

**THE CORPORATION OF THE CITY OF BRAMPTON**

**SUBDIVISION DESIGN MANUAL**



**Planning Design and Development Department  
Engineering and Development Services Division**

**Revised: December 2008**

# WHAT'S NEW IN THE CITY OF BRAMPTON'S SUBDIVISION DESIGN MANUAL

Revised: December 2008

The following general revisions were implemented in 2008 (See each section for details):

## **I** DRAFTING REQUIREMENTS

**Note: Standards and Manuals now available on-line only.**

- (2) **All Drawings:** Property fabric, light poles and hydro transformers to be included and shown.
- (4) **General Plan (Aboveground Services):** Light poles and hydro transformers to be included and shown.
- (5) **Storm Drainage:** Both modeled and actual ponding depths resulting from surcharged and or failed system shall be shown at low points on the detailed storm drainage area/FDC plans.

## **III** STORM DRAINAGE AND SEWER DESIGN

- (3) (b) **The Minor System (Storm Sewers), Minimum Standard No.2:** Storm sewers draining school blocks shall be sized to 10yr min..
- (4) (b) **The Minor System (Storm Sewers), Minimum Standard No.3:** New requirements for Commercial/Industrial where no quantity control is utilized.
- (8) **Depth of Storm Sewers:** Dwelling units must maintain a minimum of 0.3m of separation between USF above the 100yr. HGL and 2.6m of separation between HGL and road centerline.
- (17) **Easements:** Sewers crossing fence and property lines.
- (18) **Overland Flow:** Major system may not cross major collector roads in addition to regional roads.

## **IV** STORMWATER MANAGEMENT FACILITIES

- (3) (aa) **General Requirements:** Overland flow routes to pond must be min. 5m in width.
- (3) (bb) **General Requirements:** Cabled concrete to be used in specific circumstances in spillways.
- (3) (cc) **General Requirements:** Geoweb to be used in specific circumstances in spillways.
- (7) **Stormwater Monitoring Fee**

## **V** LOT GRADING AND DRAINAGE

- (3) (a) **Retaining Walls:** Slopes and acoustic barriers.
- (3) (l) **Retaining Walls:** Combination noise walls/retaining walls not permitted.

## **TABLE OF CONTENTS**

<b>I</b>	<b><u>DRAFTING REQUIREMENTS</u></b>	<b>Page 1</b>
	<ul style="list-style-type: none"><li>(1) Title Page</li><li>(2) All Drawings</li><li>(3) General Plan (Underground Services)</li><li>(4) General Plan (Aboveground Services)</li><li>(5) Storm Drainage</li><li>(6) Lot Grading Plans</li><li>(7) Plan and profile Drawings</li><li>(8) Detail Drawings</li><li>(9) General Requirements</li><li>(10) Standard Notes</li></ul>	
<b>II</b>	<b><u>ENGINEERING SUBMISSIONS</u></b>	<b>Page 5</b>
	<ul style="list-style-type: none"><li>(1) Submissions</li><li>(2) Approval</li><li>(3) Administration Fees</li><li>(4) Topsoil Removal Permit</li><li>(5) Construction</li><li>(6) Building Permits</li><li>(7) Assumption of Subdivision</li></ul>	
<b>III</b>	<b><u>STORM DRAINAGE AND SEWER DESIGN</u></b>	<b>Page 11</b>
	<ul style="list-style-type: none"><li>(19) Stormwater Management</li><li>(20) Storm Drainage</li><li>(21) The Minor System (Storm Sewers)</li><li>(22) Runoff Coefficient</li><li>(23) Pipe Capacity</li><li>(24) Flow Velocity</li><li>(25) Sewer Bedding</li><li>(26) Depth of Storm Sewers</li><li>(27) Curvilinear Alignment</li><li>(28) Camera Inspections</li><li>(29) Joints</li><li>(30) Manholes</li><li>(31) Catchbasins</li><li>(32) Rear Lot Catchbasins</li><li>(33) Storm Sewer Services</li><li>(34) Headwalls/Outfalls</li><li>(35) Easements</li><li>(36) Overland Flow</li></ul>	

<b>IV</b>	<b><u>STORMWATER MANAGEMENT FACILITIES</u></b>	<b>Page 17</b>
	(8) Planning Guidelines	
	(9) Design Guidelines	
	(10) General Requirements	
	(11) Operation and Maintenance Report	
	(12) Inspection and Monitoring Report	
	(13) Maintenance Guideline	
	(14) Stormwater Monitoring Fee	
	(15) Building Permits	
	(16) Final Update of Stormwater Management Report	
<b>V</b>	<b><u>LOT GRADING AND DRAINAGE</u></b>	<b>Page 23</b>
	(4) (I) Grading Criteria	
	(5) (I) Design Considerations	
	(6) (I) Retaining Walls	
<b>VI</b>	<b><u>WATERCOURSES, CULVERTS AND BRIDGES</u></b>	<b>Page 25</b>
	(1) Existing Watercourses	
	(2) Man-made Watercourse Channels	
	(3) Culverts and Bridges	
<b>VII</b>	<b><u>ROAD DESIGN</u></b>	<b>Page 26</b>
	(1) General Requirements	
	(2) Geometric Design	
	(3) Pavement Design	
<b>VIII</b>	<b><u>STREETSCAPE DESIGN</u></b>	<b>Page 27</b>
	(1) Sidewalks	
	(2) Driveways	
	(3) Street Name Signs, Traffic Signs	
	(4) Street Lighting	
	(5) Boulevard Sodding	
	(6) Trees	
<b>IX</b>	<b><u>GENERAL COMMENT</u></b>	<b>Page 30</b>
<b>X</b>	<b><u>LISTS OF ABBREVIATIONS</u></b>	<b>Page 31</b>

## Appendices

<b><u>APPENDIX 'A'</u></b>	<b>DRAFTING REQUIREMENTS FOR AS-CONSTRUCTED DRAWINGS</b>	<b>Page 32</b>
<b><u>APPENDIX 'B'</u></b>	<b>RESIDENTIAL BUILDING PERMIT POLICY</b>	<b>Page 34</b>
<b><u>APPENDIX 'C'</u></b>	<b>DESIGN STANDARDS FOR RURAL ESTATE SUBDIVISIONS</b>	<b>Page 35</b>
<b><u>APPENDIX 'D'</u></b>	<b>TABLE I      GEOMETRIC DESIGN CRITERIA TABLE II      INTERSECTION TREATMENT</b>	<b>Page 37</b>
<b><u>APPENDIX 'E'</u></b>	<b>FUNCTIONAL SERVICING REPORT TERMS OF REFERENCE</b>	<b>Page 39</b>
<b><u>APPENDIX 'F'</u></b>	<b>CITY OF BRAMPTON ENVIRONMENTAL PLANNING PROCESS</b>	<b>Page 43</b>
<b><u>APPENDIX 'G'</u></b>	<b>DEFINITIONS OF THE MOST COMMONLY USED TERMS IN ENVIRONMENTAL ENGINEERING</b>	<b>Page 44</b>

## ***I      DRAFTING REQUIREMENTS***

Notes:

- i. Metric criteria are to be used for all projects.
- ii. City of Brampton Standard Drawing Details are available on-line only at <http://www.brampton.ca/workstrans/standard.html>, and Specifications are available from the Engineering and Construction Services Division of the Works and Transportation Department located at 8850 McLaughlin Road, Unit 2.

### **(1)      Title Page**

Size A1

Show: Subdivision name; owner name; street names; key plan; drawing locations; list of drawings; consultants; draft plan approval number; City of Brampton; Director of Engineering and Development Services, Design and Development; Site Statistics (sewer and road lengths).

### **(2)      All Drawings**

Size A1

Show: Standard City of Brampton Title Block; Consulting Engineers Title Block; draft plan approval number; revision block; standard and general notes; north arrow; key plan; street names; lot and block numbers; building envelopes; driveway locations (from curb to street line); property fabric; easements; reserves; road widenings; existing utilities; light poles; hydro transformers; legend; reference to adjacent drawings; and City Benchmark.

### **(3)      General Plan (Underground Services)**

Scale 1:1000

Show: Storm sewers; sanitary sewers; watermains; manholes; catchbasins; valves; hydrants; rear yard catchbasins; size, length and grade for all sewers; manhole numbers; size of watermains; and utility duct locations.

### **(4)      General Plan (Aboveground Services)**

Scale 1:1000

Show: Walkways; sidewalks; curb; bus pads; temporary turning circles; barricades; street signs; traffic signs; light poles; hydro transformers; manholes, catch basins; fire hydrants and other appurtenances; engineered fill lots; temporary/permanent mailboxes; and easements.

(5) **Storm Drainage**(a) **External Storm Drainage / FDC Plans**

Scale 1:2500 or 1:5000

Show: External drainage areas; drainage through proposed plan; existing tributaries; contours at 1m intervals (maximum); and contour elevations.

(b) **Detailed Storm Drainage / FDC Plans**

Scale 1:1000

Show: Areas draining to specific sections of the storm sewers from manhole to manhole; drainage area; run-off co-efficient used; overland flow route; ponding depths (modeled and actual); type and model of ICDs; and SWM criteria for all blocks.

(6) **Lot Grading Plans**

Scale: 1:500 Residential

1:1000 Industrial and Estate Lots

Show:

- (a) Original contours at 1m intervals maximum.
- (b) Proposed and existing elevations at all lot corners.
- (c) All existing trees and other vegetation.
- (d) Complete drainage pattern of all abutting developed areas.
- (e) Existing tributaries.
- (f) Existing elevations outside subdivision limits.
- (g) Existing information of all abutting streets.
- (h) Proposed road centre line elevations every 20m, with distance and percent slope for all segments.
- (i) Gutter slope and elevations for all road elbows, intersections and cul-de-sacs.
- (j) Proposed front lot corner elevations and elevations at front and rear of building.
- (k) Proposed elevation 5m behind rear wall of house with 2% slope.
- (l) Proposed swales with invert elevations and percent slope along lot line. Include invert elevations adjacent to house.
- (m) Proposed rear yard catchbasins including top and invert elevations.
- (n) Proposed slopes.
- (o) Proposed retaining walls, including top and bottom elevations.
- (p) Proposed house types - i.e. B.S. - Backsplit W.O. - Walkout.
- (q) Proposed building envelope.
- (r) Overland flow route.
- (s) Location of siltation and sediment control devices.
- (t) Mailboxes
- (u) Engineered fill lots

**(7) Plan and Profile Drawings**

Scales:	Horizontal	1:500
	Vertical	1:50

Each street, easement, watercourse, or structure is to be drawn on a separate City Standard Plan and Profile sheet.

Show:

- (a) Plan: Walkways; sidewalks; curb radii; sewers; watermains; manholes, manhole reference numbers; catchbasins; valves; hydrants; sewer and watermain service connections; centerline chainage; benching details for all manholes; pavement design; road and ROW dimensions; road taper lengths; crossing information; CB inverts for all RLCB connections; and match lines to all adjacent drawings.
- (b) Profile: Existing and proposed road profile; high / low points; vertical curves; slope, length and grade of road; storm and sanitary sewers; watermain; size, bedding class and type of pipe; invert elevations; sewer grades; drop pipes; safety platforms; centre line chainage; manhole numbers and type; existing sewers and utilities where applicable; crossing information; centerline of intersections; and match lines to all adjacent drawings.

**(8) Detail Drawings**

Show: All applicable details to the proposed developments. i.e. cross-sections; SWM pond details; structural details; retaining wall details; and manhole details.

**(9) General Requirements**

- (a) All existing utilities must be shown in a dashed line.
- (b) Differentiate between single and semi lots on all plans (e.g. 61 s. semi lot).

**(10) Standard Notes:**

The following notes must appear on all Plan and Profile drawings.

- (a) All construction works shall comply with the Standard Drawings and Specifications of the City of Brampton and the O.P.S.
- (b) All concrete and plastic sewer pipes shall have rubber gasket joints.
- (c) All sewers shall be constructed with bedding in accordance with City of Brampton Standard Drawing 348 unless otherwise noted.
- (d) Plastic sewer pipes shall be constructed with Ultra Rib or approved equal up to the maximum diameter of 600mm.
- (e) No PVC pipe shall be used on arterial and parkway roadways.

- (f) Single catchbasin leads to be 200mm unless otherwise noted. Double catchbasin leads to be 250mm unless otherwise noted. All catchbasin leads to be either C-14-ES minimum or P.V.C. type S.D.R. 28.
- (g) All backfill for sewers, watermains and utilities on the road allowance must be mechanically compacted to 95% Standard Proctor Density except for top 0.3m which must be compacted to 98%.
- (h) All trench cuts through asphalt will be repaired with a minimum of 1.0m beyond the edge of the full cut depth.
- (i) An asphalt preservative sealer such as Re-clamite (or other approved equivalent) shall be applied after the one-year maintenance period for the top course asphalt.
- (j) The City of Brampton Traffic Services Department shall be notified 48 hours prior to the installation of any traffic signal underground plants and a representative of the City's traffic signals department shall mark the underground plant and handwell locations in the fields with the consulting engineer/contractor
- (k) All intersections have one utility duct on the leg of each street. Each duct shall be located 2.5m from the BC / EC and shall extend 0.5m behind the back of curb. Both ends of the utility duct shall be capped. The ducts shall be 100mm in diameter made of CSA certified Type 2 PVC. The minimum trench width of the duct shall be 300mm with 100mm sand bedding and backfill around the duct. Native backfill can be used from the sand backfill up to the granular sub-base. The duct shall have a minimum cover of 1.5 metres.

The following notes must appear on all Grading Plans

- (a) The proposed elevations at buildings and the basic direction of surface drainage will be subject to detailed design when house types and plot plans are available.
- (b) Rear to front drainage can be accommodated only if the separation between units is 2.4m.
- (c) The house type and driveway location shall not be changed without City of Brampton approval.
- (d) Where possible downspouts shall discharge to the ground surface via splash pads to the front of the house.
- (e) A minimum area of 5.0m shall be graded at 2% at the rear of the house.
- (f) A minimum area of 7.5m shall be graded at 2% at the rear of the house for reverse frontage lots.
- (g) A minimum clearance of 0.15m must be provided between the brickline and the final top of ground elevation at the house.
- (h) A minimum clearance of 0.20m must be provided between the siding and the final top of ground elevation at the house.
- (i) All lot grading must comply with City of Brampton Standards 420 and 421 unless otherwise noted.
- (j) Driveways shall be graded at minimum of 2% and a maximum of 8% slope.
- (k) A 0.6m separation shall be provided between driveways.
- (l) All areas beyond the plan of subdivision, which are disturbed during construction, shall be restored to the satisfaction of the City of Brampton.
- (m) All open space blocks and valley lands shall be maintained free of garbage and construction debris by the Developer until assumption of the subdivision by the City of Brampton.





SUBMISSION REQUIREMENTS FOR NEW SUBDIVISIONS	Distribution List															
	2 Sets Rolled	1 Set Rolled	2 Set Rolled	1 Set Folded	2 Sets Folded	2 Sets Folded	1 Set Folded	1 Set Folded	1 Set Rolled	2 Set Folded						
	Engineering	Transportation	Parks, Openspace & Streetscape	Acoustic	Planning	Transit	Building	Fire Department	Public Schools	Separate Schools	Conservation Authority	Traffic	Operations	Capital	Enersource Technologies	
	Dave Kenth	Brad Hale	S. Chevallier	Karen Fraser	City Planner	Doug Rieger	B. Campbell	A. MacDonald	Steve Hare	Beth Bjarnason	S. Jorgenson	Q. Hanchard	George Yip	Phil Menary	Peter Anderson	Andrew Bloomfield
<b>3<sup>rd</sup> and Subsequent Submissions</b>																
Aboveground General Plans	x	x	x			x							x		x	x
Underground General Plans	x		x										x		x	x
Plan and Profile Drawings	x	x	x												x	
Grading Plans	x		x	x											x	
SWM Pond Drawings	x		x	x												
Sections	x		x	x											x	
Storm Drainage Area Plans	x		x												x	
Erosion Control Plans	x		x													
Road Details (widening, x-sections, island treatments etc if required)	x	x	x											x widening	x	
Storm Sewer Design Sheets and Overland Flow Calculations	x														x	
SWM Report	x															
M-plan & Reference Plan (folded drawings)	x	x	x		x											
Cost Estimate (Engineering & Landscape Consultants)	x	engineering	x landscape													
Openspace & Streetscape Plans			x													
Executed Noise Attenuation Statement				x												
Final Detailed Acoustic Report (3 copies)				x												
Utility Layout (Electrical, Telecommunication & Aboveground)			x													
Street Lighting Design (drawings, calculations, cost estimate)																x
Final Community Information Map			x													
Sound Barrier / Masonry Wall Profile			x	x												

All drawings, reports and cost estimates shall be submitted directly to Engineering and Development Services.

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(2) **Approvals**

- (a) Submit drawings for signature.
- (b) Submit a copy of the preservicing agreement.
- (c) Submit two (2) copies of each of the M-plans and easement reference plans.
- (d) Deposit the securities, fees and insurance with the Treasury Department with copies sent to the Engineering and Development Services Division.
- (e) Submit copies of all other required approvals as noted below:

		Underground Approval	Full / Aboveground Approval
M.O.E. certificate of approval for	Storm	x	x
	FDC	x	x
	Pond	x	x
	Sanitary	x	x
	Water	x	x
Region of Peel	Signoff	x	x
	Security amount	x	x
Conservation Authority approval in principle		x	x
Engineering Section's signoff		x	x
Transportation Planning's signoff		x	x
Community Design, Parks Planning and Development Division	Signoff	x	x
	Security Amount	x	x
Transit signoff			x
Legal to advise that the Preservicing agreement is satisfactory		x	x
Treasury to advise that the following items are satisfactory	Insurance	x	x
	Administration fees paid	x	x
	Letter of Credit posted	x	x

(3) **Administration Fees**

Prior to approval the owner shall pay to the City of Brampton administration fees equal to three and a half percent (3.5%) of the total cost of the works. All fees collected under this section shall be pro-rated between the City and the Region in proportion to the estimated costs of the works for which each of the City and the Region is responsible.

Street lighting fees are comprised of the cost of the City's consultant, the City's administration fee, and the applicable GST. Street lighting fees shall be calculated as follows:

Review and approval of street / parkland lighting design.	\$6.96 + 15% Administration Fee + GST =	\$8.48 per light pole
<i>(The above fee shall be submitted at second engineering submission with the street lighting design.)</i>		
Inspection Services of street / parkland lighting (during the period from after approval of the plans to preliminary acceptance of the constructed works).	\$71.50 + 15% Administration Fee + GST =	\$87.16 per light pole
<i>(The above fee shall be submitted at second engineering submission with the street lighting design.)</i>		
Inspection Services of street / parkland lighting (during the period from initiation of the final inspection for assumption to assumption of the subdivision).	\$8.00 + 15% Administration Fee + GST =	\$9.75 per light pole
<i>(The above fee shall be submitted at the time when a request is made to the Engineering and Development Services Division to initiate the process of assuming the subdivision.)</i>		
All other review / approval / inspection services that are necessary during the period between preliminary acceptance and initiation of the final inspection for assumption of the subdivision.		Invoice cost by the consultant + 15% Administration Fee + GST
<i>(The above fee shall be submitted by the developer upon receipt of the invoices by the City.)</i>		

(4) **Topsoil Removal Permits**

If the owner wishes to proceed with area grading prior to the approval of the engineering drawings, the Consulting Engineer or the owner must apply for a topsoil removal permit from the Engineering and Development Services Division for permission to begin stripping and grading operations. This request must be accompanied with the following:

- (a) A plan reflecting the sediment and siltation control measures
- (f) Phase One Environmental Assessment
- (g) Confirmation from The Ministry of Culture that the Archeological Survey is acceptable.

The sediment and siltation control plan must adhere to City of Brampton's Standard 406.

No area grading shall be allowed to begin until the following items have been completed:

- (a) The plan has received draft plan approval
- (b) The owner has obtained a Topsoil Removal Permit
- (c) The security has been deposited
- (d) The owner has obtained a Road Occupancy Permit from the Works and Transportation Section.

Any erosion experienced along the valley land slopes throughout the construction and warranty period of this development shall be corrected by the Developer to the satisfaction of the Planning, Design and Development Department

The security to be deposited will be based on Three Thousand Dollars (\$3,000) per hectare of the area being disturbed, in accordance with the Topsoil Removal By-Law.

The fee for obtaining a Topsoil Removal Permit is Five Hundred Dollars (\$500) plus Twenty-Five Dollars (\$25.00) per hectare of areas being disturbed. If the subdivision proceeds with construction in an expeditious manner, this fee may be waived at the discretion of the Director of Engineering and Development Services. Stockpiling of topsoil within park blocks is not permitted unless approval is obtained in writing from the Community Design, Parks Planning and Development Division.

(5) **Construction**

Construction shall not commence without the following:

- (a) Approved drawings
- (b) A Letter of Credit posted with the Treasury Department
- (c) Administration Fees paid to the Treasury Department
- (d) An Insurance Certificate (including Environmental Liability) posted with the Treasury Department
- (e) Preservicing Agreement.

Prior to the start of construction and after the approval of engineering drawings, the developer's consulting engineer shall arrange for a preconstruction meeting.

Also prior to the start of construction the consulting engineer shall submit:

- (a) Two (2) complete sets of prints of the approved drawings.
- (b) Two (2) complete sets of reduced drawings (half scale on 11.5" x 17" paper).
- (c) Two (2) copies of the approved storm sewer design sheets.
- (d) One (1) CD of all the Engineering Drawings in Microstation Format.

(6) **Building Permits**

After completion of the underground services, concrete walkways, street name signs, and road works up to base course asphalt; the applicant must submit Building Permit application with site plans stamped and signed by the Consulting Engineer as "Approved for Grading and Drainage as being in conformity with the approved grading plans" to the Building Division. See Appendix "B" for the "Residential Building Permit Policy".

(7) **Assumption of Subdivision**

After the end of the aboveground maintenance period submit:

- (a) One complete set of as constructed originals prepared in accordance with the City of Brampton Requirements for As Constructed Drawings (Appendix A) to be retained by the Engineering and Construction Services Division of the Works and Transportation Department; including updated storm sewer design sheets and their associated drainage areas, if and as required.
- (b) Ontario Land Surveyors Statement that all Standard Iron Bars are in place.
- (c) Overall lot grading certificate.
- (d) Required Bench Marks.
- (e) Required Horizontal Control monumentation.
- (f) A digital copy of all as-constructed engineering drawings in accordance with the City of Brampton Requirements for As-Constructed Drawings in Microstation format. (Appendix "A")
- (g) An updated stormwater management report. (See Section IV - #8)
- (h) Certification stating that the asphalt preservative sealer has been applied to the top course asphalt.
- (i) Certification of the noise attenuation wall.
- (j) Fulfillment of the requirements listed under the Monitoring and Maintenance Protocol (June 2002).

### **III STORM DRAINAGE AND SEWER DESIGN**

#### **(1) Stormwater Management**

Where required, stormwater management techniques shall be implemented to the satisfaction of the City of Brampton, the local Conservation Authority and all concerned departments and agencies.

A stormwater management report is required for all subdivisions. This report is to address the stormwater management techniques to be implemented to reduce the impact of stormwater runoff from the subdivision, the minor and major drainage systems, the external drainage, and the erosion and sedimentation controls to be used.

The Stormwater Management report must state suggested methods of reducing volume and peak rates of runoff to prevent overloading of downstream facilities and the report must confirm that the plan will accommodate both the “minor” and “major” drainage systems.

The report must also implement the requirements as specified in the Subwatershed Studies and/or in the Master Environmental Servicing Studies, Environmental Implementation Reports and/or Functional Servicing Studies.

#### **(2) Storm Drainage**

Must be designed on the concept of the minor system (storm sewers) and the major system (overland flow within the right-of-way). The combination of both systems must be capable of handling a 100 year return storm without flooding private properties. Overland flow shall only be permitted to convey through walkways and within the road allowance.

#### **(3) The Minor System (Storm Sewers)**

Storm sewer shall be designed using the Rational Formula. Where other methods are considered more appropriate, prior approval by the City must be obtained.

$$Q = 2.78 ACI/1000$$

Where      Q = Flow in cubic metres per second  
               A = Area in Hectares  
               C = Run-off co-efficient  
               I = Intensity in mm/hr

The City of Brampton Standard drawing No. 342 shall be used for the storm sewer design.

The storm sewer design must meet the following City of Brampton criteria for storm sewer design, based on City of Brampton Rainfall Intensity Curves (Standard Drawing No: 343) and a time of concentration of ten (10) minutes.

(a) **Minimum Standard No. 1**

A ten-year return storm design plus adequate provision for continuous overland drainage of roads. The Consultant shall demonstrate that the hydraulic grade line in the storm sewer shall be a minimum of 0.3m below the footing elevation of the dwelling units, under conditions of the 100-year storm. Downspouts and floor drains are not to be connected to the storm sewers. In the event that the hydraulic grade line in the storm sewer exceeds the footing elevation, the storm sewer design concept has to be based on a flow controlling system. Street catchbasins shall be controlled with inlet control devices to restrict the stormwater flowing into the sewer system. This standard shall be applied to residential areas and roadways.

**OR**

(b) **Minimum Standard No. 2**

A two-year storm design (5 year on arterial roads) with a separate collection system for weeping tiles and adequate provision for overland drainage of roads. Downspouts are not to be connected to the weeping tile system. If Minimum Standard No. 1 can be achieved then Minimum Standard No. 2 will not be allowed.

Storm sewers draining school blocks shall be sized to take a minimum flow from the 10-year storm event. The 10-100 year storm event flows from the school may be conveyed overland to the road, with the exception of arterial and major collector roads. In the case where overland flows from the school discharges to an arterial or major collector road, then the flows shall be conveyed to the outlet through the pipe system.

**OR**

(c) **Minimum Standard No. 3 (for Commercial and Industrial Subdivisions only)**

A two-year design storm (5 year on arterial roads) shall be acceptable, as long as on site quantity control is being utilized.

For sites where no quantity control is utilized, the sewers must be sized for a minimum of the 5 year storm or greater as required to ensure that the major flows will be safely conveyed on surface and contained within the ROW with a maximum depth of 0.15m above the gutter invert. Supporting calculations must be included in the SWM report to supplement the design sheets to demonstrate the surface capacity.

**(4) Runoff Co-Efficient**

Unless otherwise demonstrated the following co-efficients are to be used:

<u>Land Use</u>	<u>Co-Efficient</u>
Parks	0.25
Single and Semi-Detached	0.50
Multiple, Institutional	0.75
Commercial	0.90
Industrial	0.90
Roadways	0.90

**(5) Pipe Capacity**

To be calculated on the basis of Manning's Formula using a roughness co-efficient of  $n = 0.013$  for smooth walled pipe. The minimum pipe diameters for storm sewers and foundation drain collectors are respectively 300mm and 250mm.

**(6) Flow Velocity**

Maximum flow velocities 4.5 m/s  
Minimum flow velocities 0.75 m/s

**(7) Sewer Bedding**

Class "B" bedding shall be specified under normal conditions. The pipe class shall be determined using Marston's Formula or the appropriate City of Brampton Tables. Non reinforced concrete pipe may be used for pipe sizes up to and including 375mm diameter.

**(8) Depth of Storm Sewers**

Minimum 1.5 cover below centerline of road to obvert unless otherwise noted below. Where weeping tiles are connected by gravity, the storm sewer must be sufficiently deep to accommodate these connections. The underside of footings shall be 0.3 metres higher than the 100-year hydraulic grade line. In order to minimize the number of risers in residential subdivisions the obvert for the foundation drain collector (or the 100-year hydraulic grade line) shall be at a minimum depth of 2.6 metres below the centerline of the roadway.

**(9) Curvilinear Alignment**

This is permitted in accordance with radii tables as provided by the manufacturers. The minimum pipe size permitted for the curvilinear sewers is 600mm in diameter. Curve data must be shown on drawings.

**(10) Camera Inspections**

All storm sewers and catchbasins must be cleaned and camera inspected prior to end of underground maintenance. The sewers must be clear of all debris and obstructions and any damaged or leaking sewers must be cleaned and repaired. DVD's of the repaired/cleaned sewer's must be submitted to the Engineering and Development Services Division prior to the end of maintenance for underground services.

**(11) Joints**

All concrete and plastic pipes must have rubber gasket joints.

**(12) Manholes**

- (a) Minimum size 1200mm diameter or 1200mm x 1200mm precast or poured in place concrete with precast or poured concrete bases in accordance with Ontario Provincial Standard Drawings and Specifications.
- (b) Maximum manhole spacing 100m for pipe diameters less than 1200mm and 150m for pipe diameters 1200mm or larger.
- (c) Maximum change in direction is 90 degrees for pipes 900mm and smaller, and 45 degrees for pipes over 900mm.
- (d) Tee manholes are permitted on straight runs only.
- (e) Manhole drops are to be as follows:

<u>Change in Direction</u>	<u>Minimum Required Drops</u>
----------------------------	-------------------------------

0	deg.	20mm
1-45	deg.	50mm
46-90	deg.	80mm

- (f) Drop pipes to be provided where difference in obverts between incoming and outgoing pipes exceeds 500mm.

**(13) Catchbasins**

- (a) The maximum catchbasin height measured from the top of grate to pipe invert shall not exceed 2.4m. Otherwise manhole-catchbasins with 300mm sumps shall be used. The minimum cover from the finished road grade to the obvert of the catchbasin lead shall be 1.2m. The maximum length for a catchbasin lead shall not exceed 21.5m.
- (b) The laterals shall be sized as follows:
- (c) Single                    200mm diameter at 2.0% minimum
- (d) Double                    250mm diameter at 2.0% minimum
- (e) The maximum spacing shall be in accordance with the following:
- (f) 

$\geq 10\text{m}$ pavement	$\leq 4.5\%$ slope	75m
	$> 4.5\%$ slope	60m
- (g) 

$< 10\text{m}$ pavement	$\leq 4.5\%$ slope	90m
	$> 4.5\%$	75m
- (h) Additional catch basins may be required at road intersections, elbows, and cul-de-sacs to facilitate satisfactory drainage. Catchbasin and driveway conflicts must be avoided. Double catchbasins are required at all low points.
- (i) All catchbasins must be cleaned prior to the end of maintenance for underground services.

**(14) Rear Lot Catchbasins**

The catchbasins shall be sumpless and be in accordance with City of Brampton Standard Drawings. Inlet grates must suit the location and inlet conditions. The minimum pipe size is to be 250mm diameter and at a minimum slope of 0.5% and shall be connected to manholes, catchbasins or catchbasin manholes on the street. No inlet control devices are to be used in locations where the rear lot catchbasins are connected to the road catchbasins or catchbasin manholes. Laterals are to be concrete encased for the full length of the lot and to the back of the street curb. Rear lot catchbasin frames shall be located a minimum of one metre away from all property lines.

**(15) Storm Sewer Services**

- (a) Single Family, Semi-Detached and Street Townhouses are to have 150mm concrete or 125mm PVC pipe for single or double connections. Concrete pipe is to have white connectors and test tees including stoppers, and test tees shall have the word STORM stamped into their top side for identification. PVC pipe, connectors and test tees shall be colour coded white. Test tees to be cast iron. The storm connection is to be on the left side of the sanitary connection as viewed from street to the lot.
- (b) Condominium Townhouses, Highrise Residential, Commercial or Industrial services are to be sized in accordance with approved methods and in accordance with City By-laws. The minimum pipe size shall be 250mm diameter.
- (c) Joints and Bedding for services are to be equivalent to joints and bedding for sewer pipe.
- (d) Maximum connection length within the right-of-way is 21.5m.
- (e) Minimum grade to be 2.0%
- (f) Sewer connections must be located under the driveways for all lots with frontage of 11.0 metres or less, unless written approval can be obtained from Hydro One Brampton.
- (g) All corner units must have single connections.
- (h) All “Boot Jacks” and “Y’s” are to be cast iron for storm connections.

**(16) Headwalls / Outfalls**

All exposed headwalls and other concrete structures within valley lands, SWM ponds and engineered channels must be treated with natural Wiarthon stone cladding and coping stone or must be treated with a commercially available form liner in a mason cut stone relief such as Dayton Superior Pattern # 1506SYM or # 1502ES Cut Block Ashlar Stone or approved equivalent. The edges of all riprap splash pads, outlet weir, and limestone jackets shall be finished in curved naturalized patterns. Straight lines will not be accepted. Access for maintenance vehicles shall be provided to all headwalls / outfalls.

**(17) Easements**

Minimum easement widths are as follows:

One sewer	5m
Two sewers - one trench	7m
Three sewers – one trench	9m

Sewers on easements between houses are to be concrete encased for the full length of the lot and to the back of the street curb.

Sewers that are required to cross underneath any type of fence shall do so only perpendicular to the fence property line.

(18) **Overland Flow**

- (a) The major stormwater system must be designed to accommodate runoff exceeding the capacity of the minor system for the flows up to the 100-year return frequency. Major overland flow must be contained within the road allowance and walkways only.
- (b) The maximum water depth for the overland flow shall be the lesser of 0.3m from the gutter or the water level up to the right-of-way limit.
- (c) Where overland flow is proposed to drain into the valleyland, the consultant must provide erosion protection measures for review and approval by Engineering and Development Services and the Conservation Authority.
- (d) Overland flow shall not be conveyed through parkland unless approval is obtained from the Community Design, Parks Planning and Development Division.
- (e) All subdivisions must be designed such that a preferential flow route for storm flow generated by an event greater than a 100-year return frequency is provided to a receiving system. Only under unusual extenuating circumstances will the total major system capture be permitted with no other outlet for storm flows.
- (f) The Major Storm Overland Flow (100-year and greater) in subdivision developments shall be captured within the subdivision local roads, where feasible, without over-flowing onto the arterial or major collector roads. The maximum number of catchbasins located at the lowest area on the road to achieve this requirement shall be as specified below:
  - i. The maximum number of catchbasins permitted at the low points along any roads capturing the major storm event shall be limited to four (4) double catchbasins (2 on each side of the road). Additional single catchbasins shall be installed on both sides of the double catchbasins located at a distance calculated by a maximum height of 0.15m above the lowest double catchbasin. All lots in a subdivision shall not have more than one single or double catchbasin within its frontage.
  - ii. In the event that the major storm overland flow from a subdivision exceeds the capacity of the maximum number of catchbasins as specified above, major storm overland flow shall be allowed to flow onto the arterial or major collector roads with the condition that the additional flow from the subdivisions would not cause the ponding depth to exceed 0.15m above the gutter along the arterial or major collector roads. A minimum of 2 lanes of roadway pavement must be flood-free at all times for emergency vehicles during the major storm event. However, the major overland flow shall not be permitted to flow across any arterial or major collector roads under any circumstances.

#### **IV      STORMWATER MANAGEMENT FACILITIES**

Stormwater management (SWM) facilities are to be designed in accordance with the guidelines as specified in the latest “Stormwater Management Practices – Planning and Design Manual” by the M.O.E. However, the following sections will supersede some of the guidelines in the manual. If a development is located within an area wherein an overall SWM planning study (ie Subwatershed, EIR, MESP, FSR) is available, the design criteria and recommendations as specified in the study must also be satisfied.

##### **(1)      Planning Guidelines**

During the Secondary Plan and Draft Plan process, the following recommendations must be considered when locating the Stormwater Quality facilities.

- (a) The preferred location for SWM facility is in or adjacent to valleyland where the facility can be naturalized to blend in with the surrounding environment of the valleyland.
- (b) SWM facilities should not be located next to elementary school blocks.
- (c) SWM facilities should not be located next to school walkway routes leading to elementary school blocks.
- (d) SWM facilities should not be located next to tableland park blocks and elementary school blocks that contain children’s playground facilities.
- (e) Landscaping of Stormwater Quality Facilities shall immediately follow the completion of the engineered components. Ponds that have the engineered works completed after October 31 shall be landscaped in the spring of the following year.

##### **(2)      Design Guidelines**

###### **I.      Wet Ponds**

- (a) All ponds shall be designed to an enhanced level of protection (level 1).
- (b) The average depth of the permanent pool shall be approximately 1.5m with the maximum depth limited to 2.5m. Average depth is defined as the total volume of the permanent pool divided by the surface area of the permanent pool.
- (c) The maximum allowable rise in water level above the Normal Operating Water Level (NOWL) for the pre-defined control event (regional or critical 100 year storms) will be 2.0 m. The option of increasing the maximum allowable rise in the water level to 3.5 m will be entertained as long conditions 3 (l) and 3 (m) are satisfied.
- (d) A 0.3 m freeboard will be required above the *maximum routed water level* under the Regional Storm. For Regional control ponds (i.e., pond intended to provide post to pre control for the Regional event), the maximum routed water level will equal the maximum water level to control the storm. For 100 year control ponds (i.e., pond intended to provide post to pre control for the critical 100 year event), the maximum routed water level will equal the maximum water level required for the pond to convey the Regional Storm through the pond. This assumes that the outflow rate is not limited to pre-development levels.

## II. Wet Lands

- (a) All ponds shall be designed to an enhanced level of protection (level 1).
- (b) The permanent pool shall be designed to limit the maximum depth of water to 0.3m.
- (c) The maximum allowable rise in water level above the Normal Operating Water Level (NOWL) up to the 10 year design event shall not exceed 1.0 metres.
- (d) The maximum allowable rise in water level above the Normal Operating Water Level (NOWL) for the pre-defined control event (regional or critical 100 year storms) will be 2.0 m. The option of increasing the maximum allowable rise in the water level to 3.5 m will be entertained as long conditions 3 (l) and 3 (m) are satisfied.
- (e) A 0.3 m freeboard will be required above the *maximum routed water level* under the Regional Storm. For Regional control ponds (i.e., pond intended to provide post to pre control for the Regional event), the maximum routed water level will equal the maximum water level to control the storm. For 100 year control ponds (i.e., pond intended to provide post to pre control for the critical 100 year event), the maximum routed water level will equal the maximum water level required for the pond to convey the Regional Storm through the pond. This assumes that the outflow rate is not limited to pre-development levels.

### (3) General Requirements

The following criteria shall apply to the design of stormwater management facilities of all types:

- (a) The maintenance access road around the pond shall:
  - i. Have a minimum width of 5.0m.
  - ii. A maximum cross fall of 2%.
  - iii. A maximum slope of 12:1.
  - iv. Have a minimum setback of 3.0m from any residential fence.
  - v. Provide access to the headwall, outlet structure and sediment drying area.
  - vi. Be located at the predicted 5 year water level.
  - vii. Be located such that any section of the pond is within 30m of the access road.
  - viii. Be constructed of 300mm of 50mm diameter crusher run limestone, 100 mm of topsoil and vegetated to the satisfaction to the Commissioner of Planning, Design and Development. (Turf grass seed or sod may be required where an access road crosses a Park Block).
  - ix. Have trail connections where the pond is adjacent to tableland parks.
- (b) A maximum side slope of 3:1 (h:v) between the pond bottom and 1.0m below the normal operating water level (NOWL).
- (c) A maximum side slope of 5:1 (h:v) between 1.0m below NOWL and the predicted 5 year water level.
- (d) The slopes above the predicted 5 year water level shall be:
  - i. 5:1 (h:v) where the slope backs on to an adjacent road system.
  - ii. 4:1 (h:v) where the slope backs on to the rear yard lot lines or an adjacent valley system. A 4m wide sodded area with no other vegetation in the 4:1 slope area will be required immediately behind the lot lines for parks staff maintenance access.

- (e) The minimum acceptable orifice size for the outflow control structure is 75mm.
- (f) The bottom of the forebay shall be soil. Block lining or stone is not acceptable.
- (g) Erosion control and energy dissipation solutions shall be provided around the outlets and inlets.
- (h) Armour stone shall be used at the outlets of the storm pipes.
- (i) Retaining walls are not permitted within the pond block.
- (j) Provide a gravity maintenance pipe for draining the pond including the forebay to the lowest possible level to facilitate cleaning.
- (k) A by-pass pipe shall be provided to redirect flows from the pond directly to the watercourse during maintenance. This pipe shall be closed/blocked during normal operation of the pond and open during maintenance periods. Conversely, the inlet to the pond shall be open during normal operation of the pond and closed during maintenance periods. The by-pass pipe shall be designed for a two year storm event.
- (l) All pond berms exceeding 2.0 metres in height measuring from the crest to the toe where it abuts the valley corridor must be designed by a Professional Consulting Engineer in accordance with the requirements as stipulated in the Ontario Dam Safety Design Guideline. The berms must be able to withstand the hydrostatic pressure due to the high water level in the pond. Overflow protection measures will also need to be incorporated to reduce the risk of breaching the berm during extreme conditions.
- (m) For ponds with active water level fluctuations in excess of 2.0 metres, a qualified professional consultant must provide satisfactory confirmation that the vegetation included in the landscape plan will withstand the resultant frequent water level fluctuations and the extended inundation periods.
- (n) Sediment drying areas shall be:
  - i. Sized for a minimum of 10 years of sediment accumulation. Calculations will be required in this regard.
  - ii. Sized assuming a maximum sediment height of 1.5m and sediment slope of 10:1.
  - iii. Located at or above the predicted 5 year water level.
  - iv. Located near the maintenance access road.
  - v. Setback a minimum of 6.0m away from all property lines.
- (o) Fencing around the Stormwater Management Facilities is not allowed (except where it abuts the residential lots).
- (p) No rear yard gates are permitted from residential lots to the SWM Block.
- (q) Minimum setbacks for planting from the maintenance access road adjacent to the forebay are 3.0m for caliper trees and conifers and 3.0m for shrubs.
- (r) A continuous planting bed with dense plant material shall surround the entire water edge of the pond to deter geese from accessing the water.
- (s) Plant beds shall be well defined such as to facilitate mowing equipment to operate between them. A minimum distance of 3.0m is required between plant bed edges and trees or other obstacles.
- (t) Trees shall be grouped inside plant beds or in well-defined clusters allowing mowing equipment to operate around them.
- (u) Planting shall not occur in areas designated for sediment storage.
- (v) The applicant is encouraged to provide pond frontage on two or more roads to provide access to the pond and enhance its use as a community amenity. This frontage will be unencumbered by utility and other service related facilities unless prior approval in writing is received from the Commissioner of Planning, Design and Development.

- (w) Ponds located within residential areas and major road intersections shall have a minimum 50m wide opening fronting onto a roadway for the primary purpose of acting as a community amenity.
- (x) Ponds located in association with tableland parkland will be designed such that no less than a 50m wide opening is provided. The applicant is encouraged to provide frontage on two or more roads to provide access to the pond and enhance its use as a community amenity. This requirement applies to the road frontage where the park and pond abut. The design will ensure that no less than 50% of the total park/pond frontage is retained as road frontage for the park. . This frontage will be unencumbered by utility and other service facilities unless prior approval in writing is received from the Commissioner of Planning, Design and Development.
- (y) All SWM facilities require the placement of permanent stormwater management facility warning signs as per City of Brampton's specifications. A minimum of 5 signs are required around the pond.
- (z) Fountains are not permitted in stormwater management facilities.
- (aa) All overland flow routes from the road to the stormwater management pond shall have a minimum width of 10 metres.
- (bb) A concrete block mat system such as Cabled Concrete shall be utilized in areas where frequent overland flows (i.e. less than the 100-year storm event) discharge to the pond. In addition they shall be applied to emergency spillways designated to convey the Regional event, SWM pond internal spillways, and entrance spillways for the major system conveying overland flows to the SWM facility.
- (cc) An anchored Geoweb system filled with rip-rap may be applied to emergency overflow spillways (i.e. as in Regional control facilities) or spillways conveying overland flows from 100-year capture points to SWM facilities,

**(4) Operation and Maintenance Report**

A separate operation and maintenance report for the stormwater management facility with the following details shall be submitted as part of the engineering submission.

- (a) The method and procedure for draining the forebay during maintenance.
- (b) The techniques in removing the sediment from the facility.
- (c) The procedure in diverting the storm flow away from the forebay during maintenance.
- (d) The annual loading rate and the estimate sediment accumulation in the facility.
- (e) The frequency when the facility must be cleaned.
- (f) The inspection procedures and frequency of inspections.
- (g) A description of the pond features and how the pond operates under the various storm events.

(5) **Inspection and Monitoring Report**

- (a) The owner shall engage a professional consulting engineer to carry out regular inspection, monitoring, and performance assessment of the stormwater management pond for a period of three (3) years after preliminary acceptance or until final acceptance of the pond by the City, whichever is greater.
- (b) Inspection procedures and frequencies shall be completed by the owner in accordance with the recommendations in the Maintenance Report as discussed above. An “Inspection and Monitoring Report” shall be submitted once a year to assess the pond’s performance and the same shall be submitted to Engineering and Development Services and the Conservation Authority for review.
- (c) Regular cleaning of the pond shall be completed by the owner at the recommendation of the “Inspection and Monitoring Report” or at the discretion of the Director of Engineering and Development Services. The owner shall be responsible for all costs to correct and remedy any deficiencies as recommended in this “Inspection and Monitoring Report”. Prior to final acceptance of the pond by the City, sediment shall be removed and discarded off-site, and all deficiencies, repair works, and planting restoration are completed to the satisfaction of the City.

(6) **Maintenance Guidelines**

The following requirements are for the cleaning and restoration of the forebay and sediment disposal area.

- (a) The Developer’s consultants shall inventory the existing vegetation prior to commencement of the cleaning operation.
- (b) Construct temporary berms if required around the sediment disposal area as required to prevent sediment from flowing back into the pond.
- (c) Pump any water remaining from the pond to facilitate the cleaning operation.
- (d) Prior to construction, the Landscape Architect may require plant material impacted by the work to be relocated to an on site nursery. The contractor shall maintain the plant material until it is reinstated.
- (e) All disturbed areas including the forebay shall be restored with 100 millimeters of topsoil and valleyland seed mix.
- (f) Maintenance access roads through park blocks disturbed during the cleaning operation shall be restored with topsoil, fine grading and sod.
- (g) The Contractor shall, at his own expense, replace existing trees, shrubs and aquatic plants removed or damaged during the cleaning operation to the satisfaction of the City.

**(7) Stormwater Monitoring Fee**

A stormwater monitoring fee for the purpose of evaluating the stormwater management facility for compliance with minimal standards shall be submitted to the City prior to registration of the development. The fee shall be calculated using the following formula and is based on the annual sediment loading rate as suggested in the M.O.E.E. Stormwater Management Practices Planning and Design Manual.

$$\begin{aligned} \text{Annual Sediment Loading} &= \text{Catchment Area} \times \text{Annual Loading} \\ \text{Stormwater monitoring Fee} &= \text{Annual Sediment Loading} \times 10 \text{ years} \times \$30 \end{aligned}$$

Annual Loading is dependent of the imperviousness of the catchment area.

For residential development:	Imperviousness	=	55%
	and Annual Loading	=	1.9m <sup>3</sup> /ha.
For industrial development:	Imperviousness	=	85%
	and Annual Loading	=	3.8m <sup>3</sup> /ha.

“10 years” is the estimated time when the facility must be cleaned after assumption by the City.

“\$30.00” is the estimated average cost for removing a cubic metre of the sediment from the facility.

**(8) Building Permits**

Building permits shall not be issued for any lots until the stormwater management facility has been constructed and is operational to the satisfaction of the Director of Engineering and Development Services. The Consulting Engineer must submit a certificate stating that the SWM facility has been constructed as per the approved drawings.

**(9) Final Update of Stormwater Management Report**

Prior to final assumption of the subdivision, a final update of the stormwater management (SWM) report shall be submitted to the Engineering and Development Services Division. All design changes, if any, throughout the course of developing this subdivision shall be summarized in the final report. The SWM analysis shall be updated to reflect the existing condition of the completed subdivision and the final report shall recommend any remedial works to ensure compliance with the overall criteria of the original SWM report. A final certification shall be required from the owner’s Consulting Engineer to certify that all SWM works have been completed in accordance with the recommendations of the SWM report.

## V LOT GRADING AND DRAINAGE

### (1) Grading Criteria (See Std. Dwg. No. 420 and No. 421)

- (a) Lawns and swales shall have a minimum slope of 2% and a maximum slope of 6%.
- (b) Where grade changes in excess of the above are required, the maximum slope should be 3:1 (h:v). Where these occur between dwellings the slope is to be located on the lower lot.
- (c) Grade changes in excess of 1m are to be accomplished by the use of a retaining wall. (See Sub-section (3) for design requirements for the retaining walls).
- (d) The maximum depth of rear yard swales shall be 0.3m.
- (e) The maximum depth of side yard swales shall be 0.2m. The grade adjacent to the house shall follow the grade of the swale to maintain constant depth.
- (f) At least one side yard of all dwelling units shall have a minimum (2% slope) level area of 0.6m.
- (g) The crossfall at the back of all units shall not exceed 2%.
- (h) A minimum area of 5.0m shall be graded at 2% for houses and townhouses at the rear of all units.
- (i) For all lots with detached and semi-detached dwellings having conventional rear yard setbacks and reverse frontage on arterial roads, the rear area shall be graded at 2% for at least 7.5m of the total rear yard depth.
- (j) The maximum flow allowed in a swale between two houses is that from 4 rear yards.
- (k) The maximum flow allowed in a rear yard swale shall be that from 6 rear yards and in no case will the swale lengths be greater than 3 lot widths for single and semi-detach houses. For townhouse units, eight (8) rear yards and a maximum swale length of 4 lot widths will be permitted.
- (l) Driveway grades shall not be less than 2% slope or greater than 8% slope.
- (m) The ponding depth over rear yard catchbasins shall not exceed 0.3m.
- (n) Minimum separation of 150mm shall be provided between the brickline and the final ground elevation of the houses and 200mm between the siding and the final ground elevation.
- (o) Where corner lot fencing is required by the City, the slope from the nearest point at the dwelling to any point along the fence shall not exceed 5%.
- (p) Surface drainage from residential lots or commercial blocks shall not be permitted to drain into parks without prior approval of the Community Design, Parks Planning and Development Division.
- (q) All areas beyond the plan of subdivision, which are disturbed during construction, shall be restored to the satisfaction of the City of Brampton.

### (2) Design Considerations

- (a) Grade differences between housing units shall be minimized, especially where new developments abut existing developments. The vertical distance between the first floor elevations at the rear wall of houses which back on to each other shall not be greater than that achieved by striking a 3% grade between the units.
- (b) Rear to front drainage can be accommodated only if the separation between units is increased to 2.4m.

(3) **Retaining Walls**

- (a) Retaining walls are required where a 3:1 (h:v) slope exceeds 1 metre in height. The exception to this rule is where acoustic barriers are required; in which case the 3:1 (h:v) slope may exceed the minimum height requirement.
- (b) All retaining walls are to be concrete or concrete product; the use of timber will not be accepted. The backfill is to be compacted free-draining granular material.
- (c) Retaining walls are to be constructed entirely on the upper lot so that the tiebacks do not cross property boundaries.
- (d) All retaining walls are to be designed, approved and stamped by a Consulting Engineer specializing in structural engineering. The design must be accompanied by calculations clearly demonstrating that it is structurally satisfactory for the particular location and soil type.
- (e) The detailed drawing shall have a note indicating:
  - (i) The subject walls have been designed in accordance with accepted engineering principles; and
  - (ii) The wall is suitable for the geotechnical condition of the site and for the type of loading.
- (f) The detail drawing shall show a weeping tile and incorporate a filter cloth envelope.
- (g) The installations are to be inspected during construction and certified in writing by the Consulting Engineer as to conformity to design and suitability for the site conditions. The Lot Grading Certificate will not be accepted until the Retaining Wall Certificate has been submitted.
- (h) For retaining walls 0.6m in height or less, approved lightweight slabs using tiebacks will be permitted. A Geogrid fabric or equivalent must be utilized as the tie back medium.
- (i) For retaining walls greater than 0.6m, the following systems may be utilized:
  - (i) A concrete tie-back system,
  - (ii) A heavy block system, or
  - (iii) The use of gabion baskets may only be permitted in **Industrial** Subdivisions on a site-specific case.
- (j) Protective fencing of 1.2m high is required where the exposed retaining wall face height exceeds 0.6m. The structural stability of this wall must be able to withstand any extra forces exerted by the fence as well as the earth loads.
- (k) Retaining walls shall not be located less than 1.0 metres from noise wall footings except where absolutely necessary at the discretion of the City and as designed and certified by a structural engineer for both walls.
- (l) The use of retaining walls combined with noise walls is not permitted to satisfy the minimum grading criteria. In situations such as this, the noise wall must be constructed on top of properly graded slopes gentler than 3:1 (h:v).

## **VI WATERCOURSES, CULVERTS AND BRIDGES**

### **(1) Existing Watercourses**

Shall be left in their natural state as much as possible. They shall be capable of handling the regulatory flood run-off as determined by the Conservation Authority. Invert and bank protection shall be installed as per the requirements of the Planning, Design and Development Department and Conservation Authority. Any indigenous vegetation in valley lands destroyed by construction shall be replaced by the Developer to the satisfaction of the City of Brampton. Access for emergency and maintenance vehicles shall be provided to the valleyland.

### **(2) Man-made Watercourse Channels**

Must be designed for regional flood run-off with approved lined material within the low flow channel (2-year return period) and with slopes vegetated to the satisfaction of the Director of Engineering and Development Services. Maximum side slope shall not exceed 25% (4:1 h:v). The maximum flow velocity shall not exceed 1.8m/s. The channel must be sized appropriately taking into consideration the required meander belts and long-term slope stability without impacting the required 4:1 slope. Channel side slopes adjacent to right-of-ways shall have a recoverable slope of 5:1 (h:v).

Where lit walkways and pedestrian bridges are proposed in the channels, Community Services Department must be contacted for specific requirements and standards.

Where man-made watercourses are adjacent to proposed parkland, no fence shall be installed along the common property line. Both parcels of land are to be part of a continuous open space system.

Access for emergency and maintenance vehicles shall be provided to the valleyland.

### **(3) Culverts and Bridges**

Culverts and bridges under arterial roads must be designed to prevent overtopping during all storm conditions including the Regional storm. At local roads, the over flow depth over the gutter elevation shall be 300mm and must not cause damage to private property. Stacked culverts may be permitted to facilitate flow retardation. A specific design must be submitted for the above conditions to show that the 100 year storm can be accommodated and shall include the calculation of the hydraulic grade line. Corrugated steel pipe end sections shall be used wherever possible. A recoverable slope of 5:1 (h:v) is required adjacent to all culverts and bridge. All exposed headwalls and other concrete structures within valley lands, SWM ponds and engineered channels must be treated with natural Warton stone cladding and coping stone or must be treated with a commercially available form liner in a mason cut stone relief such as Dayton Superior Pattern # 1506SYM or # 1502ES Cut Block Ashlar Stone or approved equivalent

## ***VII ROAD DESIGN***

### ***(1) General Requirements***

All roads within the City of Brampton shall be built to urban standards in accordance with the latest standards and specifications. (H.L. asphalt, curb and gutter and storm sewers).

### ***(2) Geometric Design***

All geometric design criteria with respect to horizontal and vertical control elements must conform generally with the standards as set out in the latest edition of “Geometric Design Standards for Canadian Roads and Streets” issued by T.A.C. and as further specified in Appendix D, Table I. Intersection treatment shall be in accordance with Appendix D, Table II.

### ***(3) Pavement Design***

The standard pavement for various road classifications shall be designed in accordance with the latest City of Brampton Standards. The Developer shall have the alternative of engaging a soils consultant to design a flexible pavement based on results of local soils tests and in accordance with the “Equivalent Thickness Method of Flexible Pavement Design” from the Asphalt Institute. All pavement shall be subject to the approval of the Commissioner of Works and Transportation. In no case shall the depth of granulars be less than the minimum specification on the standard drawings. Full length continuous under drains are to be used beneath the curb in all locations. The initial 3m section out of the catchbasin shall be Helcor corrugated pipe. The remaining section may be plastic material. The underdrain is to be wrapped in filter cloth.

## **VIII STREETScape DESIGN**

### **(1) Sidewalks**

#### Cul-de-sacs with less than 25 units fronting on the roadway

No sidewalks unless there is a walkway or other path leading from the Cul-de-sac to another street, park, school or plaza.

#### Cul-de-sacs with 25 or more units fronting on the roadway

Sidewalk on one side only.

#### Crescents and local through streets:

With less than 50 units fronting the roadway

17m right-of-way: sidewalk required on one side.

With more than 50 units

20m right-of-way: sidewalk required on both sides.

#### Collector or Arterial Roads

Sidewalks on both sides.

#### Industrial Roads

Sidewalks on one side only, unless specified otherwise.

### **(2) Driveways**

All residential driveways must be paved from curb to street line, or curb to sidewalks where existing, with a minimum of 150mm of 19mm crusher run limestone, 50mm HL8 and 25mm H.L.3. asphalt. The HL8 is to be installed at the time of sodding, while the HL3F is to be installed prior to the placement of the top course asphalt pavement on the roadway. Driveway slopes shall be at a minimum of 2% and at a maximum of 8%. Driveways should be perpendicular to the curb where possible. All driveways shall have minimum straight run of 6m from the front of all garages. Driveways with curvatures shall have a minimum radius of 7.3 m. Widths of depressed curb for driveways shall be as follows:

Single driveway	3.5m plus 0.3m slopes
Double driveway	6.0m plus 0.3m slopes
Shared double driveway for semi-detached	7.3m plus 0.3m slopes
Triple driveway	8.5m plus 0.3m slopes

Wherever possible, a 0.6m separation shall be provided between driveways.

The minimum clear distance between the edge of driveways and a utility structure shall be 1.2m. Driveway layouts for all lots on cul-de-sacs, and road bends must be shown on the drawings.

Lots with widths less than 11.0 m will have coupled driveways. Lots with widths of 11.0 m to 11.99 m shall have every second driveway pair uncoupled, where drainage conditions allow. All driveways on lots wider than 12.0 m are to be uncoupled. In the case of townhouses, a tree in front of every second lot is desirable, excepting conflicts with drainage, above ground and below ground services.

(3) **Street Name Signs, Traffic Signs**

The Developer shall provide, erect and maintain, at his expense, one (1) complete street name sign assembly at each “T” intersection, and two (2) complete assemblies at each “Cross” intersection within the plan. All traffic and street name signs shall be erected prior to issuance of building permits. All signs must be located and maintained as per City of Brampton Standard Drawing 430.

Traffic and street name sign fabrication, mounting materials and placement shall be as specified in City of Brampton’s latest standards.

All name legends and suffixes shall be 100mm high, PRA Series C letters.

Abbreviations for Suffixes shall be as follows:

Avenue	Ave.
Boulevard	Blvd.
Circle	Cir.
Court	Crt.
Crescent	Cres.
Drive	Dr.
Gate	Gate
Lane	Lane
Parkway	Pkwy.
Place	Pl.
Square	Sq.
Street	St.
Trail	Tr.
North	N.
South	S.
West	W.
East	E.

(4) **Street Lighting**

The Developer is responsible to arrange for the installation of streetlighting on all streets in accordance with the latest City of Brampton standards. The work must be paid for by the Developer and securities for this work lodged with The City of Brampton. Streetlights shall be installed, as a minimum, on the same side as the sidewalk.

The street lighting system on all local and collector roadways within the subdivision development shall be designed and constructed with the Communication Street Light Poles, complemented with the luminaire, arm fixture, and decorative scroll, all in accordance with the latest City of Brampton standards and specifications. The street lighting system on all arterial roadways will continue to use the conventional concrete poles unless specified otherwise by the City.

The developer shall retain a qualified electrical consultant to design the street lighting system for the subdivision in accordance with the latest City of Brampton standards and specifications. The street lighting design drawings shall be submitted to the City together with the second submission of the engineering drawings.

At all “T” street intersections, the lot line opposite the projection of the “T” street shall be free of all municipal services to permit the installation of a street light pole at this location. The depth of bury of all streetlight poles shall be 1.50m minimum. All out of plumb street light poles and transformer vaults shall be set plumb prior to assumption of the development.

(5) **Boulevard Sodding**

Boulevard sodding – all road boulevards must be fine graded with a minimum of 100mm topsoil and sodded with #1 Nursery Sod. (In industrial areas, hydro seeding to Parks specifications **may** be permitted at the discretion of the City.)

(4) **Trees**

Trees when approved for planting on the boulevard, shall be located in accordance with the applicable standard cross-section but subject to adjustments required to avoid underground utilities which are in non-standard locations, or to address site line issues.

***IX      GENERAL COMMENT***

The specifications are intended as a minimum standard of a general nature and detailed construction specifications of the current municipal standards are available in the City's Works and Transportation Department.

The consultants are to satisfy themselves of the applicability of the standards in each case.

It is also recognized that special circumstances may arise when the owner may wish to propose minor changes to the minimum standards. In all such cases, the owner shall be required to submit the proposed changes to the Director of Engineering and Development Services and Commissioner of Works and Transportation and any changes are subject to their approvals.

**X      LIST OF ABBREVIATIONS**

Ha	Area in Hectare
A.A.D.T.	Average Annual Daily Traffic
Dia.	Diameter
≤	Less than or equal to
>	Greater than
Min	Minimum
Max	Maximum
n	Manning's Roughness Co-efficient of Pipe
Q	Flow in Cubic meters Per Second
C	Run-off Factor
R.O.W.	Right-of-way
T.A.C.	Transportation Association of Canada
S.S.S.D.	Safe Stopping Sight Distance
s	Second
I	Intensity of Rain in millimeters per hour
m	Metre
cm	Centimeter
mm	Millimeter
MPa	Mega Pascal

## APPENDIX “A”

### *Drafting Requirements for “As Constructed” Drawings*

#### (1) *General Requirements*

- (a) The note “As Constructed”, including date, shall be placed on all drawings.
- (b) One complete set of As-Constructed Cromaflex / Mylar reproductions to be retained by the Engineering and Construction Services Division of the Works and Transportation Department.
- (c) All plan and profiles should have at least one benchmark as a reference for elevations.
- (d) Provide one set of general plan (or registered plan) marked in red indicating all easements, including purpose within the plan of subdivision.
- (e) All as constructed drawings must be submitted in digital format and must comply with the latest version of the Works and Transportation Department’s Appendix-A, Road Reconstruction and Environmental Assessment Standards.

#### (2) *Plan View*

- (a) All construction notes are to be removed.
- (b) All street names shall be indicated as per registered plans.
- (c) Manhole identifications are to be left on.
- (d) Items to be changed if different than proposed:
  - (i) Sewer Locations
  - (ii) Curb widths
  - (iii) Sidewalk locations
  - (iv) Manhole and Catchbasin locations
  - (v) Curb radii
- (e) All building service connections or house connections are to be shown (including industrial building sites).
- (f) All street lighting infrastructure and pole/fixture details are to be shown on a separate plan.

#### (3) *Profile View*

- (a) All as constructed sewer invert elevations are to be shown. If difference is greater than 300mm between the as constructed and the proposed sewer then the sewer should be re-drawn.
- (b) Any manhole location that differs by more than 5m from proposed is to be re-drawn.
- (c) Items to be changed if different than proposed:
  - i. Types of manholes
  - ii. Pipe Sizes
  - iii. Road grade
  - iv. Sewer grade
  - v. Sewer material
  - vi. Class of pipe
  - vii. Type of bedding
- (d) Remove all flags.
- (e) Manhole identifications are to be left on.

- (f) Sanitary sewer and watermain information should have Regional approval prior to City acceptance.
- (g) Remove obsolete road profile.
- (h) Lot grading elevations are to be as built and proposed elevations are to be removed.
- (i) All sewer connections must be shown.
- (j) All graphics to be inked and no pencil work.

**APPENDIX "B"****RESIDENTIAL BUILDING PERMIT POLICY**

1. SUBDIVISION PLAN must be registered and all engineering plans approved, prior to the issuance of building permits for ANY LOTS. All site plans must conform with the overall approved grading and drainage plan.
2. Temporary or permanent street name and stop signs shall be erected prior to the issuance of any building permit.
3. Building permits will not be released until the public roads on which the lots are fronting and the access roads thereto have been constructed up to and including curb and gutter (or base curb) and base course asphalt.
4. Building permits may be issued for model homes at the discretion of the Commissioner of Development, Design and Development prior to the completion of municipal services as described under 3 above, provided that the Regional charges have been paid.
5. Building permits will not be released until the stormwater management facilities have been constructed in accordance with the approved engineering drawings and are functional. A certificate must be issued by the Consulting Engineer certifying the completion of the stormwater management facilities.
6. Street light poles and fixtures shall be erected and operational prior to issuance of any building permits.

**APPENDIX “C”**  
**DESIGN STANDARDS FOR RURAL ESTATE SUBDIVISIONS**

This standard is to be implemented in the Toronto Gore Secondary Plan Area and elsewhere as required by the Engineering and Development Services for road and pavement construction where roadside ditches are to be utilized in lieu of curb and gutter. This option shall only be used at the discretion of the City of Brampton.

**(1) PAVEMENT DESIGN**

All roads shall be constructed with a minimum road grade of 0.50%. Curved sections around cul-de-sacs and crescents shall have the centre line road grade adjusted in order to provide a minimum gutter grade of 0.50%.

The R.O.W. width shall be 20m with 6.5m of pavement as per City of Brampton Standard 207. The R.O.W. width (and consequently the pavement width) will be as set out at the draft plan stage.

**(2) CATCHBASIN SPACING**

The maximum gutter length to the first set of catchbasins shall be no greater than 200 meters. At this point double catchbasins shall be constructed with connections to a storm sewer pipe. After this point single catchbasins shall be required at a maximum spacing of 200 meters (with double catchbasins at low points). Standard City of Brampton catchbasins shall be utilized in all cases.

**(3) UNDER DRAINS**

At all catchbasins a 3 meter length of Helcor corrugated pipe under drain shall be utilized as per the standard drawings. In addition to this, full length continuous under drains are to be used beneath the curb in all locations. The initial 3m section out of the catchbasin shall be Helcor corrugated pipe. The remaining section may be plastic material. The underdrain is to be wrapped in filter cloth.

**(4) STORM SEWER DESIGN**

All storm sewers shall be designed for the two year storm and shall utilize an inlet time for design purposes of 10 minutes with run-off factors of 0.25 for grassed areas and 0.90 for paved areas.

The sewers shall outlet to an existing stream or water course as approved by the Engineering and Development Services Division and should have a minimum depth of 1.5 meters to the top of the pipe at all locations beneath the road pavement surface.

**(5) STREET LIGHT DESIGN**

**Street lighting shall be designed as per the latest City of Brampton Standards.**

**(6) SUMMARY**

**All other subdivision design standards shall apply to rural estate subdivisions.**

**APPENDIX “D”****TABLE I****GEOMETRIC DESIGN CRITERIA**

Road Classification	A.A.D.T	Payment Width (b)	Allowable % Grade (C) (D)	Min. Centreline Radius	Min. Design Speed (km/hr)	Min. Tangent Length at Intersections
Minor Local	<1,000	8.0m	0.5 – 8.0	10m	50	N/A
Local	<1,000	8.0m	0.5 – 8.0	70m	50	N/A
Minor Collector	1,000 – 8,500	10.0m	0.5 – 6.0	190m	60	30.0m
Major Collector	8,500 – 17,000	14.0m	0.5 – 5.0	225m (AADT 8,000-13,000) (e) 320m (AADT 13,000-17,000)(e)	60 70	50.0m
Arterial	> 17,000	15.0m	0.5 – 5.0	580m (e)	90	75.0m
Industrial	N.A	10.0m	0.5 – 5.0	22m	50	50.0m

**NOTES**

- (a) Minimum stopping sight distances for all road classifications shall be based on the latest Transportation Association of Canada Guidelines.
- (b) Minimum pavement widths for standard cross sections can be found in the City of Brampton Standard Drawings Nos. 200-210.
- (c) Desirable maximum grade for all streets is 5%.
- (d) Maximum downgrade into cul-de-sac is 3%.
- (e) Minimum Centreline radius calculated using 1999 TAC guidelines assuming a normal pavement cross fall of 0.03m/m, 0.02 m/m for arterial roads and parkways.
- (f) Streets are to intersect at right angles where possible. The maximum deviation shall not exceed 10 degrees.
- (g) Grade changes in excess of 2.0% must be designed by means of a vertical curve for the design speed specified. K values shall be determined using the latest T.A.C. Guidelines. In addition the minimum length of vertical curve shall not be less than the design speed. For example a design speed of 50km/hr would require a minimum length of vertical curve of 50m.
- (h) Maximum bulb width at bends shall be as per latest City Standard Drawing 215.
- (i) The major road shall govern the right-of-way daylighting at intersections. The daylighting will be curvilinear for local and collector roads with radii as follows: local roads – 5.0m; collector roads – 7.5 m. Arterial Roads shall provide 15.0m daylight triangles (not rounding).
- (j) Intersection throat widenings at industrial and collector road intersections with arterials will be required. An additional 1.5m of pavement width (resultant pavement width of 11.5m) within the 23.0m road allowance for a distance for 45.0 m from the intersecting street line will be provided, tapering over a distance of 60.0m to the base 23.0m road allowance.

**TABLE II**  
**INTERSECTION TREATMENT**

Street to Street	Curb Radius (m)
Minor Local to Minor Local	7.5
Local to Local	7.5
Minor Local or Local to Collector	10.5
Minor Local or Local to Arterial	15.0
Collector to Collector	10.5
Industrial Streets to Industrial Streets	15.0
Collector to Arterial	18.0
Industrial Streets to Arterial	18.0
Arterial to Arterial	18.0

**APPENDIX 'E'**

**FUNCTIONAL SERVICING REPORT**

**TERMS OF REFERENCE**

**I Introduction**

- a) General location

**II Background Information**

- a) Site Constraints / Existing Conditions
  - i) Topography and Drainage
  - ii) Trans Canada Pipeline
  - iii) Trunk Sewers
  - iv) Watermains
  - v) Utilities
  - vi) Environmental Features
    - Protected Watercourses
    - Terrestrial Features
- b) Design criteria
  - i) Meteorological data used
  - ii) Type of control (quantity, quality and/or erosion)
  - iii) Quantity storage
    - On site
      - Parking lot
      - Pipe
      - Rooftop
    - Off site
  - iv) Storm events
    - For pipe
    - For pond
- c) Target flows
- d) Assumptions
- e) Itemize area specific recommendations and requirements contained in MESP / EIR / EIS and other studies relevant to the application
- f) Information related to relevant Class Environmental Assessments

### **III Proposed Conditions / Proposed Development**

- a) Include copy of the draft plan
- b) Provide comprehensive plan which coordinates road networks and drainage from adjacent properties

### **IV Stormwater Management**

- a) Collector Systems
  - i) Minor System
    - Conceptual sewer design to ensure adequate sewer slopes and pipe cover
  - ii) Major System
    - Illustrate overland flow paths
    - Identify capacity restrictions
    - Identify land requirements
- b) Grading
  - i) Conceptual grading to ensure:
    - Adequate pipe cover
    - Proper fit with adjacent subdivisions
    - Proper fit with outlet
    - Proper fit with surrounding road networks
    - Major system ponding does not exceed 0.3 metres
- c) Pond Design
  - i) Including calculations and modelling to ensure pond is functional
  - ii) Quality control sizing based on 2003 MOE design guidelines
  - iii) Erosion control satisfies relevant criteria
  - iv) Quantity / flood control satisfies relevant criteria
  - v) Other requirements (i.e. sediment drying areas, maintenance access, frontage, side slopes, etc.)
- d) Interim Servicing Conditions or Issues
- e) Stream Density (Credit Valley Secondary Plan Area)
- f) Limit of catchment areas (illustrate if right-of-way from adjacent roads is included)
- g) Infiltration measures (if appropriate)
- h) Measures to address external flows

**V Figures, Tables and Calculations (to be placed in appropriate sections)**

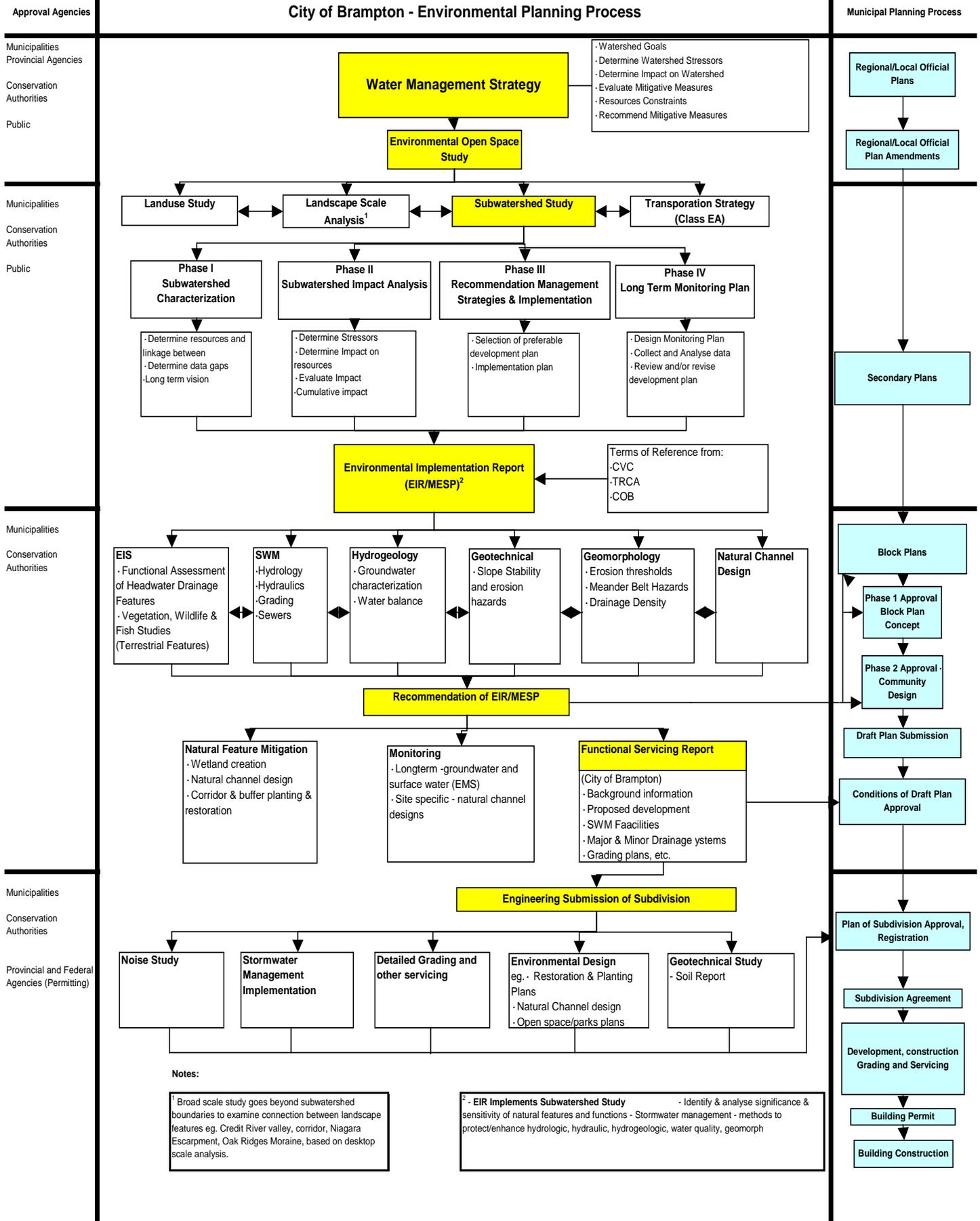
- a) Location Plan
- b) Draft Plan
- c) Tertiary / Block Plan
- d) Existing Drainage Conditions
- e) Storm Drainage Plan
  - i) Show major and minor flow paths
- f) Constraint Area Map
- g) Feasibility Level Grading and Sewer Design
- h) Feasibility Level Pond Design (plan view, cross sections profiles etc.)
- i) Tables
  - i) Stage / Storage / Discharge Rating Curves
  - ii) Development of stage – storage relationship
  - iii) Comparison of target flows vs. actual flows
  - iv) Water elevations from modelling
  - v) Summary sheet of all assumptions made
- j) Calculations
  - i) Stage / Storage / Discharge Rating curves
    - Inlet / outlet control conditions
  - ii) Orifice / weir calculations
  - iii) Sediment drying area
    - Required and available volumes
  - iv) Storage Calculations
    - Permanent pool and extended detention
  - v) Sediment Forebay Calculations
  - vi) Dispersion Length Calculations
  - vii) Drawdown time
  - viii) Meander Belt Calculations
  - ix) Stream Density Calculations

## **VI Conclusions**

- a) The consulting engineer shall stamp and sign a declaration stating that:
  - i) The FSR complies with the latest subdivision design manual
  - ii) The FSR complies with the recommendations and constraint set out in the MESP / EIR. If there are any deviations from the MESP / EIR level studies then the consultants should explain their assumptions
  - iii) The drainage of the adjacent lands will not be adversely affected

**APPENDIX 'F'**

**City of Brampton - Environmental Planning Process**



**Notes:**  
 1 - Broad scale study goes beyond subwatershed boundaries to examine connection between landscape features eg. Credit River valley, corridor, Niagara Escarpment, Oak Ridges Moraine, based on desktop scale analysis.

2 - EIR Implements Subwatershed Study - Identify & analyse significance & sensitivity of natural features and functions - Stormwater management - methods to protect/enhance hydrologic, hydraulic, hydrogeologic, water quality, geomorph

## APPENDIX 'G'

### **DEFINITIONS OF THE MOST COMMONLY USED TERMS IN ENVIRONMENTAL PLANNING AND MUNICIPAL ENGINEERING**

#### **Watershed**

A watershed is defined as the area of land that drains into a water body (lake, river, stream or creek). A watershed represents a complex ecosystem within which water flows and is influenced by natural processes and human activities. Planning on a watershed basis has become an accepted practice, as it integrates resource management and land use planning and land management practices. The watershed boundary is usually at least 1,000 km<sup>2</sup>.

#### **Subwatershed Planning**

A subwatershed plan provides a detailed understanding of existing ecosystem conditions and predictions of future conditions given various land use scenarios. Information derived from the watershed plan is then incorporated into planning documents as the basis for environmentally sound land use designations and development policies. The subwatershed drainage area is normally between 50 – 200 km<sup>2</sup>.

#### **Block Planning**

The Block Planning concept provides an appropriate balance between the development potential of environmental protection opportunities and also ensures that an appropriate fit of all land use elements can be achieved as the draft plans within the Secondary Plan Area proceed to develop. Each sub-area needs to address a full range of planning issues including urban design, land use, transportation, servicing, environmental, noise and archaeology as well as providing guidance to the preparation of draft plans of subdivision.

#### **Master Environmental Servicing Plan and / Environmental Implementation Report (MESP/EIR)**

MESP or EIR is a document that demonstrates how development can occur in accordance with the criteria and requirements of subwatershed study such as to assess the opportunities and constrains to a development as a framework for preparation a block plan design concept, evaluation of potential impact on environment and outline the stormwater management concept for the subject land.

#### **Functional Servicing Report (FSR)**

The Functional Servicing Report describes the proposed storm sewer drainage system, proposed stormwater quality and quantity control facilities, sanitary servicing, water supply, Geotechnical report, etc., all in accordance with recommendations of EIR/MESP. In other words FSR identifies servicing needs for all lands within the block plan also provides guidelines for the draft plan approval process.

Watershed Linkages

## **Watershed Linkages**

The biophysical resources of any watershed interact to create an environment that supports a diverse range of aquatic and terrestrial life and provides a multitude of recreational opportunities for watershed residents.

## **Drainage Density**

Drainage density is the ratio of total length of drainage feature (e.g. stream length, swale length, channel length) to the total drainage area attributed to those drainage features. The drainage density is measured in km/km<sup>2</sup>.

## **Ecosystem**

A biological community including humans and their natural environment.

## **Stormwater**

Surface runoff, resulting from rain or snowmelt events.

## **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

## **Conveyance Control**

A structural Best Management Practice that is located within the drainage system where flows are concentrated and are being conveyed along a corridor. Conveyance Controls include but are not limited to pervious pipes, roadside ditches, and other similar systems.

## **Major Drainage System**

That storm drainage system which carries the total runoff of the drainage system less the runoff carried by the Minor Drainage System (storm sewer). The Major Drainage 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 System 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 that may have a frequency of occurrence of one in 2, 5 or 10 years.

**Stormwater Management Plan**

The result of a study by a qualified professional which demonstrates how the combination of Source Control, Conveyance Control and, if necessary, End-of-Pipe Control facilities achieve the MESP/EIR criteria.

**Stormwater Servicing Drawing**

A drawing or series of drawings prepared by a qualified municipal engineering consultant illustrating how stormwater will be managed.

**Watercourse**

A natural well-defined channel produced wholly or in part by a definite flow of water, and through which water flows continuously or intermittently.

**End of Pipe Measures**

End of pipe measures include Best Management Practices that are installed at the end of the storm sewer system prior to discharging to the stream or river. End of Pipe facilities include stormwater ponds (wet and dry ponds), wetland treatment systems, underground water storage tanks, infiltration basins and infiltration ponds. These facilities reduce runoff, improve water quality and control flows that affect flooding and erosion within urban areas that are generally applied at a subdivision or storm sewer outlet basis.

**Rooftop Storage**

Water is stored on flat roofs, thereby attenuating flows, by installing restrictors on the roof within the plumbing system.

**Parking Lot Storage**

Water is stored on parking lots by restricting the flows getting into the catch basins or by providing a control device at the property line.

**Super Pipe Storage**

Large underground pipes are constructed in order to temporarily store flows.

**Reduce Lot Grading**

Typical grading around buildings (> 2%) is reduced to encourage infiltration.

**Rooftop Leader to Ponding Area**

Water from the roof downspouts is directed to a depressed area where infiltration and temporary storage is encouraged.

**Soakaway Pits**

Underground units, typically filled with clear stone, are constructed and infiltrate water discharged from the downspouts.

**Infiltration Trenches**

Underground trenches, constructed of clear stone, sand, or peat moss, capture runoff from grassed or paved areas and promote infiltration, store, cool and clean runoff.

**Rooftop Grading**

Units that are constructed on top of buildings to reduce runoff (via increased evapotranspiration), improve water quality and reduce energy usage.

**Grass Swales**

Linear grassed channels which attenuate runoff and promote infiltration.

**Pervious Pipe Systems**

Sewers that promote storage and infiltration through perforations constructed in the pipes.

**Pervious Catchbasins**

Catchbasins with pervious walls or bottoms.

**Vegetated Filter Strip**

Linear swales with vegetation and possibly permeable soils to promote cleaning of water as well as attenuation of runoff.

**Stream / Valley Buffer Strips**

Vegetated strips adjacent to streams / valleys which clean and attenuate runoff.

**Wet Ponds**

Stormwater ponds, which by storing water addresses issues related to water quality, erosion and flooding. Wet ponds have a permanent pool of water.

**Constructed Wetlands**

Wetlands that are designed to treat stormwater runoff.

**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.

## **Hybrid Wet Ponds**

A combination of Wet Ponds and Constructed Wetlands.

## **Dry Ponds**

Stormwater ponds designed for erosion and flood control. . Dry ponds have no permanent pool of water (i.e. these ponds are dry except during rainfall).

## **Infiltration Basins**

Aboveground or belowground facilities that are designed primarily to infiltrate runoff.

## **Filters**

Systems using sand, peat moss or clear stone which filter out pollutants in stormwater runoff.

## **Oil / Grit Separators**

Mechanical devices used for capture of spills and treatment of stormwater.

## **Distributed Runoff Control (DRC)**

Distributed runoff control (DRC) is a method for controlling instream erosion. The release rates for DRC are based on the estimated pre-development 2-year flow from the site.

## **Hydrologic Simulation Program - Fortran (HSP-F)**

The most recent hydrologic model used to examine the health of watersheds is HSP-F. The model is based on continuous modeling that uses historic rainfall data as input to generate a time series of modeled peak flows.

## **Hydrology**

Hydrology processes are central to many of natural functions and features within the subwatershed, hence maintaining hydrologic function as land use changes is important to preserve existing resources. Significant alterations to subwatershed hydrology will negatively impact on downstream properties in terms of increased flood potential or reduced base flows.

## **The Hydrologic Cycle**

The hydrologic cycle is the means by which water is transported and transformed over the earth's surface. The cycle involves the continuous process by which water is evaporated from the oceans, transported to the land and discharged back to the sea. Many complex interacting components influence the operation of the hydrologic cycle including winds, ocean currents, the distribution of land and water, vegetation, landform and other geographical features.

## **Hydraulic**

Hydraulic is the measurement of water movement through streams, watercourses and pipes, etc.

## **Stream Morphology and Erosion (Fluvial)**

Fluvial (or stream) geomorphology is the study of landforms and processes associated with rivers and therefore includes the stream channel itself as well as the floodplains and valleys in which it is situated. The morphology of a stream refers not only to the dimensions of its cross-section, but also to variations along the channel bed (profile), and its lateral expression on a floodplain (pattern in planview). Stream channels adjust their shape and form according to upstream inputs of water and sediment, and the geologic materials through which it flows.

## **Official Plan**

The Official Plan adopted by the City.

## **Private Property**

Land owned by private individuals or companies.

## **Public Property**

Land owned by the City or any other level of government, public agency or institution.

## **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.

## **References:**

- Ontario Ministry of the Environment, Stormwater Management Planning and Design Manual – March 2003
- The Wet Weather Flow Management Policy – City of Toronto – August 2003
- Credit River Water Management Strategy Update – August 2006
- Land Development Handbook by Dewberry & Davis
- The Journal of Stormwater Professionals – February 2006
- Numerous MESP/EIR and FSR reports prepared by several engineering and environmental consultants for the City of Brampton.