall event - typically 5 mm (In Toronto, storms with 24-hour volumes of 5 mm or less contribute about 50% of the total average annual rainfall volume) through infiltration, evapotranspiration & rainwater reuse.	▪ Same as (1) above	▪ Same as (1) above	▪ Same as (1) above ▪ For development sites < 2 ha, the proponent may use a simplified approach such as the Rational Method / IDF curves to compute peak flows.	▪ Same as (1) above	▪ Same as (1) above	▪ Same as (1) above	▪ Same as (1) above
3. Residential infill Housing (relatively small isolated development or intensification situations with site areas less than 5 ha and storm/combined sewer infrastructure exists) (a) Site area -	▪ Same as (1) above	▪ Same as (1) above	▪ Not applicable	▪ Same as (1) above	▪ Not applicable unless the	▪ Same as (1) above		▪ Same as (1) above

Types of Development	Water Balance	Water Quality		Water Quantity		Erosion & Sediment Control During Construction	Discharge Criteria to Municipal Infrastructure	Sewer Connections
		TSS Removal	Disinfection	Flood Flow Management	Erosion Control			
References to WWFM (interim) Guidelines	**Sections 2.2.1.1 & 2.2.1.2**	**Sections 2.2.2.1& 2.2.2.2**	**Sections 2.2.2.3 & 2.2.2.4**	**Sections 2.2.3.1 & 2.2.3.2**	**Sections 2.2.3.3 & 2.2.3.4**	**Sections 2.2.3.5 & 2.2.3.6**	**Sections 2.2.3.7, 2.2.3.8 & 3.1**	**Sections 3.2.1, 3.2.2 & 3.2.3**
greater than 0.1 ha but smaller than 5 ha with more than 2 residential units	▪ In all cases, the minimum on-site runoff retention requires the proponent to retain all runoff from a small design rainfall event - typically 5 mm (on average, the total rainfall from all small events with daily rainfall amounts, less than or equal to 5 mm, is equivalent to about 50% volume of the total average annual rainfall in Toronto) through infiltration, evapotranspiration & rainwater reuse.			▪ For development sites < 2 ha, the proponent may use a simplified approach such as the Rational Method / IDF curves to compute peak flows.	infill site is located in close proximity (within 100 m) to natural watercourses (see control requirements on Section 1 above). ▪ For small infill or intensification sites < 2 ha, erosion control in the form of stormwater detention is normally not required, provided the on-site minimum runoff retention from a small design rainfall event (typically 5 mm) is achieved under the Water Balance Criteria.		▪ Same as (1) above	
(b) Site area ≤ 0.1 ha with only one single residential unit	▪ In case the subsoil conditions on-site are not suitable for infiltration, the proponent shall provide a minimum depth of 300 mm absorbent soil for on-site pervious / landscaping areas (see Appendix F for City of Toronto standards for landscaping soil).	▪ Not applicable	▪ Not applicable	▪ For development sites within the City's chronic basement flooding areas (see Basement Flooding Relief Work Program Location Map & Schedule in Appendix D), the proponent shall consult Toronto Water – Sewer Asset Planning Section for details of requirements, where applicable ▪ The City of Toronto has adopted the 100-year storm as the level of protection for properties, where feasible, against surface flooding from ponding on streets, particularly, in areas of the City experiencing chronic basement flooding and/or when a proper major (overland flow) stormwater drainage system does not exist (see Section 2.2.3.8 for overland flow drainage system requirements).	▪ Not applicable	▪ Same as (1) above	▪ Same as (1) above ▪ Same as (1) above	▪ Same as (1) above
(c) minor additions and/or modifications to residential buildings (total dwelling unit after expansion does not exceed twice the size of the existing dwelling unit and a single	▪ Not applicable	▪ Not applicable	▪ Not applicable	▪ Same as (3b) above	▪ Not applicable	▪ Not applicable	▪ Not applicable	▪ Not applicable

Types of Development	Water Balance	Water Quality		Water Quantity		Erosion & Sediment Control During Construction	Discharge Criteria to Municipal Infrastructure	Sewer Connections
		TSS Removal	Disinfection	Flood Flow Management	Erosion Control			
References to WWFM (interim) Guidelines	**Sections 2.2.1.1 & 2.2.1.2**	**Sections 2.2.2.1& 2.2.2.2**	**Sections 2.2.2.3 & 2.2.2.4**	**Sections 2.2.3.1 & 2.2.3.2**	**Sections 2.2.3.3 & 2.2.3.4**	**Sections 2.2.3.5 & 2.2.3.6**	**Sections 2.2.3.7, 2.2.3.8 & 3.1**	**Sections 3.2.1, 3.2.2 & 3.2.3**
family home may add up to 2 units , and medium/high density residential buildings may add up to 1 additional unit) - no site alteration								
4. Non-residential and mixed uses (e.g., industrial / commercial / institutional infill) - relatively small isolated development or intensification situations with site areas less than 5 ha and storm/combined sewer infrastructure exists								
(a) Site area - greater than 0.3 ha but smaller than 5 ha, including large expansions to non-residential buildings (expansion exceeds 50% of the gross floor area of the existing building)	▪ Same as (3a) above	▪ same as (3a) above ▪ OGSs and/or other BMPs may be required for development that have a higher potential for spills (e.g., automobile service sector, dry cleaning sector, etc.) – see Toronto Municipal Code Chapter 681 – Sewers, Article I, Sewage and Land Drainage (Sewer Use By-Law No. 457-2000) for details.	▪ Not applicable	▪ Same as (3a) above	▪ Same as (3a) above	▪ Same as (1) above	▪ Same as (1) above	▪ Same as (1) above
(b) Small site area ≤ 0.3 ha,	▪ Same as (3b) above	▪ OGSs and/or other BMPs may be required for development that have a higher potential for spills (e.g., automobile service sector, dry cleaning sector, etc.) – see Toronto Municipal Code Chapter 681 – Sewers, Article I, Sewage and Land Drainage (Sewer Use By-Law No. 457-2000) for details.	▪ Not applicable	▪ Same as (3b) above	Not applicable	▪ Same as (1) above	▪ Same as (1) above	▪ Same as (1) above

Types of Development	Water Balance	Water Quality		Water Quantity		Erosion & Sediment Control During Construction	Discharge Criteria to Municipal Infrastructure	Sewer Connections
		TSS Removal	Disinfection	Flood Flow Management	Erosion Control			
References to WWFM (interim) Guidelines	**Sections 2.2.1.1 & 2.2.1.2**	**Sections 2.2.2.1& 2.2.2.2**	**Sections 2.2.2.3 & 2.2.2.4**	**Sections 2.2.3.1 & 2.2.3.2**	**Sections 2.2.3.3 & 2.2.3.4**	**Sections 2.2.3.5 & 2.2.3.6**	**Sections 2.2.3.7, 2.2.3.8 & 3.1**	**Sections 3.2.1, 3.2.2 & 3.2.3**
(c) minor additions and/or modifications to non-residential buildings (expansion does not exceed 50% of the gross floor area of the existing building) - no site alteration	▪ Not applicable	▪ Not applicable	▪ Not applicable	▪ Same as (3b) above	▪ Not applicable	▪ Not applicable	▪ Not applicable	▪ Not applicable

LIST OF ABBREVIATIONS

BMP - Best Management Practice

CSO - Combined Sewer Overflow

EOP - End-of-Pipe

HSPF – Hydrological Simulation Program FORTRAN

ET- Evapotranspiration

I/I- Inflow and Infiltration

LID - Low Impact Development

MNR - Ministry of Natural Resources

MOE - Ministry of the Environment

O&M - Operation and Maintenance

OGS - Oil/Grit Separator

PWQO - Provincial Water Quality Objectives

SWM - Stormwater Management

SWMPs – Stormwater Management Practices

TRCA - Toronto Region Conservation Authority

TSS - Total Suspended Solids

URF - Unit Response Function

UV - Ultraviolet

WWF - Wet Weather Flow

WWFMP – Wet Weather Flow Master Plan

GLOSSARY

Arterial Road	A road primarily for through traffic.
Base Flow	The portion of stream flow that is not due to storm runoff and is supported by groundwater seepage into a channel.
BMP or Best Management Practices	State of the art methods or techniques used to manage the quantity and improve the quality of wet weather flow. BMPs include Source, Conveyance and End-Of-Pipe Controls.
Catchbasin	Box like underground concrete structure with openings in curb and gutter designed to collect runoff from streets and pavement.
City	The City of Toronto
Clay (SOILS)	1. A mineral soil separate consisting of particles less than 0.002 millimeter in equivalent diameter. 2. A soil texture class. 3. (Engineering) A fine-grained soil (more than 50 percent passing the No. 200 Sieve) that has a high plasticity index in relation to the liquid limit. (Unified Soil Classification System).
Collector Road	A road on which traffic movement and access to property have similar importance.
Combined Sewer	A wastewater collection system, which conveys sanitary wastewater (domestic, commercial and industrial wastewaters) and Stormwater runoff through a single-pipe system to a treatment works.
CSO or Combined Sewer Overflow	A discharge to the environment from a Combined Sewer system that occurs because of a precipitation event when the capacity of the interceptor sewer or treatment plant is exceeded. It consists of a mixture of sanitary wastewater and Stormwater runoff.
Conveyance Control	A structural best management practice that is located within the drainage system where flows are concentrated and are being conveyed along corridor. Conveyance controls include but are not limited to pervious pipes, roadside ditches, and other similar systems.
Ditch	A long narrow trench or furrow dug in the ground, as for irrigation, drainage, or a boundary line.
Drainage	Natural or artificial means of intercepting and removing surface or subsurface water (usually by gravity).
Drainage Area	The total surface area upstream of a point on a stream that drains toward that point. Not to be confused with watershed. The drainage area may include one or more watersheds.
Drainage System	A system flow of gully inlets, pipes, overland flow paths, open channels, culverts and detention basins used to convey runoff to its receiving waters.

Dry Weather flow Sewage flow resulting from both sanitary wastewater (combined input of industrial, domestic and commercial flows); and infiltration and inflows from foundation drains or other drains occurring during periods with an absence of rainfall or snowmelt.

E. Coli Bacteria A strain of bacteria found in the gut and waste products of animals. Some strains of this bacterium can be harmful to humans or animals if consumed. Food or water can become contaminated with E.Coli where unsanitary conditions exist.

Ecosystem A biological community, including humans and their natural environment.

End-of-pipe Control A structural best management practice that is located at the end of a flow conveyance route. End-of-Pipe Controls on surface and below ground but are not limited to wet ponds, constructed wetlands and other similar systems.

Enhancement Emphasis on improving the value of particular aspects of water and related land resources.

Environment Refers to the conditions in which an organism lives and survives or the conditions in which an organism resides. These conditions can be described as aspects of a "physical", "social" or an "economic" environment, depending on the perspective perceived by the observer.

Erosion (1) The wearing away of the land surface by moving water, wind, ice or other geological agents, including such processes as gravitation creep; (2) Detachment and movement of soil or rock fragments by water, wind, ice or gravity (i.e. Accelerated, geological, gully, natural, rill, sheet, splash, or impact, etc).

Erosion Control Includes the protection of soil from dislocation by water, wind or other agents.

Evapotranspiration (ET) The quantity of water transpired (given off). Retained in plant tissues, and evaporated from plant tissues and surrounding soil surfaces. Quantitatively it is s
usually expressed in terms of depth of water per unit area during a specified period.

Exfiltration The downward movement of water through the soil, the downward flow of runoff from the bottom of an infiltration BMP into the soil.

Extended Detention A stormwater design features that provides for the gradual release of a volume of water in order to increase settling of pollutants and protect downstream channels from frequent storm events.

First Flush The delivery of a disproportionately large load of pollutants during the early part of storms due to the rapid runoff of accumulated pollutants. The first flush of runoff has been defined several ways (e.g., one half inch per impervious

	area).
Floodplain (100-year)	The area adjacent to a stream that is on average inundated once a century
General Manager	The person appointed by the City from time to time as the General Manager of Toronto Water and his or her successors or his or her duly authorized representative.
Geomorphology	A branch of both physiography and geology that deals with the form of the earth, the general configuration of its surface, and the changes that take place due to erosion of the primary elements and the buildup of erosional debris.
Groundwater	The water below the surface, and typically below the groundwater table.
Groundwater Recharge	Increases in groundwater storage by natural conditions or by human activity. See also artificial recharge
Groundwater Table	The upper surface of the zone of saturation, except where the surface is formed by an impermeable body.
Headwater	Referring to the source of a stream or river.
Hierarchical Approach	Implementation of Wet Weather Flow measures following hierarchical approach in the following order: Source Control measures, Conveyance Control measure and End of Pipe treatment to achieve the water quality and water balance target for lot level development of the preferred strategy. In some guidance documents for Stormwater quality management, this is also known as the treatment train approach.
Hydrologic Cycle	Also called the water cycle, this is the process of water evaporating condensing, falling to the ground as precipitation and returning to the ocean as run-off.
Hydrological	Relating to the properties, distribution and effects of water on and below the earth's surface, and in the atmosphere.
Infiltration	The slow movement of water into or through a soil or drainage system.
Infiltration Rate	The rate at which stormwater percolates into the subsoil measured in inches per hour.
I/I (Infiltration/Inflow	Inflow and/or infiltration of water into a sewer.
Irrigation	Human application of water to agricultural or recreational land for watering purposes.

Local Road	A road primarily for access to property.
Low Impact Development	Low impact development is a stormwater management and land development strategy applied at the parcel and subdivision scale that emphasizes conservation and use of on-site natural features integrated with engineered, small scale hydrologic controls to more closely mimic pre-development hydrologic functions.
Major Drainage System	That storm drainage system which carries the total runoff of the drainage system less the runoff carried by the minor system (storm sewer). The major system will function whether or not it has been planned and designed, and whether or not developments are situated wisely with respect to it. The Major Drainage System usually includes many features such as streets, gullies, and major drainage channels.
Minor Drainage System	That storm drainage system which is frequently used for collecting, transporting, and disposing of snowmelt, miscellaneous minor flows, and storm runoff up to the capacity of the system. The capacity should be equal to the maximum rate of runoff to be expected from the minor design storm which may have a frequency of occurrence of one in 2, or 5 years. The minor system may include many features ranging from curbs and gutters to storm sewer pipes and open drainage ways.
Natural Systems Solutions	Projects following the philosophy in which terrestrial and aquatic vegetation provides the ability to cleanse water of its contaminants.
Official Plan	The adopted Official Plan of the City of Toronto.
Oil/Grit Separator (OGS)	Systems designed to remove trash, debris and some amount of sediment, oil and grease from stormwater runoff based on the principles of sedimentation for the grit and phase separation for the oil.
Outfall	The point, location, or structure where wastewater or drainage discharges from a sewer pipe, ditch or other conveyance to a receiving body of water.
Overland Flow Path	Open space floodway channels, road reserves, pavement expanses and other flow paths that convey flows typically in excess of the capacity of the Minor Drainage System.
Peak Discharge	The greatest volume of stream flow occurring during a storm event.
Permeable	Soil or other material that allows the infiltration or passage of water or other liquids.
Pollutant	(1) Something that pollutes, especially a waste material that contaminate air, soil, or water. (2) Any solute or cause of change in physical, chemical or biological properties that render water unfit for a given use.

Pond	A body of water smaller than a lake, often artificially formed**.**
Precipitation	Any form of rain or snow.
Private Property	Land owned by private individuals or companies.
Public Property	Land owned by the City Toronto or any other level of government or public agency (such as Toronto and Region Conservation Authority, Toronto Transit Commission, school boards).
Rainfall Intensity	The rate of rainfall in millimeters per hour.
Recharge	The addition of water to ground water by natural or artificial processes.
Receiving Waters	Watercourses and Lake Ontario, to which Stormwater and Combined Sewer Overflows discharge.
Riparian Areas	Areas adjacent to a watercourse that are saturated by groundwater or intermittently inundated by surface water at a frequency and duration sufficient to support the growth of vegetation typically adapted for life in saturated soil.
Runoff	That potion of the water precipitated onto a catchment area, which flows as surface discharge from the catchment area past a specified point.
Sand	Natural mineral particles which are smaller than 2 mm, and which are free of appreciable quantities of clay and silt. Coarse sand usually designates sand grains with particle size between 0.2 and 0.02 mm.
Sediments	Soil, sand and minerals washed from land into water, usually after rain. They pile up in reservoirs, rivers and harbors, destroying fish-nesting areas and holes of water animals and cloud the water so that needed sunlight might not reach aquatic plans. Careless farming, mining and building activities will expose sediment materials, allowing them to be washed off the land after rainfalls.
Sedimentation	Deposition of material of varying size, both mineral and organic away from its site of origin by the action of water, wind, gravity or ice.
Sewage	The liquid waste from domestic, commercial and industrial establishments.

Silt	Substrate particles smaller than sand and larger than clay (3 to 60 m)
Soakaway Pit	A pit into which liquids may flow and then percolate slowly into the subsoil.
Source Control	A practice or structural measure that is usually implemented at the beginning of a drainage system or at the lot level, to reduce the volume of runoff and minimize the concentration of pollution in overland flow from private property and prevent pollutants from entering Stormwater runoff or other environmental media, as described by the Ministry of Environment.
Stakeholder	Any person, agency or group who has a direct interest in the purpose of a proposed undertaking.
Stormwater	Surface runoff resulting from rain or snowmelt events.
Stormwater Wetlands	Shallow, constructed pools that capture stormwater and allow for the growth of characteristic wetland vegetation.
Subwatershed	The drainage area of one or more contributing watercourses to a river.
Subwatershed Plan	The result of a study undertaken within the drainage area of one or more watercourses of a specific river following the guidance presented in the MOE Stormwater Management Planning and Design Manual (i.e. Humber Creek subwatershed within the Humber River Watershed).-
Swale	A shallow constructed channel, often grass-lined, which is used as an alternative to curb and channel, or as a pretreatment to other measures. Swales are generally characterized by a broad top width to depth ratio and gentle grades.
Target	A specific aim that will be achieved in the future.
Total Suspended Solids (TSS)	The total amount of particulate matter that is suspended in the water column.
Unit Response Function (URF)	Represents the hydrologic response and water quality response of the area to a pre-determined series of meteorological inputs.
UV Disinfection	A process of disinfecting that involves subjecting the item, object, or instrument to ultraviolet radiation.
Watercourse	(a) A natural well-defined channel produced wholly or in part by a definite flow of water and through which water flows continuously or intermittently. Also, a ditch, canal, aqueduct, or other artificial channel for the conveyance of water to or away from a given place, as for the draining of a swamp. (b) A stream or current of water. Legally, a natural stream arising in a given drainage basin but not wholly dependent for its flow on surface drainage in its immediate area, flowing in a channel with a well-defined bed between visible

	banks or through a definite depression (as a ravine or swamp) in the surrounding land, having a definite and permanent periodic supply of water (the stream may be intermittent), and usually, but not necessarily having a perceptible current in a particular direction and discharging at affixed point into another body of water. (c) A legal right permitting the use of a flow of a stream (especially of one flowing through one's land) or the receipt of water discharged upon land belonging to another.
Water Conservation	Reduction in applied water due to more efficient water use such as implementation of Urban Best Management Practices or Agricultural Efficient Water Management Practices. The extent to which these actions actually create a savings in water supply depends on how they affect net water use and depletion.
Watershed	The drainage area of a river.
Watershed Plan	The result of a study undertaken within the drainage area of a specific river following the guidance presented in the MOE Stormwater Management Planning and Design Manual (i.e. Humber River Watershed).
Wetland	A vegetated area such as a bog, fen, marsh, or swamp, where the soil or root zone is saturated for part of the year.
Wet Weather Flow	Stormwater runoff generated by either rainfall or snowmelt or flow resulting from sanitary wastewater that enters the combined sewer system; infiltration and inflows from foundation drains or other drains are resulting from rainfall or snowmelt.
WWFM Guidelines	Wet Weather Flow Management Guidelines prepared to support the Wet Weather Flow Management Master Plan. These guidelines provide the technical and quantitative tools needed to support the WWFM Policy and the Wet Weather Flow Management Master Plan, and are based on recent performance monitoring data and synthesis and provincial and international wet weather flow technical guidelines, standards and Manuals of Practice

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Appendix A
Wet Weather Flow Management Master Plan (Objectives) (April, 2001)

In achieving these objectives, the City of Toronto's Wet Weather Flow Management Master Plan will be guided by the following principles:

Rainwater is a resource. As a priority, rainwater (including snowmelt) should be managed where it falls on the lots and streets of our City, particularly before it enters a sewer. Wet weather flow will be managed on a watershed basis with a natural systems approach being applied to stormwater management as a priority. A hierarchy of wet weather flow solutions will be implemented – starting with "at source", then "conveyance", and finally "end-of-pipe". Toronto's communities need to be made aware of wet weather flow issues and involved in the solutions.

Water Quality

- **Meet guidelines for water and sediment quality**: Contribute to achieving federal, provincial and municipal water and sediment quality objectives and guidelines in area watercourses and along the waterfront.
- **Virtually eliminate toxics through pollution prevention**: Contribute to the virtual elimination of toxic contaminants in groundwater and surface water utilizing the principle of pollution prevention at source.
- **Improve water quality in rivers and the lake for body contact recreation**: Improve water quality for body contact recreation in rivers and recreational areas and reduce posting of beaches by the Medical Officer of Health.
- **Improve aesthetics**: Contribute to eliminating objectionable deposits, nuisance algae growth, unnatural colour, turbidity and odour in order to improve the aesthetics of area surface waters.

Water Quantity

- **Preserve and re-establish a natural hydrologic cycle**: Contribute to the re-establishment of a more natural hydrologic process to protect and restore groundwater and surface water resources, based on maximizing permeability and minimizing runoff at source.
- **Reduce erosion impacts on habitats and property**: Manage wet weather flows to reduce erosion impacts on stream and riparian habitats on public and private properties and open spaces.
- **Eliminate or minimize threats to life and property from flooding**: Eliminate or minimize threat to life and property from flooding.

Natural Areas and Wildlife

- **Protect, enhance and restore natural features (e.g., wetlands) and functions**: Contribute to the protection, enhancement and restoration of natural features and functions such as wetlands and riparian and other ecological corridors.
- **Achieve healthy aquatic communities**: Contribute to achieving healthy aquatic communities, including warmwater or coldwater fisheries as appropriate.
- **Reduce fish contamination**: Contribute to reducing fish consumption advisories due to local wet weather sources.

Sewer System

- **Eliminate discharges of sanitary sewage**: Eliminate discharges of sanitary sewage including those associated with CSOs, SSOs, treatment plant bypasses, illegal cross-connections and spills.
- **Reduce infiltration and inflow to sanitary sewers**: Reduce sanitary sewer infiltration and inflows to City design standards.
- **Reduce basement flooding**: Manage wet weather flow to reduce basement flooding.

Appendix B

B.1 City of Toronto Oil/Grit Separators (OGS) Guideline

B.2 NJDEP - Conditional Interim Certification Letters for OGS Devices:

- **VortSentry**
- **Vortechs**
- **High Efficiency CDS**
- **Baysaver Separator System**
- **Downstream Defender**
- **Stormceptor**

Appendix B.1

City of Toronto
Oil/Grit Separators (OGS) Guideline (Interim)

(August, 2006)

The following principles will be used in the review and approval of all OGS:

1. Oil/grit separators (OGS) may be used as spill controls, pre-treatment devices or as a source/end-of-pipe controls (as part of a treatment train approach) for water quality control. OGS are not typically designed to provide water quantity control and have no infiltration capability (i.e., no benefit to water balance).

2. The City of Toronto wet weather flow water quality target is the long term average removal of 80% of total suspended solids (TSS) on an annual loading basis from all runoff leaving the proposed development site based on the post development level of imperviousness. For stormwater quality control, oil/grit separators (OGS) may be applied as one element of a multi-component approached unless it is determined that it can achieve the desired water quality as a stand alone device on a site specific basis. If the OGS alone does not meet this 80% TSS removal requirement, then the device could still be used for pre-treatment or supplemental to other stormwater control measures. If indeed the OGS is used upstream and as part of a treatment train, the following component(s) of the treatment train must be capable of removing the very fine particulates that pass the OGS in order to achieve the total 80% removal required.

3. Typically oil/grit separators (OGS) are proprietary designs with a wide variety of sizes, shapes and configurations, many of them claiming to be able to achieve at least 80% removal of total suspended solids (TSS). Literature review of independent performance testing suggests that these removal efficiencies are only attainable under very specific circumstances, which are highly dependent on study design, specific site conditions, particle size distribution and the varying flow conditions under which the tests were conducted. **In the interim, the City of Toronto is prepared to accept, based on the US TARP [(1)] (The Technology Acceptance and Reciprocity Partnership) Tier I Conditional Interim Certification [(2)] by NJDEP (New Jersey Department of Environmental Protection), that OGS devices, operating alone (see Appendix B.2 for NJDEP Conditional Interim Certification Letters for OGS Devices), are capable of achieving a TSS removal efficiency of 50%. The types of OGS certified (interim) by NJDEP include: VortSentry, Vortechs, High Efficiency CDS, Baysaver Separator System, Downstream Defender, Stormceptor, etc.**

4. The City staff may consider higher (> 50%) removal efficiency claims if they are supported by new or additional field performance data verified under the same TARP Tier II Testing Protocols used in the NJDEP assessments and certification program. The NJDEP TARP Tier I Interim Approval does not preclude the City's requirement to review or approve projects proposing to use OGS under the requirements of the City's Wet Weather Flow Management (Interim) Guidelines and other applicable policies and bylaws. In the future, the City of Toronto may develop its own review program and monitoring/test protocols for the evaluation of new stormwater treatment technologies including the OGS devices.

5. The specifications of any OGS models proposed for a development must be signed and sealed by a Professional Engineer (i.e., Registered Engineer of Ontario). The required submission of information for review and approval by the City staff must include design computations documenting the

estimated performance, supported with well-documented sizing (computer modeling) program, CADD details and maintenance requirements. The OGS make and model specified on the approved Stormwater Management Report cannot be substituted with an "equivalent" model later, without the approval of City staff. Requests for substitution must be accompanied by certification of equivalency by the Professional Engineer who prepared the approved Stormwater Management Report with additional supporting documentation required for certification. It should be noted that **acceptability is not guaranteed** with the additional submissions.

6. Performance Standards – must satisfy both conditions (a) and (b)

(a) When used as a stand-alone on-site stormwater management/control device, it must achieve a minimum
80% removal of TSS from the total volume of annual runoff (on a long-term average basis) leaving the proposed development site based on the post-development level of imperviousness.

- The particle size distribution and the associated settling velocities have a significant effect on TSS removal efficiencies, and settling velocities are not linearly related to particle sizes. In actual practice, the particle size distribution varies from site to site, and even during individual events. For the purposes of computer modeling and evaluation without existing data from the site, a generic particle size distribution may be assumed and the City accepts a typical average stormwater particle size distribution and the associated settling velocities (USEPA 1983) as shown in Table 1 below, which is excerpted from Table 3.3 of the "Stormwater Management Practices Planning and Design Manual", Ontario Ministry of Environment and Energy, 1994.

Table 1. Typical Stormwater Particle Size Distribution & Settling Velocities

Particle Size (μm) – (NURP 1983)	% of Particle Mass	Average Settling Velocities (m/s)
≤ 20	0 - 20	0.00000254
20 - 40	20 - 30	0.00001300
40 - 60	30 - 40	0.00002540
60 - 130	40 - 60	0.00012700
130 - 400	60 - 80	0.00059267
400 - 4000	80 - 100	0.00550333

- For the purposes of computer modeling in sizing, the overall solids removal efficiency shall be assessed using settling velocities corresponding to the particle size distribution provided in Table 1 (based on USEPA 1983). The Ministry of Environment values in Table 1 should be used when there are no calculations or actual calibration data (laboratory and field monitoring) supporting values for particle size distribution and settling velocities different from those in Table 1.

(b) When used as a stand-alone stormwater management/control device, it must also be sized to capture and treat a minimum 90% volume of the annual runoff on a long-term average basis (i.e., shall be designed in accordance with the Toronto 1991 continuous rainfall data) without bypass (this is not required for pretreatment or spill control functions). When the design flow rate is exceeded during the bigger storms, the design must include a bypass feature to prevent scouring of collected solids and flushing out of oils trapped in the device.

- Suspended solids removal efficiency is to be calculated based on 100% of the total runoff volume resulted from all storm events that occur in an average year. The overall solids removal efficiency of the separator must take into account the portion of stormwater runoff bypassing the

OGS, as it does not receive any treatment. For OGS designed with a by-pass, the calculation of long-term suspended solid must be based on both suspended solids removal in the facility and suspended solids that by-pass the facility. (For example, when a device is sized to capture and treat only 90% volume of the annual runoff, an average TSS removal efficiency of about 90% will be required.)

- For the purposes of computer modeling analysis, the following approach shall be used:

  - Continuous rainfall event analysis, for an average year: The 1991 Toronto continuous rainfall data (15-minute time step) provided by Toronto Water has been identified as the most representative of long-term average precipitation patterns in the Toronto Wet Weather Flow Master Plan (2003); or

  - Where an OGS is preceded by an equalization or storage facility, a lower water quality design flow rate may be identified provided that at least 90% of the estimated runoff volume in the time series simulated from an approved continuous runoff model (e.g., SWMHYMO, SWMM, STORM, etc.) is treated to the applicable performance goal (e.g., 80% overall TSS removal efficiency on an annual average basis).

7. Average Event Mean Concentrations (AEMC)

(a) For the purposes of estimating the pollutant export from similar urban land-use areas for storage capacity and maintenance consideration when local average data are not available, the following AEMC (average event mean concentrations) for TSS shall be used:

Land Use	Average Event Mean Concentration (mg/L) - TSS
Residential	150
Commercial	120
Mixed	130
Open/Non-urban	200
Roads/Highway	330

(b) The average annual precipitation volume in Toronto is 840 mm.

(c) Modeling analysis based on TSS build-up/wash-off model will also be considered.

Footnotes:

(1) TARP (The Technology Acceptance and Reciprocity Partnership) was formed by the states of California, Illinois, Maryland, Massachusetts, New York, Pennsylvania, and Virginia. Through the development of common standards, TARP provides uniform guidance protocols to collect and evaluate data on technical performance. These common protocols allow interstate sharing of scientifically reliable data that enhanced the ability of states to make scientifically sound decisions. The program is designed to promote consistent standards while allows states to take advantage of collaborating state's technology evaluations faster and less resource intensive permit decisions. The US TARP Tier I NJDEP Interim Approval was based on the assessments of vendors' submission of original designs/performance claim documentation and verifications by NJCAT (New Jersey Corporation for Advanced Technology – a third

party verification entity) using full scale laboratory testing. To achieve final certification, vendors under the TARP Tier I Interim Approval are required to fund field testing as per TARP Tier II Protocol for Best Management Practice Demonstration (July 2003); NJCAT & NJDEP will provide final certification of performance claim(s) based on field monitoring results. For NJDEP Interim Certified Stormwater Technologies, go to
http://www.state.nj.us/dep/dsr/bscit/CertifiedMain.htm.; or
http://www.state.nj.us/dep/dsr/bscit/Documents.htm

(2) US TARP Tier I NJDEP Interim Approval Conditions:

Description	VortSentry	Vortechs	High Efficiency CDS	Baysaver Separator System	Downstream Defender	Stormceptor
Original Design Approved by NJDEP	Yes	No Must reduce original flow capacity marketed in literature by 60%.	No Only the "new" high efficiency design can be used. Original CDS design not approved.	No Must reduce original flow capacity marketed in literature by 54%; must increase tank surface area by 44% to 79% for design safety.	Yes	Yes

Appendix B.2
Certification Letter for VortSentry

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Division of Science, Research and Technology
Bureau of Sustainable Communities & Innovative Technologies
PO Box 409
Trenton, NJ 08625-0409
Tel: 609-292-9692
FAX: 609-292-7340

JON S. CORZINE
Governor

LISA P. JACKS(
Commissioner

March 20, 2006

Derek Berg
Research and Development Specialist
Stormwater 360™, Inc.
200 Enterprise Drive
Scarborough, ME 04074

RE: Conditional Interim Certification of VortSentry® Stormwater Treatment System by Stormwater 360™, Inc.

Dear Mr. Berg:

In accordance with the Energy and Environmental Technology Verification (EETV) Act at N.J.S.A. 13:1D-134, the New Jersey Department of Environmental Protection (NJDEP) is pleased to issue a **Conditional Interim Certification** for the VortSentry® Stormwater Treatment System by Stormwater 360™, Inc. This Conditional Interim Certification is being issued pursuant to this program's receipt and review of the New Jersey Corporation for Advanced Technology (NJCAT) verification report for the VortSentry® Stormwater Treatment System, which was dated December 2005. **This certification letter must be used in conjunction with the enclosed Interim Certification Findings document**.

The VortSentry® Stormwater Treatment System, Model VS40, sized at a loading rate of 9.8 gpm/ft^3 (0.022 cfs/ft^3) of treatment volume, has been shown to have a 69% total suspended solids (TSS) removal efficiency, measured as suspended solids concentration (SSC) (as per the NJDEP methodology for calculation of treatment efficiency) for F-95 silica sand with an average d_{50} particle size of 120 microns, an average influent concentration of 209 mg/L and 50% initial sediment loading in laboratory studies using simulated stormwater.

Based on the demonstrated laboratory performance, the NJDEP feels confident that the VortSentry® Stormwater Treatment System Model VS40 sized at a loading rate of 9.8 gpm/ft^3 (0.022 cfs/ft^3) of treatment volume has the capability of achieving, in field applications, a TSS removal efficiency of 50%. Therefore, NJDEP certifies that the VortSentry® Stormwater Treatment System, Model VS40 is capable of achieving a TSS removal efficiency of 50%, while operating at the designed loading rate of 9.8 gpm/ft^3 (0.022 cfs/ft^3). In addition, the various models of the VortSentry® Stormwater Treatment System, that are also capable of achieving TSS removal efficiencies of 50% from stormwater runoff at the respective maximum designed flow rates, are given in **Table 1** of the enclosed **Conditional Interim Certification Findings**

document and shall be permitted accordingly. The following conditions shall apply to the Conditional Interim Certification:

1. The VortSentry® Stormwater Treatment System should be the first component if used as part of a treatment train (i.e., utilized in front of best management practices such as detention, retention, and infiltration basins, etc., as defined in the NJ Stormwater Best Management Practices Manual). Use of this device in series with other manufactured treatment devices can only be approved by the Land Use Regulation Program and/or the Division of Watershed Management.
2. The VortSentry® Stormwater Treatment System shall be designed in accordance with New Jersey's water quality design storm, as required in the Stormwater Management Rules (N.J.A.C. 7:8).
3. A Quality Assurance Project Plan supporting the Technology Acceptance and Reciprocity Partnership (TARP) Tier II Protocol for Stormwater Best Management Practice Demonstration (July, 2003), and New Jersey Tier II Stormwater Test Requirements, shall be submitted to the NJDEP and NJCAT within six (6) months from the date of the Conditional Interim Certification letter.
4. Field evaluation data that are consistent with the TARP Tier II Protocol and New Jersey Tier II Stormwater Test Requirements, which are available from NJCAT or www.state.nj.us/dep/dsr/bscit/Documents.htm, shall be submitted to the NJDEP and NJCAT by September 30, 2007.
5. The appropriate devices satisfying site selection and sizing criteria must be consistent with the specifications as described in **Table 1** of the enclosed **Conditional Interim Certification Findings** document.

Please note that this approval letter shall expire on February 28, 2008, unless extended by NJDEP. For final certification of the VortSentry® Stormwater Treatment System, verified data must be generated from a full-scale field demonstration utilizing the TARP Tier II Protocol and additional NJDEP field testing requirements. If you have any questions about this Conditional Interim Certification, please contact Ravi Patraju of my staff at (609) 292-0125.

Sincerely,

Martin Rosen
Chief - Bureau of Sustainable Communities
and Innovative Technologies, DSRT

Enclosure

c: Mark Mauriello, Acting Assistant Commissioner, Land Use Management
Jill Lipoti, Acting Assistant Commissioner, Environmental Regulation
Larry Baier, Director, Division of Watershed Management
Tom Micai, Director, Land Use Regulation Program
Eileen Murphy, Director, Division of Science, Research, and Technology
Narinder Ahuja, Director, Division of Water Quality
Rhea Brekke, Executive Director, New Jersey Corporation for Advanced Technology

Certification Letter for Vortechnics

State of New Jersey
Department of Environmental Protection
Division of Science, Research and Technology
Bureau of Sustainable Communities & Innovative Technologies
PO Box 409
Trenton, NJ 08625-0409
Tel: 609-984-5418
FAX: 609-292-7340

Richard J. Codey
Acting Governor

Bradley M. Campbe
Commissioner

January 27, 2005

Vaikko Allen
Vortechnics, Inc.
200 Enterprise Drive
Scarborough, ME 04074

RE: Interim Certification of the Vortechs® Stormwater Treatment System by Vortechnics, Inc.

Dear Mr. Allen:

The letter dated July 9, 2004 from the New Jersey Department of Environmental Protection (NJDEP) described the issuance of a **Conditional Interim Certification** for the Vortechs® Stormwater Treatment System (Vortechs® System), which was in accordance with the Energy and Environmental Technology Verification (EETV) Act at N.J.S.A. 13:1D-134. The conditional interim certification was issued based on the New Jersey Corporation for Advanced Technology (NJCAT) initial verification report, dated May 4, 2004. Since the July 9th notification of the conditional interim certification of your technology, the NJDEP has instituted a policy change regarding the interim certification process for stormwater manufactured treatment devices. This letter reflects the new policy and supersedes the letter dated July 9, 2004, with the original interim certification approval not being affected.

As indicated in the NJCAT verification report, **the Vortechs® System sized at a treatment operating rate of no more than 40 gpm/ft^2, with an average influent Total Suspended Solids (TSS) concentration of 187 mg/L and zero initial sediment loading, has been shown to have a TSS removal efficiency of 64% for coarse silt particles ranging from 38-75 microns**. Based on NJCAT's verification report, the NJDEP has a high degree of confidence that the **Vortechs® System** has the capability of achieving in field applications, at a minimum, TSS removal efficiency of 50%. Therefore, NJDEP certifies that the **Vortechs® System** is capable of achieving a minimum TSS removal efficiency of 50% from stormwater runoff, and shall be permitted accordingly. In addition, the following conditions will apply to the conditional interim certification:

1. The Vortechs® System should be the first component, if used as part of a treatment train (i.e. utilized in front of best management practices methods such as detention, retention, and infiltration basins, as defined in the NJ Stormwater Best Management Practices Manual).

2. The Vortechs® System shall be designed in accordance with New Jersey's water quality design storm, as required in the Stormwater Management Rules (N.J.A.C. 7:8).
3. A Quality Assurance Project Plan supporting the Technology Acceptance and Reciprocity Partnership (TARP) Tier II Protocol for Stormwater Best Management Practice Demonstration (July, 2003) shall be submitted to NJDEP and/or NJCAT within six (6) months from the date of this Conditional Interim Certification letter.
4. Field evaluation data that is consistent with the Tier II Protocol and additional NJDEP field test requirements shall be submitted to NJDEP and/or NJCAT by August 31, 2006.
5. This approval letter shall expire on December 31, 2006 unless extended by NJDEP.

Vortechs System Model	Grit Chamber Radius (ft)	Grit Chamber Area (ft^2)	Design Flow Rate (cfs)
1000	1.5	7.1	0.63
2000	2.0	12.6	1.12
3000	2.5	19.6	1.75
4000	3.0	28.3	2.5
5000	3.5	38.5	3.4
7000	4.0	50.3	4.5
9000	4.5	63.6	5.7
11000	5.0	78.5	7.0
16000	6.0	113.1	10.1

Table 1. Design Criteria for Systems Operating at 40 gpm/ft^2.

To design the appropriate systems (operating at 40 gpm/ft^2) for specific applications, the design criteria in Table 1 must be used. For final certification of the Vortechs® Stormwater Treatment System, verified data must be generated from a full scale field demonstration utilizing the TARP Tier II Protocol and additional NJDEP field test requirements. If you have any questions about this Conditional Interim Certification, please contact Ravi Patraju of my staff at (609) 292-0125.

Martin Rosen

Chief - Bureau of Sustainable Communities
and Innovative Technologies

Enclosure

c: Sam Wolfe, Assistant Commissioner, Environmental Regulation
Lisa Jackson, Assistant Commissioner, Land Use Management
Narinder Ahuja, Director, Division of Water Quality
Mark Mauriello, Director, Land Use Regulations
Larry Baier, Director, Watershed Management Program
Eileen Murphy, Director, Division of Science, Research, and Technology
Rhea Brekke, Executive Director, New Jersey Corporation for Advanced Technology

Certification Letter for High Efficiency CDS

State of New Jersey
Department of Environmental Protection
Division of Science, Research and Technology
Bureau of Sustainable Communities & Innovative Technologies
PO Box 409
Trenton, NJ 08625-0409
Tel: 609-292-9692
FAX: 609-292-7340

Richard J. Codey
Acting Governor

Bradley M. Campbell
Commissioner

January 12, 2005

James A. Heist, P.E.
Vice President – New Product Development
CDS Technologies Inc
105 Springbrook Place
Cary, NC 27511

RE: Interim Certification of the High Efficiency Continuous Deflective Separator Unit (Model PMSU20_20_5) by CDS Technologies, Inc.

Dear Mr. Heist:

In accordance with the Energy and Environmental Technology Verification (EETV) Act at N.J.S.A. 13:1D-134, the New Jersey Department of Environmental Protection (NJDEP) is pleased to issue a **Conditional Interim Certification** for the High Efficiency Continuous Deflective Separator Unit (Model PMSU20_20_5) developed by CDS Technologies, Inc. This technology uses the mechanism of continuous deflective separation to enhance separation of sediments from stormwater runoff. This conditional interim certification is being issued based on the New Jersey Corporation for Advanced Technology (NJCAT) verification addendum report, dated December 2004.

According to NJCAT's verification report, and as indicated in the attached Conditional Interim Certification Findings, the 500 GPM (1.1 cfs) High Efficiency Continuous Deflective Separator Unit (Model PMSU20_20_5), with a 2400 micron screen opening an a configured outlet for best sediment control operating with an average influent Total Suspended Solids (TSS) concentration of 184 mg/L and zero initial sediment loading, has been shown to have a total mass TSS removal efficiency of 73.7% (per NJDEP treatment efficiency calculation methodology) for silica sand particles <100 microns (d_{50} particle size of 63 microns) in laboratory studies using simulated stormwater. Based on this demonstrated laboratory performance, NJDEP has a high degree of confidence that the High Efficiency Continuous Deflective Separator Unit (Model PMSU20_20_5) has the capability of achieving in field applications, at a minimum, a TSS removal efficiency of 50%. Therefore, NJDEP certifies that the High Efficiency Continuous Deflective Separator Unit (Model PMSU20_20_5) is capable of achieving a minimum TSS removal efficiency of 50% from stormwater runoff, and shall be permitted accordingly. In addition, the following conditions will apply to the conditional interim certification:

1. The High Efficiency Continuous Deflective Separator Unit (Model PMSU20_20_5) should be the first component, if used as part of a treatment train (i.e. utilized in front of best management practices methods such as detention, retention, and infiltration basins, as defined in the NJ Stormwater Best Management Practices Manual).
2. The High Efficiency Continuous Deflective Separator Unit (Model PMSU20_20_5) shall be designed in accordance with New Jersey's water quality design storm, as required in the Stormwater Management Rules (N.J.A.C. 7:8).
3. A Quality Assurance Project Plan, in accordance with the Technology Acceptance and Reciprocity Partnership (TARP) Tier II Protocol for Stormwater Best Management Practice Demonstration (July, 2003), and including any additional field testing requirements that the NJDEP may request, shall be submitted to NJDEP and NJCAT within six (6) months from the date of this conditional interim certification letter.
4. Field evaluation data that are consistent with the Tier II Protocol and additional NJDEP field test requirements shall be submitted to NJDEP and/or NJCAT by December 31, 2006.

Additionally, similar High Efficiency Continuous Deflective Separators units can be used to address different influent flow rate applications **providing that the hydraulic design of these units is the same as Model PMSU20_20_5**. Also, as specified in the verification report, all stormwater manufactured treatment devices sold in New Jersey must be high efficiency units configured with a sediment weir. Please note that this approval letter shall expire on June 30, 2007, unless extended by NJDEP. For final certification of the High Efficiency Continuous Deflective Separator Units, verified data must be generated from a full-scale field demonstration utilizing the TARP Tier II Protocol and incorporating any additional NJDEP field test requirements. If you have any questions about this conditional interim certification, please contact Ravi Patraju of my staff at (609) 292-0125.

Sincerely,

Martin Rosen
Chief, Bureau of Sustainable Communities
and Innovative Technologies

Enclosure

c: Sam Wolfe, Assistant Commissioner, Environmental Regulation
Ernest Hahn, Assistant Commissioner, Land Use Management
Narinder Ahuja, Director, Water Quality
Mark Mauriello, Director, Land Use Regulation
Larry Baier, Director, Watershed Management
Eileen Murphy, Director, Science, Research, and Technology
Rhea Brekke, Executive Director, New Jersey Corporation for Advanced Technology

Certification Letter for Baysaver Separator System

State of New Jersey
Department of Environmental Protection
Division of Science, Research and Technology
Bureau of Sustainable Communities & Innovative Technologies
PO Box 409
Trenton, NJ 08625-0409
Tel: 609-292-9692
FAX: 609-292-7340

Richard J. Codey
Acting Governor

Bradley M. Campbell
Commissioner

March 23, 2005

Austin Meyermann
Director of Operations
BaySaver Technologies, Inc.
1302 Rising Ridge Road
Unit 1
Mount Airy, MD 21771

RE: Interim Certification of the BaySaver Separator Device.

Dear Mr. Meyermann:

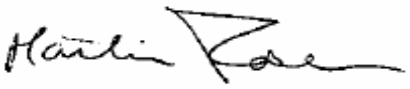
In accordance with the Energy and Environmental Technology Verification (EETV) Act at N.J.S.A. 13:1D-134, the New Jersey Department of Environmental Protection (NJDEP) is pleased to issue a **Conditional Interim Certification** for the BaySaver Separator Model 1K developed by BaySaver Technologies, Inc. This technology is hydraulically designed to use gravitational separation as a means of capturing sediments. This conditional interim certification is being issued as a result of the submission of the New Jersey Corporation for Advanced Technology (NJCAT) verification report, dated December 2004. **This certification letter must be used in conjunction with the Interim Certification Findings document.**

According to NJCAT's verification report, and as indicated in the attached Conditional Interim Certification Findings, the BaySaver Separator Model 1K provides 51% Suspended-Sediment Concentration (SSC) removal efficiency (as per NJDEP treatment efficiency calculation methodology) for laboratory simulated stormwater runoff with an average influent concentration of 205 mg/L and an average d_{50} particle size of 85 microns. Also, SSC removal testing was conducted with sediment pre-loaded in the lower chamber to 50% sediment capacity for the 1K unit. Based on this demonstrated laboratory performance, the NJDEP acknowledges that the BaySaver Separator Model 1K, with the appropriate design modifications, has the capability of achieving in field applications, at a minimum, a TSS removal efficiency of 50%, providing that the manhole diameter is increased. *Therefore, NJDEP certifies that the BaySaver Separator Model 1K with a manhole size diameter of 60 inches is capable of achieving a TSS removal efficiency of 50% from stormwater runoff at a maximum designed flow rate of 1.1 cfs, and shall be permitted accordingly.* In addition, the following conditions shall apply to the conditional interim certification:

1. The **BaySaver Separator Model 1K** should be the first component, if used as part of a treatment train (i.e., utilized in front of best management practices such as detention, retention, and infiltration basins, etc., as defined in the NJ Stormwater Best Management Practices Manual).
2. The **BaySaver Separator Model 1K** shall be designed in accordance with New Jersey's water quality design storm, as required in the Stormwater Management Rules (N.J.A.C. 7:8).
3. A Quality Assurance Project Plan supporting the Technology Acceptance and Reciprocity Partnership (TARP) Tier II Protocol for Stormwater Best Management Practice Demonstration (July, 2003), and including any additional field testing requirements that the NJDEP shall request, shall be submitted to NJDEP and/or NJCAT within six (6) months from the date of this Conditional Interim Certification letter.
4. Field evaluation data that are consistent with the Tier II Protocol and any additional NJDEP requirements shall be submitted to NJDEP and/or NJCAT by December 31, 2006.
5. Additional BaySaver models, as described in **Table 1** of the Interim Certification Findings, can be used for the respective designed flow rates since the design of these units is the same as the **BaySaver Separator Model 1K**.
6. **This certification letter must be used in conjunction with the Interim Certification Findings.**

As specified in the Interim Certification Findings, the manhole sizes for the various BaySaver Separator models to be used in New Jersey are larger than those specified in the verification report. Therefore, the devices installed in New Jersey must satisfy the dimensions specified in Table 1 of the Interim Certification Findings. Please note that this approval letter shall expire on June 30, 2007, unless extended by NJDEP. For final certification of the BaySaver Separator, verified data must be generated from a full-scale field demonstration utilizing the TARP Tier II Protocol and additional NJDEP's field testing requirements. If you have any questions about this conditional interim certification, please contact Ravi Patraju of my staff at (609) 292-0125.

Sincerely,



Martin Rosen
Chief - Bureau of Sustainable Communities
and Innovative Technologies

Enclosure

c: Lisa Jackson, Assistant Commissioner, Land Use Management
Sam Wolfe, Assistant Commissioner, Environmental Regulation
Larry Baier, Director, Watershed Management Program
Eileen Murphy, Director, Division of Science, Research, and Technology
Mark Mauriello, Director, Land Use Regulation
Narinder Ahuja, Director, Division of Water Quality
Rhea Brekke, Executive Director, New Jersey Corporation for Advanced Technology

Certification Letter for Downstream Defender

State of New Jersey

Richard J. Codey
Acting Governor

Department of Environmental Protection
Division of Science, Research and Technology
Bureau of Sustainable Communities & Innovative Technologies
PO Box 409
Trenton, NJ 08625-0409
Tel: 609-292-9692
FAX: 609-292-7340

Bradley M. Campbell
Commissioner

May 11, 2005

Pamela Deahl
Vice President
Hydro International
94 Hutchins Drive
Portland, ME 04102

RE: Interim Certification of Hydro International's *Downstream Defender®*

Dear Ms. Deahl:

In accordance with the Energy and Environmental Technology Verification (EETV) Act at N.J.S.A. 13:1D-134, the New Jersey Department of Environmental Protection (NJDEP) is pleased to issue a **Conditional Interim Certification** for the *Downstream Defender®* developed by Hydro International. This conditional interim certification is being issued as a result of the March 28, 2005 submission of the New Jersey Corporation for Advanced Technology (NJCAT) final verification report, and **must be used in conjunction with the enclosed Conditional Interim Certification Findings document**.

According to NJCAT's verification report, and as indicated in the attached Conditional Interim Certification Findings, the Hydro International *Downstream Defender®*, sized at a hydraulic loading rate of 20 gpm/ft^3 has been shown to have a 70% solids mass removal efficiency (as per NJDEP treatment efficiency calculation methodology) for F-95 sand with an average influent concentration of 240 mg/l, an average d_{50} particle size of 120 microns and zero initial sediment loading in laboratory studies using simulated storm water. Based on this demonstrated laboratory performance, the NJDEP feels confident that the *Downstream Defender®* has the capability of achieving in field applications, at a minimum, a TSS removal efficiency of 50%. Therefore, NJDEP certifies that the Downstream Defender® is capable of achieving a TSS removal efficiency of 50% from stormwater runoff at the respective maximum designed flow rates as given in Table 1 of the enclosed Conditional Interim Certification Findings document, and shall be permitted accordingly. In addition, the following conditions shall apply to the conditional interim certification:

1. The *Downstream Defender®* should be the first component, if used as part of a treatment train (i.e., utilized in front of best management practices such as detention, retention, and

infiltration basins, etc., as defined in the NJ Stormwater Best Management Practices Manual).

2. The *Downstream Defender*® shall be designed in accordance with New Jersey's water quality design storm, as required in the Stormwater Management Rules (N.J.A.C. 7:8).
3. A Quality Assurance Project Plan supporting the Technology Acceptance and Reciprocity Partnership (TARP) Tier II Protocol for Stormwater Best Management Practice Demonstration (July, 2003), and including any additional field testing requirements that the NJDEP shall request, shall be submitted to NJDEP and/or NJCAT within six (6) months from the date of this Conditional Interim Certification letter.
4. Field evaluation data that are consistent with the Tier II Protocol and any additional NJDEP requirements shall be submitted to NJDEP and/or NJCAT by February 28, 2007.
5. **As previously stated, this certification letter must be used in conjunction with the Conditional Interim Certification Findings document.**

Please note that this approval letter shall expire on August 31, 2007, unless extended by NJDEP. For final certification of the *Downstream Defender*®, verified data must be generated from a full-scale field demonstration utilizing the TARP Tier II Protocol and additional NJDEP field testing requirements. If you have any questions about this conditional interim certification, please contact Ravi Patraju of my staff at (609) 292-0125.

Sincerely,

Martin Rosen
Chief - Bureau of Sustainable Communities
and Innovative Technologies

Enclosure

c: Lisa Jackson, Assistant Commissioner, Land Use Management
Sam Wolfe, Assistant Commissioner, Environmental Regulation
Larry Baier, Director, Watershed Management Program
Eileen Murphy, Director, Division of Science, Research, and Technology
Mark Mauriello, Director, Land Use Regulation
Narinder Ahuja, Director, Division of Water Quality
Rhea Brekke, Executive Director, New Jersey Corporation for Advanced Technology

Certification Letter for Stormceptor

State of New Jersey

Richard J. Codey
Acting Governor

Department of Environmental Protection
Division of Science, Research and Technology
Bureau of Sustainable Communities & Innovative Technologies
PO Box 409
Trenton, NJ 08625-0409
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Bradley M. Campbell
Commissioner

February 15, 2005

Penh Tov
Stormceptor® Group of Companies
12 Madison Avenue
Toronto, ON M5R 2S1

RE: Interim Certification of the Stormceptor® System Model STC 900 Stormwater Treatment System by Stormceptor® Group of Companies.

Dear Ms. Tov:

In accordance with the Energy and Environmental Technology Verification (EETV) Act at N.J.S.A. 13:1D-134, the New Jersey Department of Environmental Protection (NJDEP) is pleased to issue a **Conditional Interim Certification** for the Stormceptor® System Model STC 900 that was developed by the Stormceptor® Group of Companies. This technology is a hydrodynamic separator designed to enhance gravitational separation of floating and settling materials from stormwater runoff. This conditional interim certification is being issued based on the New Jersey Corporation for Advanced Technology (NJCAT) verification report, dated September 2004.

According to NJCAT's verification report, and as indicated in the attached Conditional Interim Certification Findings, the Stormceptor® System Model STC 900 was verified by NJCAT to achieve a Total Suspended Solids (TSS) removal efficiency of 75% for laboratory simulated stormwater runoff, in compliance with all of NJCAT's testing protocols, including pre-loading the tank with sediment. In addition, the STC 900 demonstrated no scouring when tested up to 125% of the unit's operating rate with the unit loaded to 100% sediment capacity. Based on this demonstrated laboratory performance, NJDEP has a high degree of confidence that the Stormceptor® System Model STC 900 has the capability of exceeding in field applications, a TSS removal efficiency of 50%. Therefore, NJDEP certifies that the Stormceptor® System Model STC 900 is capable of achieving a minimum TSS removal efficiency of 50% from stormwater runoff, and shall be permitted accordingly. In addition, the following conditions will apply to the conditional interim certification:

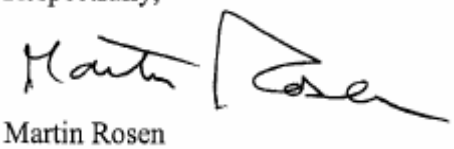
1. The Stormceptor® System Model STC 900 should be the first component, if used as part of a treatment train (i.e. utilized in front of best management practices methods such as

detention, retention, and infiltration basins, as defined in the NJ Stormwater Best Management Practices Manual).

2. The Stormceptor® System Model STC 900 shall be designed in accordance with New Jersey's water quality design storm, as required in the Stormwater Management Rules (N.J.A.C. 7:8).
3. A Quality Assurance Project Plan, in accordance with the Technology Acceptance and Reciprocity Partnership (TARP) Tier II Protocol for Stormwater Best Management Practice Demonstration (July, 2003), and including any additional field testing requirements that the NJDEP shall request, shall be submitted to NJDEP and NJCAT within six (6) months from the date of this conditional interim certification letter.
4. Field evaluation data that are consistent with the Tier II Protocol and additional NJDEP field test requirements shall be submitted to NJDEP and/or NJCAT by December 31, 2006.
5. The various models listed in Table 1 of the "Conditional Interim Certification Findings" can be used for applications associated with other flow rates.

Please note that this approval letter shall expire on June 30, 2007, unless extended by NJDEP. For final certification of the Stormceptor® System Model STC 900, verified data must be generated from a full scale field demonstration utilizing the TARP Tier II Protocol and additional NJDEP field test requirements. If you have any questions about this conditional interim certification, please contact Ravi Patraju of my staff at (609) 292-0125.

Respectfully,



Martin Rosen
Chief - Bureau of Sustainable Communities and Innovative Technologies

Enclosure

c: Sam Wolfe, Assistant Commissioner, Environmental Regulation
Lisa Jackson, Assistant Commissioner, Land Use Management
Larry Baier, Director, Watershed Management Program
Eileen Murphy, Director, Division of Science, Research, and Technology
Narinder Ahuja, Director, Division of Water Quality
Mark Mauriello, Director, Land Use Regulations
Rhea Brekke, Executive Director, New Jersey Corporation for Advanced Technology

Appendix C

Information from Toronto and Region Conservation Authority

C.1 Flood Flow Criteria Map

C.2 Unit Flow Rates for Humber River Watershed

C.3 Rouge River (Within City of Toronto) Erosion Management Criteria

C.4 Map of Rouge River Tributaries within City of Toronto

- Little Rouge Tributary "B"
- Morningside tributary

Appendix C.1: Flood Flow Criteria Map

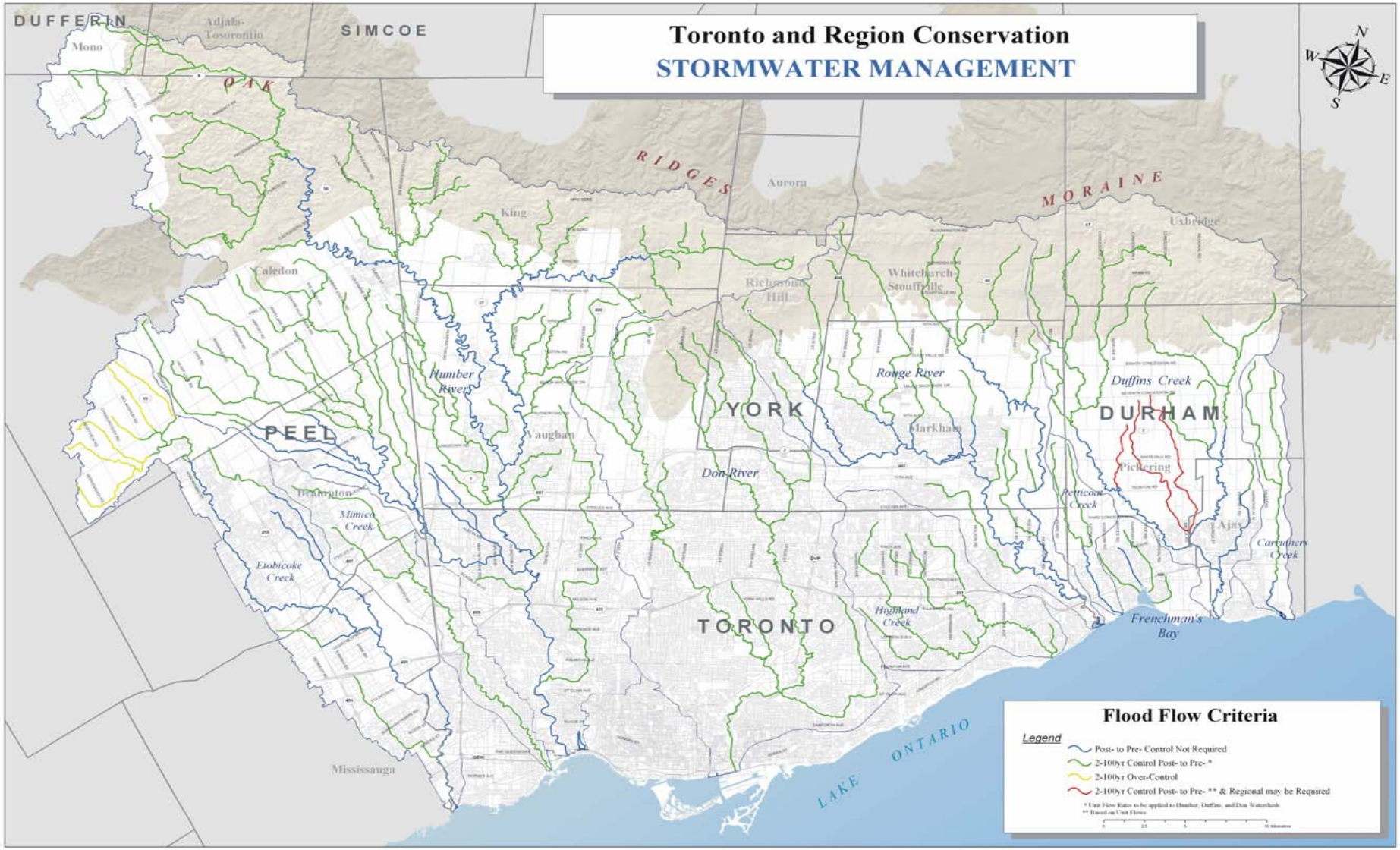


TABLE C.2: SUMMARY OF UNIT FLOW RELATIONSHIPS HUMBER RIVER WATERSHED

Return Period	Sub-Basin 4	Sub-Basin 6	Sub-Basin 10	Sub-Basin 15	Sub-Basin 19A	Sub-Basin 36	Sub-Basin 46
100-Year	Q=6.086-0.440ln(A)	Q=15.199-0.751ln(A)	Q= 14.140-1.096ln(A)	Q= 20.388-1.899 ln(A)	Q=15.911-1.785ln(A)	Q=29.912-2.316ln(A)	Q=22.973-2.256ln(A)
50 Year	Q=5.147-0.376ln(A)	Q=12.692-0.623ln(A)	Q=11.920-0.92ln(A)	Q=17.051-1.577ln(A)	Q=13.700-1.53ln(A)	Q=26.566-2.082ln(A)	Q=20.164-1.973ln(A)
25-Year	Q=4.272-0.312ln(A)	Q=10.488-0.522ln(A)	Q=9.838-0.757ln(A)	Q=14.037-1.293ln(A)	Q=11.653-1.297ln(A)	Q=22.639-1.741ln(A)	Q=17.381-1.690ln(A)
10- Year	Q=3.129-0.233ln(A)	Q=7.707-0.382ln(A)	Q=7.443-0.578ln(A)	Q=10.400-0.953ln(A)	Q=9.213-1.031ln(A)	Q=17.957-1.373ln(A)	Q=13.877-1.342ln(A)
5-Year	Q=2.410-0.175ln(A)	Q=5.755-0.283ln(A)	Q=5.557-0.427ln(A)	Q=7.930-0.731ln(A)	Q=7.358-0.829ln(A)	Q=14.625-1.136ln(A)	Q=11.468-1.123ln(A)
2-Year	Q=1.439-0.106ln(A)	Q=3.288-0.159ln(A)	Q=3.142-0.233ln(A)	Q=4.722-0.454ln(A)	Q=4.567-0.503ln(A)	Q=9.506-0.719ln(A)	Q=7.745-0.762ln(A)

Notes:

1. Q-unit flow (L/s/ha-litres per second per hectare)
2. A- area in hectares (ha)
3. Refer to Figure C.2 for location of sub-basins.
4. The unit flow relationships of 2 year through 100 year return period for Sub-Basin27A, 47, 48, 49, 50 are based on Sub-Basin 46.
5. The unit flow relationships of 2 year through 100 y ear return period for Sub-Basin 45A, 45B are based on Sub-Basin 36.

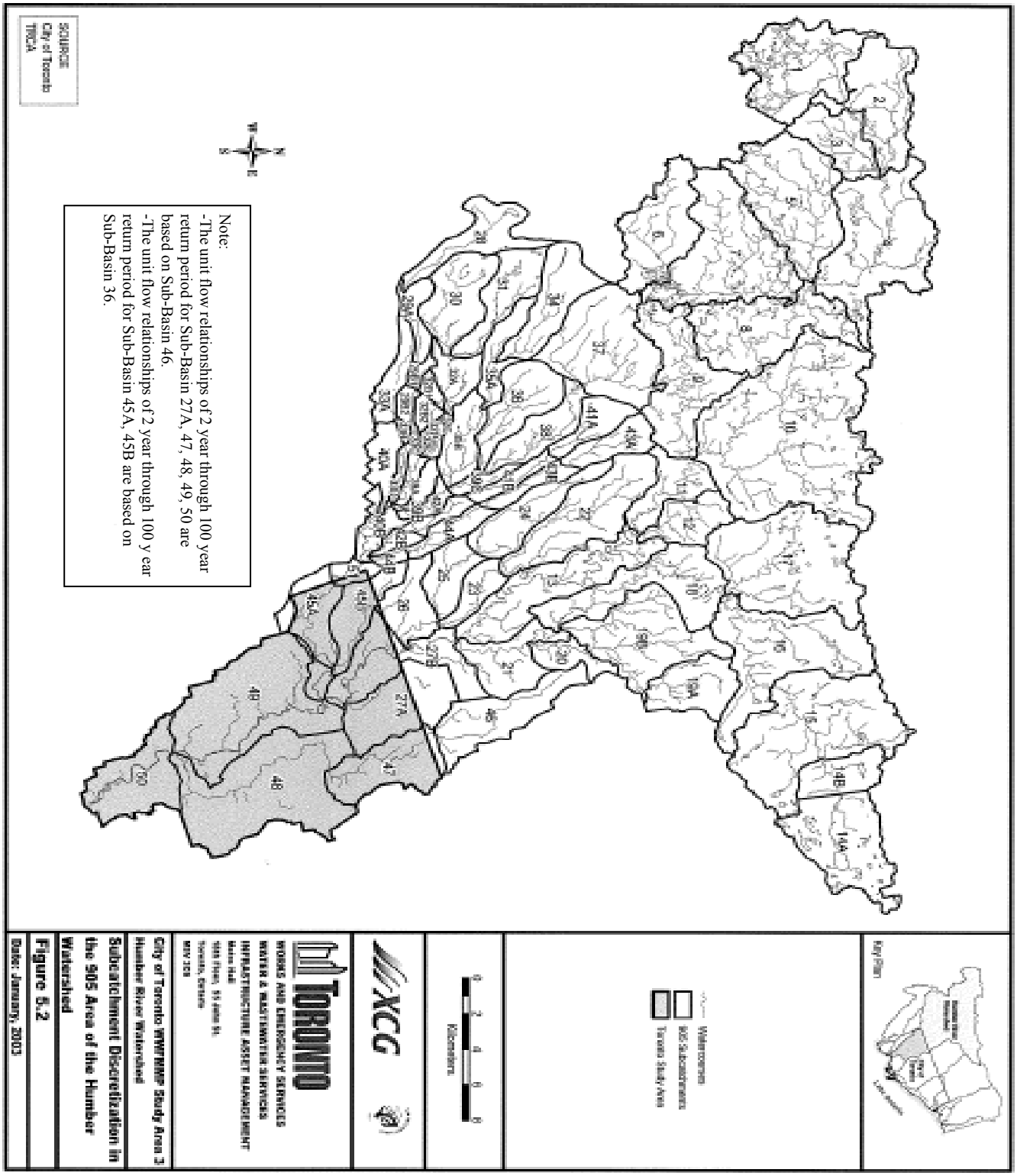


Figure C.2 Location of Humber River Watershed Basin Location

Appendix C.3 - Rouge River (Within City of Toronto) Erosion Management Criteria

1. Unless otherwise indicated below, contact Toronto and Region Conservation Authority staff to determine requirements.

2. Detain the post-development rainfall runoff from a 30 mm storm for a minimum of 24 hours for Tributary "B" of the Little Rouge Creek (south of Steeles Ave. – see map on Appendix C.4).

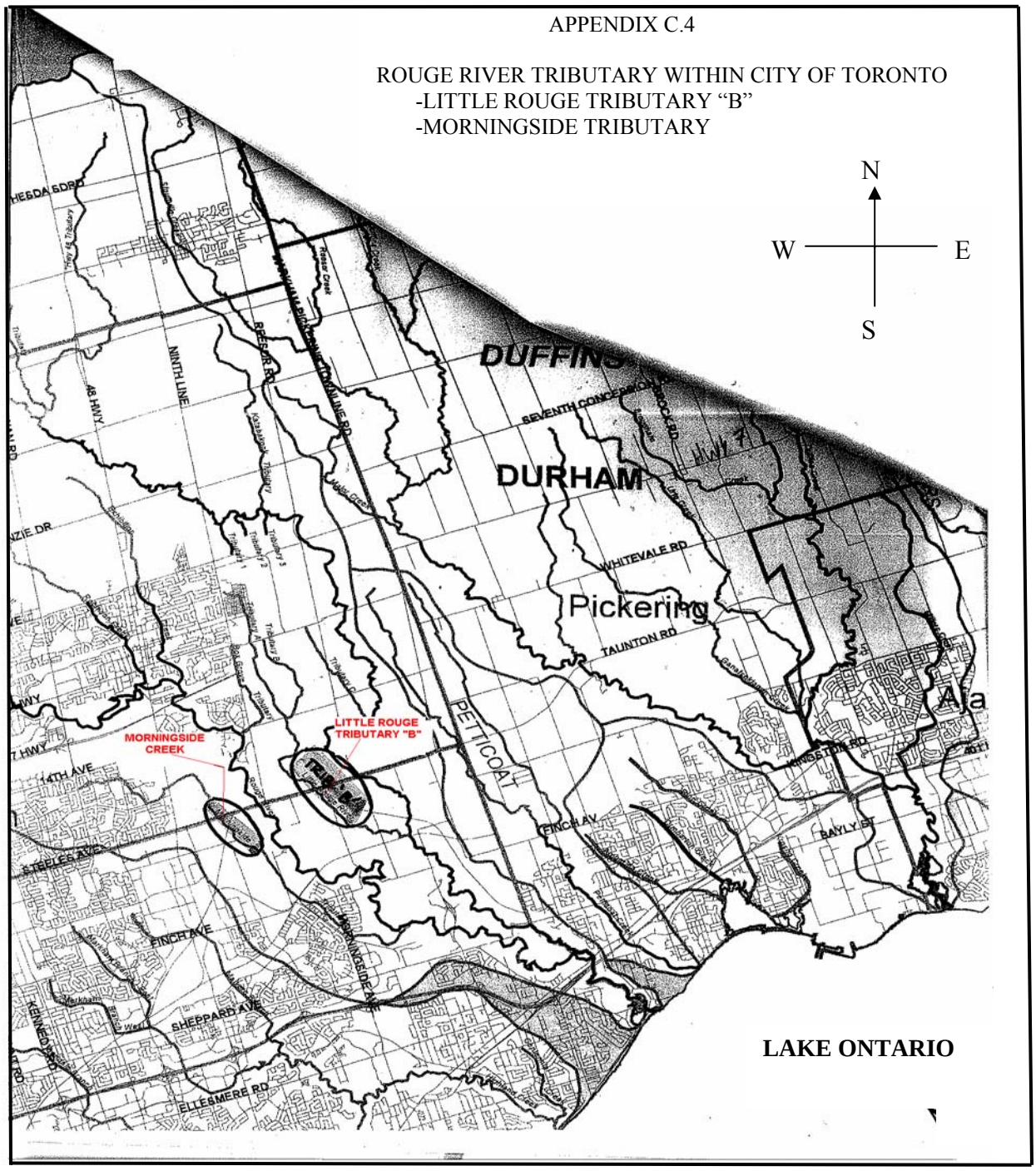
   Report Reference: "Cornell Community Master Storm Drainage and SWM Report (Marshall Macklin Monaghan, 1996)"

3. Detain the post-development rainfall runoff from a 33 mm storm for a minimum of 48 hours for the Morningside Tributary of the Rouge River (south of Steeles Ave. – see map on Appendix C.4).

   Report Reference: "Morningside Heights Master Environmental Servicing Plan (Schaeffers & Associates Ltd., 2001)"

APPENDIX C.4

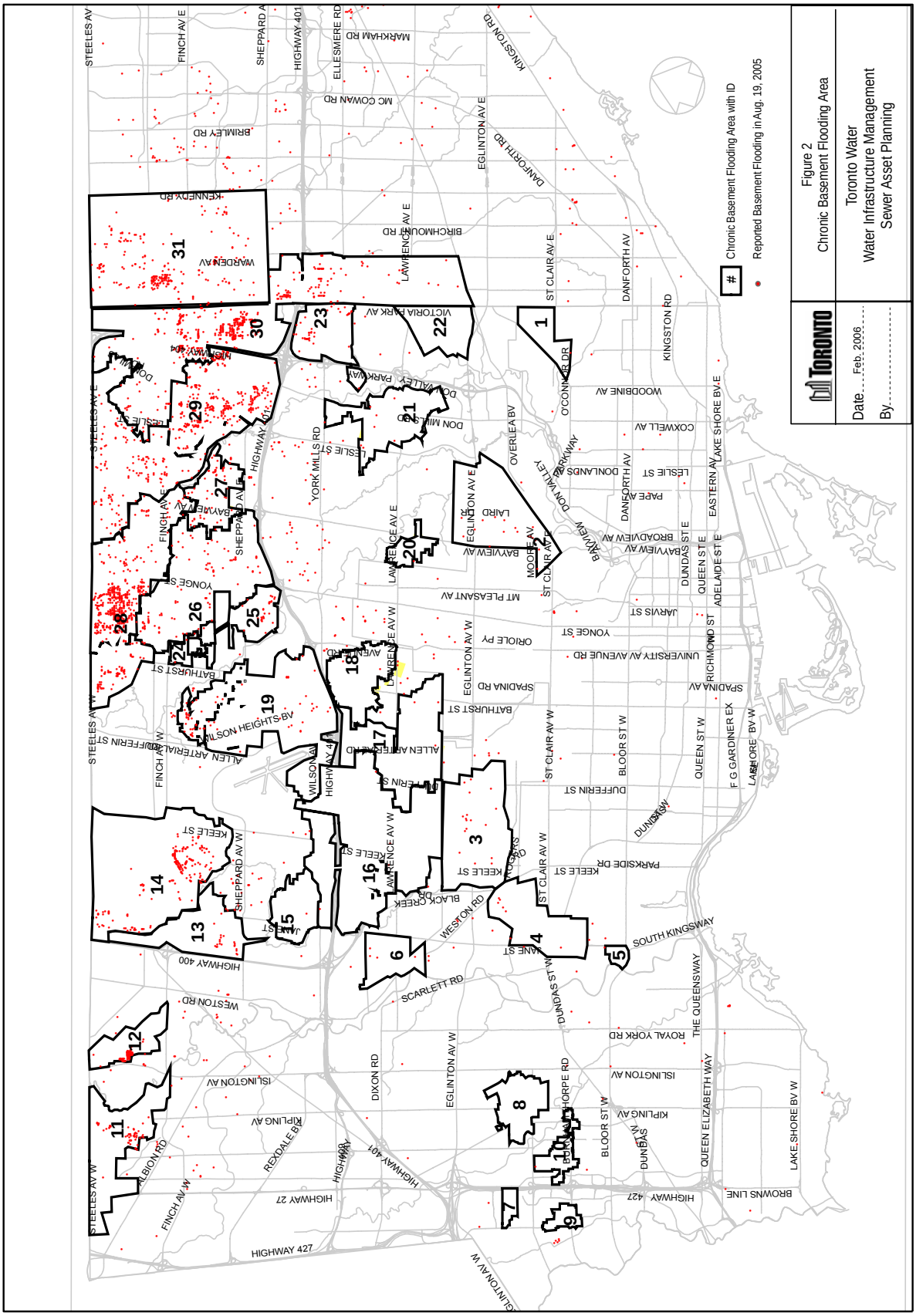
ROUGE RIVER TRIBUTARY WITHIN CITY OF TORONTO
-LITTLE ROUGE TRIBUTARY "B"
-MORNINGSIDE TRIBUTARY



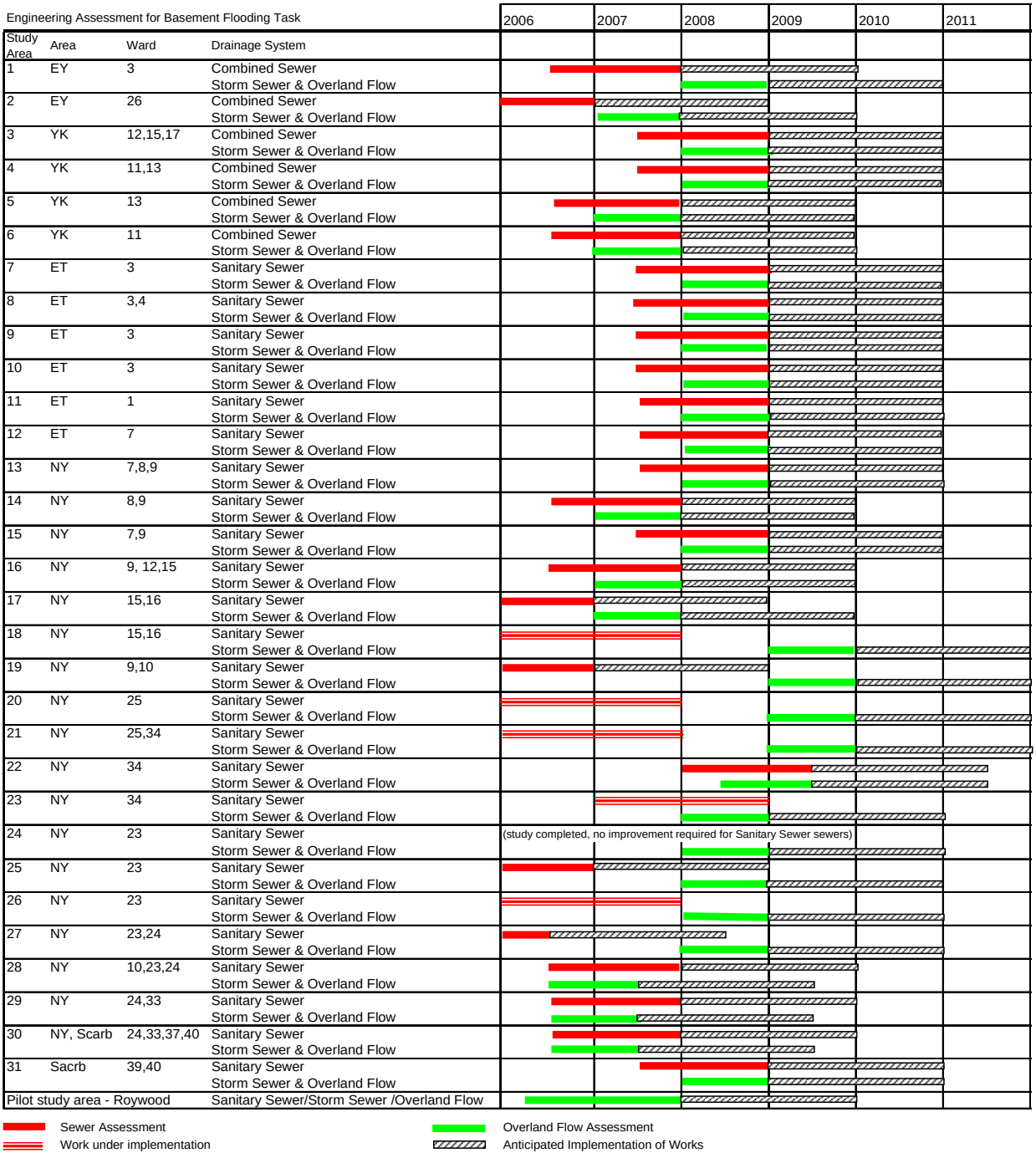
Appendix D

City of Toronto Basement Flooding Relief Work Program Location Map & Schedule

Appendix D.1 City of Toronto Basement Flooding Relief Work Program Location Map



Appendix D.2 City of Toronto Basement Flooding Relief Works Program Schedule



Appendix E

TERMS OF REFERENCE

E.1 Stormwater Management Report (Excerpted from Toronto Development Guide May, 2004)

E.2 Erosion Analysis Report (Obtained from TRCA)

E.3 Storm Outfall and Outfall Channel Design Criteria (Obtained from TRCA)

Appendix E.1

STORMWATER MANAGEMENT REPORT

TERMS OF REFERENCE

Study	Stormwater Management Report
Description	• To identify the quality and quantity impacts of the change in stormwater runoff on existing infrastructure and watercourses due to a proposed development. • To determine improvements to municipal servicing infrastructure required to support the proposed level of development. • To determine mitigation measures to minimize any negative impacts.
When Required	A Stormwater Management Report is required for the following application types: • Plans of Subdivision • Site Plan Control applications
Rationale	**Objective** The objective of a Stormwater Management Report is to evaluate the effects of a proposed development on the stormwater and drainage pattern, and to recommend how to manage rainwater/snowmelt for the proposed development, consistent with the City's Wet Weather Flow Management Policy and while also meeting TRCA, provincial and federal regulations. **Format** A Stormwater Management Report is prepared by a Registered Professional Engineer qualified in municipal engineering/stormwater management and must follow the interim guidelines on preparation of Stormwater Management Reports that are currently used in each service district. The interim guidelines will be replaced by harmonized guidelines in the future. The submission must include reports, plans, computer modeling results and design calculations relating to how storm runoff is to be managed. **Process** A Stormwater Management Report is to be submitted in conjunction with the development application. The applicant is encouraged to discuss the need, scope and the proposed stormwater management concepts and design assumptions with City staff prior to preparing the report. For Plans of Subdivision, the report is to be submitted in two stages. The Preliminary Report outlines the design assumptions and conceptual engineering schemes to manage both quantity and quality of runoffs. The Preliminary Report is to be submitted when the application is initiated and must be accepted prior to draft plan approval of a Plan of Subdivision. The Final Report provides the detailed calculations and the design of the storwmater management facilities and drainage systems based on the accepted principles in the Preliminary Report, and must be accepted prior to the final approval of the Plan of Subdivision. For Site Plan Control applications, the Final Report is to be submitted in conjunction with the development application which must be accepted prior to the site plan

	approval. An Environmental Impact Study may be required to address the impact of development on water resources features or functions on and off site (see EIS Terms of Reference). **Principles** A Stormwater Management Report must be based on established stormwater management principles, best management practices and the interim guidelines used in each service district (until they are harmonized by the Wet Weather Flow Management Guidelines) and the Ministry of the Environment Policies and the Wet Weather Flow Management Policy. The authority to request this work is provided by the Planning Act, the Provincial Policy Statement, the Official Plan, the Council approved Wet Weather Flow Management Policy and Chapter 681 of the Municipal Code – Sewer.
Required Contents	A Stormwater Management Report must include the basic quantity and quality assumptions upon which the report is based, and all appropriate functional plans of infrastructure elements for major and minor flow, which could have an impact on the layout of the Plan of Subdivision. These infrastructure elements may include stormwater management facilities, all water resources features and functions (i.e., watercourses, riparian areas, recharge/discharge areas), existing overland flow routes, surface features (i.e. top of bank of valleys) and existing infrastructure (i.e. water and wastewater infrastructure and underground utilities). Where a development proposal may impact a water resources features or function, the Stormwater Management Report must incorporate into the design the recommendations from the separate Environmental Impact Study referenced above. The Preliminary Report must provide sufficient engineering information to allow for the necessary review and acceptance of the proposed stormwater management schemes in principle. This report should address the following: • Identify constraints and potential opportunities – quantitative, qualitative, erosion sensitivity and environmental concerns related to water resources for both interim and ultimate development conditions, both on and off-site. • Identify the inlets (from upstream) and outlets (to downstream) for the minor and major systems, including overland flow routes. • Demonstrate that the proposal has maximized source control measures to reduce runoff from the site with water quality and quality objectives and targets under the Wet Weather Flow Management Policy. • Indicate if off-site land or works are required to implement the stormwater management proposals and comment to what extent (e.g. easements, dedication, land acquisition, etc.) • Indicate the interim measures required for erosion, pond siltation and sedimentation, downstream works, riparian flow considerations, during the construction phase. • Indicate if other agencies are required to grant approvals or issue permits. • Submit plans and calculations to support the proposals. The report includes the following information: 1. Location map of the subject property 2. Property description 3. Present owner contact 4. An external drainage plan including all upstream lands and any diversion of drainage routes

	5. An internal drainage plan including flood and fill lines and overland flow routes 6. Schematic layout of existing and proposed sanitary and storm sewer networks 7. Schematic layout of the subwatershed showing the main watercourse, tributaries and trunk sewers 8. Any support calculations and drawings, such as: ▪ Calculation of surface run-off ▪ Calculation of permissible release rate and required on-site storage ▪ Methods of run-off attenuation and on-site storage ▪ Measures to maintain or improve water quality ▪ Measures to minimize impact of run-off downstream including erosion, flooding etc. The Final Report must include detailed analyses (computer modeling results and calculations) and design of the major and minor systems and proposed stormwater management facilities based on the proposed design concepts and parameters accepted in the Preliminary Report. Refer to interim guidelines for specific requirements that are currently applied in each service district.
Comments	The level of detail for the Stormwater Management Report depends on the type of application, the size of the development and the types of stormwater management schemes proposed. For example, a report for a Plan of Subdivision will typically be more complex than a report in support of a Site Plan Control application.

Appendix E.2
EROSION ANALYSIS REPORT
TERMS OF REFERENCE

Phase I - Characterization (to be undertaken by a qualified fluvial geomorphologist)

1. Characterize the existing channel form to define representative reaches and classify the stability of the active channel (i.e. determine the most sensitive reaches).

2. Establish the erosion thresholds for the entire study area based on field measurements (i.e. determine critical discharge, velocity and depth of flow for the most sensitive reaches based on both bed and bank assessments - the most critical values should be used).

Phase II - Erosion Analysis

1. Establish a continuous simulation model using Qualhymo version 2.2. The modelling will include converting the existing watershed hydrology model to Qualhymo to assess the in stream erosion potential. The continuous model should have a minimum of 6 years of hourly data (i.e. preferably this data set of 6 years should include a wet year, a dry year and an average year).

2. Run the existing conditions scenario, which will set up the targets.

3. Run the future scenario (which would include the proposed developments) with and without SWM controls (i.e. all SWM ponds need to be modelled) to determine the necessary storage volume and release rates to maintain the existing erosion potential.

4. Perform a sensitivity analysis to determine how a 25% variation in the erosion thresholds stated above will affect the design of the stormwater management facilities (i.e. pond volumes and release rates). If the design of the stormwater management facility is shown to be sensitive, then the size of the facility will have to be increased to account for this sensitivity.

Appendix E.3

Storm Outfall and Outfall Channel Design Criteria
(Obtained from TRCA)

Engineering:

1. Avoid disturbance to the low flow channel of the watercourse if at all possible. Where erosion protection may be necessary, make use of granular filter layers beneath the larger stone as required and/or embed the stone - the use of filter cloth within the low flow channel of the watercourse is not acceptable and is not preferred within the outfall channel itself. Please note that potential DFO / fishery concerns can be minimized by avoiding in/near water works associated with the outfall.

2. Provide velocity calculations in support of all proposed treatment types (eg., stone, vegetation, etc.).

3. Where feasible, implement flow spreading measures downstream of the outfall once energy has been dissipated by chute blocks, etc. (i.e., in areas where there is a wide, flat flood plain between the outfall and the low flow channel).

4. Provide details of erosion and sediment control measures to be implemented during the construction period.

5. Locate the outfall channel such that it joins the watercourse at a flat angle; avoid the outside bends of meanders.

6. If at all possible, the outfall should be located outside the meander belt.

7. The outfall structure should not impact existing flood levels.

8. River run stone is generally preferred over riprap, particularly in areas with high quality habitat. Consult with Authority staff to determine when/where riprap may be acceptable.

Landscaping / Restoration:

1. A combination of trees, shrubs, and herbaceous vegetation is typically required for the restoration of disturbed areas. Ensure all plantings are native, non-invasive species, and are suitable given the soil, moisture, and light conditions of the site. Plantings should also be compatible and complementary to the existing vegetation communities.

2. In general, plantings should follow the standard densities of 1 metre on centre for shrubs and 5 metres on centre for trees. However, these guidelines may change depending on the situation (eg., increase densities for live staking).

3. Please indicate that site stabilization will occur during or immediately following construction to avoid erosion. Depending on their suitability, various techniques may be employed including hydroseeding, installing straw mulch or jute mats, etc.

4. Seeding mixtures should consist of quick-growing, non-invasive species. Manufacturers offer an assortment of mixtures that are suited to various conditions, including a slope stabilization mix, meadow

mix, and wetland mix. In particularly sensitive areas, a seed mix consisting entirely of native species should be used to avoid the invasion of aggressive vegetation. Where seeding is proposed for interim stabilization with woody material being introduced in a later phase, care should be taken in both the composition and rate of application. Ensure that the subsequent plantings are able to establish without excessive competition or or damage from small mammals.

5. If the area is very grassy, mulch and rodent guards may be needed to protect young tree stems.

6. There are no size requirements for vegetation to be planted. However, greater numbers of smaller-sized vegetation are generally preferred over fewer numbers of larger-sized vegetation. Planting large vegetation may also cause more disturbance to the site.

7. Indicate how existing vegetation to be retained will be protected (i.e., location and detail of fencing).

8. Plans should include a plan view showing planting locations, species and numbers, a detail showing the installation, and a note listing the species, size, and condition (i.e., bareroot, potted, etc.). The latter will ultimately dictate the season when works can be done.

Appendix F

LOW IMPACT DEVELOPMENT PRACTICES

The Toronto Green Development Standard (2006)

In July 2006, Toronto City Council has adopted the Toronto Green Development Standard 2006, which provides an integrated set of targets, principles, and practices to guide the development of City-owned facilities and to encourage sustainable development amongst the private sector. The Toronto Green Development Standard was created from a review of City guidelines and targets, popular private rating systems and the experiences of cities from around the world. The Toronto Green Development Standard would be a voluntary program in the initial year of implementation, while further study and stakeholder consultation is conducted. The full report is available from the City's website at www.toronto.ca/environment/greendevelopment.htm

Sustainable Technologies Evaluation Program (STEP)

One useful source of information is the Sustainable Technologies Evaluation Program (STEP), which is a multi-agency program, led by the Toronto and Region Conservation Authority (TRCA). The program was developed to provide the data and analytical tools necessary to support broader implementation of sustainable technologies and practices within a Canadian context. Its main objectives are to:

- Monitor and evaluate sustainable technologies in the areas of water and air
- Assess potential barriers to implementing sustainable technologies
- Provide recommendations for guideline and policy development
- Disseminate study results and recommendations and promote the use of effective technologies at a broader scale through education and advocacy

The website (http://www.sustainabletechnologies.ca) provides information about **STEP** and **SWAMP** (Stormwater Assessment Monitoring and Performance). The **Clean Water** section provides information on Stormwater Management, Community Wastewater, Stream Restoration, Erosion & Sediment Control, Water Conservation, etc.

Low Impact Development Practices

Low impact development (LID) is a stormwater management strategy that emphasizes conservation and use of existing natural site features integrated with distributed, small-scale stormwater controls to more closely mimic natural hydrologic patterns in residential, commercial, and industrial settings. LID does not compensate for the cumulative and adverse effects from road networks, other land clearing, and construction activities that occur outside the development site. LID can, however, be used in the various sub-basin development scenarios to help achieve larger-scale, sub-watershed protection goals. Implemented comprehensively, native soil and vegetation protection, soil improvement, and increased on-site storage and infiltration capacity at the site level are necessary to protect or enhance larger-scale hydrologic function and other watershed attributes.

Consistent with the WWFMMP long-term objectives and hierarchical principles, all new development including re-development projects are strongly encouraged to apply low impact development strategy and design techniques that are suitable and applicable to individual site conditions. A variety of lot level control measures

and techniques (non-structural and structural) were evaluated in the WWFMMP study. Some of lot level control strategies and techniques we recommend for considerations include the following:

(1) Site Planning
(2) Source Separation of Runoff
(3) Green Roof Technologies
(4) Rainwater Harvesting (Re-use)
(5) Absorbent Landscaping

As part of the WWFMMP study, a comprehensive list and description of the stormwater management and combined sewer overflow (CSO) control measures were developed. These control measures were identified and described in the document entitled, "List of CSO/Stormwater Control Alternatives – Final Report (March 2002)". Further details in environmental planning and design criteria/standards for various SWMP (stormwater management practices) refer to the MOE SWM Planning & Design Manual (March 2003).

Information of performance and efficiencies in terms of water balance and water quality controls for the various lot level control techniques and specific low impact development practices are currently being developed, as part of the Wet Weather Flow Management Guidelines Study and the document will be updated as experience is gained.

1. Site Planning

Comprehensive site planning is critical to stormwater management as it can eliminate unnecessary increases in runoff and reduce sediment/erosion problems. Site planning techniques that will minimize the creation of new runoff and provide removal of some suspended solids include:

(1) Minimize Impervious Surface

Careful site planning can reduce the impervious area created by pavement and roofs and the volume of runoff and pollutant loading requiring control. Certain site planning methods will minimize impervious surfaces and reduce the volume of runoff. These key considerations include:

- Maintain natural buffers and drainage ways
- Minimize the creation of steep slopes (>2H:1V)
- Minimize placement of new structures or roads over porous or erodible soils
- Reduce frontage and other setbacks
- Reduce the horizontal footprint of buildings and parking areas
- Reduce to one lane, or eliminate if practical, on-street parking lanes on local access roads
- Limit sidewalks to one side, or eliminate if practical, on local low traffic roads
- Utilize "turf pavers" gravel, or other porous surfaces when possible for sidewalks, driveways, transition areas between pavement edge and swales, or overflow parking areas
- Use shallow grassed roadside swales where site and soil conditions permit instead of curb and gutter storm drainage systems
- Maintain as much of the predevelopment vegetation as possible, especially larger trees that may be on site. Vegetation absorbs water, which will reduce the amount of stormwater runoff.

(2) Fit the Development to the Terrain

Wherever possible, road patterns should match the landform. For example, in rolling terrain, local streets should branch from collector streets, ending in short loops or cul-de-sacs along ridgeline. In areas where the topography is flat, the use of grids may be more appropriate. In these schemes, natural drainage ways should be preserved where possible by interrupting and bending the road grid around them. Grassed waterways, vegetated drainage channels, or water quality swales are encouraged to be constructed along street right-of-ways or on the back of lots to channel runoff without abrupt changes in the direction of flow.

(3) **Reproduce Predevelopment Hydrologic Conditions**

The goal of matching predevelopment hydrologic conditions can be addressed at the site planning level. The appropriate combination of the above techniques to maintain the curve number (CN) and time of concentration (Tc) will typically result in a design that maintains the predevelopment runoff volume, peak rate, and frequency.

In general, CN is used in hydrologic modeling to determine the runoff volume from both the pre-development and post-development conditions. Some of the techniques to maintain CNs or land cover type are:

- Reduce limits of clearing and grading
  - conserve natural resources areas
  - minimize disturbance
  - preserve infiltratable soils
  - preserve vegetation
  - preserve natural depression areas

- Site fingerprinting – minimal disturbance techniques

- Locate cleared and graded areas outside permeable soils and vegetated areas.

- Use alternative roadway designs
  - narrower road sections
  - grassed swales and infiltration trenches
  - location of roads on ridges – optimize cut/fill quantities
  - reduced imperious surfaces – use porous pavers, eliminate or reduce sidewalk to one side of local roads, reduce driveway length and width

- Reduction and disconnection of impervious areas
  - minimize rooftop imperviousness
  - disconnect impervious areas (i.e. disconnecting roof drains and directing flows to vegetated areas, breaking up flow directions from large paved surfaces and encouraging sheet flow through vegetated areas, etc.)

- Provide additional detention storage
  - swales with check dams
  - rain barrels
  - lot grading and lot-level storage
  - catchbasin restrictors/inlet controls
  - rooftop storage and rooftop gardens
  - parking lot storage

In general, the time of concentration (Tc), in conjunction with the CN, determines the peak discharge rate for a storm event. From theoretical considerations, site and infrastructure components that affect time of concentration and travel time include:

- travel distance (flow path)
- slope of the ground surface and/or water surface
- ground surface roughness
- channel shape and pattern

These concepts can be applied to low impact development practices by using techniques to control the Tc by modifying the following aspects of flow and conveyance within the development:

- maximize sheet flow
- modify or lengthen flow path
- flatter site and lot grades
- open swale BMP
- preserve and maximize site and lot vegetation

In addition to the above techniques, current recommendations under the WWFMP are to maximize infiltration when runoff quality is acceptable and as soil conditions and available space allow, in order to maintain base flow groundwater recharge. Infiltration of stormwater through the soil will generally remove pollutants and sediments and improve water quality. Infiltration systems require pretreatment of the stormwater to remove floatables, larger sediments, or spills, which could cause the infiltration system to clog and fail. To provide the storage and release of stormwater that most closely matches predevelopment conditions, infiltration options should be explored before detention/retention systems.

2. Source Separation of Runoff

Separation of roof runoff from street and parking lot runoff is encouraged. One of the targets for water balance is that essentially all roof runoff be infiltrated or evapotranspired to the extent that essentially very little runoff from roofs will discharge through overland pathways to surface waters. This management strategy assists in achieving water quality targets for discharge of contaminants to surface receiving waters and for sites near the Toronto Waterfront.

3. Green Roof Technologies

Replacing impervious rooftops with green roofs can significantly reduce the volume and rate of runoff from building lots. A layer of absorbent soil and vegetation on top of building can retain rainfall and allow it to evaporate or transpire. Green roofs are not uncommon in many parts of Europe and are becoming more common in North America. They are often applied for reasons other than stormwater management. Engineered green roofs may also provide heating or cooling savings by insulating buildings, as well as aesthetic benefits, air quality benefits, and reductions in the "urban heat island" effect, etc.

Green roofs are generally classified into two categories: extensive green roofs, which typically have a shallow soil profile of 20 to 100 mm and support mosses, grasses and sedums; and intensive green roofs with soil depths greater than 100 mm, able to support substantial vegetation (shrubs, trees, etc.). Intensive green roofs are typically landscaped features that require more maintenance than extensive green roofs. There are many designs of 'Green Roof' technologies, available for different applications.

Many studies have demonstrated quantitatively that a properly installed and maintained green roof will absorb water and release it slowly over a period of time, as opposed to a conventional roof where stormwater

is immediately discharged. Graham and Kim (2003) conducted a study in Vancouver, BC, which showed that suitably designed green roofs have great potential benefit in terms of protecting stream health and reducing flood risk to urban areas. Not only are green roofs able to filter contaminants out of rainwater that has flowed across the roof surface (Dramstad et al., 1996), but they can also treat contaminants, either by direct plant uptake, or by binding them within the growing medium itself (Johnston and Newton, 1996). The amount of stormwater retained by green roofs depends on many factors such as the volume and intensity of rainfall, the amount of time since the previous rainfall event, and the depth and saturation level of the existing substrate (Monterusso, 2003). Typical green roofs can retain 60 to 100% of the stormwater they receive (Thompson, 1998).

The City of Toronto and Ontario Centers of Excellence – Earth and Environmental Technologies (OCE-ETech), formerly CRESTech, formed a partnership to fund a study of the environmental and social benefits of green roofs in the City of Toronto. Federation of Canadian Municipalities provided additional funding for the study from its Green Municipal Fund. Ryerson University was selected over other university teams to research the City-wide benefits of green roofs. The results are documented in the "Report on the Environmental Benefits and Costs of Green Roof Technology for the City of Toronto", prepared by Ryerson University. The Ryerson University completed its report on the monetary values of some of green roofs' important benefits, including mitigating developments' impact on stormwater quality and quantity, improving buildings' energy efficiency, and reducing the urban heat island and thereby improving air quality. This report is accessible at the City of Toronto website (http://www.toronto.ca/greenroofs/findings.htm).

The City of Toronto got involved in two demonstration projects to learn about the technical, financial and information barriers of green roof technology and the two demonstration projects are:

- Eight plots covering more than 300 square meters on the podium roof on Toronto's City Hall building
- 465 square meter green roof on the Eastview Neighborhood Community Centre

The monitoring results from the two sites have been published and the results to date have been positive.

Many green roofs have been constructed but remain unknown since they are located out of sight on rooftops. City staff recently took a survey and counted approximately 59 existing public and private green roofs and 17 more planned or under construction. Some of the larger green roofs installed in the Greater Toronto Area include:

- Toronto Botanical Gardens near Edwards Gardens in Toronto, in 2005 installed a 1400 square foot green roof on an existing building using the Suprema roofing system with a 6-inch planting medium. The green roof does not have an irrigation system and is planted with sedums. It is not accessible to the public.

- Ryerson University in downtown Toronto constructed an 8,000 square feet green roof during the construction of the new Engineering building in 2004

- The University of Ontario located in Oshawa, just east of Toronto in 2004 installed two green roofs which total 9,000 square feet

- York University in north Toronto, in 2001 installed a 20,175 square foot green roof during the construction of the Computer Sciences Building. It is an inaccessible extensive green roof and is part of the site's stormwater management solution. The green roof consists 140 mm of growing medium with alpine grasses and covers approximately 66% of the total roof area. Approximately 3,000 square feet of the green roof is planted with wild flowers. The green roof has been monitored

by the Toronto Region and Conservation Authority since construction. Measurements of climate, soil and runoff quantity data are taken to quantify the stormwater quality and quantity benefits of green roofs.

- The Sears Merchandise Lofts Building in downtown Toronto was converted from a department store to a multi-residential condominium building with a 10,000 square foot intensive green roof, that was installed 2000 with accessible public pathways, decks and eight garden beds

- Mountain Equipment Coop in downtown Toronto installed an extensive green roof of 6,500 square feet during the construction of the building in 1998

- Earth Rangers Centre in Woodbridge just north of Toronto is a leading education, wildlife rehabilitation and research centre with a 15,000 square foot green roof

In addition, Toronto City Council has recently approved $200,000 for the implementation of a Green Roof Pilot Program. The purpose of the program is to encourage construction of a variety of highly visible green roofs by December 2007. In addition, the program will:

- Result in the construction of a variety of green roof types which could be used for education and promotional purposes
- Provide an opportunity to showcase various green roof technologies and planting styles
- Provide a grant of $10 per square metre of eligible green roof area up to a maximum of $20,000

The detail of the pilot program is available at the City of Toronto website:
(http://www.toronto.ca/greenroofs/incentiveprogram.htm).

4. Rainwater Harvesting (Re-use)

Rainwater harvesting (re-use) can provide several stormwater management benefits:

- **Flow control:** In areas where on-site infiltration is not feasible and the only means of stormwater destination is off-site flow to a combined sewer system, rainwater harvesting (re-use) can provide significant flow reduction benefits. Depending on the size of the water storage facility and the rate of use, a significant percentage of the annual runoff volume can be re-used. Where it is not feasible to meet a development site's full flow control obligation, rainwater harvesting can be used to manage a portion of the flow and lessen the overall flow control requirement.

- **Pollution reduction:** Where it is not feasible to meet a development site's full pollution reduction obligation, rainwater harvesting can be used to manage a portion of the flow and lessen the overall pollution reduction requirement.

The benefits of rainwater re-use go beyond stormwater management. Rainwater re-use can also reduce the amount of water drawn from lakes and reservoirs and reduce the costs of water supply infrastructure. Toronto and many North American cities have embarked upon programs to reduce water consumption and this

initiative is referred to as water conservation. Toronto has recently completed a Water Efficiency Master Plan (WEMP 2003), which has set an objective of reducing water consumption by 15% by 2011. The Water Efficiency Master Plan focuses on reducing water demand, particularly at peak hours.

Rainwater re-use/harvesting strategies have been implemented in various forms and sophistication throughout the world. A recent Rainwater Harvesting Workshop was held in Metro Hall on May 24, 2005, organized by Toronto Water. In an ongoing effort to meet the goals and objectives of the Wet Weather Flow Management Master Plan as adopted by Toronto City Council, Toronto Water is promoting the development of Rainwater Harvesting. The harvesting concept takes the issue of stormwater control one-step further by not only managing the pathways taken by runoff to receiving waters, but also actually diverting it to on-site non-potable use. Currently, the application of water harvesting is under development for three development sites in cooperation with the City. These sites are the Better Living Building at Exhibition Place, a private condominium development in the Yonge and Eglington area and the Horticulture Building at the Metro Zoo.

Current discussions on the application of rainwater harvesting at these sites include recharge of air-conditioning cooling towers, irrigation and toilet flushing, etc.

Some of the general on-site techniques may include:

- Building grey water collection
  - for toilet flushing
  - for irrigation

- Roof runoff collection
  - for toilet flushing
  - for irrigation

- Surface runoff collection
  - for toilet flushing
  - for irrigation

Re-using rainwater for irrigation could achieve the mutual targets of reducing runoff and eliminating the need for any potable water source for lawn watering, which is consistent with the Wet Weather Flow Management Master Plan (WWFMMP) and Water Efficiency Master Plan (WEMP) objectives. For rainwater re-use on single-family residential land uses, rooftop runoff is normally stored in rain barrels. For re-use on multiple family, commercial or institutional land uses, rooftop runoff is typically stored in cisterns or detention tanks. Rainwater re-use systems can also be combined with infiltration facilities. For example, in catchments where maintaining stream base flows is a key objective, first priority may be given to groundwater recharge, with only surplus water applied to in-building re-use. The proponent for a development shall provide in their Stormwater Management Report/Plan with information on how they would address the mutual targets of reducing runoff and eliminating the need for any potable water source for lawn watering, consistent with the WWFMMP and WEMP objectives. There could be a scenario that the proposed undertaking makes a beneficial contribution to addressing the City's WEMP objectives but does not completely achieve

WWFMMP targets listed in the Interim Guidelines, the City may take this contribution into consideration in assessing the off-site compensation schemes and/or trade-offs.

5. Absorbent Landscaping

Surface soil structure plays a fundamental role in stormwater management. Minimizing surface soil disturbance and using absorbent landscaping can significantly reduce the volume and rate of runoff from developed areas.

In a natural condition, surface soil layers are highly permeable. Surface plants provide a layer of organic matter, which populations of earthworms and microbes stir and mix into the soil. This soil ecosystem provides high infiltration rates and a basis for interflow that supports the base flow needs of aquatic ecosystems.

In an urbanized condition, it is common practice to remove the surface soil layers, to regrade and heavily compact the site, and then to replace only a thin layer (often 50 mm or less) of imported topsoil. This practice creates a surface condition that results in significant amount of runoff from lawn and landscaped areas.

According to a document entitled, "Stormwater Planning: A Guidebook for British Columbia, updated September 6, 2005", it suggests that runoff from landscaped areas can be virtually eliminated by providing a 300 mm layer of landscaping absorbent soil, even under very wet conditions where the hydraulic conductivity of the underlying soil is low. For illustration purposes, Figures 5.1, 5.2 and 5.3 show the benefits of absorbent landscaping in terms of runoff volume and peak flow rate reductions (excerpts from Chapter 7 of Stormwater Planning: A Guidebook for British Columbia, updated September 6, 2005). Figure 5.3 shows that absorbent landscaping is particularly beneficial in terms of reducing peak runoff rates. During large rainfall events, disturbed soil can generate nearly as much runoff as impervious surfaces, whereas surface areas with an absorbent soil layer (300 mm depth) can continue to absorb rainfall and can virtually eliminate surface runoff even in very wet conditions. Therefore, it is suggested that absorbent soil can significantly reduce peak runoff rates from most storm events, especially for land uses with large amounts of undeveloped space.

Targets and Criteria for Absorbent landscaping

- On-site pervious and/or undeveloped areas shall be "self-mitigating" (i.e. meet or help to meet rainfall capture and runoff control targets)
- Minimum depth of absorbent soil for on-site pervious / landscaping area = 300 mm
- Must meet City of Toronto standards for landscaping soil. The range of acceptable soil textures is shown below:

Typical Design Soil	
Sand	60- 70%
Silt	20- 40%
Clay	5- 10%
Organic Matter	2- 5%
pH= 7.5 or less	

P.S. Peter Simon, Planner of the City's Urban Forestry Department has agreed in principles and will provide further input into this section.

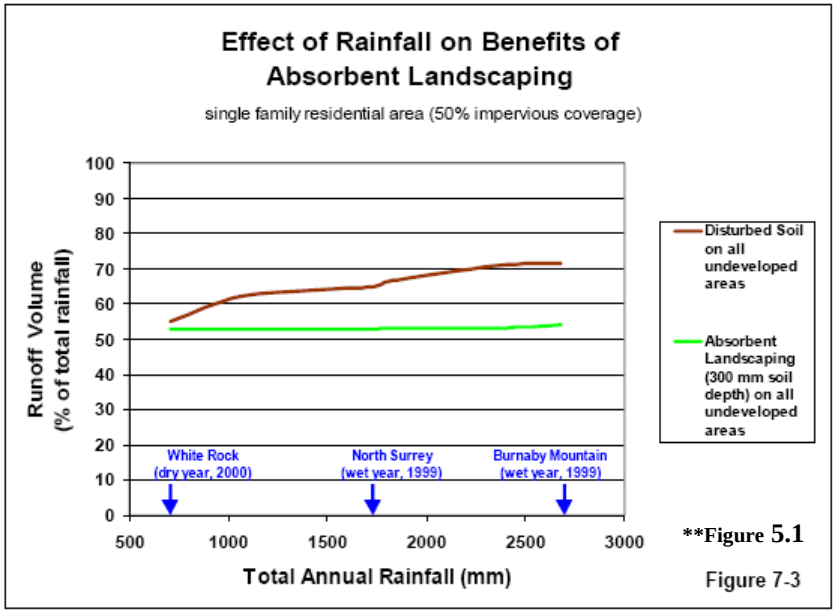


**Figure 5.1

Figure 7-3

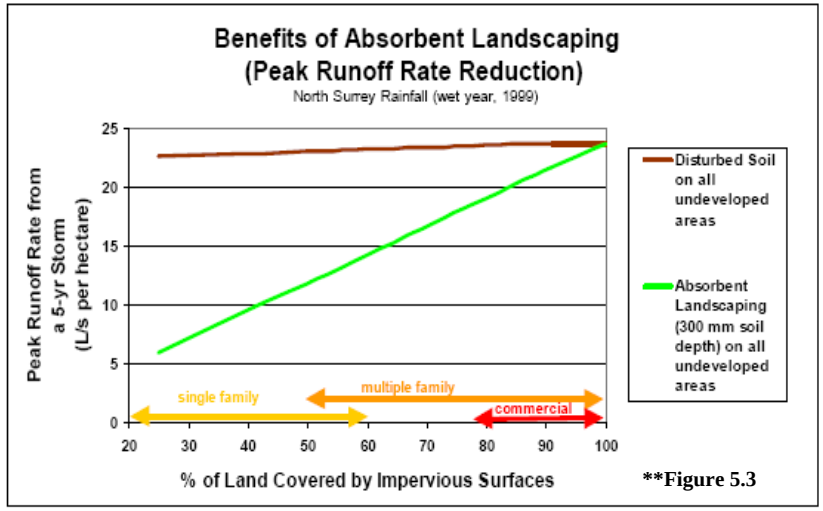


**Figure 5.3

** Excerpts from Chapter 7 of Stormwater Planning: A Guidebook for British Columbia (Updated September 6, 2005)

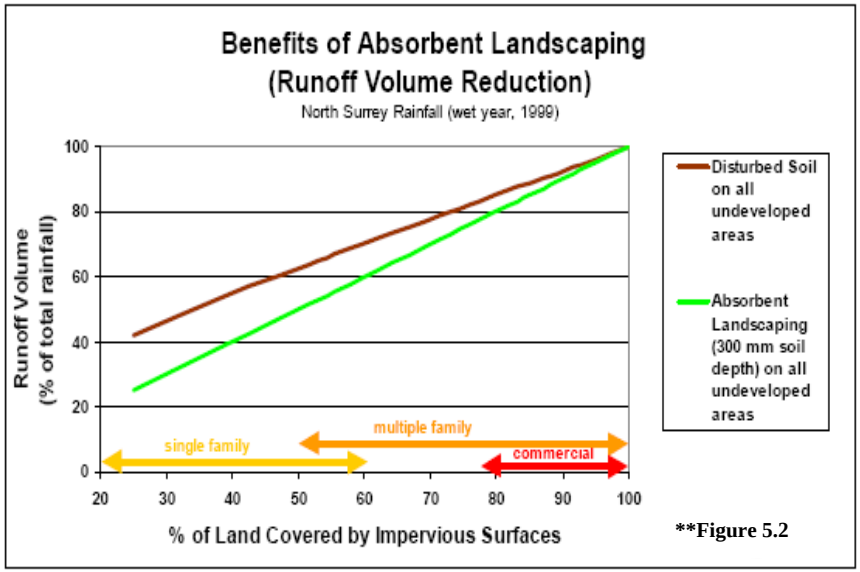


**Figure 5.2

APPENDIX G

Summary of [(1)] Sewer Use By-Law Sections Relevant to Storm Sewers Excerpts

(Table of Contents)

(1) The Amendments to the Toronto Municipal Code Chapter 681- Sewers, Article I, Sewage and Land Drainage (Sewer Use By-Law No. 457- 2000), approved by the Works Committee (October 11, 2005) and by City Council (October 26,27,28,31, 2005)

1. Definitions	*§ 681-1*

Refer to original document.

2. Prohibition of dilution	***§* 681-3**

No person shall discharge directly or indirectly or deposit or cause or permit the discharge or deposit of sewage into a sanitary sewer, combined sewer, storm sewer, municipal or private sewer connection to any sanitary sewer, combined sewer or storm sewer in circumstances where water has been added to the discharge for the purposes of dilution to achieve compliance with § 681-2 or 681-4 of this article.

3. Storm sewer requirements	*§ 681-4: A, B, C, D, E, F, G, H, I, J, Table 2*

No person shall discharge or deposit or cause or permit the discharge or deposit of matter of any type into a storm sewer, watercourse, municipal or private sewer connection to any storm sewer which may or could:

A. Interfere with proper operation of a storm sewer.

B. Obstruct or restrict a storm sewer or the flow therein.

C. Damage a storm sewer.

D. Result in any hazard or other adverse impact to any person, animal, property or vegetation.

E. Contravene or result in the contravention of a certificate of approval or provisional certificate of approval issued under the Ontario Water Resources ***Act*** [8] or the Environmental Protection Act (Ontario)[9] with respect to the storm sewer, its discharge, or both the sewer and its discharge. [***Amended 2000-10- 05 by By-law No. 869-2000]***

F. Have one or more of the following characteristics:

(1) Visible film, sheen or discolouration.

(2) Two or more separate layers.

(3) A pH less than 6.0 or greater than 9.5.

(4) A temperature greater than 40 degrees Celsius.

G. Contain one or more of the following:

(1) Acute hazardous waste chemicals.	(11) Pathological waste.
(2) Blowdown water.	(12) PCBs
(3) Combustible liquids.	(13) Pesticides.
(4) Floating debris.	(14) Reactive waste.
(5) Fuel.	(15) Severely toxic waste.
(6) Hauled sewage.	(16) Sewage

(7) Hauled waste.	(17) Waste radioactive prescribed substances.
(8) Hazardous industrial waste	(18) Waste disposal site leachate.
(9) Hazardous waste chemicals.	(19) A substance from raw materials, intermediate or final product, used or produced in, through or from an industrial process
(10) Ignitable waste.	(20) A substance used in the operation or maintenance of an industrial site.

H. Contain E. coli colonies in excess of 200 per 100 mL.

I. Contain contaminants from raw materials, intermediate or final products or wastewater from an industrial operation.

J. Contain a concentration, expressed in milligrams per litre, in excess of any one or more of the limits in Table 2 of this article entitled "Limits for Storm Sewer Discharge."

Table 2 — *Limits for Storm Sewer Discharge*

Parameter Limit	***(mg/L)***	***Parameter Limit***	***(mg/L)***
Biochemical oxygen demand	15	Toluene	0.002
Cyanide (total)	0.02	Trichloroethylene	0.0076
Phenolics (4AAP)	0.008	Xylenes (total)	0.0044
Phosphorus (total)	0.4	Di-n-butyl phthalate	0.015
Suspended solids (total)	15	Bis (2-ethylhexyl) phthalate	0.0088
Arsenic (total)	0.02	Nonylphenols	0.001
Cadmium (total)	0.008	Nonylphenol ethoxylates	0.01
Chromium (total)	0.08	Aldrin/dieldrin	0.00008
Chromium (hexavalent)	0.04	Chlordane	0.04
Copper (total)	0.04	DDT	0.00004
Lead (total)	0.12	Hexachlorobenzene	0.00004
Manganese (total)	0.05	Mirex	0.04
Mercury (total)	0.0004	PCBs	0.0004
Nickel (total)	0.08	3,3'-dichlorobenzidine	0.0008
Selenium (total)	0.02	Hexachlorocyclohexane	0.04
Silver (total)	0.12	Pentachlorophenol	0.002
Zinc (total)	0.04	Total PAHs	0.002
Benzene	0.002		
Chloroform	0.002		
1,2-dichlorobenzene	0.0056		
1,4-dichlorobenzene	0.0068		
Cis-1,2-dichloroethylene	0.0056		
Trans-1,3-dichloropropylene	0.0056		
Ethyl benzene	0.002		
Methylene chloride	0.0052		
1,1,2,2-tetrachloroethane	0.017		
Tetrachloroethylene	0.0044		

4. Spills	*§ 681-9* *A, B,C,D*

A. In the event of a spill to a sewage works, the person responsible or the person having the charge, management and control of the spill shall immediately notify the Commissioner and provide any information with regard to the spill that is requested. [***Amended 2000-10-05 by By-law No. 869-2000]***

B. The person shall provide a detailed report on the spill to the Commissioner, within five days after the spill, containing the following information to the best of his or her knowledge:

(1) Location where spill occurred;

(2) Name and telephone number of the person who reported the spill and the location and time where they can be contacted;

(3) Date and time of spill;

(4) Material spilled;

(5) Characteristics of material spilled;

(6) Volume of material spilled;

(7) Duration of spill event;

(8) Work completed and any work still in progress in the mitigation of the spill; and [***Amended 2000-10-05 by By-law No. 869-2000]***

(9) Preventive actions being taken to ensure a similar spill does not occur again.

C. The person responsible for the spill and the person having the charge, management and control of the spill shall do everything reasonably possible to contain the spill, protect the health and safety of citizens, minimize damage to property, protect the environment, clean up the spill and contaminated residue and restore the affected area to its condition prior to the spill. ***[Amended 2000-10-05 by By-law No. 869- 2000]***

D. Industries at whose premises a spill has occurred which are required to have a plan pursuant to § 681-5 of this article shall prepare an updated plan and plan summary incorporating the information set out in Subsection B and shall submit the plan summary so updated to the Commissioner within 30 days of the spill.

5. General	*§ 681-10*
➢ ***Maintenance access hole***	***A***
➢ ***Grease/oil interceptors***	***B, C***
➢ ***Sediment interceptors***	***D***
➢ ***Garbage Grinders***	***E***
➢ ***Right of entry***	***F***
➢ ***Protection from damage***	***G***
➢ ***Damage to the sewage works***	***H***
➢ ***Unauthorized entry to sewage works***	***I***
➢ ***Dental waste amalgam separator***	***J***

A. Maintenance access hole.

(1) The owner or operator of commercial, institutional or industrial premises or multi-storey residential buildings with one or more connections to a sewage works shall install and maintain in good repair in each connection a suitable maintenance access hole to allow observation, sampling and flow measurement of the sewage, uncontaminated water or storm water therein, provided that, where installation of a maintenance access hole is not possible, an alternative device or facility may be substituted with the prior written approval of the Commissioner.

(2) The maintenance access hole or alternative device shall be located on the property of the owner or operator of the premises, as close to the property line as possible, unless the Commissioner has given prior written approval for a different location.

(3) Each maintenance access hole, device or facility installed as required by Subsection A(2) shall be designed and constructed in accordance with good engineering practice and the requirements of the City of Toronto Water and Wastewater Services Standard Construction Specifications and Drawings for Sewers and Watermains, as it may be amended from time to time, and shall be constructed and maintained by the owner or operator of the premises at his or her expense. [***Amended 2002-10-31 by By-law No. 855-2002]***

(4) The owner or operator of an industrial, commercial or institutional premises or a multi-storey residential building shall at all times ensure that every maintenance access hole, alternative device or facility installed as required by Subsection A(1) is accessible to the Commissioner for the purposes of observing, sampling and flow measurement of the sewage, uncontaminated water or storm water therein. [***Amended 2000-10-05 by By-law No. 869- 2000; 2002-10-31 by By-law No. 855-2002]***

(5) The provisions of Subsections A (1) to (4) inclusive do not apply to those who own or operate dental offices. Dental offices shall provide a sampling port consisting of a valve, tap, or similar device consistent with technical guidelines that the Commissioner may establish from time to time. [***Added 2002-10-31 by By-law No. 855-2002]***

B. Food-related grease interceptors. [Amended ***2002-10-31 by By-law No. 855-2002]***

(1) Every owner or operator of a restaurant or other industrial, commercial or institutional premises where food is cooked, processed or prepared, which premises is connected directly or indirectly to a sewer, shall take all necessary measures to ensure that oil and grease are prevented from entering the sewer.

(2) The owner or operator of a premises as set out in Subsection B(1) shall install, operate, and properly maintain a grease interceptor in any piping system at its premises that connects directly or indirectly to a sewer. The grease interceptors shall be installed in compliance with the most current requirements of the Ontario Building Code.

C. Interceptors for motor oil and lubricating grease. [***Amended 2000-10-05 by By-lawNo. 869-2000; 2002-10-31 by By-law No. 855-2002]***

(1) Every owner or operator of a motor vehicle service station, repair shop or garage or of an industrial, commercial or institutional premises or any other establishment where motor vehicles are repaired, lubricated or maintained and where the sanitary discharge is directly or indirectly connected to a sewer shall install and maintain an oil interceptor designed to prevent motor oil and lubricating grease from passing into the drainage piping which is connected directly or indirectly to a sewer.

(2) The owner or operator of a premises as set out in Subsection C(1) shall install, operate, and properly maintain an oil interceptor in any piping system at its premises that connects directly or indirectly to a sewer. The oil interceptors shall be installed in compliance with the most current requirements of the Ontario Building Code.

D. Sediment interceptors. [***Amended 2002-10-31 by By-law No. 855-2002]***

(1) Every owner or operator of a premises from which sediment may directly or indirectly enter a sewer, including but not limited to premises using a ramp drain or area drain and car and vehicle wash establishments, shall take all necessary measures to ensure that such sediment is prevented from entering the drain or sewer.

(2) Catch basins installed on private property for the purposes of collecting storm water and carrying it into the storm sewers shall be equipped with goss traps or an equivalent and the installation of these catch basins on private property shall comply with the City of Toronto Water and Wastewater Services Standard Construction Specifications and Drawings for Sewers and Watermains, as it may be amended from time to time.

(3) No combination of a maintenance access hole and catch basin shall be installed on private property.

E. Garbage grinders. [***Amended 2002-10-31 by By-law No. 855-2002]***

(1) No person shall install or operate within the City any garbage grinding devices for domestic purposes, the effluent from which will discharge directly or indirectly into a storm or combined sewer.

(2) In the case of industrial, commercial or institutional properties where garbage grinding devices are installed in accordance with the Building Code, the effluent from such garbage grinding devices must comply with § 681-2.

F. Right of entry. [Amended ***2001-12-06 by By-law No. 1109-2001]***

No person shall prevent, hinder, obstruct or interfere in any way with the Commissioner or an inspector and persons deemed, by the Commissioner, to be essential to an inspection and sampling, bearing proper credentials and identification, from, for the purposes of administering or enforcing this article:

(1) Entering in or upon, at any reasonable time without a warrant, any land or premises, except land or premises being used as a dwelling house;

(2) Making such tests or taking such samples as the Commissioner or an inspector deems necessary; or

(3) Inspecting or observing any plant, machinery, equipment, work, activity or documents.

G. Protection from damage.

No person shall uncover, make any connection with, or opening into, break, alter, damage, destroy, deface or tamper or cause or permit the breaking, damaging, destroying, defacing or tampering with:

(1) Any part of a sewage works; or

(2) Any permanent or temporary device installed in a sewage works for the purposes of flow measuring, sampling and testing of sewage, uncontaminated water or storm water.

H. Damage to the sewage works.

Any person discharging sewage, uncontaminated water or storm water to the municipal sewage works shall be responsible for ensuring that such sewage, uncontaminated water or storm water conforms at all times to the provisions of this article and shall be liable for any damage or expense arising out of his or her failure to properly check and control such discharge, including the cost of investigation, repairing or replacing any part of any municipal sewage works damaged thereby.

I. Unauthorized entry to sewage works.

Unless specifically authorized by the Commissioner, no person shall enter any sewage works.

J. Dental waste amalgam separator.

(1) Every owner or operator of a premises from which dental amalgam may be discharged, which waste may directly or indirectly enter a sewer, shall install, operate and properly maintain dental amalgam separator(s) in any piping system at its premises that connects directly or indirectly to a sewer by no later than January 1, 2002, except where the sole dental-related practice at the premises consists of one or more of the following specialties or type of practice: ***[Amended 2005-10-28 by By-law No. 867-2005]***

(a) Orthodontics and dentofacial orthopaedics;

(b) Oral and maxillofacial surgery;

(c) Oral medicine and pathology;

(d) Periodontics; or

(e) A dental practice consisting solely of visits by a mobile dental practitioner who prevents any dental amalgam from being released directly or indirectly to the sewage works.

(2) Notwithstanding Subsection J(1), any person operating a business from which dental waste amalgam is or will be discharged directly or indirectly to a sewer, at premises which are constructed or substantially renovated on or after the date that this article comes into force, shall install, operate and properly maintain dental waste amalgam separator(s) in any piping system which is connected directly or indirectly to a sewer.

(3) Notwithstanding compliance with Subsection J, all persons operating or carrying on the business of a dental practice shall comply with § 681-2A(4) of this article.

6. Sewer Connections	***§ 681-11***
➢ ***Restrictions***	***A, B, J***
➢ ***Existing sub-standard municipal sewer connection***	***C***
➢ ***Reconstructed buildings***	***D***
➢ ***Existing sewer connections in contravention of Article I.***	***E, F***
➢ ***Application for a sewer connection***	***G***
➢ ***Sewer connections on public or private property***	***H***
➢ ***Methods and materials used in construction of sewer connections***	***I, L***
➢ ***Roof water leaders/downspouts***	***M, Q, S***
➢ ***Catchbasins installed on private driveways***	***O, P***
➢ ***Groundwater drainage system***	***R***
➢ ***Private swimming pool water***	***T, U***

Restrictions

A. No person shall:

(1) Erect or cause or permit to be erected any new building unless the new building is connected to the sanitary sewer or combined sewer for sanitary drainage purposes; and [***Amended 2002-10-31 by By-law No. 855-2002]***

(2) Construct, install, maintain or cause or permit to be constructed, installed or maintained, whether installed prior to the date of the passing of this article or any of its predecessors, a direct or indirect connection to the sanitary sewer connection which would permit anything other than domestic and industrial sewage to discharge into the sanitary sewer connection.

B. No sewer connection shall be constructed on any road allowance, easement, or other public land, except by the City or under a contract, agreement, or undertaking satisfactory to the Commissioner. The owner of the building shall be responsible for the cost of the sewer connection. [***Amended 2002-10-31 by By-law No. 855-2002]***

J. No person shall install double municipal sewer connections servicing two or more properties. A single set of service connections will be allowed for a property with multiple units, subject to the approval of the City.

Existing sub-standard municipal sewer connection

C. In those cases where the existing municipal sewer connection does not meet the current standard therefor as adopted by the City from time to time as a result of a resubdivision of lots or change in location of a building on a lot or the construction of a new or reconstructed building, the owner or agent shall apply to the City for a new installation or installations and for the disconnection of the existing sewer connections, where necessary, and to pay to the City the cost of such work on an actual cost basis with a minimum charge equal to the applicable flat rate, as determined by the City from time to time. [***Amended 2005-10-28 by By-law No. 867-2005]***

Reconstructed buildings

D. Reconstructed buildings.

(1) Whenever an existing building is substantially demolished, the existing municipal sewer connections shall be disconnected by the City at the municipal sewers at the expense of the owner of the building. The owner applying for the permit to construct the replacement building shall be required to apply and pay the City for the installation of new municipal sewer connections.

(2) For the purposes of this section, an existing building is substantially demolished when more than 50 percent of the exterior walls of the first storey above grade are removed, whether or not they are subsequently replaced.

(3) An owner who is applying for a permit to construct a replacement building or to disconnect a dwelling from a septic tank to connect to a sanitary sewer connection shall be entitled to use an existing municipal sewer connection which, upon inspection by the General Manager, is found to be in accordance with current Toronto Water Standard Construction Specifications and Drawings for Sewers and Watermains, provided that there is no history of sewer connection maintenance problems on public property between the sewer main and private property. The applicant shall pay for the cost of the above inspection, and any other applicable City fees in relation to the connection, the amount of which shall be determined from time to time by the City. [***Amended 2005-10-28 by By-law No. 867-2005]***

Existing sewer connections in contravention of Article I.

E. In the event that a sewer connection is installed or operated in contravention of any provision of this article, the Commissioner may, until such time as the violations are rectified, order the temporary disconnection of such sewer connection. During any disconnection in accordance with this section, no person shall use or cause or permit the use of such a connection.

F. The Commissioner shall not order such temporary disconnection unless the Commissioner has first mailed to the property owner and occupant, if any, a registered letter specifying the nature of the violation or violations of this article and indicating the intention of the Commissioner to order temporary disconnection of the sewer 30 days after the date of mailing, unless the Commissioner is satisfied that the violation or violations set out in the notice will be rectified within that time. The cost of the disconnection and reconnection shall be borne by the property owner and shall be payable to the City before any reconnection is made.

Existing sewer connections in contravention of Article I.

G Any person desiring a sewer connection shall make an application for such connection on forms supplied by the Commissioner and accompanied by such plans as may be required and pay a fee for the application. The owner of the property to be served, or the owner's agent, shall sign the application, and the owner shall be responsible for the completeness and accuracy of the information furnished on such application and plans. [***Amended 2002-10-31 by By-law No. 855-2002]***

Sewer connections on public or private property

H. Sewer connections on public or private property. [***Amended 2002-10-31 by By-law No. 855-2002]***

(1) A sewer connection on public property between the sewer main and private property shall be installed:

(a) By the City at the expense of the owner on conditions and rates determined from time to time by the City; or

(b) With the prior written consent of the Commissioner, by the owner of the property, at the property owner's expense under a contract, agreement, or undertaking satisfactory to the Commissioner, in compliance with the City of Toronto Water and Wastewater Services Standard Construction Specifications and Drawings for Sewers and Watermains, as it may be amended from time to time.10

(c) If required by the General Manager, subject to the execution of an agreement between the owner and the City setting out such terms and conditions as the General Manager may determine are appropriate, and the General Manager shall have the authority to execute any such agreement. [***Added 2005-10-28 by By-law No. 867-2005]***

(2) Sewer connections on private property shall be installed by the owner pursuant to a building permit having been issued for such purpose by the Chief Building Official of the City and in compliance with the City of Toronto

Methods and materials used in construction of sewer connections.

I. Methods and materials used in the construction of sewer connections shall resist entry of roots and acid or alkali damage, and otherwise be in accordance with requirements determined by the Commissioner from time to time. ***[Amended 2002- 10-31 by By-law No. 855-2002]***

L. In the event that any person constructs a municipal sewer connection in a manner other than provided for in this section, the Commissioner may order the reexcavation of the connection for the purpose of inspection and testing and, if necessary, reconstruction of the work, and the Commissioner may have these works performed at the expense of the owner or disconnect the sewer connection, in which case it shall not be reconnected except with the approval of the Commissioner***. [Amended 2000-10-12 by By-law No. 958-2000; 2002-10-31 by By-law No. 855- 2002]***

Roof water leaders/downspouts

M. The owner of any building erected upon lands that abut on a street which is not serviced by a storm sewer shall construct a down-pipe from the eavestrough that shall discharge the water at grade with provisions to prevent soil erosion and shall conduct the storm water away from the building in such a manner that the storm water will not accumulate at or near the building and will not adversely affect adjacent properties.

Q. Inflow and infiltration of storm water into sanitary sewer system. ***[Amended 2002- 10-31 by By-law No. 855-2002]***

(1) The owner of any building which has a roof water leader discharging storm water, either directly or indirectly, into the sanitary sewer connection shall disconnect the down-pipe from the underground portions at grade and shall conduct the storm water away from the building in such a manner that the storm water will not accumulate at or near the building and will not adversely affect adjacent properties.

(2) For the purposes of this section:

(a) "Directly" shall mean by any physical connection or series of connections between the roof water leader and the sanitary sewer system.

(b) "Indirectly" shall mean in any manner whatsoever whereby storm water enters the sanitary sewer system, and for the greater certainty includes any situation where open joints in underground sewer connections on private property permit storm water to infiltrate the sanitary sewer system.

(3) An owner may request the General Manager to conduct an inspection by means of an excavation or closed circuit television inspection to determine the source of inflow or infiltration into the sanitary sewer system. The terms of § 681-11 H(4) shall apply to any such investigation***. [Amended 2005-10-28 by By-law No. 867-2005]***

(4) If, as a result of the inspection pursuant to Subsection Q(3), the Commissioner determines that the infiltration of storm water into the sanitary sewer system occurs solely as a result of a structural problem in the City's portion of the connection, the provisions of Subsection Q(1) will not apply to the owner with respect to the premises in relation to which the inspection was performed.

(5) If, as a result of the inspection pursuant to Subsection Q(3), the Commissioner determines that the infiltration of storm water into the sanitary sewer system occurs as a result of structural problems in both the City's portion of the connection and the owner's portion of the connection, the provisions of Subsection Q(1) will not apply to the owner with respect to the premises in relation to which the inspection was performed, and the deposit will be refunded if the owner completes repairs to the owner's portion of the connection to correct deficiencies in that portion of the connection identified in the inspection.

S. Storm water drainage. [***Amended 2002-10-31 by By-law No. 855-2002; 2005-10-28 by By-law No. 867-2005]***

(1) No person shall construct, install or maintain, or cause or permit to be constructed, installed or maintained, drainage from any roof water leader or downspout that conveys storm water from any new or reconstructed residential, industrial, commercial or institutional buildings directly or indirectly to a sanitary, combined or storm sewer connection for the purpose of storm water drainage. Storm water shall be discharged at grade away from the building in such a manner that the storm water will not accumulate at or near the building and will not adversely affect adjacent properties.

(2) Where compliance with Subsection S(1) compromises or creates a hazardous situation, an application may be made to the Commissioner for an exemption from the provisions of Subsection S(1).

Catchbasins installed on private driveways

O. Where a catch basin has been installed on private property to drain storm water from a driveway which slopes towards any structure located on the property, the catch basin shall be connected to the City storm sewer where such is available, and the installation shall include: ***[Amended 2000-10-12 by By-law No. 958-2000; 2002-10-31 by By-law No. 855-2002]***

(1) A flap gate backwater valve installed directly downstream of the private catch basin, so that no storm water may back up from the City storm sewer into the private catch basin; and

(2) A sump pump, located in the overflow sump, to discharge any storm water which has collected in the catch basin while the above flap gate backwater valve has closed to prevent a backup of storm water.

P. Flap gate backwater valve and sump pumps required pursuant to Subsection O shall be installed and maintained by the owner or operator of the premises at his or her expense.

Groundwater drainage system

R. Groundwater drainage system***. [Amended 2002-10-31 by By-law No. 855-2002; 2005-10-28 by By-law No. 867-2005]***

(1) No owner of industrial, commercial or institutional premises shall do anything which may increase design peak flow rates of storm water or impair the quality of storm water discharged to a storm sewer.

(2) The direct connection of any new private sewer connection to the municipal storm sewer is prohibited for any new or reconstructed residential, industrial, commercial or institutional buildings.

(3) An owner may make an application to the General Manager for an exemption from the provisions of Subsection R(2), and the General Manager may permit a connection that does not comply with Subsection

R(2) where there is no practical alternate means of drainage available, and compliance with Subsection R(2) is not feasible.

(4) Before considering a request for an approval pursuant to Subsection R(3), the owner or operator of multi-unit residential, industrial, commercial or institutional premises shall be required to submit to the Commissioner for approval a storm water management report identifying the storm water quantity and quality control measures being proposed for the site.

(5) No direct connection or indirect interconnection between the private storm drainage system and the private sanitary drainage system is permitted.

(6) The groundwater drainage system set out in Subsection R shall be installed and maintained by the owner or operator of the premises, at his or her sole expense.

Private swimming pool water

T. Private swimming pool water. [***Amended 2000-10-12 by By-law No. 958-2000; 2002-10-31 by By-law No. 855-2002]***

(1) The waste water from a swimming pool or wading pool shall not be discharged:

(a) Into a storm drainage system;
(b) Such that it flows onto an adjoining property;
(c) Over a valley/ravine wall; and
(d) Such that it may cause erosion or instability of the valley or ravine slope.

(2) The waste water from a swimming pool or wading pool shall either be transported away by an appropriately licensed waste hauler or be discharged either by way of a temporary connection to the sanitary sewer or by way of controlled discharged to the owner's property such that the discharge is at all times contained within the property until it evaporates or infiltrates into the ground.

U. Notwithstanding Subsection T, the rain water resting on a tarp which covers a swimming pool may be discharged to a storm sewer, subject to § 681-4 of this article.

7. Confidential Information	***§ 681-12 A, B***

A. All information submitted to and collected by the City that is contained in plan summaries, reports, surveys, monitoring and inspection and sampling activities will, except as otherwise provided in this section, be available for disclosure to the public in accordance with the Municipal Freedom of Information and Protection of Privacy Act (MFIPPA).12

B. In the event that any person in submitting information to the City or to the Commissioner in any form, as required under this article, where such information is confidential or proprietary or otherwise, may be exempt from disclosure under MFIPPA, the person submitting the information shall so identify that information upon its submission to the City or the Commissioner and shall provide sufficient details as to the reason for its purported exemption from disclosure.

8. Self-monitoring, sampling and reporting requirements for industrial premises	***§ 681-13 A, B, C***

A. Every owner of an industrial premises shall carry out any monitoring and sampling of any discharge to a sewer, as may be required in writing by an inspector, and provide the results to the inspector in a format acceptable to the inspector within the time specified by the inspector.

B. An inspector may require that samples obtained under Subsection A be submitted by the owner for analysis by an accredited laboratory, at the owner's expense.

C. The owner shall supply the results of the analysis in Subsection B to the inspector in a format acceptable to the inspector within the time specified by the inspector.

9. Offences	***§ 681-14*** ***A, A1, B, B1, C, D***

A. Every person other than a corporation who contravenes any provision of § 681-2, 681-3 or 681-4 of this article is guilty of an offence and on conviction is liable, for every day or part thereof upon which such offence occurs or continues, to a fine of not more than $10,000 for a first offence and $20,000 for any subsequent conviction.

A.1. Every person other than a corporation who contravenes any provision of Section 2 or 3 of By-law No. 153-89 of the former Municipality of Metropolitan Toronto is guilty of an offence and, on conviction, is liable for every day or part thereof upon which such offence occurs or continues to a fine of not more than $5,000 for a first offence and $10,000 for any subsequent conviction. ***[Added 2001-02-01 by By-law No. 81-2001]***

B. Every corporation which contravenes any provision § 681-2, 681-3 or 681-4 of this article is guilty of an offence and on conviction is liable, for every day or part thereof upon which such offence occurs or continues, to a fine of not more than $50,000 for a first offence and $100,000 for any subsequent conviction.

B.1. Every corporation which contravenes any provision of Section 2 or 3 of By-law No. 153-89 of the former Municipality of Metropolitan Toronto is guilty of an offence and, on conviction, is liable for every day or part thereof upon which such offence occurs or continues to a fine of not more than $25,000 for a first offence and $50,000 for any subsequent conviction. ***[Added 2001-02-01 by By-law No. 81- 2001]***

C. Notwithstanding Subsections A and B, every person who contravenes any provision of any other section of this article is guilty of an offence and on conviction is liable, for every day or part thereof upon which such offence occurs or continues, to a fine of not more than $5,000.

D. In this article, "subsequent conviction" means a conviction for an offence which offence occurs after the date of conviction for an earlier offence under this article or the former Municipality of Metropolitan Toronto By-law No. 153-89, as amended.

10. Repealer; impact on existing agreements; effective dates	***§ 681-15*** ***A, B, C, D, E***

A. Former City of Toronto By-law No. 78-91, A By-law Respecting Sewers and the Discharge and Deposit of Sewage and Land Drainage; former City of North York By-law No. 31442, as amended, A By-law regulating the discharge of sewage and land drainage to the municipal sanitary and storm sewer system; former City of Scarborough By-law No. 17777, A By-law to regulate the discharge into public sewers of sewage and storm water, including industrial wastes; former City of Etobicoke By-law No. 1994-23 Sewer Use By-law; former City of York By-law No. 2880-94, To Regulate the discharge of sewage and land drainage in the City of York; former Borough of East York By-law No. 100-90, To regulate the discharge and deposit of sewage and land drainage in the Borough of East York; and Chapter 292, Sewers, Article III, of the Municipal Code of the former City of Toronto, are hereby repealed***. [Amended 2001-02-01 by By-law No. 81-2001]***

B. Notwithstanding § 681-15A, industrial waste surcharge agreements and sanitary discharge agreements entered into by the former Municipality of Metropolitan Toronto, or a compliance program issued by the Commissioner or a compliance program agreement entered into by the City pursuant to the provisions of the former Metro Toronto By-law No. 153-89, as amended, and in effect immediately prior to the passage of this article, remain in force in accordance with their terms and conditions. ***[Amended 2000-10-05 by By-law No. 869-2000]***

C. This article, with the exception of §§ 681-2 and 681-4, shall come into force on the 6th day of July, A.D. 2000. Sections 681-2 and 681-4 of this article shall come into force on November 1, 2002. ***[Amended 2002-06-20 by By-law No. 547-2002]***

D. By-law No. 153-89 of the former Municipality of Metropolitan Toronto, a By-law "To regulate the discharge of sewage and land drainage in the Metropolitan Area," with the exception of Sections 2 and Section 3, is hereby repealed. Sections 2 and 3 of By-law No. 153-89 of the former Municipality of Metropolitan Toronto shall be deemed to be in force, throughout the City of Toronto until November 1, 2002. Sections 2 and 3 of the former Municipality of Metropolitan Toronto By-law No. 153-89 are repealed as of November 1, 2002***. [Amended 2001-02-01 by By-law No. 81-2001; 2002-06-20 by By-law No. 547-2002]***

E. Former Metropolitan Toronto By-law No. 96-80, as amended, a by-law to regulate the discharge of water obtained from a private water works system into the Metropolitan sewer system and to charge a rate therefore, is repealed***. [Added 2002- 10-31 by By-law No. 855-2002]***

CHAPTER 681, ARTICLE 1
APPENDIX 2
SUBJECT POLLUTANTS

Arsenic
Benzene
Cadmium
Chloroform
Colbalt
1, 2-dichlorobenzene
Chromium
1, 4-dichlorobenzene
Copper
Cis- 1, 2-dichlorethylene
Mercury
Trans- 1, 3-dichloropropylene
Molybdenum
Ethyl Benzene
Nickel
Methylene Chloride
Lead
1, 1, 2, 2-tetrachloroethane
Selenium
Terachloroethylene
Zinc
Toluene
Trichloroethylene
Total Xylene
Di-n-butyl Phthalate
Bis (2-Ethylhexyl) Phthalate

Alkylphenols
Alkylphenol ethoxylates
Aldrin/dieldrin
Chlordane
DDT
Hexachlorobenzene
Mirex
PCBs
3, 3'-Dichlorobenzidine
Hexachlorocyclohexane
Pentachlorophenol
Total PAHs

Wet Weather Flow Management

November 2006

Guidelines