City of Cambridge
Engineering Standards and Development Manual 2013

Summary of Major Changes

The following table summarizes the major changes that have been proposed to the current Engineering Standard and Development Manual June 2007. These changes have been supplemented and incorporated into the Engineering Standards and Development Manual 2013, accordingly. The minor changes and typographical errors and/ or slight rewording for clarity have not necessarily been included in this summary.

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<td>1.4.1</td>
<td>- Refinement of subdivision application process by adding a flow chart.</td>
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<td>- Addition of other planning approvals such as Committee of Adjustment and Part Lot Controls.</td>
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<td>Grading Permit Procedure has been added in conjunction with Grading Permit By-Law No. 160-09.</td>
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<td>Requirement of a minimum thickness of 200mm for concrete sidewalk within driveway ramp is added.</td>
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<td>- For the driveway ramps where sidewalk do exists, City now requires to have 150 mm thick concrete ramp installed. An asphalt driveway ramps for properties having no concrete sidewalk may be allowed.</td>
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<td>- Minimum and maximum drive width adjusted to comply with current Zoning By-Law.</td>
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<td>- Note added for sidewalk design to complying with the accessibility design standards set out in the Accessibility for Ontarians with Disabilities Act 2012(AODA).</td>
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<td>The details for traffic control devices and pavement markings have been modified and added as Appendix “E” to this manual. Hence, section 2.1.4.1</td>
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2.1.4.2.2 removed and merged into Appendix “E”.

2.1.8  The street lighting section has been updated to reflect changes approved by the Council in 2008 as well as new details added to reflect the current updates to the manual (i.e. peer review of street light design, developer responsibility for electricity costs from date street lights are energized, outline of procedure, etc.)

2.1.9  City’s standard drawings for different types of walkways (i.e. CSD-L-07, CSD-L-11A, CSD-L-11B, CSD-L-13, CSD-L-15A, CSD-L-15B and CSD-L-16) have been added to assist the consultants.

2.1.11.2  Addition of the typical requirement that “fire hydrants spacing shall comply with DGSSM and Ontario Building Code”.

2.2.1.1  A minimum allowable depth of top soil for landscaped area is suggested to be 150mm.

2.4.1.2  The Storm Drainage policy have been tweaked to comply with current MOE SWM Planning and Design Manual (2003) and the City of Cambridge SWM Policies and Guidelines (2011).

2.5 (subsection 2.5.1.1 to 2.5.1.3.6)  Detailed description of different quality & quantity controls and management techniques for the Storm Water, such as Lot Level /Source Controls, Transport/Conveyance Controls, and End-of-Pipe Management have also been incorporated.

2.6  Details with regards to the design guidelines, material & construction specifications and other standard engineering requirements for sanitary sewers and the relevant appurtenances have been embedded.

2.8  - Additional details on design guidelines, material & construction specifications and other requirements for storm sewers and relevant appurtenance have been elaborated and few sections added.

- City’s updated rain fall IDF (Intensity Duration and Frequency) parameters have also been tabulated for the convenient use of consulting industry.

3.1.12.3  Minor changes and/ or tweaks for As-Built Drawing requirements.

3.1.12.1 and 3.1.12.1.2  Updates on requirements for digital and hard copies for As-Built drawings.

4.1( section 4.1.2 to 4.1.5 added)  - Few additions to the “Preconstruction Requirements”.

- The obligatory Chlorine Residual Maintenance Plan for new watermains is being made mandatory before start of water servicing installation.
| 4.2 | Common requirements and obligations during the course of construction have been elaborated and detailed to mitigate the construction impacts on neighbouring properties and City Right of Way. |
| 4.5.2.1 to 4.5.2.4 | - With regards to the underground, surface, landscape and SWM facility works, a brief of the developers/owners responsibilities during the maintenance period has been added to eliminate any confusion as to who does what. The intent is to help the developer understand his/her responsibilities and obligations during entire maintenance period. |
| 4.6 | - In an effort to ensure that City ends up in taking over an efficient and cost effective municipal infrastructure as a result of new construction and assumption of new subdivisions, the City’s Right-of-way Assumption Process have been revamped in consultation with operation and TPW staff. - Standard checklist has been framed to help City staff perform the visual inspection/walk through before final assumption of new subdivision. |
| Chapter – 5 City’s Standard Drawings | Minor adjustment in dimensions and addition of few standard drawings |
| Appendix ‘A’ | Traffic Impact Study-No Changes |
| Appendix ‘B’ | Cambridge and North Dumfries Hydro Inc., Material and Construction Specifications- No Changes |
| Appendix ‘C’ | Tree Management Policies and Guidelines- No changes |
| Appendix ‘D’ | CCTV Specification for Sanitary and Storm Pipes and Laterals - updated |
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CHAPTER 1 – INTRODUCTION AND PLANNING APPROVALS

1.0   GENERAL


This manual has been prepared by Development Engineering staff within the Planning and Development Department in collaboration with Transportation & Public Works Department to provide a formal means of communication and information to landowners and for the use of consulting engineers, planners, developers, architects and others involved in land development projects within the City of Cambridge.

This Manual outlines the policies, processes and standards for the grading, servicing, and/or landscaping of lands in the City of Cambridge and forms the basis to obtain approvals for the design and construction of such works. It should be recognized that the installation of municipal services and/or grading of lands can occur on lands in the City of Cambridge only where applicable planning approvals are already in place.

The intent of this Manual is to assist the development industry in the preparation and processing of engineering submissions. This Manual applies to all new Draft Plans of Subdivision, Plans of Condominium and Site Plans. It will also apply to capital projects and reconstruction projects, where deemed applicable by the City.

The criteria and standards in the Manual are considered to be minimum requirements by the City and do not relieve the Developer and/or Consultant of the responsibility of submitting a finished product of completed engineering design and construction conforming to the other applicable standards and specifications. All designs/plans submitted for approval must reflect any and all requirements of the engineering reports prepared for the development.

City of Cambridge has adopted the “Ontario Provincial Standard Drawings and Specifications (OPSS, OPSD)” and “Region of Waterloo and Area Municipalities Design Guidelines (DGSSMS)” except where amended as indicated in this Manual.

The final draft of the document was also circulated Waterloo Region Home Builders Association (WRHBA) and few consultants for their input and comments have been incorporated to address the major concerns.

This Manual is intended to help understand and identify:

a) The role and involvement of various City Departments and outside agencies with regards to the engineering approval process
b) The general requirements for subdivision development engineering including design criteria, engineering submissions, subdivision and development agreements, subdivision construction and the subdivision assumption process

c) The general site plan requirements including design criteria, submission requirements, site development agreements and site inspection approval

d) Miscellaneous requirements / procedures related City policies, including approvals and permits

e) The requirements for major studies such as Environmental Assessment Studies, Watershed and Sub-watershed Studies, Noise Attenuation Studies, Traffic Impact Studies, Geotechnical Investigation Study, Hydrogeological Studies and Servicing Studies, where applicable

f) Additional issues such as sales pavilions, model homes, construction trailers, etc.

g) Applicable subdivision and site plan standard forms and letters

h) Construction procedures and engineering standards as per the requirements of the Transportation and Public Works Department

i) Community Services Department’s requirements and procedures related to parks, tree management and recreation etc.

Development and Engineering staff wishes to thank members of Waterloo Region Homebuilders Association Liaison Committee for providing extensive comment and input into preparation of this document. Additional consultation included engineering consultants, developers, builders, City staff from different departments, staff from Grand River Conservation Authority and staff from Cambridge and North Dumfries Hydro Inc.

NOTE:
1. All references to rates and fees related to the development can be found at: [http://www.cambridge.ca/relatedDocs/2013%20Rate%20Review%20-%20Planning%20Website.pdf](http://www.cambridge.ca/relatedDocs/2013%20Rate%20Review%20-%20Planning%20Website.pdf)

2. All other City policies, procedures and By-Laws are also applicable.

1.1 Jurisdictional Responsibilities

The following is intended to provide a brief information and guidance regarding the requirements of agencies having jurisdiction over specific aspects of development. All requirements should be confirmed directly with the respective organization early in the development process. The City cannot be held responsible for additional requirements that may arise during the process.
1.1.1 Ministry of Transportation Ontario (MTO)

Access Permit

A permit is required from MTO for modification of any access from a provincial highway, use of an existing entrance for a different purpose or any new access. The onus is upon the owner/consultant to obtain this permit.

Encroachment Permit

An encroachment permit is required for work upon, under or within the limits of a Provincial highway right-of-way. It is the owner's/consultant's responsibility to obtain the requisite permit.

Sign Permit

Erection of a sign on any provincial highway corridor requires a permit from MTO. It is the owner's/consultant's responsibility to obtain this permit, as required.

Building and Fill Permits/Storm Drainage Criteria

Placement of fill material or constructing a building or any structure which impacts drainage patterns to and from the MTO corridor requires a permit. It is the owner's/consultant's responsibility to confirm MTO’s storm water management criteria and requirements for sites draining towards their corridors.

NOTE: For further information, please contact MTO's region office @ 659 Exeter Road London ON N6E 1L3. Phone (519) 873-4100.

1.1.2 Ministry of the Environment (MOE)

MOE approvals may be required for the following:

- Stormwater Management Design and Report
- Permits to Take Water (PTTW)
- Municipal and Private Water & Sewage Works, and;
- Stationary Noise Impact Assessment Studies

It is the owner's/consultant's responsibility to obtain the further information with regards to the requisite approvals and requirements. For further information, please contact MOE’s District Office: 1 Stone Road W. Guelph ON N1G 4Y2. Toll free: 1-800-265-8658 Tel: (519) 826-4255 Fax: (519) 826-4286
1.1.3  **Grand River Conservation Authority (GRCA)**

The GRCA reviews subdivisions, vacant land condominiums, Official Plan and Zoning By-law amendments, consents, variances and site plan approval applications within their area of jurisdiction. Based on the location and type of development the GRCA may require one or more studies to be completed to their satisfaction. Approvals are also required for:

- Alteration to a Water Course, Lakes and Rivers
- Creek Crossings
- Any grading, structure installation within regulated area or flood plain
- Watershed and Subwatershed Studies, and
- Storm Water Management designs and outlets, etc.

It is the owner's/consultant's responsibility to obtain the approvals. For further information contact Grand River Conservation authority, 400 Clyde Road, PO Box 729, Cambridge Ontario N1R 5W6. Phone (519) 621-2761 and Fax (519) 621-4844.

1.1.4  **Other Agencies**

Approvals may also be required from:

- Bell Canada
- Cambridge and North Dumfries Hydro Inc.
- Canada Post
- Canadian National Railway
- Canadian Pacific Railway
- Hydro One
- Rogers Communication
- Union Gas -- Canada, and
- Region of Waterloo

It is the owner's/consultant's responsibility to obtain approvals from these agencies, when necessary.

1.1.5  **Development Engineering, Planning and Development Department**

The Development Engineering section provides engineering support and advice to other Divisions within the Planning and Development Department. This division is also responsible for providing liaison, support and advice to the other departments within the City, the public and external agencies regarding development related issues.

Development Engineering is responsible for review and approval of all servicing and grading designs and plans for residential, commercial and industrial subdivision projects. The issues of concern include municipal road design/improvements, construction of municipal infrastructure, grading, storm water management, noise attenuation, general site servicing and all relevant municipal infrastructures.

Typically, Development Engineering staff is responsible for review and comments on the following planning applications:
• Official Plan and Zoning By-Law amendments
• Community Plans
• Plan of Subdivisions
• Commercial and Industrial & Multi Residential Site Plans
• Land Division and Minor Variances, and
• Building Permits

The Development Engineering section also responds to public inquiries/complaints and concerns about grading and drainage with regard to private property in new subdivisions, and offers direction and advice to citizens as and when requested. The responsibilities also include the technical input on issues related to:
  a) Committee of Adjustment, land severance and minor variance applications
  b) Draft Plan of Subdivision and/or Condominium
  c) Part Lot Control Exemptions
  d) Zoning and/or Official Plan Amendments
  e) Approval of Subdivision Engineering Drawings
  f) Subdivision agreement preparation / Plan release for registration
  g) Administration of Subdivision Agreement until assumption
  h) Site Plan review and approval
     i) Approval of Stormwater Management Reports and designs
  j) Approval of development related Studies Such as noise, geotechnical investigation, storm water management and environmental issues
  k) Approval of grading and drainage in new subdivisions
  l) administration of Grading By-law and issuance of Grading Permits

1.1.6 Engineering Services Division, Transportation and Public Works Department

The Engineering Services Division of the Transportation and Public Works Department is responsible for the development and application of engineering standards. This Division will review any required deviations to these standards through the Development Engineering Section within planning and development department.

The Engineering Services Division is also responsible for the review and approval of all servicing designs for residential, commercial and industrial site plan projects. The issues of concern include municipal road design/improvements, site access/circulation, storm water management, noise attenuation, and general site servicing (including the confirmation with regards to the capacity and the location of municipal services) and all related infrastructure.

Lastly, the Engineering Services Division is responsible for the review and approval of all traffic impact studies and transportation planning studies related to all types of development.

1.1.7 Asset Management Division

The Asset Management Division is responsible for the collection and maintenance of all data records and information related to municipal infrastructure, including all drawings and CCTV sewer inspections.
Subdivision Application Process - (Flow Chart)

PRE-CONSULTATION
Subdivision Coordination Committee reviews the conceptual Draft Plan submitted by the proponent and determines the requirements for complete submission through pre-consultation notes.

COMPLETE APPLICATION SUBMISSION
Notice of the complete application.

PUBLIC NOTICE
AGENCY CIRCULATION

PUBLIC MEETING
GENERAL COMMITTEE
Description of proposal and main issues.

PUBLIC MEETING
REPORT

NEIGHBOURHOOD MEETING
For complex and controversial issues only.

STAFF REPORT
With recommendations. If recommended for approval, a draft By-Law will be attached.

GENERAL COMMITTEE/COUNCIL
Decision about draft approval (YES to Region)

NOTICE

BY-LAW

REGIONAL DRAFT APPROVAL

NOTICE

ENGINEERING SUBMISSION
Complete engineering drawings and cost estimate required. Applicants make separate arrangements with CNDHI and other utilities.

REVIEW/CLEARANCE OF CONDITION
City and all involved agencies clear Draft Plan conditions.

SUBDIVISION AGREEMENT AND SECURITY, INSURANCE
Concurrently Subdivision Servicing Agreement prepared and agency approval sought. L of C shall be provided at this stage.

CITY CLEARANCE TO REGION

REGISTRATION
1.3. **Site Plan Approval Procedure**

1. The Site Plan information package can be picked up from the Planning and Development Department and it is also available online (http://www.cambridge.ca/planning_services/planning_operations/site_plan_approval).

   The package includes:

   a) **Site Plan Approval Information:**

   - Approval Process Reference Guide
   - Site Plan Approval Application
   - Site Plan Committee Meeting Schedule
   - Instructions for Completing Site Plan Control Agreement
   - Site Plan Sample Drawings
   - Form for Letter of Credit
   - Cost Estimate Format
   - Traffic Impact Study Guidelines
   - City of Cambridge Accessible Parking Standards

   b) **Release of Letter of Credit Information:**

   - Letter of Compliance Templates
   - Site Plan Inspection Request

2. The applicant submits a complete application, a minimum three weeks prior to a scheduled Site Plan Committee Meeting, to the Planning and Development Department. The application shall include the following:

   - Completed application form
   - Required site plan fee
   - 14 copies of site plans, grading and servicing plans, landscaping plans, elevation drawings, floor plans and color perspective drawings for all properties on a regional road, 12 copies if located on a local road
   - 4 copies of the Traffic Impact Study, if required
   - 4 copies of Storm Water Management Report
   - 4 copies of Noise Assessment, if applicable
   - 4 copies of Urban Design Brief, if applicable
   - Site Plan Control Agreement
   - Cost estimate for site works

3. The application is reviewed at the Site Plan Committee Meeting by the following City and Agency representatives:

   - Planning
   - Development Engineering/TPW
4. The meeting minutes are compiled by the Planner and distributed to the applicant and all attendees.

5. The Planner will review the cost estimate for site works when received and will advise the applicant to submit securities.

6. The applicant is to address committee comments expressed in the meeting comments and resubmit (if applicable) for the next Site Plan Committee Meeting.

7. Once all committee comments are addressed, the site plan will be signed by each committee member.

8. Following receipt of the site security insurance and four (4) numbers completed Site Plan Control Agreements, a final approval signature by the Commissioner of Planning and Development or designate will be obtained.

9. A copy of the approved plan will be sent to the applicant with a copy of the site plan control agreement and the Building Division will be notified of site plan review completion.

10. Following completion of all site works the applicant shall request an inspection by completing the Site Inspection Form and compliance form and submit it to the pertinent planner.

11. City’s planning staff will inspect the site to ensure compliance with the approved site plan and advise the developer / consultant of any deficiencies.

12. The City’s planner on the file will either release the security if no deficiencies are noted or send a letter to the applicant outlining the deficiencies and advising the applicant that a second inspection will be required with a $300.00 fee once the deficiencies are rectified.

13. Following the release of security the site plan file is closed.

NOTE:
   a. Applicant may attend the meeting if they request to do so and let planner know by 3:00 the Wednesday prior to the meeting.
b. The applicant meets separately with the Engineering Services Division to discuss the requirements for a traffic impact study, where applicable.

c. Chapter 3 and 4 of this Manual do not necessarily apply to all Site Plan Applications. In some cases Planning and Development Department may elect to enforce these sections and will acknowledge this requirement as part of the Site Plan Application process. All other sections of this manual do apply to Site Plan, unless otherwise indicated as specific to Municipal right of way.

1.4 OTHER PLANNING APPROVALS

Where no boundary changes to a parcel of land are required, the following planning approvals may also apply and approval be obtained through one of the following City processes:

1.4.1 Exemption from Part Lot Control

Exemption from Part Lot Control is a process that applies to dividing blocks of land into building lots. These blocks would first have been registered by Plan of Subdivision with an associated subdivision agreement. Council may establish revised conditions for approvals and servicing when approving an application for Exemption from Part Lot Control. Regional approval for Part Lot Control is required.

1.4.2 Committee of Adjustment

Under Section 45 of the Planning Act, the role of the Committee of Adjustment is the following:

- To consider minor variances from Zoning By-laws
- To permit changes to legal non-conforming uses or structures, and
- Interpret generalized By-laws

In addition to the above applications, the Committee of Adjustment has been delegated approval of consent applications under Section 53 of the Planning Act. Consents include applications for land division to create a new development lot, lot additions, and the establishment of easements.

1.5 GRADING PERMIT PROCEDURE

Grading Permit is required for all lands within City of Cambridge where the work on lands causes disturbance to a total land areas of 0.5 hectares or greater.

Permit shall be valid for a period of 180 days from the date of issuance, or until final inspection of the site by Planning and Development staff or inspection and clearance by the Building Inspector. The City may extend the period if required and the extensions shall be subject to a renewal fee as described in By-Law No.160-09.

Grading Permit and the fees will not be required where the owner has entered into a Subdivision
Agreement and/ or Site Plan Agreement.

For further information regarding Grading Permits, please refer to City of Cambridge By-Law No. 160-09.

For obtaining the Grading Permit in City of Cambridge following steps may be helpful:

**Step 1 - Grading Permit Application**

The Consultant/ owner will submit the following to the City:

- completed Grading Permit application (application procedure is available as Schedule ‘B’ of the By-Law No 160-09)
- copies of the Pre-Grading and Erosion Control Plans (Typically erosion and sedimentation control measures shall show vegetation, silt fencing, paige wire fencing, sedimentation traps, storm drainage, Construction entrances and temporary sedimentation control ponds)
- copies of the proposed Tree Saving Plan (also showing any other environmental features deemed important to protect)

**Step 2 – Review of Submission by the City**

Planning and Development Staff will circulate the submitted drawings to the appropriate City departments (i.e. Forestry, Environmental, etc.) for comments. Planning and Development staff will consolidate all comments and forward them to the developer's consultant for revisions, if necessary. All inquiries from the developer and the consultant shall be directed to Senior Development Engineer, Planning and Development Department.

**Step 3 – Revisions and Re-submission by Consultant**

Once the compiled comments are received from the City, the developer's consultant shall make the required changes to the drawings and re-submit to the City.

Once all comments from the City and other public approval agencies have been addressed to everyone’s satisfaction, the City will approve the plans.

**Step 4 – Letter of Credit**

Upon approval of the plans, the Developer shall submit a Letter of Credit equal to 50% of the estimated cost of sediment controls or as deemed appropriate by the City.

**Step 5 – Pre-Construction Site Meeting**

A site meeting between the consultant and the City shall be arranged prior to the installation of erosion and sedimentation control measures.
Pre-construction meeting attendees should include:

- City staff (representatives from Planning and Development, Forestry etc.)
- Consultant (Engineer, Ecologist)
- Contractor’s Project Manager
- Site Supervisor
- Developer, or representative (optional)

**Step 6 – Installation of Erosion and Sedimentation Control**

The Consultant or Contractor will initiate installation of only the erosion and sedimentation control measures based on the approved plans and in accordance with the requirements of By-Law No106-09.

**Step 7 – Inspection of Erosion and Sedimentation Control**

Once the installation of Erosion and Sedimentation Controls are complete the Developer’s Consultant shall arrange with the City, an inspection of the works prior to the commencement of any topsoil removal/grading operations.

If all works are satisfactory and all necessary securities and fees have been provided, the City will notify the Consultant or the Contractor that City staff is satisfied with the installation. Topsoil removal/grading operations may begin.

**Step 8 – Letter of Credit Reduction**

Upon receipt of a written request for a security reduction, the City staff will do an inspection of all applicable pre-grading, topsoil, erosion and sedimentation controls and process the security reduction request if controls found acceptable and in compliance with City's practices and By-Law.

**Step 9 – Erosion and Sediment Control Monitoring**

Erosion and sedimentation control measures must be maintained in a satisfactory condition by the Developer on an ongoing basis, until the development area is entirely completed (i.e. houses built, properties sodded, roads asphalted, etc.). Removal of such measures shall be the responsibility of the developer.

**Step 10 – Release of Letter of Credit**

The provisions of the Grading Permit shall remain in force until the site grading has been completed and the site has been stabilized to the satisfaction of the City. At this time, the developer may request a release of the Grading Permit and its associated L/C.
In a subdivision where grading work is ongoing, and the developer has entered into a subdivision agreement with the City which includes the provisions of the Permit, the developer may request a release from the Grading Permit and its associated L/C.

1.6. SUBDIVISION AND CONDOMINIUM - CALCULATION OF CASH-IN-LIEU OF PARKLAND

For the purpose of determining the amount of money to be paid to the municipality as cash-in-lieu for park land dedication, pursuant to Section 51.1 of the Planning Act, 1990 as amended, for plans of subdivision and condominiums, the owner of the land shall submit to the Property Division, Corporate Services Department at his or her own cost, an appraisal of the value of the lands prepared by a certified appraiser.

It will be beneficial to have the appraisal prepared and submitted to the municipality immediately following draft plan approval of the Plan of Subdivision.

The Property Division is responsible for review and approval of appraisals after consultation with other departments as necessary. Following approval of the appraisal, the Property Division advises the Community Services Department. The Community Services Department has the final say regarding the amount of cash-in-lieu of parkland and will advise the applicant, Planning staff, Transportation and Public Works Departments, and City Clerk accordingly.
CHAPTER 2 – DESIGN CRITERIA

2.1 RIGHT-OF-WAY

2.1.1 Roads
2.1.1.1 Geometric Design

1) Criteria

The geometric design of municipal roads in the City of Cambridge shall conform to the standards set out in the latest edition of the “Geometric Design Guide for Canadian Roads”, issued by the Transportation Association of Canada, or as amended herein.

All plans of subdivision and condominium are to have a minimum of two (2) points of access during construction and upon completion.

The maximum length of road shall be 100m for a cul de sac, which is measured from entry to the throat of the bulb with minimum curb radius of 15m in compliance with Ontario Building Code 3.2.5.6.

Table 2.1 - Geometric Design Parameters for Urban Roads

<table>
<thead>
<tr>
<th>Geometric Design Parameter</th>
<th>Road Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Local</td>
</tr>
<tr>
<td>Right-of-Way Width (m)</td>
<td>18.5 or 20</td>
</tr>
<tr>
<td>Design Speed (km/h)</td>
<td>50</td>
</tr>
<tr>
<td>Minimum Safe Stopping Sight Distance (m)</td>
<td>65</td>
</tr>
<tr>
<td>Minimum Visibility in Sag (K)</td>
<td>6</td>
</tr>
<tr>
<td>Minimum Visibility on Crests (K)</td>
<td>7</td>
</tr>
<tr>
<td>Minimum Horizontal Road Radius (m)</td>
<td>90</td>
</tr>
<tr>
<td>Minimum Grade (%)</td>
<td>0.5</td>
</tr>
<tr>
<td>Maximum Grade (%)</td>
<td>6.0</td>
</tr>
<tr>
<td>Maximum grade for Through Roads at Intersection (%)</td>
<td>3.5</td>
</tr>
<tr>
<td>Maximum Grade at Stop Roads at Intersection (%)</td>
<td>2.5</td>
</tr>
<tr>
<td>Intersection Angle (degrees)</td>
<td>90</td>
</tr>
<tr>
<td>Minimum Tangent Length at Intersection (m)</td>
<td>30</td>
</tr>
</tbody>
</table>
Notes:
1. Smaller numbers are for minor roads; larger numbers are for major roads. (eg. minor collector)
2. All grade changes in excess of 1% shall be designed with vertical curves.
3. Lengths of curves shall not be less than the design speed in km/hr.
4. Asphalt width to be expanded 1.0 metre on 90 degree bends.

Table 2.2 – Intersection Characteristics

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Curb Radius (m)</th>
<th>Day lighting (m)</th>
<th>Minimum Intersection Spacing (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local / Local</td>
<td>8</td>
<td>5 - Radius</td>
<td>60</td>
</tr>
<tr>
<td>Local / Collector</td>
<td>10</td>
<td>7 - Radius</td>
<td>60</td>
</tr>
<tr>
<td>Local / Arterial</td>
<td>15</td>
<td>7 - Radius</td>
<td>400</td>
</tr>
<tr>
<td>Collector / Collector</td>
<td>10</td>
<td>10 - Radius</td>
<td>60</td>
</tr>
<tr>
<td>Collector / Arterial</td>
<td>15</td>
<td>10 - Triangle</td>
<td>400</td>
</tr>
<tr>
<td>Arterial / Arterial</td>
<td>15</td>
<td>10 - Triangle</td>
<td>400</td>
</tr>
</tbody>
</table>

Notes:
1. Bus routes require a minimum curb radius of 13 metres.
2. Industrial roads require a minimum curb radius of 15 metres.
3. Intersection spacing for arterial roads is the same regardless of the type of traffic control.
4. 3 leg intersections may be spaced at a minimum of 40 metres.
5. When a City road intersects a Regional road, Regional standards apply.
6. Lay-by lanes will not be permitted on arterial roads.

2.1.1.2 Road Allowance Cross-Section

1) Criteria

All residential and commercial roads within the urban area of the City of Cambridge shall be constructed to urban standards with asphalt pavement, concrete curb and gutter, storm sewers, water and sanitary sewers, traffic control devices and street lighting. Industrial roads and roads outside of the urban area may be constructed to a rural standard with asphalt pavement, road side ditches, water and sanitary sewers, traffic control devices and street lighting.
Table 2.3 - Standard Drawings

<table>
<thead>
<tr>
<th>Category</th>
<th>Right-of-Way (m)</th>
<th>Standard Drawing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor Local</td>
<td>18.5</td>
<td>C107</td>
</tr>
<tr>
<td>Local</td>
<td>20.0</td>
<td>C106</td>
</tr>
<tr>
<td>Minor Collector</td>
<td>23.0</td>
<td>C104, C105</td>
</tr>
<tr>
<td>Major Collector</td>
<td>26.0</td>
<td>C102, C103</td>
</tr>
<tr>
<td>Arterial</td>
<td>30.0</td>
<td>C101</td>
</tr>
<tr>
<td>Rural Local</td>
<td>20.0</td>
<td>C108</td>
</tr>
<tr>
<td>Rural Industrial Minor Collector</td>
<td>23.0</td>
<td>C109</td>
</tr>
<tr>
<td>Rural Industrial Major Collector</td>
<td>26.0</td>
<td>C110</td>
</tr>
</tbody>
</table>

Notes:
1. Older areas of the City may not adhere to these standards. As a result, reconstruction works may require unique engineering solutions (refer to Substandard Roadway Report).
2. Cul-de-sac roads are not desirable and are to be limited in application. Standard drawings C-111 through C-116 may be used for design of cul-de-sacs on local and minor local urbanized roads and local and industrial minor collector roads with rural cross sections. The Standards included herein only apply to cul-de-sacs with a maximum length of 100 metres to the start of the bulb. Cul-de-sac with a length greater than 100 metres must be designed to the satisfaction of the Fire Department.

2.1.1.3 Pavement Design

1) Criteria

All roads are to be asphalt paved over granular base, in accordance with the minimum pavement structure design.

2) Design

The following table contains minimum pavement design requirements. The Developer is required to engage a Geotechnical Consultant with experience in pavement design to confirm the minimum design based on results of local soils tests. All field tests must be conducted by a recognized Soils Laboratory, and certified by a professional engineer. Copies of such tests must be submitted to the City.
### Table 2.4 – Pavement Structure Design

<table>
<thead>
<tr>
<th>Category</th>
<th>Pavement Layer</th>
<th>Typical Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Local Roads</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface Course</td>
<td>40 mm HL3</td>
<td></td>
</tr>
<tr>
<td>Binder Course</td>
<td>80 mm HL8</td>
<td></td>
</tr>
<tr>
<td>Base</td>
<td>150 mm Granular A</td>
<td></td>
</tr>
<tr>
<td>Sub Base</td>
<td>375 mm Granular B, Type II</td>
<td></td>
</tr>
<tr>
<td><strong>Collector Roads</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface Course</td>
<td>40 mm HL3</td>
<td></td>
</tr>
<tr>
<td>Binder Course</td>
<td>100 mm HL8</td>
<td></td>
</tr>
<tr>
<td>Base</td>
<td>150 mm Granular A</td>
<td></td>
</tr>
<tr>
<td>Sub Base</td>
<td>375 mm Granular B, Type II</td>
<td></td>
</tr>
<tr>
<td><strong>Arterial and Industrial Roads</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface course</td>
<td>40 mm HL3</td>
<td></td>
</tr>
<tr>
<td>Binder Course</td>
<td>100mm HL8</td>
<td></td>
</tr>
<tr>
<td>Base</td>
<td>150mm Granular A</td>
<td></td>
</tr>
<tr>
<td>Sub Base</td>
<td>400mm Granular B, Type II</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

1. Above table shows typical thickness of the pavement, however, pavement thickness should be used as recommended by geotechnical engineer.
2. No RAP will be allowed in top asphalt (HL-3) design mixes. A maximum of 20% will be allowed in base asphalt (HL-8). No other recycled additives will be allowed.
3. On roads designated as bus routes, the binder course asphalt thickness on the bus lane must be increased by a minimum of 50mm.
4. On roads that are designated Industrial, a paved “kill strip” consisting of 50mm HL-3 and 150 mm granular ‘A’, shall be constructed.
5. The developer may request substitutions of the following materials:
6. 19 mm Limestone used as a substitute for Granular ‘A’ (pit crushed).
7. Granular ‘B’, Type I used as a substitute for Type II.
8. Any material substitution requires a letter from a Geotechnical Engineer indicating favorable ground conditions, i.e. water table, native sub-base, etc.
9. Where approved by the City, substituted material use is restricted to between May 1 and September 30.

2.1.1.4 **Curb and Gutter**

1) **Criteria**

All new roads are to be constructed with concrete curb and gutter. Curb depressions are
required at each driveway apron, intersection, pedestrian crossing and park/open space entrance to accommodate wheelchair access ramps. Where the curb depression for sidewalk at an intersection radius is not a continuous apron; and the barrier section of curb between curb depressions is less than 1.0 metre, it shall also be depressed.

2) Design

Minimum curb grade is 0.5% except on cul-de-sac bulbs and outside road elbows where the grade is to be 0.75%. One-stage curb and gutter construction (OPSD 600.04, 600.07 etc.) is preferred; however, two-stage curb and gutter construction as per OPSD 600.07 or “2 stage 3 key curb” may be considered, if requested in writing by the Developer.

2.1.1.5 Driveway Ramps

1) Criteria

A hard-surface driveway ramp of concrete is required between the curb depression and the sidewalk or property line at each lot to suit the garage location and width, as permitted by the zoning by-law. Site-specific designs will be required for driveways at commercial and industrial entrances.

New driveway ramp installations not associated with a plan of subdivision require an Access Permit. Alternative materials may be submitted for consideration by the City.

The preferred slope of driveway ramp shall be between 2.0% and 8.0%. A minimum allowable width of the driveway is 2.75 meters and a maximum 7.0 meters. Please refer current version of City of Cambridge zoning By-Law for further details on driveway width.

2) Design

Concrete ramps shall be 150 mm in depth for residential lots and 200 mm in depth for commercial, industrial and institutional lots. A bedding of 125 mm of Granular “A” is required.

The City shall require a concrete driveway ramp where sidewalk do exists. Asphalt driveway ramps will be acceptable for properties having no concrete sidewalk. A minimum depth of 125 mm Granular ‘A’ base course and an asphalt pavement depth of 75 mm HL-3 in two lifts, is required. Driveway ramps shall be paved prior to placement of road surface asphalt (standard drawing C144).

Where curbing is installed in conjunction with an access and there is municipal sidewalk and/or multi-use trail, the curbing shall stop on either side of the sidewalk and/or trail and be flush to grade for 0.3 metres.

2.1.1.6 Standards and Specifications

Spacing and configuration must comply with the TAC Geometric Design Manual.
Driveways shall also conform to the current City Zoning By-Law.

2.1.2 Sidewalks

2.1.2.1 Criteria

Sidewalks shall be constructed within the municipal right-of-way (OPSD 310.010), on all urban road types, on both sides, with the exception of minor local roads where sidewalk may be installed on one side only. Where sidewalk is installed on one side of the road only, it should be located on the same side as the fire hydrants.

2.1.2.2 Design

Sidewalks are to be placed on granular material compacted to 98% Standard Proctor. A leveling course of compacted Granular ‘A’ is to be used to correct sub grade irregularities. The standard depth of concrete sidewalk shall be 150mm and under the driveway shall be 200 mm or as designed to carry the traffic loads and type of the vehicles using that driveway.

Note:

1. The construction of new Sidewalks within City limits shall comply with the design standards and requirements as set under Accessibility for Ontarians with Disability Act (AODA) Act 2012.

2. In addition to complying with the accessibility design standards set out in the Accessibility for Ontarians with Disabilities Act, the developer must also meet the accessibility design requirements and standards set out by the City of Cambridge

2.1.3 Bike Lanes

2.1.3.1 Criteria

Bicycle lanes are required on collector and arterial roadways as identified by the City. Paved shoulders are required on all rural roadways as identified by the City. Wide shared use lanes may be required as identified by the City.

2.1.3.2 Design

Bicycle lanes shall have the same structural standard as the remainder of the roadway. Bicycle lanes shall be designated through pavement marking and shall be 1.5 metres wide. Where bicycle lanes are adjacent to the curb and gutter, they shall be measured from the edge of pavement.

Bike lanes shall be delineated and signed in accordance with the Transportation Association of Canada Standards and Ontario Traffic Manuals.

The width of paved shoulders shall be designed as per the following table:
<table>
<thead>
<tr>
<th>Operating Speed</th>
<th>AADT &lt; 3000</th>
<th>AADT &gt; 3000</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;50km/h</td>
<td>1.2m</td>
<td>1.2m</td>
</tr>
<tr>
<td>51km/h – 70km/h</td>
<td>1.2m</td>
<td>1.5m</td>
</tr>
<tr>
<td>&gt;70km/h</td>
<td>1.5m</td>
<td>1.5m*</td>
</tr>
</tbody>
</table>

*1.75m where % trucks is greater than 3%

2.1.4 Traffic Control Devices and Pavement Markings

Appendix “E” of the Development Manual provides the City of Cambridge Traffic Controls and Pavement Marking Standards.

2.1.5 Transportation Impact Studies

Transportation impact studies (TIS) are necessary to assess the potential impact of traffic volumes generated by a proposed development on the surrounding road network and to identify roadway improvements that may be required to mitigate these impacts. TIS guidelines provide developers and their consultants with information on how to prepare a Traffic Impact Study to meet City requirements, in terms of approach, scope, format and content. The City of Cambridge TIS Guidelines (Appendix “A” of this Manual) must be referred prior to the commencement of any study.

2.1.6 Street Lighting

2.1.6.1 Criteria

The purpose of a street lighting system is to illuminate the municipal right-of-way. The developer shall construct a street lighting system on all urban and rural roads.

Appendix “B” of this manual provides guideline on material and construction specifications of the Cambridge and North Dumfries Hydro Inc. This document provides general requirements for the design and installation of an underground electrical distribution system and a street lighting system within a residential subdivision.

While the design and installation of a distribution system and the supply for a street lighting system must be in accordance with Appendix B; the developer may retain a consultant and contractor of their choosing for the design and installation of street lighting system, pursuant to approval of the consultant and contractor by the Commissioners of Transportation and Public Works.

Maintenance of the street lighting system is the responsibility of the developer until assumption. The developer will also be responsible for all electricity costs from the date the street lights are energized. The costs will be determined based on an average cost per light and will be charged on a sliding scale where the developer pays 100% in year one, 67% in year 2 and 33% in year 3.
Where decorative fixtures are used, the developer shall supply one replacement fixture, arm and pole for every 20 street lights, or portion thereof and/or at the City’s discretion cash in lieu of the material may be requested, unless the developer is directed to use decorative by the City.

2.1.6.2 Design

Round concrete poles with cobra head fixtures on aluminum arms and underground wiring shall be used for all street lighting pole lines on arterial and industrial roads.

Decorative street lights may be used on major collector, minor collector and local roads. The decorative fixture shall be a Cooper Lighting “Springdale”, King Luminaire K601, or approved equivalent, subject to approval by the Commissioner of Transportation and Public Works. Fixtures shall be mounted on aluminum arms and concrete poles, the design of which is subject to approval by the Commissioner of Transportation and Public Works. It is the developer’s responsibility to ensure that the fixtures and poles selected are compatible.

Flat glass lens are recommended in areas where illumination may negatively impact residents due to the proximity of homes to the roadway.

All street light poles shall be located a minimum of 15m from an intersection where traffic control devices such as a stop sign may be installed, so as to not impede motorist sight lines of such devices.

The developer shall submit the street lighting system design and photometric analysis to the Transportation and Public Works Department for approval at second submission of the Plan of Subdivision. The City at its discretion may hire a consultant to review the street light design and photometric analysis. All costs of this review will be at the developer’s expense.

A security deposit for the installation of street lights will be required as part of the Subdivision Agreement.

2.1.6.3 Standards and Specifications

The street light illumination shall comply with the standards of the latest edition of the American National Standard Practice for Roadway Lighting, as approved by the Illuminating Engineering Society of America.

All street lighting systems shall meet the requirements of the Electrical Safety Code and be inspected by the Electrical Safety Authority.

Information on material specifications and construction requirements may be obtained directly from Cambridge and North Dumfries Inc.
2.1.6.4 Subdivision Street Lighting Procedures

- Design of distribution system and street lighting system design must be coordinated between Cambridge and North Dumfries Hydro (distribution design) and the developer’s consultant for street light design.
- Standards for the street light system design must comply with section 2.1.8 of this Development Manual.
- Prior to starting the street light design, the developer and consultant must meet with the City to discuss the design.
- Street lighting design and photometric analysis must be submitted as part of the second submission of the subdivision plans to the City’s Planning Services Department for approval by the Transportation and Public Works Department.
- Approval by the Transportation and Public Works Department will include a peer review of the street light design using a consultant selected by the City at the developer’s expense.
- 100% Letter of Credit for street lighting with a 20% holdback for a warranty period starting from the date the lights are energized until assumption is required.
- Following installation of the street lighting system, Cambridge and North Dumfries Hydro Inc. will inspect the system and sign off that the system meets the design and that all equipment is in acceptable condition (i.e. no leaning poles, missing hand wells, etc.).
- When decorative fixtures are used, the developer must supply spare fixtures, arms, and poles as outlined in the Street Lighting Standards within 30 days of assumption.
- The developer is responsible for all maintenance of the street light system until assumption, including a full relamp and cleaning of the street lights within 90 days of assumption.
- The developer is responsible for all electricity costs from the date the street lights are energized as specified in section 2.1.8.1 of this Development Manual.

2.1.7 Fencing

2.1.7.1 Criteria

Fencing shall be installed where there are varying land uses on adjacent properties. Fencing shall be installed along all public open spaces, woodlots, school properties, utility corridors, along flankages and/or rear yards abutting collector or arterial roads, and higher density development and/or as deemed appropriate by the City. Fencing is not required where noise barrier walls are to be installed. All fencing must conform to City and/or OPS standards.

Permanent fencing adjacent to woodlot, open space, parkland blocks is required prior to Building Permit issuance, whereas all other permanent fencing is to be installed prior to Occupancy.

Gates providing access to public open space, or utility corridors from individual residential properties or development blocks are not permitted.

Gates may be permitted on parkland blocks, subject to the approval by the City.
2.1.7.2 Design

Construction of Fencing is required as follows:

a) **Tree protection fencing** – Fencing to be the standard Paige Wire Farm Fence complete with Tree Preservation Area concept signage to be placed 1.0 metre minimum beyond the drip line of the trees to be protected. For further details please refer City’s Tree Management Policies and Guidelines for New Developments (Appendix “C” of this manual).

b) **Sediment and erosion fencing** - as per City’s Standard Drawing CSD-ST-01– To be installed prior and during construction where required by the City.

Permanent fencing is required as follows:

a) Black vinyl chain link fencing
   - Along rear or side yards adjacent to public open space, including walkways, parkland, watercourse blocks and woodlots
   - Fencing to be 1.5 metre high, located 0.10 metres from property line on City property with the entire footing to be on City property, as per City Standard Drawing CSD-ST-03.
   - Along rear or side yards adjacent to utility corridors: Fencing to be 1.5 metre high, located on the property line. As per City Standard Drawing. Developer to consult with utility company prior to installation.
   - Adjacent to school properties: For fencing requirements of properties abutting school board consult with school board.
   - Within Region of Waterloo right-of-way Lands: For fencing requirements consult with Region of Waterloo.
   - Fencing may be required for entrances or natural features abutting the right-of-way.
   - Fencing materials are to be consistent throughout a development.

b) Galvanized chain link fencing
   - Galvanized chain link fencing is required for and only permitted for sports field applications as per the City’s standard drawings.
   - Fencing is not required where noise barriers are to be installed.

c) Post and Paige wire fencing
   - Fencing is to consist of wood 150mm diameter post with wire farm fencing as per OPSD 971.101.
   - Post and wire fencing may be required as temporary and/or protective fencing to protect park blocks, woodlot, open space, future development blocks or corridors at the City’s discretion.

d) Post and cable
   - At road crossings adjacent to utility corridors, post and cable fencing or other barrier is required to the satisfaction of the utility company and the City of Cambridge. Developer to consult with utility company prior to installation.

2.1.7.3 Noise Barrier
To comply with the Region/MOE noise attenuation requirements, the need for noise barrier wall may be imposed on new developments. A qualified professional engineer shall prepare a report and provide the noise attenuation recommendations in conformance with the current MOE and Region of Waterloo Implementation Guideline for Noise Policy requirements. This report shall be submitted in support of Draft Plan Approval of a Plan of Subdivision.

When a noise barrier wall is required, it shall be installed entirely on City/Region owned property where practical. In this case an easement on private property may be required for the maintenance purposes. The City/Region shall assume responsibility for the maintenance of these fences as appropriate. Warning clauses shall be placed on title of these lands to clarify any encumbrances or liabilities.

Maximum allowed fence height is 2.4 metres. Greater heights can be achieved with a combination of retaining wall/berms. Where maintenance of a noise wall is the responsibility of the City, the Proponent will be required to pay 55% of the estimated construction cost into a barrier replacement fund (as a perpetual maintenance fee), to be used to replace/repair the barrier in the future.

The Acoustical Engineer shall certify the final as-built condition based on the final lot grading, prior to the assumption of a Plan of Subdivision.

2.1.8 Retaining Walls

2.1.8.1 Criteria

As a minimum, all retaining walls are to be constructed of poured-in-place concrete, precast concrete or stone or approved by the City.

2.1.8.2 Design

All retaining walls are to have the face of the wall placed on the property line in such a manner that any tie backs, footings, etc., are located entirely within the property limits. In the case where an encroachment on the adjacent property is inevitable, a written consent of the property owner shall be obtained.

Retaining walls that exceed 0.6 metres in exposed height and are located on property lines, require fences. The fence must be a minimum height of 1.5 metres and comply with the Ontario Building Code.

Retaining walls exceeding 1.0 metres in exposed height are required to have a detailed drawing for the proposed retaining wall. The design, drawings and construction shall be stamped by a Professional Structural Engineer and submitted to the City for approval.

2.1.9 Walkways

2.1.9.1 Criteria

The design and location of all walkways must be approved by the City and must conform to the applicable City’s standard drawings (CSD-L-07 or CSD-L-11A or CSD-L-11B or CSD-L-13 or
2.1.9.2 Design

Walkway entrances may require curb depressions. Locations are to be determined on a site by site basis.

The walkway shall be constructed minimum 3.0 metres wide as per Standard Drawings and fencing shall be provided on both sides in accordance with Section 2.1.9.

Access control devices per City’s standard drawing CSD-ST-04, is required to prevent pedestrians or cyclists from exiting the walkway at an unsafe rate of speed directly onto the abutting road. One access gate with an adjacent bollard or two off set access gates must be installed at each end of the walkway.

2.1.10 Entrance Features

2.1.10.1 Criteria

The City does not encourage entrance features on public road allowance. However, the developer may submit for approval a design proposal for entrance features, which may consist of walls, gates, fences, trees, shrubs, flowers and other related components. Where entrance feature are approved, the developer will be required to enter into an agreement with the City for the construction and maintenance of entrance features within the Subdivision Agreement.

Under no circumstances the entrance feature shall impede the day light triangle.

The Developer shall maintain the entrance feature indemnifying the City for all claims until the subdivision has been assumed and all lots within the development have been sold or as otherwise specified in the agreement.

The Developer shall provide a payment for perpetual maintenance fees for long-term maintenance in accordance with Section 3.5 and securities in accordance with Section 3.4.

The City reserves the right to remove all or any element of the entrance feature at its discretion. Please note that, at the time of assumption, the developer may be required to remove the elements which are not up to City’s service level standard, such as irrigation systems and all appurtenances, servicing and any unapproved plant material, if any, and restore the site, at their expense.

Entrance features exceeding 1.2 metres in exposed height are required to have plans submitted to the City stamped by a Professional Engineer, detailing the proposed retaining wall construction and a building permit.

2.1.10.2 Design

Entrance features may be located within the public road allowance in centre median islands only or on a separate block adjacent to day lighting triangles. The features shall be designed to maintain proper sight distances and turning movements at driveway accesses and intersections.
An approval is required from the City for the design of the entrance feature, including plant materials, construction materials and wording. Street lighting, if any, must be compatible with the illumination requirements for public roadways.

The costs associated with installing irrigation systems will be the sole cost of the developer. The City is not responsible for the maintenance of installed irrigation systems. All proposed irrigation systems are to be installed on a metered usage system with all costs borne by the developer.

2.1.11 Fire Department Requirements

2.1.11.1 Firebreak Lots

Two (2) copies of the general above ground plan clearly identifying lots designated as firebreak lots must be submitted to the Fire Chief for review and approval. A maximum of eight (8) consecutively adjacent dwelling units may be erected, with a minimum of 15.24 meters (50 feet) provided as a break. No building permits will be issued without fire department approval.

2.1.11.2 Standard Fire Hydrants

To ensure that all fire hydrants are standard throughout the City of Cambridge, the following is required:

- Fire hydrant caps must be colour coded to indicate water flow and water system, as per the National Fire Protection Association (NFPA).
- A 100 mm stortz quick connect coupling cap is to be placed on the steamer port of all hydrants.
- All fire hydrants (private and municipal) are to be flow tested and the results submitted to the Fire Chief prior to occupancy.
- Fire hydrant spacing must be in accordance with DGSSMS and shall conform to Ontario Building Code.

2.1.12 Canada Post Facilities

The number and location of units for mail delivery must be approved by Canada Post and the City. Layout is to be done as per Canada Post standards for postal facilities. The permanent and temporary location shall be clearly shown on the approved engineering drawings.

Land use signs must be posted on-site prior to the issuance of building permits. Warning clauses are required in the purchase and sale agreements for lots adjacent to Canada Post facilities.

Temporary and permanent Canada Post facilities may not be placed in front of parks and open space blocks, including, but not limited to, storm water management blocks, channel and buffer blocks. Under extenuating circumstances, the City may, at its discretion, waive this requirement allowing mailboxes to be integrated into the park or open space setting with planting.
enhanced standard to create a mailbox area will be required as part of the landscape submission with all costs borne by the developer.

Lay-by lanes are required in rural and/ or urban developments with central mailing facilities. Where postal facilities abut a municipal sidewalk, a concrete pad (OPSD 310.010) is required between the curb and municipal sidewalk immediately adjacent to the postal pad.

Temporary facilities in a location approved by Canada Post and the City are to be installed once occupancy has begun. The locations must be kept clear of all construction materials.

All Canada Post pads are required to drain towards the road with a slope between 2% and 5%.

2.1.13 Utility Equipment Structures

2.1.13.1 Criteria

Detailed design drawings complete with all underground and above ground works showing Utility Equipment’s, Structures/Sheds (UES), must be submitted with the engineering drawings for review and approval by the City. An Agreement must be entered into by the Utility prior to installation. Prior installation the Utility must apply to the City for a building permit.

A warning clause must be included on all residential lots adjacent to the above locations, indicating above ground UES’s may be located adjacent to the property.

A Composite Utility Plan (CUP), showing the locations and elevations of all services, shall be prepared by the consulting engineers, with the consultation of all utility providers, and submit the same for City’s review and approval.

2.1.13.2 Design

UES locations will be addressed on a site by site basis. The utility is required to obtain a separate block from the developer. Final location is subject to review and approval by the City.

UES shall be setback a minimum 2.5 metres from the curb, and ideally 8.0 metres from any residential property line. Reductions from residential property line may be accepted, with City approval, should site constraints warrant.

The location of each UES must be identified on the signed Composite Utility Plan. When the Subdivision Agreement is submitted for execution, the Composite Utility Plan must also be submitted for approval by the City.

Landscaping and plantings are required to soften the impact UES’s have on the surroundings. A landscaping/planting plan must be submitted to the City for approval.

Site grading shall match with the adjacent grades and be limited to a 2% slope.

2.1.14 Street Trees
2.1.14.1 Criteria

The City requires street tree planting along public right-of-ways for all development and redevelopment, including but not limited to subdivisions, consents and site plans. With respect to site plans, the requirement for street tree planting will apply to development and redevelopment subject to Site Plan control.

The City requires the installation of street trees along all road frontages. The location of street trees must be coordinated with driveway locations, as well as underground and above ground utilities. Trees are to be placed in the grass boulevard so as to not interfere with underground utilities, intersection and driveway sight lines, day light triangles, overhead wires and I poles, as per City Standard Drawings C-101 through C-110.

For subdivision applications, street trees must be shown on the Composite Utility Plans. Those street trees, which cannot be accommodated in a subdivision due to utility conflicts or subdivision design, will be planted on nearby parkland or other near-by road right-of-way locations within the subdivision or draft plan.

The final planting location is to be staked on site for approval in the field by the City in conjunction with the Developer’s Landscape Architect prior to installation.

All street trees shall be planted in the spring (May 1st or June 30th) or fall (September 1st to October 31st) planting seasons and not during the summer months. Trees planted in October will be inspected in the spring of the following year.

1) Protection of Existing Street Trees

Existing street trees located within a public right-of-way may not be removed or damaged in any way. Developers shall make every effort to protect existing street trees and maintain the optimum growing conditions during construction. Where development or re-development of a site impacts existing street trees, the City may undertake remedial measures, including the removal of the street tree, if so required. All costs will be borne by the Developer. In addition, the Developer shall be required to replace the damaged or removed street trees with an equivalent total diameter at breast height (DBH) or, at the discretion of the City, provide an equivalent value in funding to the City for street tree planting.

2) Provision to have City install Street Trees

In those instances, where the installation of street trees must be delayed beyond the anticipated timeframe of the development or re-development, or other circumstances which make the installation of the street trees in a timely manner difficult, the development may, at the discretion of the City, provide funds to the City to have the City install street trees at such time that the City deems appropriate. In these instances, the funding requirement for the street trees shall include all costs of the street tree planting, including but not limited to supply, installation, guarantee and site restoration, as well as any fees per tree required.

2.1.14.2 Design
1) **Spacing**

The Developer is required to supply and install a minimum of one tree per 12.0 metres of roadway property line on both sides of the road allowance, to generally consist of one tree per residential lot frontage or one tree for every two townhouse units and two trees per flankage. Industrial areas require a minimum of one tree per 8.0 to 10.0 metres of roadway property line measured along both sides of the road allowance. Double rows of trees may be required at occasions within the right-of-way. Tree spacing requirements may vary with unique site conditions and will be reviewed by the City on a site-by-site basis. Spacing must reflect the ultimate size of the tree; smaller trees will require closer spacing.

2) **Setbacks**

The following suggested setbacks from City regulated structures apply:

- Driveways - 1.5 metre
- Storm/sanitary catch basin - 1 metre
- RLCB lead - 1 metre
- Street light - 5 metres
- Intersection - 10 metres

3) **Species Selection**

The selection and layout of proposed street trees should reflect an understanding that a variety of species is required to reduce the incidence of pest and disease associated with over planting of one or two species. Trees of the same species are to be clustered in groups ranging in size of 5-9 per grouping.

Species are to be selected with consideration for the specific conditions of the proposed location. Consideration should include proximity to road, proximity to natural areas including watercourses and woodlots, available area for root growth, availability of water, exposure to salt spray drift and snow storage, air quality and likelihood of soil compaction.

The recommended tree list included in Tree Management Policies and Guidelines for New Development (Appendix C) should be used in the selection of street trees. The use of species native to Waterloo Region is required on streets adjacent to parkland, woodlots, watercourses and other natural areas.

4) **Size**

Where possible, medium to large shade trees are to be selected. Medium to small trees shall be used for narrow lots, such as City residential lots. Small trees shall be used underneath overhead wires, such as hydro lines.

5) **Standards and Specifications**

The minimum caliper size for street trees is 70 mm. Any sizes less than 70 mm will require approval from the Community Services Department. All trees are to be wire
basked or balled and burlaped.

Deciduous trees should have a clear trunk with a branching height of 1.8 meters minimum. Trees adjacent to roads should have a clear trunk with a height of 2.4 meters to prevent vehicle damage and vandalism.

Street trees are to be installed with a minimum 1.2 meters root saucer covered with 75mm shredded bark mulch.

The Developer must supply a planting plan prepared by a professional Landscape Architect, complete with a plant list and notes, for approval by the City.

2.1.14.3 Guarantee and Inspection of Street Trees

All street trees must be planted a minimum of one (1) year prior to the commencement of the Maintenance Period for the Subdivision. For other development applications (e.g. consents, site plans, etc.), the Developer shall guarantee street tree planting for a period of (2) two years from Preliminary Acceptance by the City.

With a request for the commencement of the Maintenance Period for a Subdivision or development submitted prior to any City inspection for landscaping, the developer must provide an excel spreadsheet listing all street trees planted in the development, identifying street name, house and lot numbers, date of planting and species as per the sample spreadsheet. The developer shall provide certification by a consultant that all street tree planting and landscape works within the subdivision have been completed in accordance with the approved plans and approved stake out locations.

Street trees will be inspected prior to and at the end of the Maintenance Period and plant material will be accepted only if it is in vigorous, healthy, growing condition, in full leaf with no more than 20% dieback. Street trees found to be dead, defective, or not in a healthy, growing condition shall be replaced in the next planting season. All replacements and corrections must be completed prior to the commencement of the Maintenance Period and Assumption of the Subdivision. Mulch, a layer of 50 mm deep, must cover the rootball at the time of Final Acceptance or Assumption of the Subdivision. Bare soil or structures around street trees within the road allowance will not be accepted.

Delaying replacements may result in delays in security reduction and Final Acceptance by the City or Subdivision Assumption. At the time of Subdivision Assumption, all street trees must have been installed for a minimum of two year. The City and the developer may negotiate a cash-out quantity in lieu of the original and/or extended warranty.

Please note that inspections will be carried out during the growing season from June 1st to September 30th. Inspections must be requested by the developer and are scheduled according to staff availability. The City, at its discretion and at the cost of the developer, may delegate inspection duties to a qualified consultant working on behalf of the City.

2.1.15 Benchmarks

2.1.15.1 Criteria
The City requires the installation of at least one pre-numbered benchmark within each subdivision or phase of subdivision. The Benchmark plate location and elevation shall be documented and signed by the Developers Engineer or his agent.

The benchmark is to be located in a publicly accessible area (e.g. corner of park block, along the rear of a daylight triangle, bridge abutment, etc.). Locations where excessive fill has occurred will not be considered unless the fill has been engineered. The procedures to be followed are those recommended by the Federal Government Survey and Mapping Branch (Ottawa), published 1978. For detailed information, contact Transportation and Public Works Department of the City of Cambridge.

2.1.15.2 Design

The benchmark is a solid brass cap imbedded in a concrete cylinder placed flush to grade. The concrete cylinder shall be minimum 1.5 m deep X 250mm diameter utilizing 30 MPa concrete with rebar a cage. The hole must be drilled and may incorporate a Sonotube in sandy soils.

2.1.15.3 Standards and Specifications

The Benchmarks are to be installed in accordance with the Federal Government Survey and Mapping Branch (Ottawa), published 1978.

2.2 LOT GRADING AND DRAINAGE

2.2.1 Stormwater Management and Storm Drainage

2.2.1.1 Criteria

All lot areas are to be graded to provide positive surface drainage, with drainage directed away from houses to side yard or rear yard swales. The lots within a Plan of Subdivision are to be completely top soiled and sodded. The minimum depth of topsoil is 150 mm.

2.2.1.2 Design

Grading design is to be carried out in accordance with City’s Standard Drawings C126 through C131 and the following criteria:

1) Grading
   - Minimum slope within sodded areas: 2.0%
   - Maximum slope within sodded areas: 3:1
• Rear yards must have a minimum of 75% of the yard area at a slope of no greater than 5%.
• Minimum driveway slope: 2.0% away from house.
• Maximum driveway slope: 8.0% from garage to back of sidewalk.
• Side yards must be a minimum of 0.6 meters wide, graded at a minimum 2% slope away from the house.

Clear stone must be used when the building separation on side yards is 1.5 meters or less and must be inspected by the City prior to the placement of stone. The depth of the clear stone shall not be less than 150mm and placed on the geotextile membrane.

Grading shall be back to front wherever possible. Back to front drainage must be directed to a property line swale contained within a combined side yard that is directed to the front of the property. All possible effort shall be made to minimize the imperviousness of the backyards.

Where a sump pump outlets to grade, downspouts must be located a minimum of 3.0 meters from the outlet and discharge onto a concrete splash pad.

Split lot drainage will be accepted with the following criteria:

• The minimum grade on the side yard swale of the downstream lot is to be 2.5%.
• Drainage from the upstream lot is to be collected by a rear yard property line interceptor swale and directed to the side yard of the downstream lot.
• Side yard property line swales on the downstream lot are to accept drainage from one upstream lot only.
• The design of back-to-back split drainage lots is to be avoided if at all possible.
• If these criteria cannot be met, rear lot catch basins must be utilized on the split drainage lot.
• Swales shall be designed to the following:
  a) Slope Between 2.0% and 7.0%
  b) Maximum side slopes 3:1
  c) Maximum depth 300mm
  d) Minimum depth 150mm
  e) Maximum length of rear yard swales is 50 metres if directed to rear yard catch basins.
  f) All swales shall be on the common lot line.

**Note:** Phasing of developments must recognize and account for future lot grading patterns.

### 2.2.1.3 Future Building Lots or Blocks

Any lot or block that is not developed within 6 months of completion of primary services is to be graded to provide positive drainage, topsoiled, and seeded to the City’s approval.
Fencing and signage may be required at the City’s discretion.

2.2.1.4 Reporting and Legislative Framework

Table 2.5 provides a summary of the current primary policy documents and guidelines with reference to the agencies responsible for administration of each policy.

The key objective of this document is to guide the user as to what is required under Federal/Provincial policies and legislation and provide the understanding of City’s policies, criteria and role in implementation of the foregoing policies.

Although stormwater management planning and design is influenced by the mandate of various Ministries and public agencies, the City plays a central role in integrating the objectives of each policy into new development and associated stormwater management works, as well as, bearing ultimate responsibility for operation, ownership and maintenance of such works. The City’s primary objectives must include ensuring the economic sustainability and functional effectiveness of stormwater management works within the City.

2.3 STORMWATER AND ENVIRONMENTAL MANAGEMENT STUDIES

2.3.1 General Criteria

Any proposed changes in land use will affect the mechanics of storm runoff. Regardless of the status of land use planning, any proposed change in land use will need to be accompanied by stormwater and environmental management studies.

2.3.2 Design

Typically, stormwater management planning and design occurs through a multi-phase process which is completed in concert with the land use planning process. The following preferred hierarchy of planning studies in the City has been identified:

- Subwatershed Impact Studies
- Stormwater Management Plans
  - Functional
  - Detailed Design
- Groff Mill Creek Watershed Flooding Assessment- Phillips Engineering (2007)
- Mill Creek Subwatershed Plan - CH2M Gore and Storrie (1996)
- Blair, Bechtel, Bauman Subwatershed Plan - CH2M Gore and Storrie (1997)
In some instances where there are limited number of landowners, and drainage areas are discrete, there may be an opportunity to combine the Subwatershed Impact Study with the Functional Stormwater Management Plan. Prior to initiating such a process, the proponent is required to review specifics with the City of Cambridge and Grand River Conservation Authority.
<table>
<thead>
<tr>
<th>Category</th>
<th>Objectives</th>
<th>Document Reference</th>
<th>Agency Responsible for Administration</th>
</tr>
</thead>
</table>
Mill Creek Subwatershed Plan - CH2M Gore and Storrie (1996)  
Blair, Bechtel, Bauman Subwatershed Plan - CH2M Gore and Storrie (1997)  
Forbes Creek Subwatershed Study - Planning and Engineering Initiatives (2002)  
Hespeler West (East, Middle and West Creeks) Subwatershed Study Summary Report - City of Cambridge (2004) | City of Cambridge                                                                                                                                  |
| Natural Hazards (Flooding and Erosion) | Protection of life and property from flood and erosion damage | The Planning Act, 1996 Provincial Policy Statement "Natural Hazards"                                              | Ministry of Natural Resources, Grand River Conservation Authority                                             |
| Stream Morphology             | Design and Management of stream channels/floodplain based on natural fluvial principles. | Natural Channel Systems, an approach to Management and Design, MNR 1994 | Department of Fisheries and Oceans, Grand River Conservation Authority                                             |
| Fisheries                     | Protection of Fish and Fish Habitat including water quality, hydrologic regime | Fish Habitat Protection Guidelines for Developing Areas, MNR, March 1994.                                                                                                           | Department of Fisheries and Oceans, Grand River Conservation Authority                                             |
2.3.3 General Specifications

2.3.3.1 Watershed and Subwatershed Plans

The City supports the implementation of Watershed and Subwatershed Planning Studies in concert with the land use planning process. Watershed and Subwatershed planning plays an important role in the development of Official Plan Land Use Designations and Secondary Planning.

The determination as to whether a Watershed or Subwatershed Planning Study is necessary for Official Plan Amendments, Secondary Plans or individual developments will be determined in consultation between the City, the Developer(s), Grand River Conservation Authority and other Ministries or public agencies having jurisdiction.

Rationale and justification to undertake Watershed or Subwatershed Planning Studies must include consideration for:

- Type and extent of the proposed land use changes
- Area of land use change with respect to the total watershed/Subwatershed area
- Physical sensitivity/significance of the receiving watercourse
- Existing downstream conditions and land use (i.e. flood and erosion hazards, water usage).
- Location and characteristics of the development area with respect to the potential to provide integrated servicing and stormwater management which would minimize long term maintenance and operation cost incurred to the City.

2.3.3.2 Subwatershed Impact Study

This intermediate level of study may be required in areas where multiple land ownership within the Subwatershed occurs. This level of study would focus on integrating servicing and stormwater management of adjacent development to a greater level of detail than is normally achieved through the Subwatershed Plan. Typically this study would be required if the Subwatershed Plan has been completed prior to the development of preferred land use and lot plans. The objectives of this level of study will be to determine:

- Preferred servicing plan
- Road layout
- Integration of stormwater management facilities
- Opportunities to integrate recreation opportunities with stormwater management
- Phasing and cost sharing in areas of multiple ownership

The decision as to whether a Subwatershed Impact Study is warranted is determined through consultation between the various Developers, the City and Grand River Conservation Authority, and would depend on:

- Level of planning information completed in the Secondary Plan process
such as the municipal servicing concept;

- Number of development proposals/proponents involved in the study area and opportunity to integrate facilities and phase developments.

### 2.3.3.3 Stormwater Management Plans

Stormwater Management Plans are prepared in support of individual development applications. The plans shall complement the planning process associated with Draft Plans of Subdivision or individual Site Plans. Stormwater management reporting associated with this planning stage would be the "Functional Design Plan". Subsequently, in support of final subdivision design a "Detailed Design Plan" is required.

The functional design involves demonstrating the feasibility of providing stormwater management for a particular development. In areas where no Subwatershed Plan has been completed, the Stormwater Management Plan will be required to address additional issues such as environmental baseline conditions and screening of various stormwater management strategies and techniques.

The detailed design submission demonstrates how the required information, outlined in Functional Design report, has been integrated as well as addressing details related to minor system design details, landscaping, safety and maintenance aspects of facility design, and monitoring requirements.

### 2.4 STORM DRAINAGE POLICY

#### 2.4.1 Quantity Control and Flood Management

##### 2.4.1.1 Criteria

All newly developing or redeveloping areas must assess their potential impacts on local and regional flooding, and suggest mitigation measures accordingly.

The impacts from development occur both during construction and after the development is complete. The conversion of pervious land to impervious surfaces results in increased rate and volume of stormwater runoff, reductions in groundwater recharge and reduction of evapotranspiration. The changes in surfaces imperviousness change the hydrologic characteristics of the landscape by reducing infiltration into the soil and evapotranspiration from vegetation which results in a dramatic increase in the rate and volume of stormwater runoff. New impervious surfaces, compaction of soils, and loss of native vegetation reduces the amount of precipitation that infiltrates into the ground. Uncontrolled stormwater runoff can lead to increased flooding, degraded water quality, stream channel erosion, hydrologic modifications, and destruction of sensitive habitats and landscapes.

Hence properly designed and implemented SWM facilities and SWM design practices can mitigate these impacts.
2.4.1.2 Design Policies and Principles

In areas where no Watershed or Subwatershed Planning or Subwatershed Impact Study has been completed, the City policy require that runoff peak flows are controlled to pre-development levels as a minimum, unless the proponent can demonstrate through appropriate modeling and analysis that uncontrolled flow will not cause detrimental impacts on flood conditions to downstream properties and watercourse systems and have capacity within storm conveyance system. Before the City will accept any increase in runoff rates, it must also receive endorsement from all other agencies having jurisdiction.

Where the Subwatershed Plans or Subwatershed Impact Studies have been completed, the Developer will be required to comply with the recommendations of the specific plan. Any variations will need to be appropriately supported by detailed analysis and must also be approved by all agencies having jurisdiction.

City of Cambridge encourages and promotes the design and programs that:

- Protect and improve surface water quality
- Protect groundwater quality and quantity
- Provide stormwater management facilities that are efficient, and minimize life cycle costs
- Maintain the natural hydrologic cycle and function of the watersheds through a range of mechanisms through implementation of Low Impact Development stormwater management practices and principles.
- Prevent increased risk of flooding and stream erosion
- Use the treatment train approach to reduce runoff volume and to treat stormwater runoff on-site through the use of source, conveyance and end-of-pipe controls

The following represents a general overview of the guiding principles and parameters for the design of stormwater management and drainage systems in the City of Cambridge:

- All newly developing or re-developing areas must assess their potential impacts on local and regional flooding and mitigate accordingly
- All stormwater system designs for water quality treatment and quantity control shall be in accordance with the MOE SWM Planning and Design Manual (2003) and City of Cambridge SWM Policies and Guidelines (2011)
- Enhanced water quality treatment shall be provided as defined by the MOE SWM Planning and Design Manual and City of Cambridge SWM Policies and Guidelines
- Design shall consider the entire uncontrolled drainage area including all external flows
• Minor Systems shall be sized to capture and convey the 5 Year Storm
• Hydraulic Grade Line in the storm sewer for the 100 year storm is a minimum of 300 mm below the basement footing elevation.

2.4.2 Erosion Control

2.4.2.1 Criteria

Depending on the downstream water level and the nature of the soil strata affected, stream banks can be subject to increased erosion potential. In these cases, the Developer will be required to provide appropriate protection in accordance with the Watershed or Subwatershed Plans or with the Subwatershed Impact Study, as well as policies of the Conservation Authorities.

In areas where no Subwatershed Plan exists, it shall be the responsibility of the Developer to provide adequate erosion protection in accordance with Provincial Guidelines, unless it can be demonstrated through appropriate modeling and/or analysis that erosion processes will not be adversely affected by the proposed development.

2.4.2.2 Design

Sediment and erosion control measures that can be implemented within the City of Cambridge shall be consistent with the Grand River Conservation Authorities Erosion and Sediment Control Guidelines. Implementation details for certain sediment and erosion controls are covered under the Ontario Standard Specifications (OPSS) 577. Due to the presence of endangered species in the downstream rivers and streams, the pertinent authorities should be consulted to ensure that sediment and erosion controls are adequate.

The following is a general list of requirements; however, since the list is intended to cover a broad range of development proposals, portions of the list may not be applicable for all development proposals:

• Erosion and Sediment Control Plans
• Erosion and Sediment Control Phasing
• Worksite Isolation Plan for In-stream Construction
• Spill Control and Response Plan
• De-watering Plan
• Storm Drain Outfall Protection
• Storm Drain Inlet Protection
• Seeding/Sodding
• Sediment/Silt Control Fence
• Interception/Diversion Swales and Dykes
• Vehicle Tracking Control/Mud Mats/ Construction Access Mud Mats
• Construction Parking location
• Sediment Traps
• Rock Check Dams
• Temporary Sediment Control Ponds/Basins
• Topsoil Stockpiles
• Restoration

The design of erosion and sediment control measures shall be in accordance with the City of Cambridge By-law 16-09

2.4.2.3 Erosion Control and Management

Erosion control and management involves:

• Extended Detention storage for the 25 mm rainfall event as outlined in the Provincial Guidelines (ref. SWMP Planning & Design Manual, MOE, 2003), in the absence of specific direction from a Subwatershed or Watershed Plan.
• Assessment of downstream erosion susceptibility and critical flow values in conjunction with event modeling.
• Assessment of downstream erosion critical velocity or shear forces.

In areas where the downstream receiving watercourse is determined to be unstable, or where control over control of flow rates is ineffective or not feasible, design of channel alterations may be considered, subject to design in accordance with natural channel design principles (ref. Ministry of Natural Resources, 1994).

Storm sewer outfalls in natural channels should be provided with proper protection against erosion which includes appropriate bank scouring protection on either side of the outfall and creek. When a storm sewer outlet outfalls to a steep and/ or deep valleys, drop structures should be designed in such a manner as to provide integral bank stability. Such local erosion protection measures should be designed so as not to interfere with the natural channel forming processes of the receiving watercourse system.

2.4.3 Major System

2.4.3.1 Criteria

Flows in excess of the minor system capacity, i.e. during periods of surcharging are referred to as major system flow. The major system comprises the minor system, as well as the overland route followed by runoff not captured by the minor system (i.e. either due to excessive flow or operational failures). Common elements of the major
system include natural streams, valleys, swales, ponds, roadways, dedicated blocks and drainage channels.

The level of protection should be established based upon sound economic analysis and the nature of the area drained, i.e. risk to loss of life and property damage.

2.4.3.2 Design

The City supports the policies of GRCA, which generally require that no new building be subject to flood damages from the Regulatory flood as per the revised Technical Guidelines for Flood Plain Management in Ontario. The Regulatory flood is the greater of the Hurricane Hazel flood (transposed), modeled 100 year flood, observed flood, or frequency-based 100 year flood.

No development, other than necessary access or services, should intrude upon Hazard Lands without the approval of GRCA and the City. In conjunction with this objective, the City shall require the Developer to delineate floodplains in a proposed development resulting from the 100 year and Regional Storm for both the pre- and post-development conditions.

The major overland flooding should not exceed 150 mm depth over the crown during a 100 year event for any roadway and should remain within the designated right-of-way. Blocks dedicated through easement or ownership to the City will be required to convey overland flow from roadways to open watercourse systems. These blocks should be designed for stability and safety to the satisfaction of the City.

2.4.4 Minor System

2.4.4.1 Criteria

The minor system, handles urban drainage from relatively "minor" storms having a frequency (return period) of 5 years. These works typically consist of drainage pipes, roadway gutters and swales, enclosed conduits and roof leaders. Their purpose is to prevent frequent flooding which may cause inconvenience to the motorists, home and business owners and pedestrians.

The City will not allow residential development to proceed until adequate provision, in the form of storm sewers, has been made available.

2.4.4.2 Design

The minor or convenience system, comprising street gutters, catch basins and storm sewers, shall be designed to a 1 in 5 year un-surcharged standard. In some higher value commercial areas, the criteria may be increased to 1 in 10 year floods at the discretion of the City.

2.4.5 Quality Management
2.4.5.1 Criteria

Water quality treatment will be required for all new development within the City. Water quality treatment performance shall conform to Provincial requirements (ref. Stormwater Management Practices -Planning and Design Manual, MOE, Water Management Policies, Guidelines Provincial Water Quality Objectives (Blue Book), MOE, (2003)).

In areas of existing development where re-development is proposed, provisions for water quality measures will be evaluated on a site-specific basis, based on the feasibility of implementation. Where on-site measures are considered infeasible, the City may consider the potential for contributions to off-site improvements (i.e. cash-in-lieu), subject to agency concurrence. A master plan approach to compensation for off-site works is advocated by the City.

In areas where a Subwatershed Plan has been prepared and approved, the guidelines and criteria cited within the plan shall be adopted by the Developer.

2.4.5.2 Design

Specific guidelines for stormwater management protection application have been developed by the Province based on the type of fisheries habitat downstream of the proposed development.

Three levels of protection are given, with the goal to maintain or enhance existing aquatic habitat, based on the suspended solids removal performance for the different end-of-pipe stormwater management facilities developed in the continuous simulation modeling. These levels of protection are based on a general relationship between the end-of-pipe stormwater management facilities long-term suspended solids removal and the lethal and chronic effects of suspended solids on aquatic life. The levels of protection correspond to the following long-term suspended solids removal:

- **Enhanced protection (Level 1 Quality)** corresponds to the end-of-pipe storage volumes required for the long-term removal of 80% of suspended solids
- **Normal protection (Level 2 Quality)** corresponds to the end-of-pipe storage volumes required for the long-term removal of 70% of suspended solids
- **Basic protection (Level 3 Quality)** corresponds to the end-of-pipe storage volumes required for long-term removal of 60% of suspended solids

As a general consideration, maintenance of the natural hydrologic cycle including infiltration is encouraged where soil conditions permit. Therefore the use of stormwater management practices, which enhance or maintain infiltration, should be considered for each development. Generally, active infiltration measures will be applicable in permeable soils areas only, and their use will require supporting soils documentation. Passive measures such as disconnection of roof leaders have been historically utilized in many areas and should be implemented as a matter of course in all areas unless specific constraints preclude these measures.

In all cases, the potential for groundwater contamination shall be considered, particularly
where infiltration of road runoff is contemplated. In areas where hydrogeological concerns are identified and/or critical linkages to fisheries habitat are present, additional study and analysis may be required to determine the appropriate level of mitigation.

2.5 SWM QUALITY AND QUANTITY CONTROLS

2.5.1 General

Current stormwater management practice (SWMP) advocates the consideration of the practice on a hierarchical basis, whereby more pro-active techniques are considered first. The Stormwater management practices are grouped under the following headings in order of preferred application.

- Lot Level Techniques / Source Controls;
- Transport or Conveyance Controls;
- End-of-Pipe Management Techniques.

The philosophy behind this hierarchy is that stormwater management techniques are usually more effective when applied at the source. It will be the responsibility of the proponent and his/her consultant to demonstrate that any technique, not currently approved by the City, will address the intended function within expected maintenance and cost parameters, to the satisfaction of the City.

The design of source, conveyance and end-of-pipe controls shall be in accordance with the guidelines from latest version of MOE SWM manual, unless otherwise noted herein or discussed with the City prior to design stage for special circumstances.

2.5.1.1 Source Control

2.5.1.1.1 Roof Leader Discharge to Surface

All lots with frontage 12.0 metres or less must have their downspouts connected to the storm sewer unless otherwise directed by the commissioner, Planning & Development Department or designate. For lots with frontage greater than 12.0 metres, roof leader discharge to surface is encouraged. Roof leaders should be directed to front or rear yard pervious (grassed) areas wherever possible to promote infiltration and shall not discharge to impervious areas directly connected to the storm sewer (e.g., driveways, parking areas), unless there is no other feasible option. Roof leaders shall discharge to the ground surface via splash pads or extension pipes and flows shall be directed away from buildings to prevent ponding or seepage into the foundation drain. Roof leader outlet locations shall be identified on the lot development plan.

2.5.1.1.2 Roof Leader Discharge to Soakaway Pits
The City encourages Soakaway pits/ infiltration galleries. An overflow connection to the storm sewer may be provided to ensure that in the event of the system failing that adequate drainage is maintained. A soakaway pit is typically connected to the roof leader of a single house and may be used to store runoff and promote infiltration (subject to acceptable geotechnical and hydrogeological investigations in support of the approach). Soakaway pits shall be located a minimum of 5.0 m from buildings with basements to avoid infiltration to drainage tiles and sump pumps.

2.5.1.1.3 Rear Lot Ponding

Rear lot ponding or other areas of extended ponding on residential lots is not permitted.

2.5.1.1.4 Green roofs

The City may accept green roofs for the commercial buildings if recommended by the professional and is in compliance to LID principles for green roof design guidelines and will need to have it included in the site plan or plan of subdivision agreement.

2.5.1.1.5 Rooftop Storage

The City of Cambridge may allow in specific cases, a rooftop storage for water quantity controls provided that developer's consultant certifies its functionality and the structural engineer deems appropriate in terms of load carrying capacity of the structure.

2.5.1.1.6 Surface Storage

Commercial, industrial, institutional and infill residential developments may use parking lot and/or above ground storage to control post-development flows to match the predevelopment flows or the available capacity of the receiving storm sewer systems. The maximum ponding depth shall be 300 mm and grading shall be between 0.5% and 5%. The connection from the site into the receiving storm sewer system shall be through an orifice plate which restricts the flow to the required rate. The 5 year and 100 year ponding elevations and storage volume at each ponding location must be included on the design drawings. Ponding areas should be designed to ensure that they have a safe emergency overflow which directs water away from structures. All surface storage designs shall be completed in accordance with the design guidance in the MOE SWM manual and shall be included in the site plan or plan of subdivision agreement.
2.5.1.1.7 Detention Vaults/ storage tanks

Detention vaults are usually precast concrete tanks constructed below grade which detain stormwater and release it at a controlled rate. The City may permit the use of detention vaults to provide quantity control only for re-development sites, small sites or those designated in an MESP where no practical alternative exists for an end-of-pipe facility. The detention vault shall be included in the site plan or plan of subdivision agreement. The storm sewer connection from the detention vault into the receiving municipal sewer is to be controlled by an orifice pipe designed to restrict the inflow to the required rate. These systems may also incorporate an infiltration component where hydrogeological and geotechnical investigations support this approach only for roof water storages. Any such facilities shall be readily accessible for any required maintenance activities.

2.5.1.1.8 Bioretention swales

Bioretention swales/ areas are designed to store and infiltrate stormwater runoff. Water quality is improved through the use of bioretention, as particles are filtered out as water passes through the filter bed. If the underlying soil has a low infiltration rate, an under drain may be required to prevent standing water. The design of these systems shall be in accordance with the guidance in the MOE SWM manual.

2.5.1.2 Conveyance Controls

2.5.1.2.1 Super/oversize Pipes

Oversized pipes are designed like storm sewers. Oversized pipes serve as both the detention and conveyance structures. The City of Cambridge may permit the use of oversized pipes to provide quantity control only for re-development, infill areas, and some smaller developments where geotechnical and hydrogeological investigations support this approach and where no practical alternative exists for an end-of-pipe facility. The design shall be in accordance with the guidance in the MOE SWM Manual.

2.5.1.2.2 Pervious Pipe System

Subject to the City’s review and approval, the pervious pipe systems for stormwater from “clean” sources such as rooftops may be permitted to pervious pipe system provided that the pipes are designed in accordance with the most current MOE SWM manual and LID principles and must have an overflow mechanism into the storm sewer.
It should be noted that the perforated pipe system may be permitted if supported and recommended by the Geotechnical and Hydrogeological investigation reports.

2.5.1.2.3 Bioswales and Enhanced Grassed Swales

The City supports the use of bioswales and enhanced grassed swales, if feasible. The design of these systems shall be in accordance with the guidance from the MOE SWM manual and the LID philosophies.

2.5.1.3 End-of-Pipe Controls

2.5.1.3.1 Infiltration Trenches

Infiltration trenches are permitted and encouraged for use in the City to promote infiltration of runoff (subject to acceptable geotechnical and hydrogeological investigations in support of the approach). Measures to prevent sediment and debris from entering these systems should be provided.

2.5.1.3.2 Sand Filters

Sand filters may be limited to very small drainage areas and shall require a form of pre-treatment and shall not be used as a stand-alone SWM facility. The design should incorporate measures to allow the filter to be backwashed. The MOE SWM manual outlines the conditions and criteria for filters.

2.5.1.3.3 Vegetated Filter Strips

Vegetated filter strips are vegetated areas adjacent to impervious areas that improve the quality of and reduce the velocity of stormwater with gradual slopes and vegetation such as grasses. They are frequently used to pre-treat stormwater runoff prior to other LID practices such as infiltration trenches.

2.5.1.3.4 Oil/Grit Separators

Subject to approval by the City and Grand River Conservation Authority, designated approved oil/grit separators may be installed on small sites where other water quality control is not feasible.

When completing sizing calculations for oil/grit separators, the following guidelines shall apply:

- TSS removal efficiency equivalent to the Enhanced level of treatment is required (i.e., minimum 80% TSS removal), and shall be based on the particle size distribution presented in Table 7.
- Calculations shall be completed using the approved rainfall data and City of Cambridge IDF Parameters.
The owner is responsible for maintaining and repairing oil/grit separators installed on private property. Operation and maintenance requirements for oil/grit separators shall be identified in the SWM report for the site and shall be implemented by the owner to ensure that the continued performance of the device as designed is achieved as per the Certificate of Approval, if applicable. City of Cambridge takes no responsibility for the maintenance of such devices.

2.5.1.3.5 Extended Detention Wet Ponds

Wet ponds shall be designed in accordance with the governing guidelines which are currently documented in the MOE SWM manual unless otherwise specified in the City’s Manual or guidelines provided in City’s current Storm Water Management Policies and Guidelines.

2.5.1.3.6 Dry Ponds

Dry ponds shall not be permitted as a stand-alone treatment system. Dry ponds may be used as a part of a treatment train approach provided that the Enhanced level of water quality treatment is achieved.

Dry ponds shall be designed in accordance with the governing guidelines which are currently documented in the MOE SWM manual unless otherwise specified in the City’s Manual or guidelines provided in City’s current Storm Water Management Policies and Guidelines.

2.5.2 Sediment and Erosion Control during Construction

2.5.2.1 Criteria

New urban developments generally produce increased sediment loading to the surrounding streams particularly during construction. In order to avoid the inherent detrimental side effects from development (i.e. harmful impacts to aquatic organisms and their habitat, poor water quality and aesthetics, restricted channel conveyance etc.), it is recommended that sediment control measures be instituted. Some of these measures typically include, sediment traps (temporary or permanent), vegetation screens, catch basin filter bags and phased stripping of developable lands. In all cases, it is recommended that sediment loading be controlled as per guidelines published by the Grand River Conservation Authorities, and "Ontario Guidelines on Erosion and Sediment Control for Urban Construction Sites".

2.5.2.2 Design

As a minimum all Erosion and Sediment Control Plans should incorporate recommendations and protection measures pertaining to:
• Construction Scheduling
• Minimizing soil exposure and re-establishment of vegetative cover
• On-site sediment and erosion techniques
• Site Supervision
• Monitoring and Maintenance
• Site Restoration
• Special Considerations (i.e. in-stream construction/crossings, fisheries timing constraints)

2.6 SANITARY SEWERS

The City of Cambridge Development Manual for sanitary sewers is to be read in conjunction with the Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS). In the case that the Development Manual differs from the DGSSMS, the Development Manual will supersede the DGSSMS.

Sanitary sewers designed and constructed in accordance with the most recently revised specifications of the City of Cambridge Development Manual, shall be required in all residential subdivisions unless specifically exempted from this requirement by the City. All sanitary sewers shall be designed in such a manner and be of adequate size and depth to provide for the service of adjacent lands where so required by the Commissioner of Transportation and Public Works Services.

A lateral sewer connection from the sewer main to the edge of the road allowance shall be constructed for each property in the plan of subdivision. In general, house service connections are to be to the center of each lot or as approved, and installed in accordance to Ontario Provincial Standard Specifications.

All sanitary lift stations must meet Provincial, Regional and City of Cambridge requirements.

All sanitary sewers, appurtenances and connections shall be guaranteed for a minimum period of three (3) years after initial inspection and acceptance of all underground services by the City, but shall not be released from the maintenance period until the sewers have been inspected by video inspection and finally accepted by the City.

Prior to commencement of the maintenance period for sanitary connections, invert elevations at the property line in table form shall be provided to Senior Development Engineer.

2.6.1 Sanitary Design Guidelines

The Region of Waterloo and Area Municipal Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS) Part B – Design Guidelines shall form the basis of the design criteria for sanitary sewer except as extended or amended herein. The following outlines the supplementary design
criteria to be applied to the design of Sanitary Sewer works for development in the City of Cambridge.

2.6.1.1 Design Flows

In addition to the actual sanitary flow generated by the development the quantity calculations for sewage flow shall also include the infiltration. Allowance shall be made in the designed capacity of the sewer to provide for future sewage requirements. The calculations shall be in accordance with MOE requirements.

2.6.1.2 Flow Calculations – Refer to DGSSMS

Sanitary sewer flows are to be determined using the following design criteria.

2.6.1.2.1 Residential – Refer to DGSSMS

Based on the projected population per current zoning, an average flow of 0.35 m3/c/d or 0.004 l/s/c shall be used to calculate the actual sanitary flows. Peak the average flow using the Harmon Formula (Refer to DGSSMS)

2.6.1.2.2 Industrial

An average flow of 0.50 l/s/ha or higher shall be used. A higher design flows for point sources known to have significantly greater flows shall be used instead of average design allowance. It is preferred to use actual flows for large known discharges if available. The peaking factor shall be as per MOE guidelines “Typical Industry Sewage Flow Peaking Factors”

2.6.1.2.3 Commercial (Refer to DGSSMS)

- Average flow for Core =1.16 l/s/ha; Shopping Mall = 0.3 l/s/ha; General = 0.6 l/s/ha.
- Use higher design flows for point sources known to have significantly greater flows than the average design allowance.
- Use actual flows for large known discharges
- Use peak factor of 2.5 as per DGSSMS.

2.6.1.2.4 Schools – In accordance with MOE Design Guidelines

2.6.1.2.5 Other Miscellaneous Average Flow rates – In accordance with MOE Design Guidelines
2.6.1.2.6 Infiltration

Add an infiltration allowance of 0.15 l/s/ha, or as directed by the Municipality.

**Note**: Person Per Unit (ppu) densities are not to be used for sanitary flow calculations.

2.1.6.3 Design Flow Calculations

Design flow calculations for sanitary sewer system shall be completed on sanitary sewer design sheet (C125) in accordance with MOE guidelines.

**Note**: Trunk sewers to be designed to maximum 85% of full pipe capacity. Local sewers are not to be designed over 95% of full pipe capacity.

2.6.1.4 Minimum Pipe Size – Refer to DGSSMS /MOE design guidelines.

2.6.1.5 Manning’s “n”

The value of manning’s coefficient “n”, shall be 0.013 for all pipe materials.

2.6.1.6 Pipe Slope

Provide for a minimum slope of 0.5% on all sanitary lines with a minimum of 1.0% gradient for the first leg of sanitary sewer. The maximum gradient shall be within MOE requirements.

2.6.1.7 Flow Velocities – Refer to DGSSMS

All sanitary sewers shall be designed to have a minimum flow velocity, when flowing full, of at least 0.8 m/s. Velocities in sanitary sewers shall not be greater than 3 m/s.

2.6.1.8 Selection of Bedding and Class of Pipe – Rigid Pipe – Refer to DGSSMS

2.6.1.9 Selection of Bedding and Class of Pipe – Flexible Pipe

Flexible sanitary sewer pipe shall be designed to accommodate external dead and live loading (i.e. Traffic, soil, ground water changes, frost actions, soil settlement, etc.) imposed on it in accordance with the criteria and methodology as outlined in the current version of the MOE Design Guidelines.

Deflection testing shall be in accordance with OPSS 410.07.16.05. A mandrel or pig, not less than 95% of the base inside diameter (as defined in the CSA or ASTM standard to which the pipe is manufactured), shall be successfully drawn
through the flexible sewer pipe installed. A total of two (2) tests shall be completed; one prior to initial acceptance and the second at the end of the maintenance period. All tests shall be carried out in the presence of Development Engineering staff and the Consultant Engineer.

2.6.1.10 Pipe Depth

In order to achieve frost protection cover, a sanitary sewer pipe obvert elevation shall not be less than 2.4 metres below the finished grade. Pipe insulation is required where a minimum cover is not achievable.

2.6.1.11 Testing

2.6.1.11.1 Basic Requirements

Complete sewer lines shall be tested by the contractor in the presence of Development Engineering staff and the Consultants, for infiltration. In cases where the ground water is above the crown of the pipe, an infiltration test will be required. In all other cases, ex-filtration tests shall be made. In tests for infiltration the leakage shall not exceed 0.15L/mm of diameter per 100m of sewer pipe per hour. In testing for ex-filtration, the above allowable leakage shall be increased by 25%.

In testing for ex-filtration the minimum head on the section of sewer being tested shall be 0.6 m measured from the crown of the pipe at the high end of the line provided the maximum head on the line shall not be greater than 4.5 m. If the maximum head on the line is greater than 4.5 m, ex-filtration testing will not be acceptable.

The duration of tests shall be one (1) hour. The Contractor shall, at no additional cost to the Subdivider, repair leaks to the satisfaction of the Subdivider’s Engineer and the City Engineer. The method of repair has to be described in detail and submitted as a letter to the City Engineer for their review and approval.

2.6.1.11.2 Inclusion of Service Connections and Manholes

All service connections included in the test section shall be taken into account in computing allowable leakage. An allowance of 3.0L/h/m of head above the invert shall be made for each manhole included in a test section. If a test produces more than the allowable leakage, the Contractor shall test manholes separately.

2.6.1.11.3 Plugging of Wyes, Tees and Stubs

All wyes, tees and stubs shall be plugged with flexible jointed caps, or acceptable alternative, and securely fastened to withstand the internal test pressure. Such plugs or caps will be readily removable and their removal shall provide a socket
suitable for making a flexible jointed service connection or extension.

2.6.1.11.4 Balancing

Leakage up to 25% in excess of the above limits will be approved in any test section, provided that the excess is off-set by leakage measurements in adjacent sections such that the total leakages are within the amount allowable for the combined sections.

2.6.1.12 Industrial Area Requirements (Refer to DGSSMS)

Vitrified clay pipe (VC) is not allowed in Industrial areas. The preferred pipe is Polyvinyl Chloride (PVC) however Polyethylene pipe (PE) can be used upon approval by the Commissioner Transportation and Public Works Services.

2.6.2 Maintenance Holes

2.6.2.1 Structure (Refer to DGSSMS)

All maintenance holes 3000mm and smaller shall be precast concrete and shall be in conformance to applicable Ontario Provincial Standard Drawings (OPSD).

2.6.2.2 Spacing – Refer to DGSSMS

The acceptable maximum spacing between sanitary maintenance holes for different pipe sizes shall be as follow;

- 200mm to 450mm 90m
- Larger than 450mm to 900mm 120m
- Larger than 900mm at approval of Commissioner Transportation and Public Works Services, City of Cambridge.

2.6.2.3 Pipe Size (per DGSSMS)

2.6.2.4 Drop Inlet Structures

A drop structure shall be provided where an invert elevation difference between any two pipe legs is 0.61 m or more. The structure should be in accordance with MOE Design Guidelines and OPSD 1003.01 (external); 1003.031 (internal).

2.6.2.5 Safety Grates – Refer to DGSSMS

2.6.2.6 Minimum Invert Drop – Refer to DGSSMS

2.6.2.7 Location – Refer to DGSSMS
2.6.2.8 Watertight Lids – Refer to DGSSMS

2.6.2.9 Flow Direction Changes – Refer to DGSSMS

2.6.3 Services

All sanitary sewer connections shall be inspected and tested at the same time as the sanitary sewer mains.

All sanitary sewer connections shall be guaranteed for a period of Three (3) years. This guarantee period shall commence at the same time of approval of the sanitary sewer mains means when they are placed on Maintenance Guarantee.

2.6.3.1 Minimum Diameter

A minimum sanitary service size, as per DGSSMS, is 100mm.

2.6.3.2 Location

All sanitary services shall be installed perpendicular to the main wherever practical.
Sanitary services for single and semi-detached dwellings shall be as per City’s Standard Drawing C126 and C127 or per approved plans by the City.

2.6.3.3 Slope – Refer to DGSSMS

2.6.3.4 Depth – Refer to DGSSMS

2.6.3.5 Connections to Maintenance Holes – Refer to DGSSMS

Sanitary service connections to maintenance holes are permitted. If the invert of the service entering the maintenance hole is 0.61m or more above the lowest invert, a drop pipe must be installed inside the maintenance hole to direct flow to the main channel and to avoid splashing and the accumulation of debris on the benching.
For 100mm and 150mm diameter services, factory made tees or wyes shall be used.
For services 200mm and larger, a maintenance hole shall be installed within the road corridor or in the boulevard.
Under special circumstances, on specific road reconstructions, site plan projects (case by case) and intensification projects, service saddles may be used at the discretion of the Chief Municipal Engineer.
2.6.4 Curvilinear Sewers – Refer to DGSSMS

2.6.5 Geotechnical Report

A geotechnical investigation report must be submitted to the City as part of the design of sanitary sewer. Recommendations regarding the sanitary sewer bedding, trenching, dewatering and type of pipe shall be made accordingly.

2.6.5.1 Soil Tests

The geotechnical report shall include test results and recommendations for the use and/or disposal of unsuitable soils in accordance with the current regulations.

Soil test bores shall be placed at intervals not exceeding seventy five (75.0 m) metres or as required by the Commissioner of Transportation and Public Works Services and to a depth of not less than one and one half (1.5 m) metres below the deepest proposed structure, where applicable. If the depth of the proposed structure is unknown, then the soil test borings shall be completed to a depth not less than four and one half (4.5 m) metres below the proposed pavement grade. Soil classifications, moisture content, etc., shall be recorded and noted on the plans and profiles submitted for acceptance. Where poor or unstable soil conditions have been noted, additional borings shall be taken to establish the boundaries of this soil.

In addition to samples taken for mechanical analysis, representative samples shall be obtained for California Bearing Ratio (CBR) tests.

On smaller projects a minimum of two mechanical analysis and two CBR tests will be required.

All tests shall be conducted by a recognized soils laboratory certified by the Canadian Council of Independent Labs (CCIL) and copies of such tests shall be submitted to Senior Development Engineer.

2.6.6 Easements

City of Cambridge requires minimum of 6.0 m or 2 times the depth for sanitary sewers (where depth is from the proposed final grade to the invert rounded up to the nearest half meter), whichever is the greater.

2.6.7 MATERIAL SPECIFICATION

The Region of Waterloo and Area Municipal Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS) Part C – Material
Specifications shall form the basis for material selection except as extended or amended herein. The following outlines the supplementary specifications to be applied to the design and construction of Sanitary Sewer works for development in the City of Cambridge.

2.8 STORM SEWERS

2.8.1 General Criteria

The objective of the storm water management and sewer pipe design submission is to achieve consensus with respect to storm water management measures which should be implemented in subdivisions. The City requires that a storm sewer system be used to collect runoff from lots and the right-of-way and that a storm sewer system be constructed on every street within all plans of residential subdivision.

All new development shall conform to the requirements of watershed/sub-watershed studies and comply with the current version of MOE’s Storm Water Management Planning and Design Manual. New development shall be designed to mitigate impacts to the watercourse, valley features and associated vegetation including erosion, flooding, water quality and other detrimental impacts. For additional information regarding the City’s policy including drainage within parks and open space, refer to City’s Stormwater Management Policies and Guidelines revised August 2011, Tree Management Policies and Guidelines for New Developments revised February 2002 and Region of Waterloo Design Guidelines. City Standard C-124 provides a Storm Sewer Design Sheet.

2.8.2 Design

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

\[ Q = 2.78 \times \frac{A \times C}{1000} \times I \]

Where,

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

The storm sewer design must meet the following City of Cambridge criteria for storm sewer design, based on current City of Cambridge Rainfall Intensity Curves and a time of concentration of ten (10) minutes.
City of Cambridge SWM IDF parameters are tabulated under. For the details of Design refer to City's Stormwater Management Policies and Guidelines.

Please note that City of Cambridge IDF parameters is an update to the Regional storm and reflective of the rainfall intensities within the City boundaries.

The values of Rainfall Intensity (I) are determined by the expression:

\[ I = \frac{A}{(T_c + B)C} \]

Where A, B, and C are defined as follows:

<table>
<thead>
<tr>
<th></th>
<th>2 yr</th>
<th>5 yr</th>
<th>10 yr</th>
<th>25 yr</th>
<th>50 yr</th>
<th>100 yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>573.1</td>
<td>1219.8</td>
<td>1728.6</td>
<td>2226.9</td>
<td>2640.0</td>
<td>3015.1</td>
</tr>
<tr>
<td>B</td>
<td>5</td>
<td>10.5</td>
<td>14</td>
<td>17</td>
<td>19</td>
<td>21</td>
</tr>
<tr>
<td>C</td>
<td>0.761</td>
<td>0.823</td>
<td>0.849</td>
<td>0.865</td>
<td>0.866</td>
<td>0.870</td>
</tr>
</tbody>
</table>

Tc (Time of Concentration) and Inlet Time of Concentration shall conform to the MOE Guidelines.

For more information on Tc, please reference the Region of Waterloo DGSSMS (February 2013) Section B.4.

The runoff coefficients to be used for designing storm pipes within City limits are:

- a) Parks and open space 0.20 – 0.35
- b) Single residential 0.45 – 0.65
- c) Semi-detached residential 0.45 - 0.65
- d) Downtown house, Town house, apartments, schools and churches 0.50 - 0.80
- e) Downtown / Suburban Shopping and Industrial 0.90–1

### 2.8.3 Design Frequency

The storm sewer should be designed to accommodate the 5 year rainfall event plus adequate provision for continuous overland drainage of roads, unless otherwise approved by the City of Cambridge. In special circumstances, it may be allowed or required to either increase or decrease this standard.

### 2.8.4 Sewer Location

Location of storm sewer shall be as per standard engineering drawing for pertinent road
allowance, where possible. Generally, the obvert of storm sewers are to be placed 1.5 meter below the finished grade at the centerline of the road or at a minimum 1.0 meter below the dwelling basement floor elevation. Where foundation drainage is provided by sump pumps, the minimum cover will be no less than 1.2 meters. Foundation and weeping tile drains may be connected by gravity to the storm sewer. Joint burial/common trenching with wastewater sewers will not be considered.

2.8.5 Easement Requirements

Sewers within easements between houses are to be concrete encased for the full length of the lot, up to the back of the street curb and easement width shall be as per following table.

Table 2.7 – Easement Requirements

<table>
<thead>
<tr>
<th>Size of Pipe (mm)</th>
<th>Depth to Obvert (m)</th>
<th>Minimum Width of Easement (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 to 375mm</td>
<td>2.6m maximum</td>
<td>3.0m</td>
</tr>
<tr>
<td>450 to 1500mm</td>
<td>2.6m maximum</td>
<td>5.0m</td>
</tr>
<tr>
<td>1650mm and up</td>
<td>2.6m maximum</td>
<td>6.0m plus 3 times O.D. of Pipe</td>
</tr>
</tbody>
</table>

Notes:
1. Regardless of the above guideline for Easement Requirements, all situations will be reviewed and judged on individual cases at the discretion of the City of Cambridge.
2. No foundations, permanent structures (except municipal servicing and underground structures) and building overhangs shall be allowed within easements.

2.8.6 Pipe Radius

Pipe sizes for storm sewers shall conform to Region of Waterloo and Area Municipalities Design Guidelines and Supplement Specifications (DGSSMS). Maintenance holes are to be placed in accordance with the City’s spacing requirement and/or as required by the pipe manufacturer. The City will allow the use of prefabricated manhole tees. The minimum centerline radius allowable shall be in accordance with the minimum radii table as provided by the pipe manufacturer.

2.8.7 Limits of Construction

Sewers shall be terminated with a manhole at the subdivision limits when external drainage areas are considered in the design. The design of the terminal manholes must
allow for the future extension of the sewer. When external areas are not included on the sewer design, the sewer shall extend at least halfway across the frontage and/or flankages of any lot or block in the subdivision.

### 2.8.8 Pipe Size, Type and Capacity

The City of Cambridge will allow the use of concrete pipe with no size limit or PVC pipe (SDR-35 only) to a maximum of 450 mm in diameter. The minimum size for storm sewers within City right of way shall be 300 mm. Foundation drain collectors shall be a minimum of 150 mm. Single catch basin connections shall be 250 mm and double 300 mm. For the calculation of pipe capacity Manning’s Formula using a roughness coefficient of $n = 0.013$ for smooth walled pipe shall be used unless otherwise discussed with the City prior to design.

### 2.8.9 Standards and Specifications

OPSS-410 is modified as follows:

The use of cement asbestos pipe will not be allowed.

As a substitute, PVC Ultra Rib pipe may be allowed to a maximum diameter of 450mm.

Where Ultra Rib pipe is used, high performance stone must be used for both bedding and cover material.

All native trench backfill material to be compacted to 98% Standard Proctor density (SPD). All granular backfill shall be compacted to 100% Standard Proctor density.

Prior to the issuance of building permits, the Contractor, Consultant and City staff must visually inspect the storm system.

The Developer will be responsible for providing 2 video inspections (on DVD with file compatible to City’s requirement) of all storm sewer pipe including catch basin leads and rear lot catch basins. The first video inspection shall be completed prior to Building Permit issuance and the second prior to surface asphalt. All storm sewer video inspections shall include a written report by the Consultant, which will include their recommendations, based on their review and assessment of the storm sewer video and contractor’s report.

### 2.8.10 Minimum and Maximum Pipe Velocity (Grade)

The minimum velocity allowed for storm sewer is 0.8 m/s and the maximum allowable is 6.0 m/s under peak theoretical flows. In the last reach before the outlet, the maximum allowable velocity shall be 3.5m/s.

The gradient range will be governed by the velocity criteria. In no case shall the
gradient be less than 0.5% for pipes less than 600mm in diameter and 0.25% for pipe
greater than 600mm in diameter. When minimum cover cannot be met, pipe insulation
shall be provided and City will review pipe gradient. When foundations are connected to
storm sewers through gravity, the hydraulic grade line should be shown on plan and
profile drawings.

2.8.11 Catch basins and Ditch Inlets

1) Criteria

Catch basins or ditch inlets are used to collect surface water from gutters, swales or
ditches. The maximum areas collected by any catch basins shall be 2,000m² of
pavement or 5,000m² of grass. Catch basins are to be constructed flush to base course
asphalt and raised only prior to surface asphalt. Maximum catch basin spacing shall be
in accordance with the following table.

<table>
<thead>
<tr>
<th>Road Gradient (%)</th>
<th>Maximum Spacing (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 3</td>
<td>90 for 2 lane and 75 for four lane roads</td>
</tr>
<tr>
<td>&gt;3</td>
<td>60</td>
</tr>
</tbody>
</table>

NOTE:
1) The Engineer shall ensure that the catch basin spacing is adequate to collect
storm water.

2) Design

Road catch basins shall be located upstream of pedestrian crossings and shall not be
located within driveway curb depressions. Double catch basins are required at all low
points having flow from two directions. Grates for road catch basins are to be flush type
as per DSSMS E4-01. For arterial and major collector roads, the City may allow
curb face inlet catch basins. The first joint out of a road catch basin is to be concrete
encased, if concrete pipe is used, or have a flexible joint if PVC pipe is used. Catch
basin leads are to be a maximum of 25 metres in length.

Rear yard catch basins shall be sump less. Grates for catch basins in rear yards,
parks and open spaces with pedestrian traffic are to be flush type OPSD
400.020.

The first joint out of a rear yard catch basin is to be concrete encased, if concrete pipe is
used, or fully concrete encased from the catch basin to the private property line, if PVC
pipe is used.
Ditch inlet catch basins are to be as per OPSD 705.03

Where the development property abuts a park or open space block, drainage from the development property shall not drain into the park or open space block unless approved by the City. A rear lot Catch basin on the development property may be required in such cases.

2.8.12 Maintenance Holes

1) Criteria

Maintenance Holes are to be provided at the end of pipe, pipe junctions, change in pipe alignment (vertical and horizontal), change in pipe size or material and where the maximum pipe run is attained. Maintenance Holes are to be constructed flush to base course asphalt and raised only prior to top asphalt.

The Maintenance Holes shall be sized adequately to receive pipes and the minimum size shall not be less than 1200 mm diameter. The maintenance hole connections should conform to the DGSSMS construction Specification D.3.3.3.

Manhole frame and cover to OPSD 401.01 – Type ‘A’ stamped with the word ‘STORM’. For additional information related to manholes within parks and open space, refer to the Community Services Department.

<table>
<thead>
<tr>
<th>Pipe Size (mm)</th>
<th>Maximum Spacing (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>600 and smaller</td>
<td>90</td>
</tr>
<tr>
<td>Larger than 600</td>
<td>130</td>
</tr>
</tbody>
</table>

2) Pipe Angle at Maintenance Hole

Change in pipe direction of more than 90° is not allowed. The maximum change in direction for pipes 1,050mm and larger shall be 45°.

3) Head Losses and Drops
Suitable drops shall be provided across maintenance holes to compensate for the loss in energy due to the change in flow velocity and for the difference in the depth of flow in the sewers.

In order to reduce the amount of drop required, the designer shall, wherever possible, restrict the change on velocity between the inlet and outlet pipes to 0.6 m/s.

Where the difference in elevation between the Invert of inlet pipe and manhole exceed 610mm metres, an external drop pipe shall be placed on the inlet pipe. The drop structure shall be provided in accordance with MOE Design Guideline and OPSD 1003.01 and 1003.031

The minimum drops across manholes shall be as per the following table.

**TABLE 2.10 – Minimum Drops across Manholes**

<table>
<thead>
<tr>
<th>Change of Direction</th>
<th>Minimum Drop (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>20</td>
</tr>
<tr>
<td>1° to 45°</td>
<td>30</td>
</tr>
<tr>
<td>46° to 90°</td>
<td>60</td>
</tr>
</tbody>
</table>

### 2.8.13 Connections to Main Sewer, Sump Pumps and Surface Drainage

1) **Service Laterals**

It is City’s preference to have foundation drains connected to a storm sewer by gravity, if the basement elevation is at a minimum of 300mm above 100 year hydraulic grade line in the sewer.

In conjunction with a gravity connection, the City may, in specific cases, require having a standby pump and a sump pit installed and connected to foundation drain pipe as an emergency backup (see drawing C135 b).

If the gravity connection is not achievable, the foundation drains shall be drawn down to a sump pit and pumped to storm sewer service connection or to yard, dry well, swale or other approved outlet as suggested by SWM report and hydrogeological study.

*Under no circumstances should sump pump be allowed to discharge to sanitary sewer.*

The details for weeping tile/ foundation drain connections to the sump pit shall be in accordance with City’s Standard Drawings C135 or C136, as applicable"
Sump pump discharge to grade must meet the following criteria. A sump pump outlet to grade located a minimum of 3.0 meters from any downspout will be permitted. Only one Sump pump discharge will be permitted per side yard swale. Note that in all circumstances, the elevation of the building footings must be 0.3 meters above the hydraulic grade line. Where this condition and any of the conditions a) to d) below cannot be met, sump pumps shall be connected to the storm sewer.

a) Where a lot is back to front draining (all drainage to the front) and there is no sidewalk, sump pump discharge to grade is permitted.

b) Where a lot is split draining (1/2 to the back and 1/2 to the front) and there is no sidewalk, sump pump discharge to grade to the front or back is permitted.

c) Where a lot is split draining (1/2 to the back and 1/2 to the front) and there is sidewalk, sump pump discharge is permitted only to the back where there is a rear lot catch basin.

d) Where a lot is front to back draining (all drainage to the back) sump pump discharge is permitted to the back where there is a rear lot catch basin.

Where provisions for a gravity or sump pump system cannot be made, a foundation drain collector (FDC) system with a minimum slope of 0.5% will be considered, subject to the proponent providing a detailed technical justification.

The location of service laterals at lot frontages is detailed on City Standard Drawing.

The connection of foundation drains to sanitary sewer network is strictly prohibited.

2) Service Lateral Sizing

Single-family semi-detached and multiple residential areas (foundation drain only) shall have a minimum size of 150 mm diameter PVC SRD 28.

Commercial and Industrial Areas (sized for surface drainage) shall have a minimum size of 300 mm diameter (PVC acceptable up to 450 mm).

Multi-Unit Blocks: Freehold developments shall be provided with individual unit service connections to the foundation drainage system. Condominium/Shared Ownership developments shall be provided with a minimum of two (2) connections per block.

Service lateral depth at the street line shall be 1.2 m minimum.

Refer to the Region of Waterloo or OPSD Standards for wastewater service connections.

3) Main Line Connections

Installation of service tees at the main sewer shall be as follows:
• For storm main sewer pipe of all sizes, prefabricated tees from the plant shall be utilized unless otherwise approved by the City.

• The storm sewer shall be drilled or cored rather than breaking through the pipe wall on site.

4) Identification

100 mm x 50 mm wooden markers placed from the invert of the storm service to 1.0 meter above ground level shall be placed at the ends of each residential connection (street line). The top 0.5 metre of the markers are to be painted white.

5) Roof Leader Criteria

For all residential buildings, the stormwater roof leaders must discharge to a sodded area with the use of a concrete ‘splash’ pad.

6) Overland Flow Routes

Major flows in excess of the minor system capacity shall be safely routed to the receiving watercourse. An overland flow route must be established through all areas and shall be contained within either the road right-of-way or by other lands in the City’s ownership or control (i.e. through blocks or easements). Overland flow routes must be appropriately stabilized to resist erosion during a design event, to the satisfaction of the City of Cambridge.

Drainage blocks are required to allow drainage of public lands, while easements are required to allow drainage on private lands.

The depths of flooding permitted on streets and at intersections during the 1:100 year storm are as follows:

a) For all classes of roads, the depth of flow at the gutter (in meters) multiplied by the Velocity of flow (m/s) shall not exceed 0.65 m/s.

b) For all roads, the depth of water at the crown shall not exceed 0.15 metres and shall be contained within the right-of-way or block.

c) Flow across road intersections shall not be permitted for minor storms (generally 1:5 year or less). To meet criteria for major storm runoff, low points in roads must have adequate provision to safely accommodate overland flow.

d) Where possible, overland discharge routes within residential areas shall also provide public access to parks and open space. Drainage blocks which also act as public access routes are subject to approval by the City.

e) The depths of flooding (i.e. 1:100 year event) on residential property with a rear yard catch basin, public open space and parking areas shall not exceed 0.3 metres.
2.8.14 Inlet/Outlet Structures

Inlet and outlet structures shall be fully detailed on the engineering drawings. The details provided shall include the existing topography, proposed grading and the works necessary to protect against erosion of the channel and undermining of the structure.

Appropriate erosion protection shall be provided at all inlets/outlets to prevent erosion of the watercourse and of the area adjacent to the headwall. The extent of the erosion protection shall be indicated on the engineering drawings and shall be dependent upon the velocity of the flow at the storm outlet/inlet, the soil conditions, the flow in the existing watercourse and slope conditions.

The openings to inlets and outlets must be protected to prevent unauthorized access and blockage of the system. Rodent /safety grates are required where pipes exceed 300mm diameter. Culverts larger than 1800mm may not require grates where the system is open at both ends and the length is determined to be acceptable. Where grates are not utilized, warning signs will be required. Wording on signs is to be to the City’s satisfaction. Safety guards are required on structures where a vertical face exists greater than 1.0 metre in height, unless agreed to by the City.

The invert of outlet pipes in stormwater management ponds is be set at the permanent pool elevation or the 1:5 year flood elevation in watercourse systems, unless otherwise justified to the satisfaction of the City.

Complete slope restoration shall be provided where slope stability is an issue. Natural stabilization methods are encouraged, including plant replacement/enhancement and bioengineering techniques.

All outlets to a regulated watercourse require a permit from GRCA.

2.8.15 Culverts and Bridges

Road crossings of major watercourses shall be designed to the listed flood frequencies. For major events (1:100 year and Regional), transverse water crossings shall have a depth at the crown of the road of 0.15 metre and a maximum velocity of 0.4 m/s.

Table 2.11 – Design Criteria for Bridges and Culverts (3 Metres Diameter or Greater)

<table>
<thead>
<tr>
<th>Road Classification</th>
<th>Design Flood Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arterial</td>
<td>1:100 Year to Regional</td>
</tr>
<tr>
<td>Collector</td>
<td>1:50 Year</td>
</tr>
<tr>
<td>Urban Local</td>
<td>1:25 Year</td>
</tr>
<tr>
<td>------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Temporary Detour</td>
<td>1:10 Year</td>
</tr>
</tbody>
</table>

Driveway culverts must have a minimum size of 375 mm with 3:1 side slopes sodded or as approved by the City.

Bridges and other major drainage structures shall require special designs as determined by the City and Region Hydraulic calculations.

2.8.16 Subdrains

Road Subdrains shall be required if recommended in the geotechnical investigation report. Subdrains shall be constructed 3 meters on the upstream side of single catchbasin and on both sides for double catchbasin with 100mm corrugated steel pipe or perforated PVC or equivalent and wrapped in filter cloth. Subdrain inverts should be maintained at least 0.5 meter below subgrade level and should follow the surface grades of the road.

The location of the subdrains shall be determined by the City staff in consultation with consulting engineer.

2.9 SEWER MATERIAL SPECIFICATION

2.9.1 Pipe Materials

Refer to the DGSSMS and the Ontario Building Code for acceptable materials.

2.9.1.1 Cast Iron Maintenance Hole Lids – Refer to DGSSMS

2.9.1.2 Cast Iron Catchbasin Frames and Grates – Refer to DGSSMS

2.9.1.3 Maintenance Hole and Catchbasin Adjustment Units – Refer to DGSSMS

2.9.1.4 Slotted Pipe Drain – Refer to DGSSMS

2.9.1.5 Flexible Couplings – Refer to DGSSMS

2.9.1.6 Watertight Connectors – Refer to DGSSMS
2.10 CONSTRUCTION SPECIFICATIONS

The Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS) Part D – Construction Specifications shall form the basis for construction except as extended or amended herein. The following outlines the supplementary specifications to be applied to the design and construction of Sewer works for development in the City of Cambridge.

2.11 WATERMAINS

The Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS) Part B – Design Guidelines shall form the basis of the design criteria for Watermain except as extended or amended by the City Engineering Standards Drawings (Chapter 5) of this document. The OPSD standards may be applied with the approval of City of Cambridge wherever required.

Note: The City of Cambridge will only accept 200mm diameter watermain as a minimum size within City’s road right of way.
CHAPTER-3 PROCEDURES

3.1 DRAWING SUBMISSION REQUIREMENTS

All submissions are to be complete including all engineering drawings, landscape drawings, cost estimates, required reports and other supporting information, as required.

All drawings must measure 594 mm x 841 mm (A1 metric). Minimum top, bottom and right hand borders shall be 10 mm and minimum left hand borders shall be 40 mm. All drawing sheets shall include a City of Cambridge Title Block in the bottom right hand corner, a Consulting Engineer's Title Block immediately above and revision table above the Title Block.

Mylars are required for “as-built” drawings. Paper drawing sheets are required for all other submissions. Electronic files are also required for upgrading of City’s Asset Management Data.

3.1.1 General Drawing Requirements

All engineering drawings shall be signed, sealed and dated by an Engineer registered with Professional Engineers of Ontario, and Landscape Drawings by a registered Landscape Architect, who is accredited a full member with the Ontario Association of Landscape Architects.

Computer-Aided Design (CAD) shall be used to generate all engineering and landscape drawings. The following layers must be identified:

1. Storm – Storm Sewer
2. Sanitary – Sanitary Sewer
3. Water – Water System
4. Lot Lines – Property fabric (lots, semidetached and townhouse)
5. Street Names – Text of all street names
6. North Arrow
7. Legend
8. Lot Block Numbers – Text of all parcel numbers
9. Curb – Curb and Gutter
10. Sidewalk
11. Vegetation

All Engineering drawings shall be signed, sealed and dated by an Engineer registered with Professional Engineers of Ontario and/ or a Landscape Architect, as appropriate.

All elevations are to relate to a City of Cambridge geodetic datum and the bench mark
shall be described on the drawings.

All plans must be submitted using “real world” co-ordinates based on a 6 Universal Transverse Mercator Projection, North American Datum 1983 (NAD83). All mapping supplied to the City must snap to the adjacent property boundaries. Number of Drawings sets required is as follows:

- **First Submission**: 5 sets of full size Drawings
- **Second and Interim Submissions**: 5 sets of full size Drawings
- **Approved Drawings**: 5 sets of full size & 2 sets of 11”x17” size.

A complete set of engineering and landscape drawings shall include but not limited to:

1. Cover Sheet
2. General Notes
3. General Plan / Legal
4. Composite Above Ground/Utility Plan (May submit with second submission)
5. Underground Services Plan
6. Phasing Plan
7. Storm Drainage Area Plans
8. Sanitary Drainage Area Plans
9. Water Main Servicing Plans
10. Erosion and Sedimentation Control Plan
11. Grading Plans
12. Plan and Profile Drawings
13. Traffic Control and On-Street Parking Plan
14. Landscape /Tree Management Plan
15. Street Tree Planting Plan
16. Park/Open Space Concept and Grading Plan
17. Details Sheets
18. Miscellaneous Details and Standard Drawings (City/OPSD/DGSSMS)
19. Storm Water management Plans

### 3.1.2 General Notes

This sheet shall list the following notes:

- **a)** City of Cambridge’s general design criteria that apply to all sheets. The pertinent notes for the project can be extracted from the design criteria chapter (i.e. lot service, pipe sizes, curb type, CB grate type, etc.).
- **b)** Special warnings from utility companies and government agencies, i.e. existing structures and buried services.
- **c)** City of Cambridge’s policies and by-laws which apply to the construction activity (i.e. hours of work, mud tracking, required permits, construction access, etc.
- **d)** A summary table of all municipal underground services indicating:
  - Pipe material, diameter, length
• Manhole / Catchbasin- invert elevations, size and number.
e) A summary table of all Municipal roads including: right-of-way widths, centerline lengths, and number of lanes.

3.1.3 Planting Notes

Refer to Appendix ‘C’ for a complete list of planting trees and notes to be included in landscape submissions.

3.1.4 General / Servicing and Underground Plans

1. All Drawings shall be drawn using metric scales. General plan(s) shall be drawn to a scale of 1:1000 with a key plan in right top corner, highlighting the individual plan to a scale of 1:5000. These plans shall show land uses, road layout, street names, lot numbers, legal description of adjoining lands and lands to be dedicated to the City of Cambridge.

2. General Plans showing above-ground services shall:
   • Show all existing and proposed curbs, road allowances, road widths, street names, catch basins, manholes, hydrants, street lights, road grades and tree plantings.
   • Show the removals of all buildings, structures, pavements, fences etc, if applicable.

3. General Plans showing below-ground services shall:
   • Show all existing and proposed sewer lengths, sizes, types, invert elevations, catch basins, manholes, slopes (to two decimal points) and direction of flow.
   • Show all existing and proposed watermains, sizes, hydrants, valves and fittings.
   • Show all house connections including water and sanitary.

4. General Plans showing drainage shall:
   • Show storm drainage areas, including the areas outside the subdivision, hectares and run-off coefficients.
   • Show Catchbasins, both on street and rear yards.
   • Show sanitary drainage areas, hectares and densities.
   • Show existing elevations and proposed elevations and other pertinent
information and permanent overland drainage swales forming part of major/minor storm design system to be included in registration and deeds, together with specific elevations at the following points:

a) Ensure that the elevations for footings shall be a minimum 0.75 metres above the maximum ground water table;
b) centerline of the proposed road in front of each lot is shown;
c) both corners at the front of each lot;
d) existing and proposed elevations extending at least 6.0 metres externally;
e) centerline of each lot at 19.0 meter setback;
f) both corners at the rear of each lot.

- Show all berms by height and location.
- Show sectional details of all proposed swales.
- Show all slopes created indicating top of slope ratio of the slopes.
- Show in a legend a sample lot indicating base of footing elevations, rear lot line, existing and proposed elevations at rear lot corners, lot number, existing and proposed elevation at 6 meters setback, proposed elevation at 19 meters setback, existing and proposed front lot corners, street line, proposed centerline road grade and direction of flow by arrows.
- Show if there is a design split in the grading of the lot.

The proposed elevation at 6.0 metre setback from the street should be a minimum of 300 mm and a maximum of 900 mm above centreline of road in front of the lot, unless approved otherwise.

All sanitary, storm and water structure are to be uniquely identified on general plans as well as plan and profile drawings using a five digit numbering scheme (XXYYY) where XX represents the asset number range assigned to the subdivision and YYY is a block of structure identifiers unique with the entire subdivision. The structure identifiers are to be prefixed with:

a) Storm Catchbasin DC
b) Catchbasin Lead DL
c) Storm Inlet DI
d) Storm Outlet DO
e) Storm Pond DW
f) Storm Pipe DP
g) Storm Manhole DM
h) Sanitary Pipe SP
i) Sanitary Manhole SM
j) Sanitary Pumpstation PS
k) Water Valve WV
l) Water Chamber WC
m) Water Pipe WP
n) Fire Hydrant WH

NOTE: Double catch basin is considered as one structure and Pipes are separated by Valves, junctions and reducers.

3.1.5 Composite Utility Plan

In lieu of the municipal consent and /or UCC applications for individual utilities, the applicant is required to submit a Composite Utility Plan on scale of 1:500 showing; road layout, all underground services/utilities, all above ground appurtenances to the services, all street furniture including sidewalk, all street trees, traffic signs and driveways. The plan must include all utility structures/buildings. The plans must be stamped/signed off and dated by all pertinent utility agencies/departments and send to the consulting engineer prior to submission to the City for review and approval. This plan must form part of the Certified Engineering Submission.

3.1.6 Traffic Control Plan

The developer shall submit a Traffic Control Plan and on Street Parking Plan at a scale of 1:500. The plan will show all roadways, property lines (including designation of schools and parks), driveways, fire hydrants, sidewalks, bike paths, street lighting, traffic signage (including the specific locations of each regulatory, warning and information sign), pavement markings and on street parking opportunities.

The Transportation and Engineering Services Division must approve all traffic control plans.

On street available parking must be evaluated to confirm that it will provide for a minimum 0.5 spaces per lot.

3.1.7 Phasing Plan

If Site Plan or Plan of Subdivision is to be developed in stages, a Phasing Plan showing current and future phases is to be prepared at a scale of 1:1000. The City may request various scales in order to create composite plans with other developments. If this information can clearly be shown on the General Plan/Underground Services Plan, the two drawings can be combined. The Phasing Plan’s function must be substantiated with an interim Stormwater Management and Traffic Report (and other reports as required by the City.)

3.1.8 Storm Drainage Plans
Storm drainage plans are to be drawn to a scale of 1:1000. If large external drainage areas are to be detailed, a separate External Drainage Area Plan is to be produced. A scale of 1:5000 is acceptable for larger external drainage areas and is to indicate the total area to be drained by the proposed storm sewers. Storm water management facilities shall be shown with reference to detailed drawings at some other location in the drawing submission. The Storm Drainage Plan is to be compatible with the Grading Plan and must indicate the following:

a) Existing contours (0.5m intervals);
b) Drainage patterns of adjacent lands and a breakdown of contributing external areas specifically showing the lands for future development;
c) Run-off coefficients and area of tributary areas internal and external to the development for each section of the storm sewers within the development;
d) Direction of run-off (overland flow);
e) Street Names;
f) Manhole and Catchbasin Numbers;
g) Pipe Sizes;
h) Directions of flow in the sewers;
i) Complete major and minor storm system;
j) Any catch basins or swales, on lots, parks or blocks, required to accept storm runoff.

3.1.9 Erosion Control Plan

Erosion and Sediment Control plans are to be drawn to a scale of 1:1000. The plan must provide a phasing and construction schedule that shows the works required to mitigate sediment contamination of affected creeks, adjacent lands, and storm sewer systems and how they are to be staged. Plans must indicate all information required as per By-law 160-09.

NOTE: No person shall alter the grade of land in the City of Cambridge until they have complied with By-law 160–09. This Grading Permit By-law is to preserve topsoil and regulate site alterations in Cambridge”.

3.1.10 Subdivision Grading Plans

Grading plans for all lots and blocks are to be drawn to a scale of 1:500 showing existing contours (0.5m intervals), established from elevations taken in the field. A key plan shall be shown in right top corner, highlighting the individual plan. The plans are to include the following information:

3.1.10.1 Existing Elevations at:

a) The corners of each lot and block.
b) External elevations extending to a minimum 60 metres perimeter external to the Plan.
c) Flow direction for external drainage.
d) The base of all large trees 10cm or more in diameter DBH plus their drip line, and the composite drip line of all contiguous vegetated areas such as woodlots, hedgerows etc.
e) Regular intervals within any woodlot or other natural blocks where deemed necessary to determine the effect of grade change on tree preservation.

3.1.10.2 Proposed Elevations at:

a) Intervals along the centre line of all proposed roads (maximum 20 metre spacing); the slope of each road section is to be noted.
b) All high points (e.g. split drainage, rear and side yards, top and bottom of slopes).
c) The corners of each lot and block.
d) 15 metre intervals along cut-off swales and ditches.
e) The exterior grade at the front and rear of each structure.
f) Any other points necessary to present a proper picture of the proposed drainage scheme including tops of catch basins and bottoms of swales and associated easements.
g) Critical transition points adjacent to walkways or existing lots or (provide section details where useful).
h) Top of grate and invert elevations for all sanitary and storm structures including rear yard catch basins.

3.1.10.3 Other Required Information:

a) Street furniture including road structures (e.g. catch basins and manholes, fire hydrants, hydro transformers, communication pedestals and street lights).
b) Direction of gutter flow at catch basins.
c) Direction of overland flow routes including points of outlet and ponding limits for the 1:100 year event.
d) Label all lots with a drainage type and refer to a detail on the detail drawings.
e) Indicate existing trees and proposed tree saving limits. Indicate provisions for the preservation of any existing trees where identified for retention.
f) Detail retaining walls and structures where required, including top of wall and bottom of wall elevations.
g) Show all fencing, easements and noise attenuation structures.
h) Indicate the regulatory flood limits of watercourses.
i) Provide percent grade where swales are at a minimum slope or are otherwise critical.
j) Specify run vs. rise ratio where slopes are created with a slope greater than 10% (Note: maximum slope = 3:1).
k) Show the proposed elevation at 6 meter setback from the street that should be a minimum of 300 mm and a maximum of 900 mm above centerline of road in front of the lot.

### 3.1.10.4 Individual Lot Grading Plans Requirements

- Individual Lot Grading Plans shall be submitted in triplicate with all building permit applications.
- The individual grading plans must be in conformance with the overall Subdivision Grading Plans, as approved.
- Sittings for single homes and semis shall be prepared as one lot per sheet at a scale of 250:1 on legal paper unless a different scale is required by the sheet size.
- Sittings for townhouse blocks shall be prepared as one block per sheet at a scale of 250:1 and sheet size of 11" by 17" unless a different scale is required by the sheet size.
- All grading plans shall include a title block with the name of builder/Developer/subdivision/registered plan number, lot number and municipal address (if available), architect/designer company, scale of drawing and date of preparation.
- A key plan with north arrow is required in the upper right hand corner.
- All rear yard drainage shall be directed away from house in defined swales that outlet at the curb, the sidewalk or a catch basin.
- The minimum slope within sodded areas shall be 2% and maximum slope within sodded areas shall be 3:1. However, rear yards must have a minimum of 75% of the yard area at the slope of no greater than 5% unless permission is obtained.
- Driveways are not to be used for a drainage outlet.

The plan shall also show the following:

1. Location and elevation of storm, wastewater and water service connections.
2. Elevation of culverts, drainage ditches, sidewalks and easements.
3. Existing elevations as per topographic survey indicating existing buildings and drainage patterns for all buildings on adjacent lands including retaining walls, downspout discharge areas etc.
4. Length and proposed grade of all drainage swales.
5. Surface runoff for all adjacent and proposed lots using arrows to show the direction of flow.
6. The house type and elevations of the finished first floor top of foundation wall, basement floor and underside of the footings.
7. The proposed elevations at the lot corners, landings, garage slab and all entrances (indicating the number of risers), the existing roads and
catch basins.

8. Width of driveway between property line and road curb to comply with City driveway entrance permit requirements unless prior permission is obtained.

9. The location, length and percent slope of proposed driveways (minimum and maximum permissible driveway grades are 2% and 8% respectively)

10. Type and details of proposed retaining walls, including top and bottom of wall elevations (if any).

11. Location of approved erosion and sedimentation controls (if any).

12. Location of sump pump, infiltration gallery and discharge point. (if any).

13. Certification of noise controls as required.

14. All elevations are to be referred to a geodetic City benchmark.

15. Utility structures within boulevard area (1.5 metres clearance required from driveway to street light pole, hydrants, transformers, communication pedestal, etc.).

16. Tree management plan to the approval of developer's arborist whenever required under draft plan or other condition.

Note:
Lots submitted must be approved by the Developer's Engineer for conformance to the overall subdivision design. The individual lot grading plans must be stamped, signed and dated by the consulting engineer with the following wording prior to being reviewed by the City: “We certify that the proposed grades at the lot corners are correct, and that the lot grading of the subject lot is in general conformity to the approved subdivision grading plans and City of Cambridge standards.”

3.1.10.5 Lot Grading Certification Procedure

The Owner’s / Developer’s Engineer shall ensure that the following procedures have been undertaken prior to issuance of the lot grading certification.

The City of Cambridge has been advised that the Owner/Developer’s Engineer has visited the site to confirm that the lots have been graded and sodded in accordance with the overall grading plan. The ground elevation adjacent to the house/dwelling must be compatible with the lot grading which has been completed. This process is to be completed as soon as possible after sodding, but not later than two months after placement of the sod, unless otherwise agreed to by the City.

The Owner/Developer’s Engineer will then immediately arrange to meet with representative from the City’s Planning Operations Division on site and review each lot in the plan that is to be certified. The Owner/Developer’s Engineer or representative and City staff will agree on those lots that can be certified by a visual inspection and identify those lots, which require more surveying or more work to determine how they can be certified. The Owner/Developer's Engineer will then certify all lots where an agreement has been reached by the parties in the field.

The Owner/Developer’s Engineer will re-survey those lots that cannot be certified by a visual inspection and/or, if necessary, require the builder to do further work in order that
such lots can be made certified. This work shall commence within one month after the initial inspection. It should be noted that if the builder does not correct the work as instructed by the Owner/Developer’s Engineer, the responsibility will fall directly upon the Owner/Developer.

Lots, which cannot be certified due to poor grading or due to changes in the type of house built on the lot, will be brought to the attention of the Senior Development Engineer in writing. The Owner’s Engineer, on behalf of the Owner, will prepare a new grading plan(s) for these lots and will submit to the City, builder, and home owner, if necessary, for approval.

Lot grading certificates will be accepted by the City of Cambridge following the inspection and certification of lots in the field. This in no way relieves the Owner of his responsibility to rectify any grading deficiency problems that may arise within the one year of the maintenance period following certification.

Please note that prior to the final release of the owner’s/Developer’s obligations under the subdivision agreement, a final grading certificate must be submitted indicating that all properties in the subdivision have been developed in conformity with the approved overall grading plan.

The following is a sample lot grading certification letter to be utilized.

I,…………………….., a Professional Engineer in the Province of Ontario, do hereby certify that grading of Lot No…………  in the Registered Plan No. -------------  has been completed in a satisfactory manner in general conformity with the approved lot grading plans and with the City of Cambridge lot grading guidelines.

PROFESSIONAL ENGINEER: __________________________________________

(Signature) __________________________________________

(Title) __________________________________________

(Engineer’s Stamp) __________________________________________

THE CORPORATION OF CITY OF CAMBRIDGE ACCEPTANCE: ____________________________
3.1.11 Plans and Profiles

All plan and profile drawings are to be drawn to a horizontal scale of 1:500 and a vertical scale of 1:50 and shall include:

a. A key plan in the top right corner, highlighting the individual plan and a North arrow in each plan view.

b. A Legend including a standard City of Cambridge Block on each plan

c. Where two or more sheets are required for each street, match lines must be used and there should be no overlap or duplication of information.

d. Two short streets may be shown on one plan profile if space permits.

e. The datum shall refer to a standard City of Cambridge Geodetic Bench Mark, stating Bench Mark number, location and elevation.

f. All existing and proposed curbs, road allowances and street names.

g. All existing lot numbers and blocks, all existing iron bars and registered plan numbers.

h. All existing and proposed watermain sizes, with hydrants, valves, fittings and other utilities.

i. All existing and proposed sewer lengths, sizes, types, grades (to two decimal points), direction of flow, manholes and catchbasins.

j. All house connections. Preferably all services to be in center of lot.

k. All manholes with proper symbols and their types referred to a City standard or Ontario Provincial Standards.

l. Structure identifiers shall be shown as outlined in section 3.1.4.

m. Centerline of road plotted on the plan view with stations of B.C.’s, E.C.’s, road limits and intersections.

n. On the profile, the length between grade points, the proposed grades at 20 metre intervals and all vertical curve information including BVC, EVE, Low/high points etc.

o. The street line elevations at the limit of the subdivision and the adjacent land topography for a minimum distance of 60 metres.

p. On all profiles, the type of sewer bedding to be used and the maximum allowable trench widths.
q. A cross-section of pavement design indicating depths and types of the granular material and the asphalt.

r. A cross-section of all major swales and drainage ditches, if any.

s. Cross-sections of all walkways.

3.1.12 As-Record Drawings

“As-built” drawings constitute the original approved Mylar engineering and landscape drawings that have been revised to include “as-built” conditions. The “as-built” drawings shall be submitted to the City for the City’s permanent records upon completion of construction and prior to the request for the City to initiate the assumption process.

As-built information and drawings for municipal infrastructure shall be submitted to the satisfaction of the Asset Management Division.

For parks and open space built by the Developer, as-built drawings are required prior to the City undertaking Maintenance.

The “as-built” revisions shall be based upon an “as-built” survey of all the subdivision services and works.

All the as-built drawings shall be submitted prior to start of the maintenance.

3.1.12.1 “As-Record” Drawing Requirements

The drawings must indicate the following information:

- House connections – location and invert at the property line
- “As-Record” drawing (shown in revision column with date);
- All construction notes shall be removed
- The registered plan number must be shown on the plan view of each drawing as well as the General Plan/Underground Services Plan
- Date of installation of assets and specify actual material for life cycle analysis
- Lot and block numbers shall be in conformity with the Registered Plan
- Street names shall be in conformity with the Registered Plan
- All easements to be verified and provide Reference Plan and PIN Numbers
- All street trees and planting areas including revisions to species,
quantity and condition

- Record of timing for planting, including date of replacement planting if applicable

### 3.1.12.2 Digital Data/GIS Compatibility

The Final Submission Requirements shall consist of one (1) CD of digital submission (Preferred format is PDF) and one (1) set of Mylars 24” x 36” or premium bond originals., “As-record” drawings may also be submitted in a ‘DXF’ Digital Format.

### 3.1.12.3 Acceptance of “As-Record” Drawings

The City will review each submitted drawing and staff will inform the consulting engineer for any error, omission or discrepancy, in any. Drawings shall be revised if discrepancies are found or insufficient details are provided. Prior to assumption of the plan, a complete set of Mylars shall be submitted along with the digital files. Final As-record submission/deliverable for the City shall meet minimum standards as detailed below and show;

- Service connections – location (swing ties) and invert at the property line
- “As-record” drawing notation (shown in revision column with date)
- All construction notes shall be revised to the past tense
- Limit of construction (differentiate using line weights, line types, etc.)
- Date of installation of assets
- Size, grades and inverts for all pipes and manholes
- Actual material and bedding of assets labeled in profile
- Municipal Address numbers and street names
- True north and construction north indicators
- All property lines, right-of-way lines and easements
- All street trees
- Drawings scale (typically 1:250 horizontally and 1:50 vertically for reconstruction, 1:500 horizontally and 1:100 vertically subdivision development)
- All elevations shall be geodetic
- Identify any discrepancies in existing utilities between the drawings and the actual as located in the field
- Line weight and label values are maintained as per the Proposal Drawing. New installations shall be easily identifiable via their hierarchy
- Asset ID labels

The Community Services Department will require “As-Record” drawings of all park and blocks, prior to assumption or when conveyed to the City.

A legal and topographic survey of the blocks should contain the following information:

- Spot elevations taken on a 5 metre grid for all park blocks unless otherwise
specification.

- Water, storm, electrical, sanitary (if applicable) servicing locations and connections.
- All invert, rim elevations for services, pipe sizing and gradients.
- Complete topographic information of all structures (including paved areas, trails, and parking lots), vegetation, and landforms within the block.

### 3.2 ENGINEERING SUBMISSION

#### 3.2.1 General

Once Draft Plan Approval has been obtained, a detailed combined Engineering and Landscape Submission can be made to the Planning Operations Department. Specific requirements of other Agencies and Departments are the responsibility of the Developer or his/her Agents.

Prior to proceeding with the detailed design and preparation of the drawings, the Developer’s Consulting Engineer and Landscape Architect should first submit a copy of the Ontario Land Surveyor’s calculated plan, a digital version of approved draft plan, preliminary road profiles and preliminary grading plans. After satisfactory review of this preliminary submission by the City, the Consultant(s) will be in a position to proceed with detailed design.

#### 3.2.2 Special Consideration of Pre-Draft Plan Approval Engineering Submissions

The City may consider, at its discretion that an engineering submission may be made prior to Draft Plan Approval, if the noted criterion below is satisfied. The consideration of Pre-Draft Plan Approval (DPA) submissions will be at the sole discretion of the Commissioner Planning and Development Department and his/her decision will be final. This decision shall be based on the Director’s satisfaction that the plan has advanced through the approval process to the point where potential changes would be minor in nature. The Developer shall supply the following prior to the City accepting the drawings for review:

- The request shall be made in writing from the Developer;
- The Developer shall pay to the City $5,000, for the review of the drawings;
- All engineering submissions shall conform with the contents noted within this manual;
- The Developer shall provide to the City a letter agreeing that the submission of drawings prior to Draft Plan Approval is at the sole risk of the Developer, and further that the City will not be held responsible for any costs associated with changes required to the submission as a result of changes to the Draft Plan or as may be required by the Director, Development Planning.

The engineering drawings will not be approved and no pre-servicing or subdivision agreement will be entered into prior to DPA and the engineering drawings will not
influence the DPA requirements. All reports in support of the draft plan must be reviewed and approved by the pertinent authorities. Lastly, a second review of the drawings shall not be undertaken by the City until such time a Draft Plan Approval has been granted for the development. At that point in the approval process the normal review and approval process shall commence.

3.2.3 First Submission of Engineering Design
This submission will not be reviewed until a complete package is received. The following shall be submitted as one package:

- Five (5) complete sets of drawings as outlined in Section 3.1.1.
- A Letter of Retention to the City from the Developer indicating which Consultant firm has engaged for the design and complete general construction supervision of all municipal services.
- A Letter of Retention from the Developer/Owner indicating which Geotechnical Consultant has been retained to supervise in total, all filling operations and the installation of bedding and backfill in all trenches within road allowances and easements and that he will carry out sufficient tests to certify to the Developer and the City that the installation and compaction of bedding, backfill and engineered fills is in compliance with the City’s specifications.
- A Letter of Retention from the Developer/Owner indicating which Landscape Architect he/she has engaged for the design and complete general construction supervision of all landscape works.
- Three copies of the following:
  a) A storm sewer drainage plan including the whole storm sewer area to be drained through the proposed system, showing contours drainage boundaries and patterns of adjacent lands.
  b) Standard Design Sheet for storm sewers.
  c) Standard Sanitary Sewer Design Sheet.
  d) A sanitary sewer drainage plan including the whole sanitary sewer area to be drained through the proposed system.
  e) Standard design sheet for pipe strength and bedding unless special designs are required.
  f) Complete sets of detailed cost estimates for all grading and construction of municipal services including the Schedule of services.
  g) Copy of approved draft plan and conditions.

NOTE: A red-lined, marked set of drawings will be returned to the Consultant with the City’s comments. A letter summarizing the City’s comments will be provided and a meeting can be arranged if clarification is required.

3.2.4 Second or Subsequent Submission of Engineering Design
The following plans and documents are required for the Second or Subsequent Submission.
a) The red-lined/marked-up previous submission drawings  
b) Two complete sets of drawings as outlined in Section 3.1.1 and/or Item1 of first submission.  
c) Traffic Impact Study.  
d) Street Light Design  
e) Ministry of Environment and Energy (M.O.E.E.) Application Forms for Sewers and Watermains (original plus two copies) duly signed by the consulting engineer, together with:  
f) Three additional sets of plans and profiles of all proposed roads and services and a general plan of underground services, to be submitted by the City to the Ministry of the Environment and Energy and the Regional Municipality of Waterloo  
g) Copies of all approvals (Ministry of Transportation, N.E.B., C.N.R., M.N.R., G.R.C.A. and City Community Services Department, etc.) if applicable

**NOTE:** The MOE application will not be forwarded to the Region or MOE until the City has conceptually approved the sanitary, storm sewer and watermain design for the development.

### 3.2.5 Final Submission of Engineering Designs

The following shall be submitted as one package:

a) Five (5) complete sets of drawings as outlined in Item 2 Section 3.2.4, revised as required following all previous submissions, including an electronic copy.  
b) Three (3) complete sets of the revised cost estimates including an electronic copy.  
c) Four (4) copies of the draft M-Plans and all applicable reference plans.  
d) Cambridge and North Dumfries Hydro approvals.  
e) Copies of applications for approval to all ministries, authorities and agencies, as they pertain to the particular development.  
f) Submission of street names approved by the City.  
g) Two (2) complete set of contract documents including tender forms and specifications.

### 3.2.6 Additional Submissions

The Consultant shall submit a letter accompanying the drawings indicating the extent of the changes and which drawings have been changed. The letter must also certify that no other changes have been made to the drawings. The letter must be stamped, dated and signed by a Professional Engineer, as reflected in the changes to the drawings.

Each additional engineering submission shall be accompanied by a certified cheque in the amount of **$2,000.00** payable to the City of Cambridge.
Each additional Landscape submission shall be accompanied by a certified cheque in the amount of $1,000.00 payable to the City of Cambridge.

3.2.7 Revisions to Approved Engineering Drawings

Should revisions be required to the approved drawings, the Consultant shall submit the revised drawings with the title block revised showing the current revision number and date.

Revision of approved Composite Utility Drawings shall be re-circulated by the developer/consultant to the Utilities for approval. Following the Utilities approval, the revised drawings shall be submitted with the title block showing the revision number and date indicating the “Original Approval Date”.

3.3 COST ESTIMATE

The Consulting Engineer shall submit to the Senior Development Engineer a detailed cost estimate based on the latest estimated unit prices for construction items. The estimate shall include:

- Summary Sheet
- Detailed costs based on latest unit prices and quantities on a street-by-street basis and parkland dedication.
- A total of 13% engineering, inspection and contingencies component.
- A 6% GST component on the overall estimate, including the 13% and Parkland component.

3.4 SECURITY REQUIREMENTS

3.4.1 Grading Permit

The administration fee for grading permit is outlined in grading by-law 160-09.

3.4.2 Subdivisions

The cost estimate (Section 3.3) shall be included as a Schedule in the Subdivision Agreement, and shall be used as the basis for securities posted by the Developer. The Developer must furnish the City with Financial Securities to cover 100 per cent of the cost of construction (including the cost of all public services, landscape, engineering and contingency fees, off-site services and G.S.T. where applicable). No work shall commence on the site until the Financial Securities are in place with the City.

Periodic reductions in the Financial Securities may be authorized upon the completion of various stages of the subdivision, as detailed in Section 4.3 of this manual.
3.5 COST SHARING

When the City is involved in the cost sharing of the subdivision contracts, the following procedure shall be implemented before the awarding of the contract.

The Owner shall submit to the Senior Development Engineer, a complete list of bidders, contract prices and cost sharing breakdown, along with the Owner's Engineer’s recommendation of awarding the contract. Two sets of the schedule of services will also be required with cost estimates, including a breakdown of all cost sharing.

The minimum process of analyzing and approving the City's cost share is as follows:

a) When the estimated value of the City's share of the project cost is less than $40,000 the Owner's engineer shall produce a minimum of three (3) written quotations outlining the appropriate costs. The City may then approve the lowest acceptable quotation.

b) When the estimated value of the City share of the project falls within the range of $25,000.01 to $39,999.99, the Owner's engineer shall obtain a minimum of three (3) formal quotations which would be obtained through formally advertising the project. The Commissioner of Transportation and Public Works and the Director of Purchasing may then jointly approve the lowest acceptable quotation. However, should there be less than three (3) formal quotations and the City's share exceeds $25,000 but is less than $40,000, approval shall be obtained from the City Treasurer.

c) When the estimated value of the City's share is $40,000 or greater, the Owner's consulting engineer shall call public tenders with formal advertising in at least one (1) local newspaper. All tenders that fall within the category shall obtain the approval of the City Council.

In the preparation of the cost sharing analysis by the Owner's Engineer, actual tender or quoted rates shall be used in comparing the prices of oversized utilities with the prices of utility sizes necessary to service the subdivision.

If direct comparisons do not exist on the engineering drawings between the minimum services required versus the actual oversized utility, the Owner's Engineer shall then add the appropriate item(s) to the tender or quote package in order to determine the difference in value from the basic utility to the oversized services.

The City's share of the cost will be calculated based on the lowest price differentials that are obtained for the installation of utilities on which there is to be cost sharing. These prices may not necessarily be established by the rates submitted within the low overall tender or quote.

In the event that the Owner's Engineer determines that a contractor has submitted an unbalanced bid, the Owner's Engineer shall confirm and resolve the discrepancy with the City.
Chapter 4 - CONSTRUCTION AND ASSUMPTION

4.1 REQUIREMENTS PRIOR TO THE CONSTRUCTION

Prior to the start of construction, a signed copy of the Final Engineering and landscape drawings must be submitted to the City and following shall happen;

4.1.1 Developer Securities, Insurance

Prior to commencing construction the following must be received and approved by Planning and Development department:

- All financial requirements, including Letters of Credit for Erosion and Sediment Control, Site Servicing, Lot Grading and Surface works and Engineering Fees Paid in Full. The initial letter of credit for servicing shall be based on the approved cost estimate for underground services up to and including base asphalt and curb, using the latest unit prices including 9% contingencies, 6% engineering fees and applicable G.S.T.
- Contractor’s Liability Insurance, in the amount of $5,000,000 naming the City of Cambridge as a co-insured party.

4.1.2 Approval for Construction

The City will issue a letter authorizing the developer to commence construction upon receipt of the following:

- MOE Certificate of Approval for Sewers, Watermains and/or Storm Water Management Facilities
- Approved Engineering Drawings
- Approved Cost Estimate in Excel Spreadsheet submitted electronically in the form of Schedule “E” of the Subdivision Agreement
- Full Payment of all Fees, and Securities as outlined
- Insurance Certificate as outlined
- Two weeks written notice from the developer

4.1.3 Subdivision Agreement

The Subdivision Agreement must be executed prior to external servicing, connection to existing municipal services or the removal of any trees. The tree removal may be permitted in special circumstances; however, a prior approval from City will be required in accordance with By-Law 160-09.
4.1.4 Chlorine Residual Maintenance Plan

For development that is approved under a Subdivision Agreement, the Developer shall provide a Chlorine Residual Maintenance Report, before construction of Watermain. This report shall:

- be completed and signed by the Developer’s Design Engineer
- state the location of all permanent dead-end water mains as well as any temporary dead-end water mains that are created through phasing
- state locations where these dead-ends can be effectively flushed
- state that the volume of water and frequency that flushing of these dead-end water mains is to occur to ensure that minimum chlorine residuals are maintained as stated in DGSSMS B 2.6.1.

This report shall be submitted to Municipality for their review and approval in conjunction with the Water Distribution Report.

The form of flushing shall be determined by each Municipality (i.e. autoflusher, bleeds, manual flushing) and shall be given upon request by the Developer. Regardless of the method chosen, manual flushing and residual confirmation shall only be performed by Municipal licensed operators. All water used for flushing shall be recorded by the Municipality and charged to the Developer at the Municipality’s current water usage rate. All labor, materials, and equipment associated with flushing and confirmation of residuals shall also be charged to the Developer.

The locations and frequency of flushing and associated costs charged to the Developer shall continue until such time that the Developer’s Design Engineer provides a supplemental report to the Municipality. This supplemental report shall state that a location may be removed from regular flushing due to water turnover now occurring and residuals staying above (i.e. build-out/occupation consumption, removal of temporary dead-end). Confirmation of this shall be verified by the Municipality.

Upon final acceptance of the subdivision’s water infrastructure, all responsibility for determining and maintaining flushing requirements and associated costs shall be that of the Municipality.

4.1.5 Entrance and Road Cut Permits

Prior to any work commencing on site, a Driveway Entrance Permit must be obtained by the Developer from the Transportation and Public Works in on a City Road or proof provided if the access is off a Regional road.
4.1.6 Pre-construction Meeting

The Consultant shall arrange a mandatory Pre-construction Meeting prior to the commencement of construction. Representatives from the following departments and agencies shall be invited to attend:

a) The City
b) Regional Municipality of Waterloo
c) Grand River Conservation Authority
d) Utility and Pipeline Companies
e) Developer
f) Contractor (General and Main Subs)
g) Soils Consultant
h) Engineering Consultant

4.2 REQUIREMENTS DURING THE CONSTRUCTION

4.2.1 Subsequent Site Meetings

During the course of the construction periodic site meetings are encouraged by the City but it is solely at the discretion of the Consultant to request site meetings when and if required. The frequency and the intervals, depending on construction progress and the arising field issues and conflicts. The Consulting Engineer shall notify the Senior Development Engineer at least one week in advance for all scheduled site meetings or at least a day in advance if the issue is of urgent nature.

4.2.2 Mud and Debris Tracking and Dust Controls

The Developer shall be responsible for all mud and debris that is tracked onto the roadways from vehicles entering or leaving construction sites and dust generated during full course of construction. The Developer shall, upon verbal and/or written request by the City, immediately proceed with clean-up operations at his expense. Should the Developer fail to clean as directed, the City will have the cleaning carried out, draw on the Developer's L/C for costs and/or lay additional charges.

The Developer will be responsible for ensuring that all of the subdivision streets will be swept a minimum of once a week during the construction season. If on-site building activity warrants, the streets may need to be scraped before they can be swept, and cleaning may be required on a daily basis. The Developer will also ensure that abutting streets affected by the subdivision activity are also cleaned when they have been impacted. City staff will inspect on a periodic and on a complaint basis. If it is determined by the City that the Developer is not adhering to the street sweeping requirements he will be faxed a work order by the City to clean the streets. The Developer will have 24 hours to comply with the work order. Should the City deem it necessary to respond to a cleanup of the subdivision streets and / or abutting streets
after having notified the Developer, this work will be invoiced to the Developer.

4.2.3 Quality Control

It is the Developer’s responsibility to provide for quality control testing for all phases of construction. Apart from utilizing the services of a Consultant to design and administer construction of the subdivision project, the developer is required to engage a Soils Consultant for trench backfill compaction as well as granular, asphalt and concrete testing.

The City, at its discretion and for its sole use, may arrange for independent quality control testing at the Developer’s cost. This particular testing is provided in order that the City may compare results with the Soils Consultant.

The results of all geotechnical tests shall be copied to the City on a monthly basis. Daily results are to be forwarded to the Consultant immediately and the City must be notified of any faulty results, with recommended remedial measures.

4.2.4 Sediment and Erosion (Environmental) Control Monitoring

In addition to the Erosion and Sediment control monitoring protocol as specifies by the City or GRCA, the developer is responsible for implementation of standard on site controls during construction and the performance of any constructed control features (i.e., storm water management ponds, channel works). The Erosion and Sediment Controls shall be installed and maintained as per approved plans.

4.3 SUBDIVISION CONDITIONS FOR THE BUILDING PERMIT

The following is a list of standard conditions that must be agreed upon and/or met prior to the issuance of Building Permits: (NOTE: Schedule “G” of the Subdivision Agreement must be referenced for additional conditions).

- Completion of base servicing and certification by the Consultant.
- 100% completion of sewers and watermains, base course asphalt and curbs installed and accepted for approval for maintenance by the Commissioner of Planning and Development Department.
- Watermains tested and commissioned
- 100% operation of stormwater management facilities.
- Site posting of land use signs (identifying land uses and facilities such as mail boxes).
- All traffic signage installed, including all parking regulations as per the approved Traffic Control Plan.
• Registration of the Subdivision Plan and the Subdivision Agreement.
• Submission of each builder’s purchase/sale agreement to confirm warning clauses.
• Confirmation that all silt/erosion controls are in place and functioning.
• Final Composite Utility Plan duly signed by all utility representatives & consultant and approved by City.
• Site to be clean of debris/garbage and all roads clean and safe for access.
• Letter from Waterloo Region confirming approval of Regional services.
• Fire Break plan submitted and approved by City Fire Department.
• The Developer/Owners agreement that building permits will not be issued for lots set out in Schedule "G" attached hereto for the purposes of Firebreaks, unless otherwise approved by the Fire Chief.
• Installation of permanent fencing along all woodlot edges and natural areas and per approved plans, as applicable.
• Payment of City’s development charges, if applicable.
• All the applications for building permits shall be accompanied by a Plot Plan showing how the individual lot or parcel of land is to be drained and graded. Such drainage shall be in accordance with the approved lot grading and drainage plan and the conditions specified in section 3.1.10.4.
• The Developer/Owner shall at all times maintain the roads in reasonable and adequate fashion until such time as they are completed and accepted and will provide that all manholes, catch basins and any other protrusion constructed on or in the roadway are kept at such a level in relation to the surface of the road so that, in the opinion of the Commissioner of Planning Services no harm will come to snow plows or other equipment that may be used on the roadway by the City.

4.3.1 Model Homes

Notwithstanding section 4.3, building permits for model homes may be issued subject to:

a) A maximum of one permit per parcel of land may be issued prior to registration of the plan provided the Subdivision Servicing Agreement, security and insurance are in place
b) A maximum of five model home permits may be issued after the registration of the plan
c) Fire Department must be satisfied that adequate access and water supply is available to meet the firefighting needs
d) The owner/builder must agree to maintain the access during construction of model homes
e) The owner/builder must acknowledge in writing that model home(s) will not be sold or occupied until all other requirements of the subdivision servicing agreement have been complied with for the issuance of building permits
f) The owner/builder must contact Cambridge and North Dumfries Hydro Inc. directly and make the necessary arrangements if a hydro service is required during construction
g) The owner/developer acknowledge in writing, that they understand the permanent underground service will not be available until the electrical distribution system for the plan of subdivision has been fully installed, inspected and energized.

h) Development Charges normally payable at the issuance of a building permit must be paid prior to the issuance of the building permit for a model home.

4.4 SECURITY REDUCTIONS

Security Reductions may be requested throughout the construction of the subdivision as per the conditioned defined in pertinent section of subdivision agreement. Each reduction request must be made by the consultant in writing to the City and include the Developer’s Statutory Declaration of payment of accounts and the Consultant’s statement of work completed. Security reduction will not be authorized until inspections of the public services have been completed and any deficiencies repaired/rectified to the satisfaction of the City. Security reductions will be based on the construction values of the work items included in Schedule “E” of the Subdivision Agreement.

4.5 MAINTENANCE PERIOD

Once all of the public services are completed as per the subdivision agreement, a Maintenance Period for each service as defined in the relevant section of the agreement shall commence upon written certification from the Consultant. A letter of general conformance will not be accepted.

4.5.1 Process for Start of Maintenance Period

Prior to the commencement of the Maintenance Period, the following shall occur:

- The Consulting Engineer shall provide to the Development Engineer, completion dates for each of Underground Services to Base Asphalt, and Surface Works.
- All sewers, watermains and road works constructed to the City of Cambridge standards.
- All sewers flushed and clear of debris
- Watermain operational and boxes plumbed
- Approval and initial acceptance of Chlorine Residual Maintenance Plan (section 4.1.4 of this manual) by the Manager Operations Compliance, City of Cambridge-Public Works Department.
- Carry out video and visual inspections of the storm and sanitary sewers to the satisfaction of the City.
- A mandatory visual inspection conducted by Development and Engineering staff.
along with the Consultant in attendance, for the underground services (sanitary, storm and water, including appurtenances and connections), road base, binder asphalt and curb

- Developer's Engineer shall ensure that all noted deficiencies have been rectified to the satisfaction of the City.
- Produce a statutory declaration that all accounts related to the installation of said services have been paid.

Once all the required documentation has been reviewed and accepted by the Senior Development Engineer, all inspections of the works have been performed, and all deficiencies have been rectified, the Development Engineer will establish the date for commencement of maintenance period and issue a letter.

4.5.2 Developer's Responsibilities during Maintenance Period

During the maintenance period, the Developer shall be responsible for the maintenance of all works and services. As the end of the maintenance period approaches, the Consultant shall arrange for an inspection of the works. Any deficiencies noted are to be rectified to the satisfaction of the City. When the Consultant is satisfied that the work is complete and acceptable, the City shall be advised, and a final inspection with the City shall be arranged.

4.5.2.1 Underground Works to Base Asphalt

The Developer shall be responsible to maintain or cause to be maintained, all underground servicing and related structures including the base asphalt thereof in perfect order and in complete repair for a period of not less than three (3) years from the date of approval of maintenance.

The Developer shall make good in a permanent manner satisfactory to the Commissioner TPW or his/her representatives, any and all damage or injury to the work during the Maintenance Period. Should the Developer fail to carry out these repairs within five (5) business days of being requested in writing by the Development Engineering/TPW Engineering staff, the Commissioner may affect the required repairs to be carried out.

During the Maintenance Period, the Developer will monitor and maintain the street drainage and storm sewer system, which includes infiltration trenches, soakaway pits and other quality control features, and appurtenances in a satisfactory working condition. Catchbasins shall be cleaned out a least once per year. It may be necessary to clean catchbasins and inlets more than once per year due to restricted sump capacities or the amount of dirt and debris on the road surface. The City will carry out periodic inspections of the catchbasins, and in particular late summer early fall, if the City determines a Developer is not cleaning the catchbasins a work order will be faxed to the Developer.
and if the catchbasins are not cleaned within five (5) business days, the City will arrange to have the catchbasins cleaned, and the work will be invoiced to the Developer. The City will notify the Developer of any additional works that the City identifies as necessary to be carried out, and the Developer will ensure that they are carried out so that these systems perform in a satisfactory manner.

The City will respond and carry out emergency repairs on an as needed basis at the Developer’s expense, and the Developer will be notified of these repairs the next working day.

4.5.2.2 Surface Works including surface asphalt

The Developer shall maintain or cause to be maintained, all surface engineering works and every part thereof in perfect order and in complete repair for a period of not less than two (2) years from the date of the Maintenance Period Acceptance. It is recognized that within a subdivision, there may be a variety of Maintenance Period Acceptance dates for different items.

The developer will be responsible for maintenance of surface asphalt for a minimum period of one (01) year, starting from the date of approval for maintenance.

The Developer shall make good in a permanent manner satisfactory to the Commissioner of TPW or his/her representatives, any and all damage or injury to the work during the Maintenance Period. Should the Developer fail to carry out these repairs within five (5) business days of being requested in writing by the Director of Development Services or his representatives, the Director of Development Services may affect the required repairs to be carried out.

4.5.2.3 Storm Water Management Facilities

The maintenance of the SWM facility is the sole responsibility of the developer prior to the City’s assumption of the facility. The developer is also responsible to demonstrate that the performance of these facilities during the maintenance period had been in accordance with the City and MOE’s standards for Monitoring and Operational procedures.

A lot sheet is to be submitted to Public Works Services about the drain down time with respect to stage, performance of infiltration trenches (specific detail will be given), sand filters, etc. Include operation and performance of ponds. The Developer will maintain detailed records of any performance related alterations made to stormwater facilities.

4.5.2.4 Landscape Works

The Developer shall maintain or cause to be maintained, all landscaping works and every part thereof in perfect order and in complete repair for a period of not less than two (2) years from the date of the Maintenance Period Acceptance.
4.6 CITY RIGHT-OF-WAY ASSUMPTION

4.6.1 Process for Assumption

Following the completion of all construction and expiration of the Maintenance Period, the Developer may request Assumption of the subdivision. The consultant may provide Assumption Package within five (5) business days of the end of the maintenance period, to the Development Engineering staff confirming that all deficiencies, identified prior to the start of maintenance, have been rectified. At this stage, following is required;

- Cover letter requesting final acceptance and indicating the initial acceptance date
- Written acceptance or clearance from City’s TPW and CSD Departments as well as the other agencies like Grand River Conservation Authority, Regional Municipality of Waterloo, Cambridge and North Dumfries Hydro and Other Utility Agencies.
- Confirmation from the City Solicitor that the Developer’s Solicitor has submitted all records of the transference of easements, reserves and municipal lands.
- Parkland, walkway, open space conveyance and/or cash-out resolved and/or cash-in-lieu of parkland to the satisfaction of the Community Services Department.
- Parkland construction by developer to City satisfaction including all certifications, product warranties, manuals and inspections as required.
- Woodlot conveyance to the satisfaction of Community Services.
- All landscaping within the right-of-way to the satisfaction of Community Services, including the provision of securities or cash-out, where applicable.

A final visual inspection/walk through shall be conducted by representatives from the City (representative from both development services and TPW), with the Developer’s Consultant and the Contractor for the underground and surface works which includes sanitary, storm and water services including appurtenances and connections, road base, binder asphalt and curb. The City will require a minimum of two weeks prior notice to schedule an inspection date. All items must meet City standards and specifications in the entire stage of the subdivision. City staff will use the standard checklist list (section 4.6.1.4) for visual inspection and will provide a deficiency list to for rectification.

In case if no deficiency is identified or the recorded deficiencies have been addressed to the satisfaction of the staff, the City will issue formal acceptance letter. Upon final acceptance of the underground works the remaining letter of credit will be released to the Developer.
4.6.1.1 Underground Services

The following shall occur prior to the final assumption of the underground services within City right of way including sidewalks, base asphalt and curb & gutter;

- Furnish the Commissioner of Planning and Development Department or his/her representatives with a statement by a registered Ontario Land Surveyor that he/she has found and/or replaced all standard iron bars and monuments as shown on the registered plan;

- The Consultant shall certify that all subdivision works have been constructed in accordance with the approved plans and specifications including a final Stormwater management analysis and submission. All SWM facilities are subject to approval by both the Development Engineering/TPW and the Community Services Department.

- Provide the City with revised set of “as-constructed” Mylars and AutoCAD dwg (for the entire subdivision), including any changes made during the maintenance period.

- Submit a log of all maintenance activities the Developer undertook during the maintenance period;

- Ring deflection test shall be performed on sewer pipes constructed with non-rigid Plastic pipe. Maximum deflection shall not exceed 7.5% of the base inside diameter of the pipe. This testing shall take place prior to final acceptance at the end of the Maintenance Period and before surface asphalt is placed. Testing shall be done as per SSMS Specification for Sanitary Sewer Construction;

- Prior to the inspection, all services shall be cleaned and all sewers flushed. A CCTV inspection deliverables (as defined in Appendix D of this manual) for storm and sanitary pipes are also required prior to the visual site inspection; and

- Certification by the consulting engineer that all water valve boxes are straight up, operational and on grade.

Upon final acceptance of the underground works the letter of credit for such works will be released to the Developer.

4.6.1.2 Surface Works

Final assumption by the City for surface works may be accepted within each phase on a street by street basis. The following shall occur prior to final assumption by the City surface works:

- Representative from the City and the Developer’s Consultant shall conduct a visual inspection. The City will require a minimum of two weeks prior notice to
schedule an inspection date. All items must meet City standards and specifications.

- Submit a log of all maintenance activities the Developer undertook during the maintenance period;

- All items shall be formally checked and approved by the City Engineer or his/her representatives, and correct all deficiencies identified through this inspection to the Cities satisfaction;

- Re-lamping and cleaning of all street lights to Cambridge and North Dumfries Hydro Standards, within the past 90 days; and

- Certification by the Acoustical Engineer that all noise attenuation features have been constructed or installed as per the approved Acoustical Report

- All traffic controls and signage including the pavement markings must be in place and in good condition

Upon final acceptance of the Surface Works the letter of credit for surface works will be released to the Developer.

### 4.6.1.3 Storm Water Management Facilities

Prior to final acceptance of all storm water management ponds following shall occur:

- All SWM facilities shall be cleaned and certified as to their design depths and volumes. Quality and quantity analysis must show all operating parameters and must meet the original requirements of the Stormwater Management Report.

- The storm water management pond shall be cleaned of all debris and sediment and maintenance done as per requirements.

- The cleaning of all filtration devices (i.e. OGS, Stormceptor, control structures etc.) to the requirement and the specifications by the manufacturer and/or to the possible extent, followed by an inspection by City staff for acceptance of such structures.

- Consultant Engineers Letter certifying that the SWM pond elevations are as per designed and approved plans.

The timing of final acceptance of the storm water management system will be based on contributing development. Until contributing development is complete it continues to impact the sewers and SWM ponds in the completed sections. This will necessitate extending the maintenance period beyond the initial maintenance period. Procedures to transfer the responsibilities from one developer to the other will be provided at final acceptance of downstream developer.
### 4.6.1.4 Final Walk / Assumption Check List

Below is a check list of the typical deficiencies, to be inspected during final walk.

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Side Walks</strong></td>
<td>• Surface defects like Cracks, spalling, graffiti markings, names, footprints etc.</td>
</tr>
<tr>
<td></td>
<td>• Joints</td>
</tr>
<tr>
<td></td>
<td>• Settlements</td>
</tr>
<tr>
<td></td>
<td>• Separations</td>
</tr>
<tr>
<td></td>
<td>• Heavingibel</td>
</tr>
<tr>
<td><strong>Boulevards</strong></td>
<td>• Dead grass</td>
</tr>
<tr>
<td></td>
<td>• Stones and rocks</td>
</tr>
<tr>
<td></td>
<td>• Settlements</td>
</tr>
<tr>
<td></td>
<td>• Walkway crossings</td>
</tr>
<tr>
<td><strong>Curb and Gutter</strong></td>
<td>• Settlement</td>
</tr>
<tr>
<td></td>
<td>• Cracks</td>
</tr>
<tr>
<td></td>
<td>• Gouges</td>
</tr>
<tr>
<td></td>
<td>• Heaving</td>
</tr>
<tr>
<td><strong>Drive Way Ramp</strong></td>
<td>• Surface defects like Cracks, spalling, graffiti markings, names, footprints etc.</td>
</tr>
<tr>
<td></td>
<td>• Joints</td>
</tr>
<tr>
<td></td>
<td>• Settlements</td>
</tr>
<tr>
<td></td>
<td>• Separations(difference in top of driveway ramp and sidewalk or curb not greater than 2.0cm)</td>
</tr>
<tr>
<td></td>
<td>• Heaving</td>
</tr>
<tr>
<td><strong>Base and Surface Asphalt</strong></td>
<td>• Cracks such as progressive edge crack, and alligator cracks</td>
</tr>
<tr>
<td></td>
<td>• Bleeding, raveling, slippage, shoving or rutting etc</td>
</tr>
<tr>
<td></td>
<td>• Grass/ weeds between asphalt edge and curb&amp; gutter</td>
</tr>
<tr>
<td><strong>Sewer Pipes</strong></td>
<td>Any operational or structural defects or deficiencies as per CSA PLUS 4012-10, Modified standard</td>
</tr>
<tr>
<td><strong>Sewer Structures</strong></td>
<td>• Purging</td>
</tr>
<tr>
<td></td>
<td>• Benching</td>
</tr>
<tr>
<td></td>
<td>• Debris</td>
</tr>
<tr>
<td></td>
<td>• Sign of infiltration or surcharges</td>
</tr>
<tr>
<td></td>
<td>• Spot invert elevation checks</td>
</tr>
<tr>
<td><strong>Watermain</strong></td>
<td>• Confirm if the requisite Chloride Residual Maintenance Plan has been concluded in conforming to the DGSSMS.</td>
</tr>
<tr>
<td></td>
<td>• Spot check for traceability of watermain</td>
</tr>
<tr>
<td></td>
<td>• Check for grades for main valves and see if operational</td>
</tr>
<tr>
<td></td>
<td>• Leak detection</td>
</tr>
<tr>
<td></td>
<td>• Verticality of services boxes and valve operation</td>
</tr>
<tr>
<td></td>
<td>• Check for appropriateness of number of turns on Valve boxes and double check if the hydrants are operational</td>
</tr>
</tbody>
</table>
| **SWM Facility** | • Signage showing address of the facility  
• Spot Check for elevations  
• Inlet and outlet operational and functional deficiencies i.e. debris, siltation, erosions or blockage  
• Structural deficiencies  
• Slopes and vegetation  
• Access path and gates condition  
• Culverts (invert elevations, debris etc.)  
• Cleaning of filtration devices (i.e. OGS, Stormceptor etc.)  
• Health of vegetation within the facility |
| **Retaining and Noise Walls** | • Spot checks for Top and Bottom elevations  
• Railings, if proposed |
| **Trees and Fencing** | In accordance with Tree Management Policies And Guidelines |

**Note:** Deficiencies are not limited to the above list. City staff may supplement the site specific deficiencies, if and when necessary.
CHAPTER 5- STANDARD DRAWINGS
<table>
<thead>
<tr>
<th>Standard Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C101</td>
<td>30m ROAD ALLOWANCE – Arterial Road with Bike Lanes</td>
</tr>
<tr>
<td>C102</td>
<td>26m ROAD ALLOWANCE – Major Collector</td>
</tr>
<tr>
<td>C103</td>
<td>26m ROAD ALLOWANCE – Major Collector with Bike Lanes</td>
</tr>
<tr>
<td>C104</td>
<td>23m ROAD ALLOWANCE – Minor Collector</td>
</tr>
<tr>
<td>C105</td>
<td>23m ROAD ALLOWANCE – Minor Collector with Bike Lanes</td>
</tr>
<tr>
<td>C106</td>
<td>20m ROAD ALLOWANCE – Local</td>
</tr>
<tr>
<td>C107</td>
<td>18.5m ROAD ALLOWANCE – Minor Local</td>
</tr>
<tr>
<td>C108</td>
<td>20m ROAD ALLOWANCE – Rural Local Road</td>
</tr>
<tr>
<td>C109</td>
<td>23m ROAD ALLOWANCE – Rural Industrial Minor Collector</td>
</tr>
<tr>
<td>C110</td>
<td>26m ROAD ALLOWANCE – Rural Industrial Major Collector</td>
</tr>
<tr>
<td>C111</td>
<td>20m ROAD ALLOWANCE – Local Cul-De-Sac Type “O”</td>
</tr>
<tr>
<td>C112</td>
<td>20m ROAD ALLOWANCE – Local Cul-De-Sac Type “P”</td>
</tr>
<tr>
<td>C113</td>
<td>18.5m ROAD ALLOWANCE – Minor Local Cul-De-Sac Type “O”</td>
</tr>
<tr>
<td>C114</td>
<td>18.5m ROAD ALLOWANCE – Minor Local Cul-De-Sac Type “P”</td>
</tr>
<tr>
<td>C115</td>
<td>20m ROAD ALLOWANCE – Rural Cul-De-Sac Type “O”</td>
</tr>
<tr>
<td>C116</td>
<td>23m ROAD ALLOWANCE – Rural Industrial Minor Collector Cul-De-Sac</td>
</tr>
<tr>
<td>C117</td>
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<tr>
<td>C120</td>
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Transportation and Public Works Department

CITY STANDARDS INDEX

Standard Number | Description                  | Last Updated
----------------|------------------------------|-------------------
C101            | 30m ROAD ALLOWANCE – Arterial Road with Bike Lanes       | January 2014
C102            | 26m ROAD ALLOWANCE – Major Collector                       | January 2014
C103            | 26m ROAD ALLOWANCE – Major Collector with Bike Lanes      | January 2014
C104            | 23m ROAD ALLOWANCE – Minor Collector                       | January 2014
C105            | 23m ROAD ALLOWANCE – Minor Collector with Bike Lanes      | January 2014
C106            | 20m ROAD ALLOWANCE – Local                                 | January 2014
C107            | 18.5m ROAD ALLOWANCE – Minor Local                         | January 2014
C108            | 20m ROAD ALLOWANCE – Rural Local Road                      | January 2014
C109            | 23m ROAD ALLOWANCE – Rural Industrial Minor Collector     | January 2014
C110            | 26m ROAD ALLOWANCE – Rural Industrial Major Collector     | January 2014
C111            | 20m ROAD ALLOWANCE – Local Cul-De-Sac Type “O”            | January 2014
C112            | 20m ROAD ALLOWANCE – Local Cul-De-Sac Type “P”            | January 2014
C113            | 18.5m ROAD ALLOWANCE – Minor Local Cul-De-Sac Type “O”   | January 2014
C114            | 18.5m ROAD ALLOWANCE – Minor Local Cul-De-Sac Type “P”   | January 2014
C115            | 20m ROAD ALLOWANCE – Rural Cul-De-Sac Type “O”           | January 2014
C116            | 23m ROAD ALLOWANCE – Rural Industrial Minor Collector Cul-De-Sac | January 2014
C117            | PAGE LEFT BLANK INTENTIONALLY                               | January 2014
C118            | PAGE LEFT BLANK INTENTIONALLY                               | January 2014
C119            | PAGE LEFT BLANK INTENTIONALLY                               | January 2014
C120            | PLACEMENT OF SIGN & METER POSTS SET IN SIDEWALK            | January 2014
C121            | STANDARD CONCRETE WALKWAY (Street to Street)              | January 2014
C122            | PLAN: MID BLOCK CROSSING / WALKWAY ACCESS BARRIER         | January 2014
C123            | ELEVATION: OFFSET GATE / WALKWAY ACCESS BARRIER           | January 2014
C124            | STORM SEWER DESIGN SHEET                                   | January 2014
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C155 (WMC 75-100) METER CHAMBER FOR 75 TO 100mm DIA WATER SERVICES (PAGES 1 & 2)

C156 (WMC 150-250) METER CHAMBER FOR SINGLE-PIPE, DUAL-PURPOSE (FIRE/DOMESTIC) SERVICES DIA 150-250mm (PAGES 1 & 2)

C157 (WMC-150-200a) METER CHAMBER FOR 150/200mm DIA FIRE SERVICE WITH DETECTOR CHECK VALVE (PAGES 1 & 2)

C158 (WMC-150-200b) METER CHAMBER FOR DUAL DOMESTIC AND FIRE SERVICES (PAGES 1 & 2)

C159 (WMC 250a) METER CHAMBER FOR 250mm DIA FIRE LINE DETECTOR CHECK VALVE c/w METER SERVICES (PAGES 1 & 2)

C160 (WMC 250b) METER CHAMBER FOR DUAL DOMESTIC AND FIRE SERVICES (PAGES 1 & 2)

C161 CHAIN LINK SECURITY FENCE GATE – BLACK VINYL DETAIL

C162 CHAIN LINK SECURITY FENCE – BLACK VINYL DETAIL

C163 STORM WATER SIGN – STREET NUMBER AND ADDRESS

CSD-L-O7 TYPICAL STONEDUST PATH C/W SHOULDER

CSD-L-11A 3.0m ASPHALT PATH C/W SHOULDER DETAIL (50mm ASPHALT)

CSD-L-11B 3.0m ASPHALT PATH C/W SHOULDER DETAIL (75mm ASPHALT)

CSD-L-13 STONE DUST PATH WITH GEOGRID

CSD-L-15A ASPHALT PATH WITH GEOGRID (50mm ASPHALT)

CSD-L-15B ASPHALT PATH WITH GEOGRID (75mm ASPHALT)
NOTE:

CROSSFALL

1. All dimensions are in metres.

- 3.0% For Roads ≤ 1.0% Grade
- 2.5% For Roads > 1.0% Grade

STANDARD REFERENCES

- Curb and Gutters
- Concrete Sidewalks
- Concrete Driveways
- Landscaping

MINIMUM DEPTH OF COVER

(from η of road elevation)

- Sanitary Sewer
- Storm Sewer
- Watermain
- Gas Main
- Hydro
- Telephone
- Cable T.V.

Minimum earth cover to be maintained at all ditch crossings.
NOTES:
1. All dimensions are in metres.

CROSSFALL
3.0% For Roads<1.0% Grade
2.5% For Roads >1.0% Grade

MINIMUM DEPTH OF COVER
Sanitary Sewer.......................... 2.4m
Storm Sewer........................... 1.5m
Watermain............................... 2.0m
Gas Main............................... 0.6m
Hydro.................................. 0.9m
Telephone.............................. 0.75m
Cable T.V.............................. 0.75m
Minimum Earth Cover To Be Maintained At All Ditch Crossings.
CITY OF CAMBRIDGE
26m ROAD ALLOWANCE: Major Collector with Bike Lanes

NOTES:
1. All dimensions are in metres.

CROSSFALL:
3.0% For Roads < 1.0% Grade
2.5% For Roads > 1.0% Grade

MINIMUM DEPTH OF COVER:
(from centreline of road elevation)
Sanitary Sewer
Storm Sewer
Watermain
Gas Main
Hydro
Telephone
Cable T.V.

2.4m
1.5m
2.0m
0.6m
0.8m
0.75m
0.75m
CITY OF CAMBRIDGE
23m ROAD ALLOWANCE - Minor Collector with Bike Lanes

Scale: Not to Scale
Drawing No: C105

NOTE:
1. All dimensions are in metres

CROSSFALL:
3.0% For Roads<1.0% Grade
2.5% For Roads>1.0% Grade

Location of underground hydro and telecommunication cables
Location of fire hydrants, trees, telecommunication pedestals (above grade)

MINIMUM DEPTH OF COVER:
(from centreline of road elevation)
Sanitary Sewer..................... 2.4m
Storm Sewer....................... 1.5m
Watermain......................... 2.0m
Gas Main......................... 0.6m
Hydro......................... 0.9m
Telephone......................... 0.75m
Cable T.V......................... 0.75m

Concrete curb and gutter as per OFSD 600.04
Surface asphalt binder asphalt granular surface "A"
Granular subbase "B"
NOTES:

1. All dimensions are in metres.
2. Utilities switching unit/plant to be located in a private easement.

CROSSFALL

3.0% For Roads < 1.0% Grade
2.5% For Roads > 1.0% Grade

MINIMUM DEPTH OF COVER
(from centreline of road elevation)

<table>
<thead>
<tr>
<th>Utility</th>
<th>Depth (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sanitary Sewer</td>
<td>2.4m</td>
</tr>
<tr>
<td>Storm Sewer</td>
<td>1.5m</td>
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<tr>
<td>Watermain</td>
<td>2.0m</td>
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<tr>
<td>Gas Main</td>
<td>0.6m</td>
</tr>
<tr>
<td>Hydro</td>
<td>0.9m</td>
</tr>
<tr>
<td>Telephone</td>
<td>0.75m</td>
</tr>
<tr>
<td>Cable T.V.</td>
<td>0.75m</td>
</tr>
</tbody>
</table>
NOTES:

1. All dimensions are in metres.
2. All telecommunication pedestals and fire hydrants are to be located 0.3m inside road allowance.
3. Hydro pad mounted transformers to be located in a private easement.

CROSSFALL
3.0% For Roads<1.0% Grade
2.5% For Roads >1.0% Grade

MINIMUM DEPTH OF COVER
Sanitary Sewer.............. 2.4m
Watermain.................. 2.0m
Gas Main.................... 0.6m
Hydro........................ 0.9m
Telephone.................... 0.75m
Cable T.V.................... 0.75m
Minimum Earth Cover To Be Maintained At All Ditch Crossings.
NOTE:
1. All dimensions are in metres

STANDARD REFERENCES
Curb and Gutters
Concrete Sidewalks
Concrete Driveways
Landscaping

As Per
O.P.S.D.
&
O.P.S.S.

CITY OF CAMBRIDGE
Transportation & Public Works Department

20 m ROAD ALLOWANCE - Local Cul-De-Sac Type "O"

Standard No: C111

Drawn By: H. Douglas  Design By: C. Robertson  Approved By: E. S. KOVACS
Date: February 2007  Date: February 2007  Date: February 2007

Revised: February 2007
NOTES:
1. All dimensions are in metres

STANDARD REFERENCES
Curb and Gutters
Concrete Sidewalks
Concrete Driveways
Landscaping

As Per
O.P.S.D.
&
O.P.S.S.
NOTE:
1. All dimensions are in metres

STANDARD REFERENCES
Curb and Gutters
Concrete Sidewalks
Concrete Driveways
Landscaping
As Per
O.P.S.D.
&
O.P.S.S.

CITY OF CAMBRIDGE
Transportation & Public Works Department

18.5 m ROAD ALLOWANCE - Minor Local Cul-De-sac Type "O"

Drawn By: C. Schumacher
Design By: Kealy Dedman
Approved By: George Elliot
Commissioner of Transportation & Public Works

Date: August 2013
Date: August 2013

Standard No: C113

Revised: August 2013
NOTES:
1. All dimensions are in metres.

STANDARD REFERENCES
Curb and Gutters
Concrete Sidewalks
Concrete Driveways
Landscaping
As Per
O.P.S.D.
&
O.P.S.S.
NOTES:
1. All dimensions are in metres.

STANDARD REFERENCES
Curb and Gutters
Concrete Sidewalks
Concrete Driveways
Lanscaping

As Per
O.P.S.D.
&
O.P.S.S.
NOTE:
1. ALL DIMENSIONS ARE IN mm EXCEPT AS NOTED.
1. Refer to OPSD 310.010 for expansion joint details.
2. Prior to construction of any concrete walkway, a review is required to assess lighting requirements.
3. 50 mm polyethylene pipe to be installed within walkway.
4. This detail to be used where a walkway connects two streets. Other locations only upon city approval.
NOTE:

All dimensions are in millimetres.
DETAIL 'A' - Sleeve Connection
- Pin is to be Min. 75mm clear of pathway.
- Refer to detail "B" for Pin Detail
- PVC gasket
- Galvanized steel sleeve to have 110 I.D. & 118 O.D.
- 4 TK galvanized flanges with 2-19 Ø hole for open and closed positions

DETAIL 'B' - Pin
- 4 TK x 25 Ø
- 18 Ø Rod
- 12 Ø Hole
- Taper to 12 Ø

NOTES:
1. All dimensions are in millimeters.
2. This drawing to be read in conjunction with drawing C120.
3. All gate material must be galvanized after fabrication.
4. All 40 mm Ø pipe must be standard schedule 40 new butt weld pipe.
5. Gate post to extend a minimum of 1000 mm into foundation sleeve pipe.
6. Pin is welded to gate with 300 mm long galvanized chain.
7. Direction sign to be a minimum of 1.5 mm TK aluminum or galvanized chain metal riveted to gate at each corner.
8. All welding and galvanizing drips and splatters to be removed.

CITY OF CAMBRIDGE  Transportation & Public Works Department

ELEVATION: OFFSET GATE / WALKWAY ACCESS BARRIER

Drawn By: H. Douglas  Design By: C. Robertson  Approved By: E. S. KOVACS
Date: February 2007  Date: February 2007  Commissioner of Transportation & Public Works

C123  Scale: Not to Scale

Standard No:  Revised: February 2007
### Design Parameters

Design Storm: 1 in 5 Years

1 = \(a/((tc+b)^c)\)

- \(a\) = Manning's \(n\)
- \(b\) = Minimum Cover: \(m\)
- \(c\) = Time of Energy - Depends on \(R\)

### DRAINAGE AREA

<table>
<thead>
<tr>
<th>Street</th>
<th>From</th>
<th>To</th>
<th>Area (ha)</th>
<th>(A \times R)</th>
<th>Total Area (ha)</th>
<th>(T) of C (min)</th>
<th>(I)</th>
<th>(Q) (m³/s)</th>
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<tbody>
<tr>
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</tbody>
</table>

### Pipe Selection

- Length of Pipe (m)
- Pipe Size (mm)
- Type of Pipe (Full, Full, Act)
- Slope (m/m)
- Cap. (m³/s)
- Velocity (m/s)
- Time of Flow (min)
- Remarks

---

**STORM SEWER DESIGN SHEET**

**CITY OF CAMBRIDGE**

Transportation & Public Works Department

**DRAWN TO SCALE, NOT TO SCALE**

Standard No. C124

Drawn By: L. Drunen

Design By: J. Syed

Approved By: E. Kovacs

Revised: March 2007

7/18/20129:21 AM
<table>
<thead>
<tr>
<th>Street</th>
<th>From TO M.H. M.H.</th>
<th>Area (ha)</th>
<th>Prop. Density (p/unit)</th>
<th>Cumulative Area (ha)</th>
<th>Peak Pop. Fact (m³/s)</th>
<th>Comm. Area (ha)</th>
<th>Cum. Area (ha)</th>
<th>Indust. Area (ha)</th>
<th>Cum. Area (ha)</th>
<th>Total Area (ha)</th>
<th>Cum. Infiltr. Area (ha)</th>
<th>Total Flow (m³/s)</th>
<th>Dist. (m)</th>
<th>Dia. (mm)</th>
<th>Slope (%)</th>
<th>Cap. Vel. (Full) (m/s)</th>
<th>Remarks</th>
<th>C+I+I Total Area (ha)</th>
<th>Cum. Infilt. Flow (m³/s)</th>
<th>Full Peak Flow (m³/s)</th>
<th>Act. Peak Flow (m³/s)</th>
<th>Remarks</th>
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</thead>
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**Sanitary Sewer Design Parameters**

- **Residential Area and Population**
- **Commercial**
- **Industrial**
- **Institutional**
- **Infiltration**
- **Residential Harmon Peaking Factor**

**Design Parameters**

- **Average Daily Flow**
- **Per Person** (vp/day)
- **Commercial**: cums/p
- **Minimum Full Velocity**: m/s
- **Maximum Peak Flow Fact.**
- **Infiltration Rate**: l/s/Ha
- **Residential Harmon Peaking Factor**

**Other Design Details**

- **DATE**: 4/19/2007
- **DESIGNED BY**: Max
- **CHECKD BY**: Min
- **Project Number**: n = 0.013

**Sanitary Sewer Design Sheet**

- **City of Cambridge**
- **Transportation & Public Works Department**
- **Scale**: Not to Scale

**Standard**: C125
We Certify that the proposed grades at the lot corners are correct and that the lot grading of the subject lot is in conformity to the approved subdivision grading plans and the City of Cambridge Standards.

LEGEND

- FF = FINISHED FIRST FLOOR ELEVATION
- U/S FTG = UNDERSIDE OF FOOTING ELEVATION
- BF = BASEMENT FLOOR ELEVATION
- GF = GARAGE FLOOR ELEVATION
- TFW = TOP OF FOUNDATION WALL
- HP = HIGH POINT
- XXX = EXISTING ELEVATION
- (XXX) = PROPOSED ELEVATION
- (XXXX) = PROPOSED DIMENSION
- A = FLOW DIRECTION
- | = PROPOSED SWALE
- = WINDOW WELL
- ▼ = BUILDING ENTRANCE & No. OF RISERS

CITY OF CAMBRIDGE Transportation & Public Works Department

TYPICAL LOT GRADING PLAN 'TYPE 1'

Standard No: C126

Drawn By: L. Drennan  Design By: J. Syed  Approved By: E. S. KOVACS
Date: March 2007  Date: March 2007  Commissioner of Transportation & Public Works
We Certify that the proposed grades at the lot corners are correct and that the lot grading of the subject lot is in conformity to the approved subdivision grading plans and the City of Cambridge Standards.
NOTES:

(FOR ALL GRADING TYPES)

1. Difference between building line elevation and side yard swale elevation is to be min. 0.15 m and max. 0.30 m, according to side yard width.

2. A min. 0.6 m apron is to be maintained against all dwelling units to allow access from side entrances to the front and rear yards, 0.60 m access to be on garage side if no side door.

3. Slopes within lots are to have a max. grade of 3:1.

4. Difference between side door sill and ground elevation to be max. 0.40 m.

5. Difference between top of foundation wall and building line elevation to be min. 0.15m.

6. Min. 75% of rear yard area to be graded between 2% and 5%.

7. Type "B" lots with through drainage from other type lots abutting the rear lot line are to be min. of 12m in width.

8. Driveway Grades:
   From curb to street line min. 2%, max 8%.
   From street line to garage min. 2%, max 8%.
NOTES:

(FOR ALL GRADING TYPES)

1. Difference between building line elevation and side yard swale elevation is to be min. 0.15m and max. 0.30m, according to side yard width.

2. A min. 0.6 m apron is to be maintained against all dwelling units to allow access from side entrances to the front and rear yards, 0.60 m access to be on garage side if no side door.

3. Slopes within lots are to have a max. grade of 3:1.

4. Difference between side door sill and ground elevation to be max. 0.40 m.

5. Difference between top of foundation wall and building line elevation to be min. 0.15m.

6. Min. 75% of rear yard area to be graded between 2% and 5%.

7. Type "B" lots with through drainage from other type lots abutting the rear lot line are to be a min. of 12m in width.

8. Driveway Grades:
   - From curb to street line min. 2%, max 8%.
   - From street line to garage min. 2%, max 8%.
NOTES:

(FOR ALL GRADING TYPES)

1. Difference between building line elevation and side yard swale elevation is to be min. 0.15 m and max. 0.30 m, according to side yard width.

2. A min. 0.6 m apron is to be maintained against all dwelling units to allow access from side entrances to the front and rear yards, 0.60 m access to be on garage side if no side door.

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5. Difference between top of foundation wall and building line elevation to be min. 0.15 m.

6. Min. 75% of rear yard area to be graded between 2% and 5%.

7. Type “B” lots with through drainage from other type lots abutting the rear lot line are to be a min. of 12 m in width.

8. Driveway Grades:
   - From curb to street line min. 2%, max 8%.
   - From street line to garage min. 2%, max 8%.
NOTES:
1. ALL DIMENSIONS ARE IN MM EXCEPT AS NOTED
2. WHERE WATERMAIN IS LOCATED IN BOULEVARD THE SERVICE BOX IS TO BE LOCATED 600 MM BEHIND CURB AND SET TO FINISHED GRADE

CITY OF CAMBRIDGE Transportation & Public Works Department

STANDARD 25 mm Ø BLOW-OFF

Drawn By: C. Schumacher Design By: P. Hille Approved By: E.S. KOVACS
Date: January 2004 Date: January 2004 Commissioner of Transportation & Public Works

Scale: Not to Scale Standard No: C132
NOTES:

1. ALL DIMENSIONS ARE IN mm EXCEPT AS NOTED.

2. THREADED TIE RODS - TOP AND BOTTOM 19 mm Ø AND LENGTH AS REQUIRED.

3. RETENTION CLAMPS - REQUIRED AT FIRST JOINT ON BOTH SIDES OF OFFSET.

4. CORRUGATED SLEEVE - MUST BE USED. THE DIAMETER MUST BE AT LEAST 225mm GREATER THAN THE DIAMETER OF THE WATERMAIN. THE CORRUGATED PIPE SHALL BE 1.0m LONGER THAN THE OUTSIDE DIAMETER OF THE SEWER PIPE IT PASSES UNDER.

5. MANUFACTURED BENDS - MUST BE USED TO OBTAIN THE DESIRED ANGLES OF DEFLECTION.
NOTES:

1. Provide fitting to adapt to tail pieces (MIP thread): No soldered connections.

2. Meter to be installed horizontally.

3. Meter and tail pieces to be supplied by the City of Cambridge (15mm to 25mm). Larger sizes to be supplied by City of Cambridge at owners expense and must be installed by a licensed plumber.

4. Minimum size of water service to be 19mm (3/4") nominal pipe size.

5. Install offset "C" in such a location that meter reader will have direct access to reading head. Any obstruction beside or above the meter will be basis for refusal of "FINAL PLUMBING" approval.

6. Water meter to be installed within 2.0m of the point that the service pipe meets the building line.

7. No more than 30m of service pipe is permitted before the meter.

8. Wire connecting the water meter to water meter remote to be 18 gauge, 3-wire and the installation shall conform to the latest requirements of the Electrical Code.

9. Where service size is >19mm (3/4") and reduction is required to match approved meter size, ball valves and piping between valves shall be equal in size to the defined meter size to a minimum of 19mm (3/4").

N.P.S. = nominal pipe size

## SPECIFICATIONS

<table>
<thead>
<tr>
<th>METER SIZE</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/8&quot;</td>
<td>7 1/2&quot;</td>
<td>16&quot;-24&quot;</td>
<td>24&quot;</td>
<td>6&quot;</td>
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<tr>
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<td>190mm</td>
<td>400mm-600mm</td>
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<td>25mm</td>
<td>273mm</td>
<td>400mm-600mm</td>
<td>700mm</td>
<td>200mm</td>
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</tbody>
</table>
NOTES:

1. All dimensions are in mm EXCEPT AS NOTED.

2. Pipe through floor joist is optional/pipe may be installed through the foundation wall if it meets the minimum height and cleanout assembly spacing requirements.

3. Optional design is to outlet under the footing pending elevation of storm sewer.

CITY OF CAMBRIDGE Transportation & Public Works Department

WEEPING TILE CONNECTION TO STORM SEWER (WITHOUT GRAVITY CONNECTION TO STORM)

drawn by: C. SCHUMACHER  design by: R. TURK  Approved by: C. ELLIOT

date: JUNE 15, 1993  date: JUNE 19, 2013  Commissioner of Transportation & Public Works

Revised: June, 2013

Standard No: C135a
NOTES:

1. All dimensions are in mm EXCEPT AS NOTED.

2. Pipe through floor joist is optional/pipe may be installed through the foundation wall if it meets the minimum height and cleanout assembly spacing requirements.

3. Optional design is to outlet under the footing pending elevation of storm sewer.

CITY OF CAMBRIDGE  Transportation & Public Works Department

WEERING TILE CONNECTION TO STORM SEWER (WITH GRAVITY CONNECTION TO STORM)

drawn by: C. SCHUMACHER  design by: R. TURK  Approved by: C. ELLIOT

date: JUNE 15, 1993  date: JUNE 19, 2013  Revised: June, 2013

Scale: Not to Scale  Standard No: C135b
NOTES:

1. All dimensions are in mm EXCEPT AS NOTED.
2. Drywell to be located in the front or rear yard depending on which is lowest in relation to the basement floor elevation.
NOTES:
1. Provide fitting to adapt to tail pieces (MIP thread): No soldered connections.

2. Meter to be installed horizontally.

3. Meter and tail pieces to be supplied by the City of Cambridge (15mm to 25mm). Larger sizes to be supplied by City of Cambridge at owners expense and must be installed by a licensed plumber.

4. Minimum size of water service to be 19mm (3/4") nominal pipe size.

5. Install offset "C" in such a location that meter reader will have direct access to reading head. Any obstruction beside or above the meter will be basis for refusal of "FINAL PLUMBING" approval.

6. Water meter to be installed within 2.0m of the point that the service pipe meets the building line.

7. No more than of 30m of service pipe is permitted before the meter.

8. B/F must conform to City of Cambridge bylaws, vertical positioning must be approved.

9. By-pass circuit to be installed only if requested and approved by Public Works.

<table>
<thead>
<tr>
<th>SPECIFICATIONS</th>
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</thead>
<tbody>
<tr>
<td><strong>METER SIZE</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>5/8&quot; 15mm</td>
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<tr>
<td>3/4&quot; 19mm</td>
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<td>1&quot; 25mm</td>
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<tr>
<td>1 1/2&quot; 38mm</td>
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<td>2&quot; 50mm</td>
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CITY OF CAMBRIDGE  Transportation & Public Works Department
STANDARD COMMERCIAL WATER METER ASSEMBLY

Drawn By: C. Schumacher  Design By: J. Walsworth
Date: January, 2004  Date: January, 2004
Approved By: E.S. KOVACS  Commissioner of Transportation & Public Works
Revised: April 2013 - HD
NOTES:

1. Provide fitting to adapt to flanges. No soldered connections.

2. Meter to be installed horizontally.

3. Meter to be supplied by the City of Cambridge at owners expense and must be installed by a licensed plumber.

4. Install register in such a location that meter reader will have direct access to reading head. Any obstruction beside or above the meter will be basis for refusal of "FINAL PLUMBING" approval.

5. Water meter to be installed within 2.0m of the point that the service pipe meets the building line.

6. No more than 30m of service pipe is permitted before the meter.

7. B/F must conform to the City of Cambridge bylaws. Vertical positioning must be approved.

8. By-pass circuit to be installed only if requested and approved by Public Works.

### SPECIFICATIONS

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<thead>
<tr>
<th>METER SIZE</th>
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<th>B</th>
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<td>300mmø STM</td>
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<td>FIRE HYDRANT</td>
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<td>HEDGE</td>
<td>GATE VALVE &amp; VALVE BOX</td>
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<tr>
<td>EDGE OF PAVEMENT</td>
<td>EDGE OF PAVEMENT</td>
<td>WATER CHAMBER</td>
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<td>ROUND IRON BAR</td>
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<td>PROPERTY LINE, STREET LINE</td>
<td>SQUARE IRON BAR</td>
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<td>UTILITY POLE</td>
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<td>UTILITY POLE WITH GUY WIRE</td>
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<td>BUILDING STRUCTURE OUTLINE</td>
<td>STREET LIGHT</td>
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<td>CHAINLINK FENCE</td>
<td>PARKING METER</td>
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<td>WOODEN FENCE</td>
<td>TRAFFIC CONTROL SIGN (STOP, NO PARKING ANY TIME, ETC.)</td>
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<td>RW</td>
<td>RETAINING WALL</td>
<td>MAILBOX</td>
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CITY OF CAMBRIDGE Transportation & Public Works Department

STANDARD LEGEND

Scale: Not to Scale

Standard No: C139

Drawn By: H. Douglas
Design By: J. Syed
Approved By: E. S. KOVACS

Date: March 2007
Date: March 2007
Commissioner of Transportation & Public Works
Revised: Nov. 2007
CURB, GUTTER and SIDEWALK

DRIVEWAY ENTRANCE

PLAN VIEW OF DRIVEWAY

NOTES:
1. All dimensions are in mm EXCEPT AS NOTED.
2. For curb and gutter dimensions see O.P.S.D. 600.04; for sidewalk information see O.P.S.D 310.020
3. Driveway ramps and sidewalks across ramps to be min. 200mm thick for all Commercial, Industrial, and Institutional lots.
4. Expansion Joints on either side of volume changes.
5. When entire road is rebuilt, including area under proposed curb and gutter, the 125mm of bedding may be omitted and the curb constructed directly on the compacted granular ’ B ’.

CITY OF CAMBRIDGE Transportation & Public Works Department

STANDARD SIDEWALK, CURB AND GUTTER

Drawn by: C. Schumacher | Designed By: B. Hamilton | Approved by: E.S. KOVACS
Date: June 28, 1993 | Date: June 24, 1993 | Commissioner of Transportation & Public Works

Scale: Not to Scale

Standard No: C140

Revised: January, 2010 - HD
NOTES:

1. All dimensions are in mm EXCEPT AS NOTED.

2. Driveway ramps and sidewalks across ramps to be min. 200mm thick for all Commercial, Industrial, and Institutional lots.

3. Expansion joints on either side of volume changes.

4. When entire road is rebuilt, including area under proposed curb and gutter, the 125mm of bedding may be omitted and the curb constructed directly on the compacted granular 'B'.
NOTES:

1. All dimensions are in m except as noted.

2. In all cases, a ramp shall have a broom finish.

3. Sidewalks to be 200mm thick across driveway ramps to all commercial, industrial and institutional lots.


5. Joints are to be sawcut every 1.5m and full depth expansion joints every 6.0m, rather than dimensions shown on O.P.S.D. 310.010.

CITY OF CAMBRIDGE Transportation & Public Works Department

RESIDENTIAL CONCRETE SIDEWALK WITH CURB RAMP

Drawn by: C. Schumacher Designed By: B. Hamilton Approved by: E.S. KOVACS

Date: March 24, 1995 Date: March 15, 1995 Commissioner of Transportation & Public Works

Revised: April 2013-HD

Scale: Not to Scale

Standard No: C142
NOTES:

1. All dimensions are in mm except as noted.

2. Dummy joints are to be every 1.5m and all joints are sawcut. Expansion joints every 6.0m, rather than dimensions shown on O.P.S.D. 310.010
NOTES:
1. ALL DIMENSIONS ARE IN mm EXCEPT AS NOTED.
2. FOR CURB DIMENSIONS, SEE D.P.S.D. 600.04
3. SIDEWALK DIMENSIONS, SEE STD. C142
4. Section 3.1.1.10 (a)(b) - SPECIAL REGULATIONS FOR ATTACHED GARAGE AND CARPORTS

CITY OF CAMBRIDGE  Transportation & Public Works Department

ASPHALT DRIVEWAY RAMP WITH DROP CURB

Drawn by: C. Schumacher  Designed By: J. Syed  Approved by: Kealy Dedman
Date: August 2013  Date: August 2013  Director of Engineering

Scale:
Standard No: C144

Revised: August 2013

50mm HL-3 fine surface mix asphalt
125mm granular 'A'

to establish grade at this point - Rise 1mm in 50mm from top of full curb, not drop curb.
PLAN VIEW

SECTION 'A-A'

NOTES:
1. ALL DIMENSIONS ARE IN mm EXCEPT AS NOTED.
2. FOR CURB DIMENSIONS, SEE O.P.S.D. 600.04
   SIDEWALK DIMENSIONS, SEE STD. C142.
3. DRIVEWAY RAMPS AND SIDEWALKS ACROSS RAMPS TO BE MIN. 200mm THICK FOR ALL COMMERCIAL, INDUSTRIAL AND
   INSTITUTIONAL LOTS.
4. EXPANSION JOINTS IN SIDEWALK AT CHANGE IN THICKNESS.
5. FOR LOTS SMALLER THAN 11.0m MAXIMUM WIDTH OF DRIVEWAY & CURB CUT AS PER ZONING BYLAW #150-85.
6. Section 3.1.1.10 (a/b) - SPECIAL REGULATIONS FOR ATTACHED GARAGE AND CARPORTS

CITY OF CAMBRIDGE Transportation & Public Works Department

CONCRETE DRIVEWAY RAMP WITH DROP CURB

Drawn by: C. Schumacher Designed By: J. Syed Approved by: Kealy Dedman
Date: August 2013 Date: August 2013 Director of Engineering

Scale: Standard No: C145

Revised: August 2013
NOTES:

1. ALL DIMENSIONS ARE IN mm EXCEPT AS NOTED.
2. FOR CURB DIMENSIONS, SEE O.P.S.D. 602.04 FOR SIDEWALK DIMENSIONS, SEE STD. C142
3. DRIVEWAY RAMPS AND SIDEWALK ACROSS RAMPS TO BE A MIN. 150mm THICK FOR ALL RESIDENTIAL LOTS
4. FOR LOTS SMALLER THAN 11.0m MAXIMUM WIDTH OF DRIVEWAY & CURB CUT AS PER ZONING BYLAW #150-86.
5. Section 3.1.1.10 (a)(b) - SPECIAL REGULATIONS FOR ATTACHED GARAGE AND CARPORTS
NOTES:
1. ALL DIMENSIONS ARE IN mm EXCEPT AS NOTED.
2. FOR CURB AND GUTTER DETAILS, SEE O.P.S.D. 600.04
3. FOR COMBINED SIDEWALK, CURB AND GUTTER DETAILS, SEE STANDARD C140.
4. FOR DRIVEWAY WITH DROP CURB SEE STANDARD C145
5. DRIVEWAY RAMPS AND SIDEWALKS ACROSS RAMPS TO BE A MIN. 200mm THICK FOR ALL COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL LOTS.
NOTES

*A CLEAN SHARP FINE SAND IS TO BE USED AS JOINT FILLER.
GRADING & BEDDING DETAILS FOR SIDEWALK, CURB & GUTTER

1. ALL DIMENSIONS ARE IN mm EXCEPT AS NOTED.

CITY OF CAMBRIDGE Transportation & Public Works Department

GRADING & BEDDING DETAILS FOR SIDEWALK, CURB & GUTTER

Drawn by: C. Schumacher  Designed By: D. Law
Date: January, 2005  Date: January, 2004

Approved by: E.S. KOVACS Commissioner of Transportation & Public Works

Revised: January 2010-HD

Scale:

Standard No: C149
**Sign Specification**

**Primary Sign Panel:**
3/4” Crezon board.

**Text:**
Helvetica Bold
3” text height with 3.5” baseline to baseline
small text is 1.5”
4” gap between Categories

**Colours:**
Border: PMS (Pantone) 307U Text colour: Black
Background: White
**Logo:** PMS (Pantone) 307 U, PMS (Pantone) 117 U
Note:Logo and Specs (Visual Identity Guide) is sent with sign package

**Posts:** 2 X 6” X 6” P/T Posts

**Foundation:** Direct burial, 2 X 16” X 48” Holes

**Installation:**
6 X 1/4” X 4” Selftapping screws with washers.
**Sign Specification**

**Primary Sign Panel:**
3/4" Crezon board.

**Text:**
Arial Bold
Size as indicated

**Colours:**
Green band: PMS (Pantone) 627 CVC
Text colour (not on green band): Black
Text on Green band: White

**Cambridge Logo:** PMS (Pantone) 307 PMS (Pantone) 117

**Note:** Logo and specs (visual identity package)

**Canada, Ontario & AMO Logos:** Sent as eps files

**Posts:** 2 X 6" X 6" P/T Posts

**Foundation:** Direct burial, 2 X 16" X 48" Holes

**Installation:**
6 X 1/4" X 4" Self tapping screws with washers.
19mm Copper Tubing Type K
Minimum Radius 75mm

19mm Ball Valve

Fastener (eg. electrical tape)

2.0m 2x4 Buried 1.0m

To Watermain being Tested.
Connection Detail as per DGSSMS D.2.3.8
**PLAN**

**METER CHAMBER for WATER SERVICES**

**Parks/Irrigation Systems**

**NOTES:**

1. ALL DIMENSIONS IN mm UNLESS OTHERWISE NOTED
2. WATER METERS SUPPLIED BY CITY (25mm OR LESS AT NO CHARGE, 37mm OR GREATER MUST BE PAID FOR IN ADVANCE) AND INSTALLED BY OWNER
3. PROVIDE INSTALLATION FOR REMOTE READING - INCLUDING 50mm CONDUIT FROM CHAMBER WALL TO A 100mmX100mm (4"X4") PRESSURE TREATED WOODEN POST TO BE SUPPLIED AND INSTALLED BY OWNER/APPLICANT. ABOVE GRADE HEIGHT OF POST 1.0m (MIN); BELOW GRADE DEPTH OF POST 0.9m (MIN)
4. MINIMUM 2.0m GROUND COVER OVER WATER PIPE REQUIRED
5. ALUMINUM LADDER RUNGS AS PER OPSD 405.01 TO BE PLACED AS SHOWN TO BASE
6. MINIMUM HEIGHT FROM TOP OF PIPE TO UNDERSIDE OF CHAMBER IS 1.5m
7. CHAMBER SHALL BE WATERTIGHT
8. ALL VALVES AND CONNECTIONS MUST BE SUFFICIENTLY TIED BACK AND MADE SECURE
9. MAXIMUM DISTANCE OF CHAMBER FROM PROPERTY LINE IS 3.0m
10. B/F MUST CONFORM TO THE CITY OF CAMBRIDGE BY-LAW NO. 146-03
METER CHAMBER for WATER SERVICES

Maximum Water Meter Size 50mm (2") Ø
Minimum Water Meter Size 16mm (5/8") Ø

NOTES:
1. ALL DIMENSIONS IN mm UNLESS OTHERWISE NOTED
2. WATER METERS SUPPLIED BY CITY (25mm OR LESS AT NO CHARGE, 37mm OR GREATER MUST BE PAID FOR IN ADVANCE) AND INSTALLED BY OWNER
3. PROVIDE INSTALLATION FOR REMOTE READING - INCLUDING 50mm CONDUIT FROM CHAMBER WALL TO A 100mmX100mm (4"X4") PRESSURE TREATED WOODEN POST TO BE SUPPLIED AND INSTALLED BY OWNER/APPLICANT. ABOVE GRADE HEIGHT OF POST 1.0m (MIN); BELOW GRADE DEPTH OF POST 0.9m (MIN)
4. MINIMUM 2.0m GROUND COVER OVER WATER PIPE REQUIRED
5. ALUMINUM LADDER RUNGS AS PER OPSD 405.01 TO BE PLACED AS SHOWN TO BASE
6. MINIMUM HEIGHT FROM TOP OF PIPE TO UNDERSIDE OF CHAMBER IS 1.5m
7. CHAMBER SHALL BE WATERTIGHT
8. ALL VALVES AND CONNECTIONS MUST BE SUFFICIENTLY TIED BACK AND MADE SECURE
9. MAXIMUM DISTANCE OF CHAMBER FROM PROPERTY LINE IS 3.0m
Maximum 150mm (6") of risers at chamber access; otherwise chimney will be used

Extension service box

Finished Grade

City R.O.W.

Private Property

Ladder

3.0m Max Chamber to PL

2% 2%

2% 2%

450 (MIN)

1.8m (MIN)

1.5m (MIN)

2.0m

2.0m

100mm x 100mm (4" x 4") Pressure Treated Wooden Post To Be Supplied And Installed By Owner/Applicant Above Grade Height Of Post 1.0m (MIN)

Below Grade Depth Of Post 0.9m (MIN)

Long Radius Bend

Ball Valves or Equivalent (three required)

Supports (three required)

Thrust Block & Mega Holder Required On Pipe Outlet & Supply Larger Than 50mm (2"): (MIN) 100mm (4") Overlap of Opening (all sides)

Chamber Standard

OPSD 1101.012 - 1800 ID

See Note 3

Flow

Curb Stop

Service Supply

By-Pass Tee (two required)

SIDE VIEW

METER CHAMBER for WATER SERVICES

Maximum Water Meter Size 50mm (2") Ø
Minimum Water Meter Size 16mm (5/8") Ø
WATER METER CHAMBER for 75 & 100mm Ø METER

NOTES:

1. ALL DIMENSIONS IN mm UNLESS OTHERWISE NOTED
2. A METER SIZING DATASHEET MUST BE SUBMITTED AND REVIEWED BY THE CITY'S ENGINEERING DEPARTMENT TO DETERMINE APPROVED METER SIZE FOR ALL INSTALLATIONS. METERS SUPPLIED BY CITY AND INSTALLED BY OWNER. METERS MUST BE PAID FOR IN ADVANCE BEFORE BEING RELEASED.
3. PROVIDE INSTALLATION FOR REMOTE READING - INCLUDING 37mm CONDUIT FROM CHAMBER WALL TO A 100mm x 100mm (4" x 4") PRESSURE TREATED WOODEN POST TO BE SUPPLIED AND INSTALLED BY OWNER/APPLICANT. ABOVE GRADE HEIGHT OF POST 1.0m (min); BELOW GRADE DEPTH OF POST 0.9m (min)
4. MINIMUM 2.0 METERS GROUND COVER OVER WATER PIPE REQUIRED
5. ALUMINUM LADDER RUNGS AS PER OPSD 405.01 TO BE PLACED AS SHOWN TO BASE
6. MINIMUM HEIGHT FROM TOP OF PIPE TO UNDERSIDE OF CHAMBER IS 1.5 METERS
7. CHAMBER SHALL BE WATERTIGHT
8. ALL VALVES AND CONNECTIONS MUST BE SUFFICIENTLY TIED BACK AND MADE SECURE
9. MAXIMUM DISTANCE OF CHAMBER FROM PROPERTY LINE IS 3.0 METERS
**NOTES:****

1. ALL DIMENSIONS IN mm UNLESS OTHERWISE NOTED
2. A METER SIZING DATASHEET MUST BE SUBMITTED AND REVIEWED BY THE CITY’S ENGINEERING DEPARTMENT TO DETERMINE APPROVED METER SIZE FOR ALL INSTALLATIONS. METERS SUPPLIED BY CITY AND INSTALLED BY OWNER, METERS MUST BE PAID FOR IN ADVANCE BEFORE BEING RELEASED.
3. PROVIDE INSTALLATION FOR REMOTE READING - INCLUDING 50mm CONDUIT FROM CHAMBER WALL TO A 100mm x 100mm (4” x 4”) PRESSURE TREATED WOODEN POST TO BE SUPPLIED AND INSTALLED BY OWNER/APPLICANT. ABOVE GRADE HEIGHT OF POST 1.05m (42”); BELOW GRADE DEPTH OF POST 0.6m (24”)
4. MINIMUM 2.0 METERS GROUND COVER OVER WATER PIPE REQUIRED
5. ALUMINUM LADDER Rungs AS PER OPD 405.01 TO BE PLACED AS SHOWN TO BASE
6. MINIMUM HEIGHT FROM TOP OF PIPE TO UNDERSIDE OF CHAMBER IS 1.5 METERS
7. CHAMBER SHALL BE WATERTIGHT
8. ALL VALVES AND CONNECTIONS MUST BE SUFFICIENTLY TIED BACK AND MADE SURE
9. MAXIMUM DISTANCE OF CHAMBER FROM PROPERTY LINE IS 3.0 METERS
10. DOMESTIC AND FIRE SERVICE LINES ARE TO BE SEPARATED WITHIN THE METER CHAMBER. SINGLE SERVICE LINES THAT SUPPLY WATER TO MEET THE NEEDS OF BOTH DOMESTIC AND FIRE SUPPRESSION NEEDS ARE ONLY ALLOWED IF AT LEAST ONE OF THE FOLLOWING CRITERIA IS MET:
   a) DOMESTIC DEMAND (AS PROVIDED BY THE OWNER/BUILDER IN THE STANDARD WATER CUSTOMER DATA SHEETS) EXCEEDS 100 gpm AND/OR
   b) THE LENGTH OF PRIVATE PIPING FROM THE CHAMBER EXIT TO THE FURTHEST SERVICE CONNECTION IS 250M OR GREATER; NOTE THIS IS APPLICABLE TO THE MAIN WATER LINE AND DOES NOT INCLUDE ADDITIONAL LENGTH ASSOCIATED WITH SERVICE CONNECTIONS, HYDRANT LEADS, STUBS, ETC.

IF AT LEAST ONE OF THESE CRITERIA IS MET, A SINGLE SERVICE LINE THAT CONFORMS TO STANDARD WMC 150-200 MAY BE USED AT THE OWNER/BUILDER’S OPTION. APPROVAL TO USE WAC 150-250 MUST BE OBTAINED BY SUBMITTING A FORMAL REQUEST DETAILING HOW THE CRITERIA HAS BEEN MET TO THE CITY OF CAMBRIDGE TRANSPORTATION & PUBLIC WORKS DEPARTMENT, SUBJECT TO THE REVIEW AND APPROVAL OF THE COMMISSIONER OF TRANSPORTATION & PUBLIC WORKS. UPON FORMAL SUBMISSION OF A SITE PLAN APPLICATION OR A PRE-CONSULTATION (SITE PLAN) APPLICATION,

---

**PLAN**

(Precast / Poured in place, ref dwg OPD 1108.01)

---

**CITY OF CAMBRIDGE**

Transportation & Public Works Department

**Scale:** Not to Scale

**Eng Standard No:** C156 (wmc 150-250)

**Drawn By:** C. Schumacher

**Date:** April, 2006

**Design By:** J. Austin

**Approved By:** E. S. KOVAC

**Date:** April, 2006

**Commissioner of Transportation & Public Works**

**Revised:** April 2013 - HD
CHAMBER DIMENSIONS

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<th>Meter Size</th>
<th>Chamber Length</th>
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<tr>
<td>Inches / mm</td>
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<tr>
<td>6 / 150</td>
<td>4100</td>
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<tr>
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NOTES:
1. ALL DIMENSIONS IN mm UNLESS OTHERWISE NOTED
2. A METER RATING DATA SHEET MUST BE SUBMITTED AND REVIEWED BY THE CITY'S ENGINEERING DEPARTMENT TO DETERMINE APPROVED METER SIZE FOR ALL INSTALLATIONS. METERS SUPPLIED BY CITY AND INSTALLED BY OWNER, METERS MUST BE PAID FOR IN ADVANCE BEFORE BEING RELEASED.
3. PROVIDE INSTALLATION FOR REMOTE READING INCLUDING 50m CONDUIT FROM CHAMBER WALL TO A 100mm X 100mm (4" X 4") PRESSURE TREATED WOODEN POST TO BE SUPPLIED AND INSTALLED BY OWNER/APPLICANT. ABOVE GRADE HEIGHT OF POST 1.0m (min); BELOW GRADE DEPTH OF POST 0.5m (min).
4. MINIMUM 2.0 METERS GROUND COVER OVER WATER PIPE REQUIRED.
5. ALUMINUM LADDER RUNGS AS PER OPNS 405.01 TO BE PLACED AS SHOWN TO BASE.
6. MINIMUM HEIGHT FROM TOP OF PIPE TO UNDERSIDE OF CHAMBER IS 1.5 METERS.
7. CHAMBER SHALL BE WATERTIGHT.
8. ALL VALVES AND CONNECTIONS MUST BE SUFFICIENTLY TIED BACK AND MADE SECURE.
9. MAXIMUM DISTANCE OF CHAMBER FROM PROPERTY LINE IS 3.0 METERS.
10. METER DIMENSIONS MAY BE OBTAINED FROM PUBLIC WORKS ONCE METER SIZE & TYPE HAS BEEN DETERMINED.

CONFIRM DIMENSIONS WITH PUBLIC WORKS DEPARTMENT WHEN ORDERING SPECIFIC METER

SIDE VIEW

(precast / Poured In Place, Ref Dwg Opsd 1108.01)

CITY OF CAMBRIDGE Transportation & Public Works Department

<table>
<thead>
<tr>
<th>Meter Chamber for Single-Pipe, Dual-Purpose (Fire/Domestic) Services dia 150-250mm</th>
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<tbody>
<tr>
<td>Drawn By: C. Schumacher</td>
</tr>
<tr>
<td>Design By: J. Austin</td>
</tr>
<tr>
<td>Approved By: E S KOVACS</td>
</tr>
<tr>
<td>Date: April 2006</td>
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<tr>
<td>Date: April 2006</td>
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</table>

Scale: Not to Scale
Standard No: C156 (WMC 150-250)
Revised: APRIL 2013
CHAMBER DIMENSIONS

<table>
<thead>
<tr>
<th>Meter Size</th>
<th>Chamber Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 / 150</td>
<td>4100</td>
</tr>
<tr>
<td>8 / 200</td>
<td>4400</td>
</tr>
<tr>
<td>10 / 250</td>
<td>4700</td>
</tr>
</tbody>
</table>

CONFIRM DIMENSIONS WITH PUBLIC WORKS DEPARTMENT WHEN ORDERING SITE SPECIFIC METER

NOTES:
1. ALL DIMENSIONS IN mm UNLESS OTHERWISE NOTED
2. A METER SIZING DATASHEET MUST BE SUBMITTED AND REVIEWED BY THE CITY'S ENGINEERING DEPARTMENT TO DETERMINE APPROVED METER SIZE FOR ALL INSTALLATIONS. METERS SUPPLIED BY CITY AND INSTALLED BY OWNER, METERS MUST BE PAID FOR IN ADVANCE BEFORE BEING RELEASED.
3. MINIMUM 2.0 METERS GROUND COVER OVER WATER PIPE REQUIRED
4. ALUMINUM LADDER RUNGS AS PER OPSD 405.01 TO BE PLACED AS SHOWN TO BASE
5. MINIMUM HEIGHT FROM TOP OF PIPE TO UNDERSIDE OF CHAMBER IS 1.5 METERS
6. CHAMBER SHALL BE WATERTIGHT
7. ALL VALVES AND CONNECTIONS MUST BE SUFIICIENTLY TIED BACK AND MADE SECURE
8. MAXIMUM DISTANCE OF CHAMBER FROM PROPERTY LINE IS 3.6 METERS
9. METER DIMENSIONS MAY BE OBTAINED FROM PUBLIC WORKS ONCE METER SIZE & TYPE HAS BEEN DETERMINED.
10. METER DIMENSIONS MAY BE OBTAINED FROM PUBLIC WORKS ONCE THE METER SIZE & TYPE HAS BEEN DETERMINED.

SIDE VIEW
(Precaet / Poured In Place, Ref Dwg Opsd 1108.01)

(See Page 1.)

CITY OF CAMBRIDGE
Transportation & Public Works Department

Meter Chamber
for Single-Pipe, Dual-Purpose (Fire/Domestic) Services dia 150-250mm

Drawn By: C. Schumacher
Design By: J. Austin
Approved By: E S KOVACS

Date: April 2006
Date: April 2006

Standard No: C156 (WMC 150-250)

Revised: APRIL 2013
PLAN for 150mm / 6" + 200mm / 8" Ø SERVICE

METER CHAMBER FOR 150/200mm Ø FIRE LINE DETECTOR CHECK VALVE c/w METER

NOTES:

1. ALL DIMENSIONS ARE TO BE IN mm UNLESS OTHERWISE NOTED.
2. WATER METERS SUPPLIED BY CITY (25mm OR LESS AT NO CHARGE 37mm OR GREATER MUST BE PAID FOR IN ADVANCE) AND INSTALLED BY OWNER.
3. PROVIDE INSTALLATION FOR REMOTE READING - INCLUDING 50mm CONDUIT FROM CHAMBER WALL TO A 100mm X 100mm (4" X 4") PRESSURE TREATED WOODEN POST TO BE SUPPLIED AND INSTALLED BY OWNER/APPLICANT. ABOVE GRADE HEIGHT OF POST 1.0m (min), BELOW GRADE DEPTH OF POST 0.9m (min).
4. MINIMUM 2.0 METERS GROUND COVER OVER WATER PIPE REQUIRED
5. ALUMINIUM LADDER RUNGS AS PER OPSD 405.01 TO BE PLACED AS SHOWN TO BASE.
6. MINIMUM HEIGHT FROM TOP OF PIPE TO UNDERSIDE OF CHAMBER IS 1.5 METERS.
7. CHAMBER SHALL BE WATERTIGHT.
8. ALL VALVES AND CONNECTIONS MUST BE SUFFICIENTLY TIED BACK AND MADE SECURE.
9. MAXIMUM DISTANCE OF CHAMBER FROM PROPERTY LINE IS 3.0 METERS.
10. DETECTOR CHECK VALVE SHALL HAVE CLEARANCE THROUGH STANDARD METER CHAMBER COVER, OTHERWISE THREE-PIECE COVER SHALL BE USED. ALL PIPING & FITTINGS ON DOMESTIC METER PIPING SHALL BE BRASS AND/OR COPPER.
11. ALL PIPING & FITTINGS ON DETECTOR CHECK METER PIPING/ASSEMBLY SHALL BE COPPER OR BRASS.
CITY OF CAMBRIDGE

METER CHAMBER FOR 150/200mm Ø FIRE SERVICE
WITH DETECTOR CHECK VALVE - SIDE VIEW

2400 Ø reinforced precast concrete valve chamber as per OPSD 701.02 (2400 I.D.)
2% min
Aluminum entry ladder or steps as per OPSD 405.01
Maximum 150mm(6") of risers at chamber access; otherwise chimney will be used
Remote Reader Installation - 50mm conduit to be installed from chamber wall to a suitable location
Febco® (model 800) or approved equal Detector Check Valve for fire protection service line (supplied and installed by the Property Owner)
Gate Valves c/w hand cranks (2 required)
Pipe Clamp Use Mega Lug® Or Uni-flange® Type Joint Restraint (Both Ends)
Reducing Tee
600 x 150 Deep Sump (min)

SIDE VIEW for 150mm / 6" + 200mm / 8" Ø SERVICE

METER CHAMBER FOR 150/200mm Ø FIRE LINE DETECTOR CHECK VALVE c/w METER
METER CHAMBER FOR 150/200mm Ø FIRE LINE DETECTOR CHECK VALVE c/w METER

NOTES:
1. ALL DIMENSIONS ARE TO BE IN mm UNLESS OTHERWISE NOTED.
2. WATER METERS SUPPLIED BY CITY (25mm OR LESS AT NO CHARGE 37mm OR GREATER MUST BE PAID FOR IN ADVANCE) AND INSTALLED BY OWNER
3. PROVIDE INSTALLATION FOR REMOTE READING - INCLUDING 50mm CONDUIT FROM CHAMBER WALL TO A 100mm X 100mm, (4" X 4") PRESSURE TREATED WOODEN POST TO BE SUPPLIED AND INSTALLED BY OWNER/APPLICANT. ABOVE GRADE HEIGHT OF POST 1.0m (min); BELOW GRADE DEPTH OF POST 0.9m (min)
4. MINIMUM 2.0 METERS GROUND COVER OVER WATER PIPE REQUIRED
5. ALUMINIUM LADDER RUNGS AS PER OPSD 405.01 TO BE PLACED AS SHOWN TO BASE
6. MINIMUM HEIGHT FROM TOP OF PIPE TO UNDERSIDE OF CHAMBER IS 1.5 METERS
7. CHAMBER SHALL BE WATERTIGHT
8. ALL VALVES AND CONNECTIONS MUST BE SUFFICIENTLY TIED BACK AND MADE SECURE
9. MAXIMUM DISTANCE OF CHAMBER FROM PROPERTY LINE IS 3.0 METERS
10. DETECTOR CHECK VALVE SHALL HAVE CLEARANCE THROUGH STANDARD METER CHAMBER COVER, OTHERWISE THREE-PIECE COVER SHALL BE USED. ALL PIPING & FITTINGS ON DOMESTIC METER PIPING SHALL BE BRASS AND OR COPPER
11. ALL PIPING & FITTINGS ON DETECTOR CHECK METER PIPING/ASSEMBLY SHALL BE COPPER OR BRASS
12. IF DOMESTIC WATER SERVICE IS 100mm OR GREATER, WATER METER STANDARD WMC 250s IS TO BE USED
3000 I.D. METER CHAMBER FIRE LINE DETECTOR CHECK VALVE c/w METER

PLAN for 250mm / 10" Ø SERVICE

NOTES:

1. ALL DIMENSIONS IN mm UNLESS OTHERWISE NOTED
2. WATER METERS SUPPLIED BY CITY (25mm OR LESS AT NO CHARGE 37mm OR GREATER MUST BE PAID FOR IN ADVANCE) AND INSTALLED BY OWNER
3. PROVIDE INSTALLATION FOR REMOTE READING - INCLUDING 50mm CONDUIT FROM CHAMBER WALL TO A 100mm x 100mm (4" x 4") PRESSURE TREATED WOODEN POST TO BE SUPPLIED AND INSTALLED BY OWNER/APPLICANT. ABOVE GRADE HEIGHT OF POST 1.0m (min); BELOW GRADE DEPTH OF POST 0.9m (min)
4. MINIMUM 2.0 METERS GROUND COVER OVER WATER PIPE REQUIRED
5. ALUMINIUM LADDER RUNGS AS PER OPSD 405.01 TO BE PLACED AS SHOWN TO BASE
6. MINIMUM HEIGHT FROM TOP OF PIPE TO UNDERSIDE OF CHAMBER IS 1.5 METERS
7. CHAMBER SHALL BE WATERPROOF
8. ALL VALVES AND CONNECTIONS MUST BE SUFFICIENTLY TIED BACK AND MADE SECURE
9. MAXIMUM DISTANCE OF CHAMBER FROM PROPERTY LINE IS 3.0 METERS
10. ALL PIPING & FITTINGS USED ON DOMESTIC METER PIPING 2" OR LESS SHALL BE BRASS AND/OR COPPER
11. ALL PIPING & FITTINGS ON DETECTOR CHECK METER PIPING/ASSEMBLY SHALL BE COPPER OR BRASS
**PLAN for 250mm / 10" Ø SERVICE**

**METER CHAMBER FOR DUAL SERVICE WITH DETECTOR CHECK VALVE ON FIRE SERVICES**

**NOTES:**
1. ALL DIMENSIONS IN mm UNLESS OTHERWISE NOTED
2. WATER METERS SUPPLIED BY CITY (25mm OR LESS AT NO CHARGE 37mm OR GREATER MUST BE PAID FOR IN ADVANCE) AND INSTALLED BY OWNER
3. PROVIDE INSTALLATION FOR REMOTE READING - INCLUDING 50mm CONDUIT FROM CHAMBER WALL TO A 100mm x 100mm (4" x 4") PRESSURE TREATED WOODEN POST TO BE SUPPLIED AND INSTALLED BY OWNER/APPLICANT. ABOVE GRADE HEIGHT OF POST 1.0m (min); BELOW GRADE DEPTH OF POST 0.9m (min)
4. MINIMUM 2.0 METERS GROUND COVER OVER WATER PIPE REQUIRED
5. ALUMINIUM LADDER RUNGS AS PER CPSD 405.01 TO BE PLACED AS SHOWN TO BASE
6. MINIMUM HEIGHT FROM TOP OF PIPE TO UNDERSIDE OF CHAMBER IS 1.5 METERS
7. CHAMBER SHALL BE WATERTIGHT
8. ALL VALVES AND CONNECTIONS MUST BE SUFFICIENTLY TIED BACK AND MADE SECURE
9. MAXIMUM DISTANCE OF CHAMBER FROM PROPERTY LINE IS 3.0 METERS
10. ALL PIPING & FITTINGS USED ON DOMESTIC METER PIPING 2" OR LESS SHALL BE BRASS AND/OR COPPER
11. ALL PIPING & FITTINGS ON DETECTOR CHECK METER PIPING/ASSEMBLY SHALL BE COPPER OR BRASS
GATE & GATE POST DETAILS

<table>
<thead>
<tr>
<th>FRAME MEMBER Min. OD (mm)</th>
<th>Post Dia. Min. OD (mm)</th>
<th>Post Length Min. OD (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>42.9</td>
<td>88.9</td>
<td>2.7</td>
</tr>
</tbody>
</table>

NOTES:
1. ALL DIMENSIONS ARE IN mm EXCEPT AS NOTED.
2. ALL FENCE FABRIC SHALL BE COATED WITH BLACK VINYL.
3. POSTS, CAPS, BRACES & TOP RAIL SHALL BE ELECTROSTATICALLY PAINTED WITH BLACK POLYESTER POWDER-COAT PAINT.
4. CORE WIRE SHALL BE 9 GAUGE AND WITH VINYL COATING EQUAL 6 GAUGE EXTERIOR.
### POST DETAILS - Options A, B, C or D

**NOT TO SCALE**

**OPTION A**
- **IN EARTH**
  - End, Corner, Straining or Gate Post: 88mm O.D., Galvanized Schedule 40.

**OPTION B**
- **IN SOLID ROCK**
  - Overburden less than 450mm
  - End, Corner, Straining, Gate or Line Post: 69mm O.D., Galvanized Pipe Rail, Schedule 40.

**OPTION C**
- **IN SHALE, LOOSE OF FRIABLE ROCK OR SOLID ROCK**
  - Overburden more than 450mm
  - Distance X: End, Corner, Straining or Gate Post - 300mm Min.
  - 25mm Max. Clearance

### POST DETAILS

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>O.D. (mm)</th>
<th>STANDARD (m)</th>
<th>RETAINING WALLS (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LINE</td>
<td>60.3</td>
<td>2.5</td>
<td>2.0</td>
</tr>
<tr>
<td>End, Corner, Straining and Gates with Openings 5.1m Max.</td>
<td>88.9</td>
<td>2.7</td>
<td>2.3</td>
</tr>
<tr>
<td>Gates with Openings 10.0m Max.</td>
<td>114.3</td>
<td>2.7</td>
<td>--</td>
</tr>
</tbody>
</table>

**Notes:**
1. All dimensions are in mm except as noted.
2. All fabric shall be coated with black vinyl.
3. Posts, caps, braces and top rail shall be electrostatically painted with black polyester powder-coat paint.
4. Core wire shall be 9 gauge and with vinyl coating equal 6 gauge exterior.
5. For pedestrian gate detail, refer to City of Cambridge Standard Drawing CSD-ST-02.

---

**CHAIN LINK SECURITY FENCE-BLACK VINYL DETAIL**

**CITY OF CAMBRIDGE**

**COMMUNITY SERVICES DEPARTMENT**

**SCALE:** Not to Scale

**STANDARD NO.**

**C162**

**Drawn By:** E. Otten

**Design By:** L. Simmons

**Date:** May, 2000

**REVISED: MAY 2012**
Storm Water Management Area
City of Cambridge

NUMBER
Address Street Name

This storm water management area has been
designed to function as a Wet Pond and has been
landscaped to assist the storm water
management function and to provide an aesthetic
feature for the neighbourhood. Risks include
fluctuating water levels and thin ice.

For further information, please call the
Transportation and Public Works
Department at 740-4682

Notes:
1. Contractor shall be responsible to supply and install signs facing street.
2. Signs are to be attached to two posts using appropriate stainless steel bolts
and vandal proof aluminum breakaway nuts. Use either
3.6m long u-channel posts or 1.5m base u-channel posts with 1.0m in ground and 2.6m
posts bolted with 0.8m overlap on base posts using vandal proof break away nuts
above ground. Posts supplied by contractor.
3. Minimum sign height is 2.0m from the bottom of lowest point of sign to ground.
4. Contractor to submit final artwork (graphic and text) of sign for written city approval
prior to manufacturing and installation.
5. 850mm x 950mm aluminum sign c/w 1.5” radius corners

6. Black border 5/8 wide painted onto white background
7. Black lettering painted onto white background. (No transfers allowed)
   Graphic colours as per City of Cambridge logo specifications.
   (PMS 307U and PMS 117U)
   All colours to be painted onto white background. (No transfers allowed.)
8. Address of site to be indicated on sign. To obtain Address contact
   City of Cambridge Planning Services Department, 740-4650 ext 4611.
   Street address to be assigned to street from which frontage maintenance access
to SWM is constructed.
9. Applicable Pond type to be indicated in body of text.
   (Wetland, Dry Pond, Wet Pond)
10. Minimum Height of text for Address Number (as per by-law 167-03) shall be 100 mm
TOPSOIL & SEED ALL EDGES (TYP)

4" (100mm) STONEDUST, COMPACTED DEPTH

6" (150mm) GRANULAR 'A', COMPACTED DEPTH

COMPACTED SUBGRADE

300mm (1") (TYP)

VARIES

2%

STONEPATH - CROWNED

TOPSOIL & SEED ALL EDGES (TYP)

VARIES

2%

100mm (4") STONEDUST, COMPACTED DEPTH

150mm (6") GRANULAR 'A', COMPACTED DEPTH

COMPACTED SUBGRADE

300mm (1") (TYP)

STONEPATH - CROSS SLOPED

NOTES:
1. REPLACE 100mm (4") STONEDUST (COMPACTED DEPTH) WITH 75mm (3") ENVIROBOND STABILIZED CRUSHED STONE PAVING MATERIAL (COMPACTED DEPTH) WHERE INDICATED ON SITE PLAN.
2. CONTRACTOR SHALL CUT / FILL EXISTING GRADE AS REQUIRED IN ORDER TO ACCOMODATE PROPOSED TRAIL. ANY SIDE SLOPES REQUIRED TO MATCH EXISTING GRADES SHALL NOT EXCEED 2:1 SLOPE.
3. CROSS SLOPES SUBJECT TO FINAL APPROVAL OF LANDSCAPE ARCHITECT

TYPICAL STONEPATH C/W SHOULDER

CITY OF CAMBRIDGE
COMMUNITY SERVICES DEPARTMENT

DRAWN BY: L. DRENNAN
DESIGN BY: S. RIESE
STANDARD NO. CSD-L-07
DATE: JANUARY 2007
REVISED: JANUARY 2007
ASPHALT PATH - CROSS SLOPED

NOTE:
CROSS SLOPES SUBJECT TO FINAL APPROVAL OF LANDSCAPE ARCHITECT PRIOR TO PAVING.

ASPHALT PATH - CROWNED

ASPHALT PATH c/w SHOULDER DETAIL (50mm ASPHALT)

CITY OF CAMBRIDGE
COMMUNITY SERVICES DEPARTMENT

DRAWN BY: L. DRENNAN
DESIGN BY: S. REISE
DATE: FEBRUARY 8, 2007
REVISED: MARCH 2013
STANDARD NO. CSD-L-11-A
MOWING STRIP TO BE SEEDED ON 150mm (4") COMPAKTED DEPTH OF TOPSOIL AS PER SPECIFICATIONS

300mm (12") (TYP) VARIES 300mm (12") (TYP)

2% CROSS SLOPE

100mm (4") STONEDUST, COMPAKTED DEPTH, MATERIAL TO CONFORM TO APPLICABLE OPSS.

150mm (6") GRANULAR 'A', COMPAKTED DEPTH, MATERIAL TO CONFORM TO APPLICABLE OPSS.

BX 1100 GEOGRID BY TERRAFIX

TERRAFIX NON-WOVEN 270R GEOTEXTILE

COMPACTED SUBGRAGE.
MOWING STRIP TO BE SEEDED ON 150mm (4") COMPACTED DEPTH OF TOPSOIL AS PER SPECIFICATIONS.

300mm (12") (TYP)

VARIES

2% CROSS SLOPE

50mm (2") HL3 ASPHALT, COMPACTED DEPTH, ALL MATERIALS AND APPLICATION PROCEDURES SHALL CONFORM TO OPSS 310.

100mm (4") GRANULAR 'A' COMPACTED DEPTH, MATERIAL TO CONFORM TO APPLICABLE OPSS.

200mm (8") GRANULAR 'B', COMPACTED DEPTH, MATERIAL TO CONFORM TO APPLICABLE OPSS.

BX 1100 GEOGRID BY TERRAFIX

TERRAFIX NON-WOVEN 270R GEOTEXTILE

COMPACTED SUBGRADE.
MOWING STRIP TO BE SEEDED ON 150mm (4") COMPACTED DEPTH OF TOPSOIL AS PER SPECIFICATIONS

300mm (12") (TYP)

3.0m (10'-0")

300mm (12") (TYP)

2% CROSS SLOPE

75mm (3") HL3 ASPHALT, COMPACTED DEPTH. ALL MATERIALS AND APPLICATION PROCEDURES SHALL CONFORM TO OPSS 310.

100mm (4") GRANULAR 'A' COMPACTED DEPTH. MATERIAL TO CONFORM TO APPLICABLE OPSS

200mm (8") GRANULAR 'B', COMPACTED DEPTH. MATERIAL TO CONFORM TO APPLICABLE OPSS.

BX 1100 GEOGRID BY TERRAFIX

TERRAFIX NON-WOVEN 270G GEOTEXTILE

COMPACTED SUBGRADE.
APPENDIX “A”

Traffic Impact Study Guidelines

January 2007
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1.0 INTRODUCTION

1.1 Traffic Impact Study

The goal of a traffic impact study (TIS) is to assess the potential impact of traffic generated by a proposed development and to identify the roadway improvements required to ensure that the road network will operate safely and efficiently upon completion of the development.

A TIS is an important part of the development review and approval process. A TIS assists public agencies in making land use decisions where the proposal may have a significant impact on traffic operations within the immediate area of the development and in some cases within the overall transportation network.

The TIS benefits the municipality by:

- Providing decision makers with a basis on which to assess transportation implications of a proposed development applications;
- Providing a rational basis on which to evaluate if the type and scale of the development is appropriate for a particular site and what improvements may be necessary, on and/or off of the site, to provide for safe and efficient traffic flow;
- Providing a basis for assessing existing or future localized transportation system deficiencies which should be improved;
- Addressing transportation-related issues associated with development proposals that may be of concern to neighbouring residents, businesses and property owners; and
- Providing a basis for negotiations for improvements and funding participation in conjunction with a development or zoning application.

A TIS may vary in scope and complexity depending on the type and size of the proposed development.

1.2 Need and Justification

The City has prepared these guidelines in order to streamline the approval process and provide a standardized framework for consultants to follow when submitting studies for review. At all times, they should be complemented with good engineering judgment.

1.3 Purpose of Guidelines

The purpose of these guidelines is to ensure that TISs prepared for the City’s review meet the following criteria:
1. Objective assessment – the study will evaluate the impacts of proposed new development in a rational manner.
2. Consistency – the study will utilize assumptions consistent with the city’s accepted methodologies and parameters and thus be comparable to other traffic studies in the area;
3. Recognized by developers and consultants – the guidelines will provide a standard approach to be followed and will reduce confusion and delay in processing development proposals;
4. Promote understanding of process – the steps outlined in these guidelines will enable proponents, reviewers and elected officials to understand the process more effectively; and
5. Ease of review by staff – a standardized set of guidelines will aid staff in the timely review of TISs.
2.0 GENERAL REQUIREMENTS

2.1 Need for a Traffic Impact Study

There are a number of criteria under which a traffic impact study may be required. In general, a TIS should be conducted whenever a proposed development will generate more than 75 additional peak hour trips to or from the site.

A TIS may also be required when there are less than 75 additional peak hour trips under one or more of the following conditions:

- The development is located in an area of high roadway congestion and/or a high employment or population growth area.
- The development requires an amendment to the Official Plan.
- The development, its access(es) or type of operation is not consistent with land-use zoning or transportation plans.
- As part of the proposed development, a new traffic signal is proposed.
- If in the opinion of the City, the development has the potential to create unacceptable adverse traffic operational and/or safety impacts on the road network.

The onus is on the applicant to demonstrate that a TIS is not required.

2.2 Staff Consultation

It is strongly recommended that prior to commencing a TIS that the consultant meet with City staff to review the level of detail required, to confirm the scope, provide contacts with regional staff and to determine data requirements and their availability.

In addition, developments that may impact the regional or provincial road network may require additional information or analysis. The applicant should contact these road authorities, where applicable, to determine these requirements.

2.3 Study Updates

A TIS typically has a shelf life of 5 years. Major changes within the study area may reduce the usefulness of the document if they were not considered in the initial assessment. Where the timing of subsequent development approvals exceeds five years, a new TIS will generally be required.

2.4 Qualifications to Conduct Traffic Impact Studies

It is the applicant’s responsibility to retain a qualified transportation engineering consultant experienced in traffic engineering and transportation planning. The consultant must be a registered Professional Engineer in the Province of Ontario and a
Member of both the Transportation Association of Canada and the Institute of Transportation Engineers.

The TIS must be stamped and signed by the Professional Engineer. The signing Engineer is verifying that appropriate assumptions and methodologies have been utilized in the completion of the TIS and that he/she is the individual who is taking corporate and professional responsibility for the work.

Alternatively, at the discretion of the City, the City may retain a consultant at the proponent’s expense.

2.5 Data Collection

The applicant must provide both electronic and hard copies of all raw data collected for the TIS.

2.6 Submission Requirements

The applicant must submit five copies (unless otherwise advised by the City) of the final TIS complete with all supporting documentation. The applicant must also submit an electronic copy of all analyses contained in Appendices.

All information submitted to City staff in connection with any TIS will be considered to be in the public domain.
3.0 TRAFFIC IMPACT STUDY REQUIREMENTS

The following sections outline the required content for the TIS. In general, the content and extent of the TIS will depend on the location and size of the proposed development and the prevailing traffic conditions in the surrounding area.

The TIS should consist of a main document supplemented by technical appendices containing required detailed analyses. The following is a suggested structure that will aid staff in a timely review of the TIS:

- Description of the Proposal (with site plan or plan of subdivision if applicable);
- Study Area (with map identifying the study area and site);
- Horizon Year(s) and Time Periods for Analysis;
- Existing Conditions (exhibits required);
- Background Traffic Demand – Existing and Future Background (exhibits required);
- Site Generated Traffic Demands (exhibits required);
- Total Traffic Demand – Future Background plus Site Generated Traffic (exhibits required);
- Evaluation of Impacts of Site Generated Traffic;
- Access Location Analysis;
- Improvement Alternatives Required to Mitigate Traffic Impacts, including Traffic Impacts for Future Background and Total Traffic with and without Mitigation Measures (tabular summaries); and
- Recommendations.

Maps, graphs and tables should be placed adjacent to relevant text.

3.1 Description of the Proposal

The TIS should include a full description of the proposed development. It is recommended that this include the following elements, as appropriate:

- Municipal address;
- Existing land uses or permitted use provisions of the Official Plan, Official Plan Amendments, Zoning Bylaws, etc.;
- Proposed land uses and relevant planning regulations to be used in the study;
- Total building size and building location on the site;
- Floor space including a summary of each type of use and/or number of units;
- Anticipated date of occupancy;
- Approximate days and hours of operation;
- Planned phasing of the development;
- Nearby intersections and access points for adjacent developments, including type of traffic control and existing access restrictions;
• Proposed access points and types of access (e.g. full moves, right-in-right-out only, specific turning restrictions, etc.);
• Locations of elementary school and senior citizen residences/facilities; and
• Nearby transit facilitates and stops.

If the development is to be constructed in phases then a description of each phase and its proposed timing of implementation should also be included.

A site plan or plan of subdivision of suitable scale must be submitted for consideration in the review of the TIS.

3.2 Study Area

The study area should extend far enough from the development to contain all municipal, regional and provincial roadways that will be noticeably affected by the traffic generated by the proposed development. The analysis area should include all roads, ramps and intersections through which peak hour site traffic comprises 5% or greater of the existing capacity on an intersection approach.

Roads in the area of the development that have an annual traffic growth in excess of 5% and intersections where volume to capacity (V/C) ratios for the overall intersection or for shared through/turning movements increase to over 0.85 or where the V/C ratio for exclusive turning movements increase to 0.95 should also be evaluated. The City reserves the right to establish the study area as may be deemed necessary.

Within the study area, the applicant must use maps and other documentation to identity the components of the existing transportation system, including the following:

• All adjacent and nearby roads, indicating the number of lanes and the posted speed limit on each;
• All adjacent and affected intersections, indicating the type of control, lane configuration, lane widths and any turning or similar restrictions;
• On-street parking locations and areas with parking prohibitions in the vicinity of the site, clearly identifying those that would be affected by the proposed development;
• Transit routes;
• Heavy vehicle prohibitions and restrictions;
• Other transportation facilities, as appropriate.

Potential future transportation improvements that are currently being considered and may accommodate a proportion of the traffic demand produced by the development should be identified. These improvements should be described in sufficient detail to assess their implications for travel to/from the development. In each case, the status and anticipated date of implementation must be identified.
3.3 **Horizon Year(s) and Time Periods for Analysis**

The horizon year for TIS analysis is 5 years from the date of the TIS, unless an earlier date for full occupancy of the project can be identified and approved in advance by City staff.

Horizon years must also be identified for any interim phases of the development. Additional horizon years may also be required depending on the magnitude of the development, ranging from a minimum of 5 years after the study date to a maximum of full build-out of the defined study area. This type of longer-range evaluation is generally only required for larger scale projects, such as those generating 500 or more peak-hour trips.

Typically the AM Peak and PM Peak traffic periods will constitute the heaviest combination of site related and background traffic. However, Saturday, Sunday and site specific peak period analyses may be required for some proposed developments, such as retail, entertainment, religious, institutional and sports facilities.

3.4 **Existing Traffic Conditions**

The TIS must include exhibits showing the existing traffic volumes and turning movements for roadways and intersections in the study area, including pedestrian and heavy vehicle volumes.

Traffic volumes may be acquired from the City, Waterloo Region or from previous approved transportation planning, traffic operation or traffic impact studies in the study area. Traffic counts that are more than two years old must be recounted to ensure that they reflect current traffic levels.

Regardless of the age of the traffic volume data, a minimum one hour field observation during the peak hour must be undertaken at each affected intersection to verify that traffic volumes through each intersection reflect actual demand and to confirm the necessary adjustment factors for level of service calculations.

3.5 **Background Traffic Demand**

3.5.1 **Background Traffic**

The background growth in traffic should be established in consultation with City staff through one of the following methods:

- Estimation of roadway growth factors from a calibrated traffic forecasting model;
- Regression analysis of historical traffic growth; or
- Traffic growth forecasts established through a previous land-use or transportation planning study.
It is important that the proponent/consultant consult with City staff to obtain agreement on the most applicable strategy for addressing background traffic growth in the TIS.

3.5.2 Other Area Developments

All significant developments under construction, approved and in the approval process within the study area that are likely to occur by the specific horizon year(s) are to be identified and included in the background traffic growth for the study. The land-use types and magnitude of the probable future developments in the horizon years should be identified through consultation with City staff.

3.5.3 Transportation Network Improvements

Changes to the present or planned transportation network should be determined from the approved City, Regional and Provincial capital programs, if available, and consultation with City staff. The impacts of the transportation system changes should be identified; in particular, diversion of volumes from other facilities to new or improved facilities should be estimated.

3.5.4 Transit Considerations

In areas with transit service, the existing service should be identified as having significant potential impact and possible changes in modal split should be evaluated.

3.6 Site Generated Traffic Demands

All trip generation, trip distribution, assignment and modal split assumptions should be in accordance with standard/accepted techniques and based on local parameters. Sources should be well documented and any assumptions that may be considered less than conservative should be rigorously justified. Any “soft” parameters where there is a significant uncertainty or a range of possible values should be subjected to sensitivity analysis unless a demonstrated “worst case” situation is assumed.

3.6.1 Trip Generation

Consultation with City Staff is recommended to ensure that appropriate and agreed upon trip generation rates are being employed in the TIS. Available trip generation methods, in order of preference include:

- Trip generation surveys from similar developments in the City, Region and GTA, which have similar operating characteristics as the proposed development. Modifications should be made to the trip generation rates to account for differences in the surveyed and proposed development sites;
- "First principles" calculations of anticipated trips to/from the site; and
• ITE Trip Generation (most recent edition) rates, provided that differences in the site nature and size are accounted for.

Where appropriate, it may be justified to change the trip generation of the proposed development to account for:

• Captive market effects/"Synergy" - Represents trips which are shared between two or more uses on the same site, i.e., a motorist visiting a retail store and a grocery store on the same site;
• Pass-by trips - trips that represent intermediate stops on a trip already on the road network, i.e. a motorist stopping into a retail store on their way home from work. It should be recognized that pass-by trips must be accounted for in the turning movements into/out of the site; and
• Travel Demand Management (TDM) strategies.

All trip generation assumptions and adjustments assumed in the calculation of "new" vehicle trips should be supported and documented. Sensitivity analysis should be undertaken where trip generation parameters have the potential to vary considerably and most probable values cannot be readily identified.

A table should be provided in the study report identifying the categories and quantities of land uses, with the corresponding trip generation rates or equations and the resulting number of trips. For large developments that will be phased in over time, the table should identify each significant phase separately.

3.6.2 Trip Distribution

The directions form which traffic will approach and depart the site can vary depending on several location specific factors, including:

• Size of the proposed development;
• Type of proposed development;
• Surrounding and in some case competing land uses, population and employment distributions; and
• Prevailing conditions on the existing street network.

The trip distribution assumptions should be supported by one or more of the following, in the order of preference:

• Transportation Tomorrow Survey (TTS) data, if applicable;
• Origin-destination surveys;
• Comprehensive travel surveys;
• Existing/anticipated travel patterns;
• Output from transportation planning models; and
• Market studies.
Engineering judgment should be utilized to determine the most applicable of the above methodologies for each particular application.

3.6.3 Trip Assignment

Trip assignment assumptions should reflect the most "probable" travel patterns expected. They should consider logical routings, available and projected roadway capacities and travel times. Traffic assignments may be estimated using a transportation planning model or "hand assignment" based on knowledge of the proposed/future road network in the study area.

3.7 Total Future Traffic Demand

A summary of the existing and future traffic demands should be provided in the form of exhibits/illustrations that summarize the following:

- Existing traffic;
- Future background;
- Site generated traffic; and
- Future total traffic (Future background + site generated traffic).

Summary exhibits must be provided for each peak period and analysis horizon. It is recommended that the exhibits be provided within the body of the document where they are referenced as opposed to an appendix. This layout will aid in the timely review of the TIS.

In some cases, interim traffic conditions may need to be assessed to reflect phasing of developments, interim site access arrangements or planned transportation system improvements.

3.8 Evaluation of Impacts of Site Generated Traffic

An evaluation of all signalized and unsignalized intersections that will be affected by site generated traffic volumes for all relevant time periods is required. Summaries are to be provided in tabular format. Appendix A provided assumptions to be used in these analyses.

The objective must be to ensure that no new “problem” movements are created by the development and that “problem” movements that exist are not worsened with the addition of site generated traffic. Supplementary surveys or analyses may be required to access saturation flows, gap availability and projected queue lengths.

An appendix to the TIS must provide complete documentation of all assumptions used in the analyses concerning lane configuration, lane use, pedestrian activity, on-street parking, vehicle classification, saturation flows, traffic signal timing, utilization of inter-green timing and other relevant parameters. Existing signal timings, as provided
by the Region of Waterloo, should be used for analysis of existing intersections. Modified timings, subject to approval by the Region of Waterloo, may be considered as a measure to address capacity or level of service deficiencies.

3.8.1 Capacity Analyses at Intersections

For each intersection, the analyses must include level of service calculations with average vehicle delays and volume to capacity (V/C) ratios for overall intersection operations and individual critical movements for each combination of time period and time horizon.

The analyses must incorporate adequate crossing times for pedestrians and appropriate assumptions for modeling heavy vehicle operations. A summary of the conclusions should be included in the report with full documentation provided in an appendix.

The City accepts both the Highway Capacity Manual (HCM) and Canadian Capacity Guide (CCG) methodologies of intersection analysis. Analysis may be performed using the most current versions of CCG, HCS and/or Synchro. Prior approval of the City is required to use a software product other than those listed above. Under this circumstance, it should be recognized that the City reserves the right to request that specific intersection analysis is undertaken with one of the above noted software packages, should the verification of results be required.

The analysis must include identification of signalized intersections where:

- V/C ratios for overall intersections operations, through movements or shared through/turning movements increase to 0.85 or above;
- V/C ratios for exclusive movements increase to 0.90 or above; or
- Queues for an individual movement are projected to exceed available turning lane storage.

The analysis must include identification of unsignalized intersections where:

- Level of service, based on average delay per vehicle or on individual movements is LOS “E” or greater; or
- The estimated 95th percentile queue length for an individual movement exceeds the available queue storage.

3.8.2 Safety Analysis

The TIS must include an evaluation and identification of potential safety and/or operations issues associated with the following, as applicable:

- Weaving;
- Merging;
• Sight distance;
• Vehicle-pedestrian conflicts;
• Traffic infiltration;
• Access conflicts;
• Cyclist movements;
• Heavy vehicle movement conflicts;
• Transit operational conflicts.

Where the proposed development is in the vicinity of an intersection or roadway with identified safety problems, existing collision data (available from the City) must be reviewed and an assessment of the impact of the proposed development provided.

3.9 Access Analysis

3.9.1 Geometrics

The number and location of access points must not negatively impact the flow of traffic along abutting roads. Access points should be located on minor roads where feasible. The justification for more than one access must be based on the volume of site traffic and not on design preference.

The locations of access points must line up with existing intersections wherever possible. Where this is not possible, access points must be adequately spaced from both adjacent roads and access points to adjacent properties. The number of exit lanes, radii and vehicle storage should be appropriate to accommodate site generated traffic demands. The throat length at the access must be sufficiently long to minimize conflicts between site and through traffic on the road network.

Access points must be evaluated in terms of capacity, safety and adequacy of queue storage capacity. Access points should be free of all encumbrances and provide appropriate sight triangles. Proposed loading facilities and access to/from these facilities must be evaluated to ensure they are adequately designed so that they will not adversely affect traffic on City roads.

Access standards must be in accordance with those outlined in the Geometric Design Guide for Canadian Roads, most recent edition, issued by the Transportation Association of Canada (TAC).

3.9.2 Turn Lane Requirements

The TIS must examine the requirements for right and left turn lanes. Adequate spacing must be provided between access points to avoid potential turn lane overlaps. All design standards must be in accordance with those outlined in the TAC Manual.
The TIS must include a pavement marking and signage plan for the roadway(s) along the frontage of the development showing both existing and proposed traffic control devices.

### 3.9.3 Sight Distance Evaluation

At each access point and at each intersection where a new road is proposed, the sight distance requirements must be determined based on appropriate standards (TAC Manual). These must be compared with actual field measurements in the TIS to determine any areas of concern.

### 3.10 Improvement Alternatives to Mitigate Traffic Impacts

The physical and operations road network deficiencies identified in the TIS must be addressed and feasible solutions to mitigate these deficiencies identified. Functional design plans and detailed design drawings may be required for identified improvements to ensure their feasibility. An engineer’s cost estimate must be provided for all identified infrastructure improvements.

### 3.11 Recommendations

The final section of the TIS must present recommendations for improvements within appropriate time perspectives. Recommendations must be sensitive to the following issues:

- Timing of short term and longer range network improvements that are already planned and scheduled;
- Anticipated schedule for adjacent developments;
- Size and timing of individual phases of the proposed development;
- Logical sequencing of various improvements or segments;
- Right-of-way needs and availability of additional right-of-way within the appropriate time frames;
- Local priorities for transportation improvements and funding;
- Cost effectiveness of implementing improvements at a given stage of development; and
- Necessary lead time for additional design and construction.

The recommendations should also address the implementation sequence(s) and the preferred sequence, based on compatibility with the overall roadway system needed to provide for the safe and efficient movement of people and goods.
Appendix A
Traffic Impact Study Assumptions

A. Saturation Flow

The saturation flow rate is a measure of the rate at which vehicles may enter the intersection on a green phase. The Highway Capacity Manual (HCM) and Canadian Capacity Guide (CCG) methodologies vary in terms of their definition of saturation flow rates. The proponent/consultant must ensure that the factored saturation flow rates calculated by intersection analysis software package reasonably reflect the actual rates being obtained at the intersection.

Saturation flow rates may need to be modified to reflect downstream congestion/constraints. Field observations and surveys should be undertaken to determine appropriate assumptions under these circumstances.

<table>
<thead>
<tr>
<th>Movement</th>
<th>Saturation Flow Rate (veh/hr/lane)</th>
</tr>
</thead>
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<tr>
<td>Advanced Left</td>
<td>1750</td>
</tr>
<tr>
<td>Through</td>
<td>1800</td>
</tr>
<tr>
<td>Right</td>
<td>1550</td>
</tr>
</tbody>
</table>

B. Lost Time

Lost time occurs at the start of each green phase. The following values are for passenger vehicles. Variations from these assumptions should be supported by documented engineering studies. Where heavy vehicles comprise a significant proportion of the traffic flow, higher values should be applied.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Lost Time (sec)</th>
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</thead>
<tbody>
<tr>
<td>Advanced green</td>
<td>1.0</td>
</tr>
<tr>
<td>Back-to-back-lefts</td>
<td>1.0</td>
</tr>
<tr>
<td>Main phase</td>
<td>5.0</td>
</tr>
</tbody>
</table>
C. Lane Utilization

Where two or more exclusive lanes are provided on an approach for the same movement, an appropriate lane utilization assumption must be assumed. In the case of dual left turns, a lane utilization factor must be incorporated to account for this reduced capacity compared to that of two left turn lanes, i.e., generally the capacity of a dual left turn lane is not twice the capacity of a single left turn lane. This differential becomes more pronounced with increased presence of buses and other heavy vehicles.

D. Signal Timing Parameters

The applicant must contact the Region of Waterloo to confirm acceptable minimum and maximum cycle length, pedestrian and vehicular phase times; amber and all-red intervals times; and right-turn-on-red and inter-green movement assumptions to be used in capacity analyses.

E. Peak Hour Factors

The Peak Hour Factor (PHF) accounts for volume fluctuations within the one-hour analysis period, i.e. the peak 15-minute period, and generally ranges between 0.85 and 0.95. Actual PHFs should be assumed for all present day background intersection analyses. A PHF of 0.9 will be assumed for all proposed/future unsignalized and signalized intersections. Higher PHFs may be utilized if supported by defensible and documented surveys/data.

F. Pedestrian Walking Speeds

Analyses will utilize a pedestrian walking speed of 1.2 m/s, unless the proposed development is within 500 meters of an elementary school or a senior citizens residence or facility where a value of 1.0 m/s will be used.

G. Heavy Vehicle Factors

Heavy vehicle factors provide a conversion rate to equate trucks and buses to an equivalent number of passenger car units (PCU) within the traffic stream. An average factor of 2.0 PCUs should be assumed for trucks, buses and recreational vehicles. In situations where a high percentage of multi-unit or heavily loaded vehicles is measured or projected, a higher PCU factor should be used.

H. Critical Gaps

A critical gap represents the gap in main street traffic that a motorist on a side street is willing to accept to proceed across or into the main street traffic flow. Critical gap assumptions should reflect the most recent research provided in the Highway Capacity Manual published by the Transportation Research Board. Deviations from these values must be justified by engineering studies.
Cambridge and North Dumfries Hydro Inc.,
Residential Subdivisions
Materials and Construction Specification
2006
# RESIDENTIAL SUBDIVISIONS

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1.1 **Purpose**

This specification prescribes the general requirements for the installation of an underground electrical distribution and street lighting system within a residential subdivision. It is the Developer's and its contractor's responsibility to familiarize themselves with these specifications.

Cambridge and North Dumfries Hydro Inc. (CNDHI) reserves the right to refuse to energize any part of the electrical plant which does not conform to these specifications. CNDHI assumes no responsibility whatsoever for the cost of repairs, relocating, or delays in energizing the system incurred as a result of disregarding these specifications.

1.2 **Provincial Statutes and Municipal By-Laws**

All work is to be done in accordance with Electrical Safety Authority Ontario Regulation 22/04 – Electrical Distribution Safety.

The latest edition of the Ontario Electrical Safety Code is also applicable where required (ie. street lighting installations). The Developer and its agents are to familiarize themselves with, and abide by, all relevant Provincial Statutes and Municipal By-Laws. Such relevant regulations include in part, the Occupational Health and Safety Act and Regulations for Construction Projects. Also applicable are City of Cambridge, Township of North Dumfries and Regional Municipality of Waterloo By-Laws including but not limited to regulating entry upon road allowances, and traffic control. Developers must comply with CNDHI’s clearance requirements to ensure adequate separation to CNDHI’s hydro facilities. Developers must also plant trees in accordance with CNDHI’s clearance requirements.

1.3 **Scope of Work**

CNDHI, as indicated in the Development Agreement, will give assistance to the Developer by performing several tasks on its behalf. Also, the Developer and its agents shall be responsible for other necessary tasks as specified in this agreement.

Specific task assignments are summarized below.
1.3 Scope of Work (cont.)

1.3.1 CNDHI Responsibilities:

a) Design of Electrical Plant and Street Lighting System
b) Co-ordinate design and approvals with Bell Canada, Rogers Cable T.V., City of Cambridge, Township of North Dumfries, Regional Municipality of Waterloo, and Union Gas as required.
c) Supply and install easement marking posts as required.
d) Supply and install all materials required to complete terminations, both low and high voltage.
e) Supply and install service cable, from lot line to meter base, including trenching and backfilling.
f) Inspect, test, and energize all electrical plant.

1.3.2 Developer Responsibilities:

a) Supply required drawings (either via e-mail or on diskette/CD) to CNDHI.
b) Purchase and install cables, ground rods, enclosures, underground vaults, ducts, transformers, multiplex junction units, switches, marking discs, meter bases, other equipment, and accessories as per these specifications.
c) Provide copy of purchase order for transformers to the Engineering Department of CNDHI at time of order placement.
d) Arrange for delivery of transformers to CNDHI premises at 1500 Bishop Street in Cambridge.
e) Forward transformer certified test results upon equipment delivery and prior to equipment delivery to site.
f) Load and transport transformers from Bishop Street to site for installation.
g) Forward copies of certified primary and secondary cable test results from manufacturer to CNDHI prior to cable installation.

1.4 Procedure

For developer installed residential subdivisions, a general procedure has been adopted. This procedure specifies the sequence of events that occurs for new subdivision construction within the boundaries of the City of Cambridge and the Township of North Dumfries:
1.4 Procedure (cont.)

a) Developer submits required drawings to CNDHI with covering letter indicating electrical loading, development staging, and tentative construction schedule. An on-street parking plan shall be submitted if one is available. For semi-detached or twin lots, developer shall indicate whether driveways are to be located in the center of the lot or at the sides. For condominium/row housing developments, developer shall number each unit and indicate whether the heating is electric or non-electric.

b) Developer is to provide CNDHI with roadway classification as per I.E.S. RP-8-00 guide for the design of Roadway Lighting from the governing roadway authority (City of Cambridge, Township of North Dumfries, Region of Waterloo) e.g. Road Class - major, collector, local, etc., Area Class - commercial, intermediate, residential.

c) CNDHI carries out design of electrical distribution and street lighting systems.

d) CNDHI prepares cost estimates.

e) CNDHI forwards drawings and/or notification to the utilities and communication companies operating in CNDHI’s service area.

f) CNDHI forwards drawings to City of Cambridge, Township of North Dumfries and Regional Municipality of Waterloo for approval of location of electrical plant.

g) CNDHI forwards drawings to the Developer and/or its engineering firm for comments.

h) CNDHI receives Municipal approvals, forwards design drawing(s), cost estimates and easement requirements to Developer. The design drawings are to be reviewed by the Developer and its contractor. Any discrepancies or items needing clarification are to be discussed with the CNDHI Representative responsible for the project. One approved copy of the design drawing(s) must be returned to CNDHI prior to commencement of construction.

i) CNDHI prepares and forwards to Developer three copies of the Development Agreement. Developer may make additional copies if required.

j) CNDHI receives signed copies of Development Agreement and required financing from Developer. CNDHI executes copies of agreement.

k) Developer requests CNDHI approval of contractor(s), has site graded to within 150mm (6”) of final grade and notifies CNDHI of tentative construction schedule.
1.4 Procedure (cont.)

l) Developer installs electrical plant in accordance with approved drawings bearing the stamp "FOR CONSTRUCTION" with the ESA Certificate of Approval (Design) signed and dated by a Professional Engineer. CNDHI inspects work in progress. No backfilling or concrete encasement shall take place prior to inspection by the CNDHI representative.

m) Developer submits to CNDHI a grade sheet showing the actual final elevation of the top of all equipment enclosures, the proposed finished grade beside all equipment enclosures and the difference between these grades. A drawing showing the as-constructed location of any equipment installed on an easement shall also be submitted. Grades and location shall be checked and confirmed by the Developer’s engineering firm immediately after the contractor has installed the enclosure(s). This ensures that any corrections to enclosure elevation can be made prior to placement of ducts and installation of cables.

n) CNDHI inspects and approves Electrical Plant for energization. An ESA Record of Inspection and an ESA Certificate shall be signed and dated by a qualified CNDHI representative prior to energization.

o) Electrical plant is energized. Guarantee period of one year commences upon issuance of a defect free Final Inspection Report. Letter of Credit may be reduced to 10% of estimated value of installed Electrical Plant upon receipt of:

i) A Statutory Declaration stating that all amounts relative to the installation of the Electrical Plant have been paid in full;

ii) Evidence, to the satisfaction of CNDHI, that there are no outstanding claims pursuant to the Construction Lien Act (Ontario);

iii) A breakdown of actual costs for the installation of the Electrical Plant.

iv) A certificate indicating the location and elevation of equipment enclosures.

p) The Letter of Credit may be reduced to zero after Notice of Final Acceptance of the Electrical Plant has been issued to the Developer by CNDHI, after expiration of the Guarantee period and after any deficiencies have been corrected to the satisfaction of the CNDHI inspector.

1.5 Plan of Subdivision

The Developer shall submit to CNDHI all required drawings in AutoCAD " .DWG " or " .DXF " format on a 3.5" diskette, compact disc or via e-mail.

Semi-detached lots shall be identified by underlining the lot number. A north indicator shall be shown near the top right corner. The plan shall be laid out to conform with Drawing UGS-00A included in this specification, when possible. Property lines and lot
numbers are to be placed on one layer, while sidewalks, curbs, parking areas, underground services, etc. are to be placed on one or more different layers.

1.6 Plan of Multiple Unit Developments

The Developer shall submit to CNDHI all required drawings in AutoCAD "*.DWG" or "*.DXF" format on a 3.5" diskette, compact disc or via e-mail.

A north indicator shall be shown near the top right corner. Property lines, buildings, parking areas, sidewalks, etc. are to be placed on one layer, while underground services, grades, etc. are to be placed on one or more different layers.

1.7 Registration Plans

The Developer shall forward to CNDHI two prints of the Registered Plan of Subdivision and/or two prints of the Reference Plan showing the subdivision.

1.8 Civil Engineering Plans

The Developer shall forward to CNDHI one set of prints of the approved Civil Engineering Plans (including grading plans) and one copy of any subsequent revisions to the approved plans.

1.9 Tree Saving Plan

The Developer shall forward to the CNDHI a copy of the tree saving plan for the development so that trees being preserved are taken into account in the hydro design.

1.10 Ontario Energy Board (OEB) – Connections and Expansions

1.10.1 Economic Evaluation Formula

CNDHI is regulated by the OEB. OEB regulations apply to all subdivision agreements dated November 1, 2000 or later.

Refer to the CNDHI Economic Evaluation Policy (latest edition) for more information about charges or rebates. This policy is updated regularly to reflect current cost and rate projections.

1.10.2 Alternate Bids

Section 3.3 of the Distribution System Code permits a developer to complete work that has normally been completed by the electric utility. (i.e. high voltage and streetlight terminations in new equipment.) Two conditions must be satisfied for the above clause to apply:
1. The project requires a capital contribution by the Developer – This is a requirement for all new subdivisions.
2. The construction work must not involve existing utility plant – This is true for most work carried out in a new subdivision except for connections to existing lines/equipment.

For work meeting the above criteria the developer may choose to use a contractor that is approved by CNDHI. A list of approved and qualified electrical contractors is included in Appendix ‘C’ – Qualified Electrical Contractors.

If a developer wishes to use a contractor that is not on the approved list, the proposed contractor shall contact the CNDHI Purchasing Supervisor who will provide information on the required submittals that must be provided in order to be considered for approval. The developer is encouraged to provide as much time as possible for the pre-approval process.

Where a developer uses an approved contractor for the work noted in this section, the developer shall select, hire, and pay the contractor for this work and assume full responsibility for the quality of this work.

A CNDHI representative shall inspect and approve all termination work prior to the connection of the new equipment to the existing utility power distribution system. The developer shall pay all costs associated with the additional inspection and approval by the CNDHI representative.

1.11 Electrical Safety Authority (ESA) Streetlighting System Compliance Requirements

In accordance with ESA Bulletin 30-9-1 dated April, 2002, all streetlighting systems designed or tendered after January 1, 2003 shall meet the requirements of the Electrical Safety Code. Material and installation requirements are provided in standard drawings SLS-003 and SLS-004.
For all new installations, a permit shall be obtained by the Developer or its Contractor and all associated fees shall be paid.

Details on the new processes and regulations can be found at:
http://esainspection.net/pdf/30_9_1.pdf

Application forms can be found at:
http://esainspection.net/pdf/ICIA%20Application%206.2.pdf

A sample street light application can be found at:
http://esainspection.net/pdf/Streetlights%20Sample%20Application.pdf

The fee schedule can be found at:
http://esainspection.net/pdf/Inspection%20Fees%20For%20New%20Installations.pdf

Concrete street light pole drawings provide for service entrance switch mounting requirements and larger handholes to accommodate individual light fusing.

Consult the CNDHI Engineering Department for further information.
TREE MANAGEMENT POLICIES AND GUIDELINES FOR NEW DEVELOPMENTS

(April, 1999 – Revised February, 2002)
EXECUTIVE SUMMARY

Urban development is preceded by site clearing and grading which results in removal of trees and vegetation from the urban forest. Through the use of Tree Management Policies and Guidelines for New Developments, the City of Cambridge aims to reduce the amount of removal of vegetative cover that occurs during development. This is done by requiring that developers of subdivisions and site plans consider opportunities to maintain and enhance on-site vegetation in conjunction with site development. A three phase approach to tree management during development is outlined, with the use of security deposits to ensure planned approaches are undertaken.
# TREE MANAGEMENT POLICIES AND GUIDELINES FOR NEW DEVELOPMENTS

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1. **TREE MANAGEMENT PLAN POLICY**

It is the policy of Cambridge Council that, where warranted by the presence of existing trees and other vegetative cover, proponents of draft plans of subdivision, consents and site plans are required to complete a General Vegetation Inventory and Analysis as part of the development application. This will ensure that areas of significant vegetation in development proposals are identified and accurately located in the early stages of the planning and design process. In order to identify and effectively manage vegetation communities throughout the planning process, the following system of data collection and analysis will be utilized.

- General Vegetation Inventory and Analysis - required for all lots and blocks within a subdivision
- Detailed Vegetation Management Plan - only required for lots or blocks containing existing vegetation that requires further study as defined in the General Vegetation Inventory and Analysis.
- Tree Preservation/Compensation Plan - only required for lots on which the developer/builder requests to build a structure that is to be located deeper on the lot than that approved on the Detailed Vegetation Management Plan and/or the revised grading will have an adverse effect on the Detailed Vegetation Management Plan where it has identified that there are trees to be retained.

2. **TREE MANAGEMENT PLAN GUIDELINES**

2.1 **General Approach to Tree Management**

The owner/developer will employ a recognized professional in tree management who will assess and evaluate vegetation on a proposed development site prior to designing the draft plan of subdivision or site plan. The evaluation will consist of an inventory and map of existing trees, shrubs and other vegetation. The initial evaluation will assess the site vegetation as it relates to its condition, health and susceptibility to development impacts, aesthetics, contribution to ecosystem, contribution to wildlife diversity, birds, and stormwater management, etc. This evaluation will result in a tree management plan that optimizes existing quality vegetation. Overlay of the proposed development will:

i) Identify what measures will be taken when designing grading, road pattern layout, lot layout, building location, etc. to maximize tree saving potential.

ii) Provide a clear outline of how tree management relates to the engineering drawings for servicing, grading, drainage and stormwater management. In locations that necessitate total clear cutting, there will be an assessment to determine if there is a potential to transplant trees. Compensation plantings will be incorporated into lot street frontages, parks and stormwater management areas.

iii) Identify opportunities where there could be/should be tree management with fairly major measures (i.e. revisions to draft plan, retaining walls, site plan review, defined building envelopes, changes to grading plans, tree wells, modifications to building designs. etc.).
iv) Identify opportunities where there could be/should be tree management with minor measures and reasonable care (i.e. careful grading, fencing of driplines, signage, identification tags, letters of credit, monitoring and reporting regularly during construction).

v) Identify opportunities to restore some of the integrity of the trees or woodlot (i.e. pruning, treatment of diseased trees, woodlot improvements, transplanting, replanting, enhanced planting and landscaping, etc.).

To summarize, the implementation of these Tree Management Policies and Guidelines for New Developments will ensure that tree management for new developments will be optimized. Providing standards through the Tree Management Policies and Guidelines for New Developments ensures that plans and reports submitted by the owner/developer are more uniform; the approval process is more efficient; and the responsibilities of those involved are formally addressed.

2.2 General Vegetation Inventory And Analysis

2.2.1 Overview

The General Vegetation Inventory and Analysis shall be included as part of the formal submission of a draft plan of a subdivision or site plan to the City of Cambridge. It will be submitted to the Planning Services Department and in turn forwarded to the Community Services Department and approved by the Forestry Technician in conjunction with appropriate Departments (i.e. Planning Services). Upon review, a decision will be made if there is a requirement for a Detailed Vegetation Management Plan and further involvement of the Forestry Technician in development plan review.

This report will contain an inventory, documentation and analysis of vegetation, site topography, soils and drainage and any other significant natural and physical features present on the site. This inventory will provide a general overview evaluation of the area proposed for development and the relationship of natural features with surrounding natural areas.

The analysis is to be conducted based on an environmental appreciation of the above features. It will identify and provide reasons for vegetation units which require or do not require further data analysis and a detailed vegetation management plan. Based on the analysis prepared by the recognized professional in tree management, areas of quality vegetation will be incorporated into tree management areas. This will optimize the retention of high quality vegetation.

2.2.2 Requirements For Submission

The following information is required for the General Vegetation and Analysis. Some items may not be pertinent to a particular project, while other projects may require additional information. The Cambridge Natural Areas Inventory as well as watershed studies, where they have been completed, may provide some of the required inventory information.
2.2.2.1 Assessment/Inventory Form

Biological characteristics for each vegetation unit indicating:

- vegetation type (eg. hedgerow, deciduous forest, marsh, etc.)
- species association or plant community
- number of trees (relative species abundance)
- canopy closure (percentage)
- dominant tree species
- rare or unusual tree species, including those with heritage value
- tree condition rating (biological health and structural condition)
- sensitivity to disturbance
- diameter at breast height (D.B.H.) measured averages
- location number on map

2.2.2.2 Mapping

The recognized professional in tree management will ensure that an appropriate scale (generally 1:500) is utilized to properly convey all the required information on submissions. Site boundaries are to be outlined on all maps and shall include features intersecting or outside the development area that may affect the site vegetation or the adjacent site vegetation. In some instances air photos may also be required for submission.

Map 1: Vegetation Units

- illustrate the vegetation units defined through resolution and analysis of functional associations in the subject environment
- vegetation units accurately located relative to the property boundaries
- dripline/bushline locations and elevations that define the edge of a vegetation unit accurately located relative to the property boundaries

Map 2: Physical Features

- topography and slope located accurately relative to the property boundaries
- existing drainage patterns
- surface water
- ground water discharge areas
- soil type and location

2.2.2.3 Analysis

The analysis is to be prepared by the recognized professional in tree management and is to contain the following:

- priority areas for tree management
- opportunities/benefit of priority areas
- potential problems
- rare or unusual trees, including those with heritage value
- contribution to local biodiversity
• vital physical requirements of the vegetation units
• recommendations regarding future layout/grading of the draft plan of subdivision or site plan

NOTE: High quality vegetation units are best preserved as part of large blocks either private or public (i.e. multiple unit dwelling block, park block, edge of stormwater management block, etc.). Also, consideration should be given to relocating existing trees on-site to perpetuate the local seed source.

The analysis will provide valid rationale for:

• vegetation units not requiring further data collection and analysis
• vegetation units requiring further data collection and analysis in the detailed vegetation management plan

2.3 Detailed Vegetation Management Plan

2.3.1 Overview

The Detailed Vegetation Management Plan will be submitted in conjunction with stormwater management, grading and servicing plans as a condition of draft approval. The Detailed Vegetation Management Plan is to be undertaken for only those lots and/or blocks requiring it, as identified in the previously described General Vegetation Inventory and Analysis. If pre-grading is requested, the Detailed Vegetation Management Plan must be approved prior to issuance of the grading permit. If tree management will affect final design, the Detailed Vegetation Management Plan may be required prior to draft approval.

While the General Vegetation Inventory and Analysis identifies vegetation units worthy of preservation, the Detailed Vegetation Management Plan identifies exactly which trees will be preserved and what protection and tree maintenance measures will be implemented to ensure their survival. The Detailed Vegetation Management Plan requires an assessment on an individual tree basis. The quality of individual trees within a vegetation unit is determined based upon criteria reflecting vigour, aesthetics, and ability to survive construction impacts. With this information, decisions about the status of the trees can be made. Detailed information at this time will allow for a comparison of the pre-construction and post-construction situation and will be beneficial when assessing the tree damage and future compensation requirements.

A map accurately defining the location of the new woodlot driplines and appropriate recommendations to either retain, remove, or transplant for each individual tree or groups of trees is required. This will be accompanied by an analysis which outlines the necessary protection and tree maintenance measures required.
2.3.2 Requirements For Submission

The detailed inventory is to consist of all trees having a minimum D.B.H. of 10 cm in residual areas that may be potentially affected by site clearing, grading or any other construction operation. This will include, but is not limited to trees within 15 m of any newly proposed woodlot edge; trees occurring on lots or blocks as individual specimens; hedgerows; or small groups of trees. Rare or unusual trees must also be identified.

All such trees are to be tagged using proper forestry tags as a means of identification in the field and be accurately located and assessed to determine:

- potential impacts that the proposed development layout, stormwater management systems, grading and servicing will have on the remaining vegetation
- the need for suitable protection measures
- possible preservation techniques to enhance the condition of residual trees

The following information is generally required for the Detailed Vegetation Management Plan (some items may not be pertinent to a particular project, or other projects may require additional information).

1. Tree Data Sheet

Biological data for each tree greater than or equal to 10 cm D.B.H. is to be structured in an organized chart form (using Appendix A). This form shall include the consultant’s name, address, telephone number, and date of inventory, as well as the following:

- tree tag number
- location (lot or block number)
- tree species
- diameter at breast height (D.B.H.)
- tree condition (vigour)
  - good, dead branches less than 10%, signs of good compartmentalization on any wounds, no structural defects;
  - fair - 10 - 30% dead branches, size or occurrence of wounds presents some concerns, minor structural defects
  - poor - more than 30% dead branches, weak compartmentalization, early leaf drop, presence of insects/disease, major structural defects
  - dead - tree exhibits no signs of life
- proposed action (remain, relocate, remove)
- reasons for removal/relocation if proposed
2. **Mapping**

An appropriate scale is to be utilized which properly conveys all of the required information. It should be at a scale of approximately 1:500. The following information is required to be included:

- accurate location and ground level elevation of all trees (10 cm D.B.H. or greater) and their dripline surveyed relative to property boundaries
- symbolized recommendations for each individual tree (i.e. retain, remove)
- proposed lot locations, street pattern, building envelopes, driveway locations and building types
- location of all services (type, width and depth of trench)
- grading information (i.e. existing and proposed grades; cut and fill areas/limits; potential disruption of water and surface drainage)
- location, size, and depth of stormwater management facilities including pumping stations and access roads
- accurate location of all new woodlot edges and location and species of recommended plantings (if required) or transplantings
- symbolized recommendations of trees to be transplanted and their proposed new location
- location and nature of recommended tree protection measures

3. **Analytical Report** (may be incorporated on mapping if appropriate)

The analytical report is to contain but is not limited to the following:

- conclusion of inventory and analysis including summary of the anticipated grading and construction impacts
- identification of any trees or stands of trees that are of significance to the local community and should be preserved for this reason (e.g. local landmarks, visual screens, heritage trees, etc.)
- description of protective measures:
  - construction details - fencing, signage
  - erosion control
  - pre-construction, during construction and post-construction recommendations to increase the likelihood of tree survival
  - tree transplants and enhancements plans - i.e. timing, locations, moving procedures and maintenance program

The analytical report will provide sound rationale for the removal of every individual tree.

2.3.3 **Verification of Protection Measures**

Written verification from the recognized professional in tree management that all of the recommended tree protection measures have been installed in accordance with the Detailed Vegetation Management Plan as approved by the City of Cambridge, Community Services Department. This letter of verification is to be submitted prior to any rough grading.
Owners/developers shall be required on an ongoing basis to undertake measures to prevent damage to existing site vegetation that has been designated for retention. These measures may take place prior, during or following the physical development of the subdivision or site plan and may include, but are not limited to:

- selective removal of trees that are in poor condition and may pose safety concerns along with the new proposed edge of a woodlot;
- planting of trees to create/protect a new woodlot edge;
- the installation of temporary protective barriers prior to the stripping of topsoil, grading, or any other construction activity on the site. This fencing will provide adequate protection of the trees to be retained (minimum 1 m beyond the dripline of the tree). The fencing will be monitored regularly and will be kept in good repair and remain in place until all construction work is completed. The standard will be Paige Wire Farm Fencing. Snow fencing is not acceptable;
- areas delineated and protected by the temporary protection barrier shall remain undisturbed and shall not be used for temporary storage, placement or excavation of fill or top soil, the storage of construction materials or equipment, the storage of debris;
- information signs shall be posted on fences of protected areas at a maximum 45 m intervals; an example of concept signage is included in this report as Appendix B;
- where the root system of the trees to be retained are exposed or damaged by grading or other construction activity, they shall be pruned in accordance with proper arboriculture techniques (such as standard horticulture practices set out by Landscape Ontario) and the areas surrounding the root system shall be backfilled with native material immediately after damage occurs to prevent drying die back;
- construction contaminants such as fuels, oils, etc. shall be kept clear of tree preservation areas; note that the feeder root system of a tree often extends well beyond the dripline of the tree (outside the protected area); and
- the existing grades within the tree retention areas shall not be disturbed; if it is necessary to change the grades around tree retention areas the developer may be required to undertake preservation techniques such as dry welling and root feeding; all filling and grading that is approved within a tree retention area will be undertaken manually.

2.3.4 Tree Maintenance Reporting

The recognized professional in tree management shall be on site with a copy of the approved Detailed Vegetation Management Plan during critical stages of grading and construction to ensure strict adherence to the recommendations of the plan. During this timeframe, weekly inspection sheets pertaining to tree removals/maintenance, grading adjacent to protective areas (i.e. problems identified, progression, successes) should be forwarded to the Community Services Department, Forestry Technician for review.

This Post-Grading Tree Maintenance Report is to be prepared by the recognized professional in tree management and is intended to document compliance with the tree protection measures as described in the approved Detailed Vegetation Management Plan. The timing of the Post-Grading Tree Maintenance Report is to coincide with the implementation of all tree protection measures and the completion of the initial site grading. All of the needs of the retained trees will be assessed immediately and the Post-Grading Tree Maintenance Report detailing all recommended tree maintenance measures shall be submitted to and approved by the Community Services Department, Forestry Technician.
The following information will generally be required in the Post-Grading Tree Maintenance Report:

- assess damage to trees that are to be retained caused by initial site grading and clearing
- identify and provide a dollar value of trees that were to be retained but have been inadvertently damaged or removed
- utilizing this dollar value of trees inadvertently damaged or removed, propose a compensation/enhancement plan indicating replacement trees of equal or greater dollar value and proposed tree planting locations for the rehabilitation of the disturbed areas
- identify areas designated for removal or where removals have not been conducted
- recommend additional trees to be removed or transplanted
- recommend scheduled preservation methods such as: pruning (crown and root); fertilization/watering; welling; and structural surgery.

Release of the tree management security deposit for the subdivision may be delayed until such time as these recommendations and requirements have been satisfied and detailed in the final Tree Maintenance Report.

2.4 Tree Preservation/Compensation Plan

2.4.1 Overview

A Tree Preservation/Compensation Plan will only be required for lots on which the developer/builder requests to build a structure that is deeper on the lot than that approved on the Detailed Vegetation Plan and/or revised grading will have an adverse effect on the Detailed Vegetation Plan where the Detailed Vegetation Plan has identified that there are trees to be retained.

2.4.2 Requirements for Submission

The following information is generally required for the Tree Preservation/Compensation Plan:

- the tree dimensions and bearings of the property;
- the locations, dimensions and set backs of all proposed buildings and structures;
- the location of paving and driveway areas;
- walkway locations;
- existing and proposed grades;
- cut and fill areas;
- indication of ground water and surface drainage (existing and proposed);
- location and type of services and utilities;
- location of proposed stock piles of top soil and backfill material;
- work zone requirements;
- location of isolated trees or single species clusters showing driplines and the species size, condition and sensitivity of tree to development is to be noted;
- location of woodland areas showing:
  - location of tree or trees to be removed for selective thinning
    (these are to be marked in the field)
- location of new woodlot edges (marked in the field)
- edge driplines and new plantings if required
- an outline of tree protection measures including:
  - construction details and location of fencing
  - erosion control measures
  - pre-stressing of trees
- name, address and telephone number of:
  - developer
  - builder
  - consultant who provided tree data and recommendations.

3. SECURITY DEPOSITS

A security deposit in the form cash or acceptable letter of credit to a maximum of $50,000.00 will be required for the Detailed Vegetation Management Plan on lots or blocks that are to come into public ownership. The value of the trees to be retained through the Detailed Vegetation Management Plan will be determined through consultation with the Forestry Technician. Factors used in the valuation include: quality of trees, quantity of trees, potential risk to trees and species. It will be collected through the subdivision agreement. Seventy-five percent of the deposit will be released upon certification by the consultant who prepared the Detailed Vegetation Management Plan that it has been implemented as shown. If trees have been removed or irreparably damaged during the construction process, the owner/developer must replace them to the satisfaction of the Forestry Technician, or the deposit fee or portion thereof will not be refunded. Twenty-five percent of the deposit will be held back for a three year maintenance period. The amount returned at the end of three years may be reduced based on survival of the trees to be retained.

For private lots and blocks, the security for vegetation management will be included in the lot grading deposit (currently $1000 per lot or $4000 per acre on a block). Ninety percent of the deposit is released when the lot grading certificate is submitted. Ten percent of the deposit is held back for a one year maintenance period. The amount returned at the end of one year may be reduced based on survival of the trees to be retained. For site plans, vegetation management will be included in the $50,000 (maximum) for all site works.

By entering into the Subdivision Agreement, the subdivider will be responsible for providing builders with the information contained in the approved Detailed Vegetation Management Plan. However, it is recognized that information may have to be supplemented by the building permit applicant where necessary, and such applicant will be responsible for consolidating all information to reflect a specific site development. It is also recognized that Planning and Community Services staff may have to be somewhat flexible when reviewing specific building designs and preference of the builders and home purchasers. However, the basic intent of the approved Detailed Vegetation Management Plan must be maintained in every instance.
4. **APPROVAL PROCESS**

The recognized professional in tree management should contact the City of Cambridge, Community Services Department and the Planning Services Department, prior to undertaking vegetation assessments. City staff will help to clarify what is required and the information that is already available, thereby reducing the possibility of delays or unnecessary expenses. Contact with other government agencies such as the Ministry of Natural Resources and the Grand River Conservation Authority may also be appropriate. It is noted that Environmentally Sensitive Policy Areas are governed through the Regional Official Policies Plan. Any development proposed within or contiguous to those areas will be subject to special policies, procedures and approvals as required by the Regional Municipality of Waterloo and the City of Cambridge. The Cambridge Official Plan identifies Locally Significant Natural Areas which are also subject to special policies, procedures and approvals as required by the City of Cambridge.

Should the applicant not submit the General Vegetation Inventory and Analysis in conjunction with the draft plan of subdivision or site plan, a recommendation will be submitted to the Planning and Development Committee that the application be deferred until such time as the requirement is satisfied. The Community Services Department and the Planning Services Department will make resources available to undertake the following tasks related to subdivision development:

- provide examples of similar studies
- provide technical assistance as appropriate
- arrange meetings with other agencies or groups
- review the draft version of the assessments

Six (6) copies of the General Vegetation Inventory and Analysis should be submitted to the Planning Services Department, Planning Operations Division, for review. A reasonable amount of time is permitted for review and comments of the documents. The applicant is encouraged to participate in this review process. For example: a site visit with the applicant, recognized professional in tree management and City of Cambridge staff is usually appropriate during this period. The comments of any reviewing departments are copied and provided to the recognized professional tree management through the City’s Planning Services Staff. The recognized professional in tree management will be advised of any changes to the proposed plan of subdivision or site plan that will be recommended, as well as draft conditions that will be included in the reports submitted to the Planning and Development Committee.

As a condition of draft approval of the plan of subdivision or site plan approval, the Detailed Vegetation Management Plan is required to be submitted to the Planning Services Department to be distributed to and approved by the Community Services Department, Forestry Technician, Forestry Division, prior to any grading, site servicing or construction on the property. Again, six (6) copies are required for submission. Once approved, the tree management areas should be identified on all the grading plans and servicing drawings to ensure co-ordination between tree management and site development. The subdivision agreement or development agreement will require the approved Detailed Vegetation Management Plan to be implemented. Securities will be required to be deposited in this regard. Prior to any grading, site servicing or construction on the property, a verification of protection letter is to be received by the Community Services Department, Forestry Technician. This will ensure on-site compliance with the recommendations contained within the Detailed Vegetation Management Plan. If pre-grading approval is requested, the securities will be required at that time. The owner/developer is responsible for engaging a recognized professional in tree management to monitor construction and provide timely reports to ensure that all tree management areas are properly defined and protected.
Joint inspections between a representative of the Community Services Department, the recognized professional in tree management and the excavation consultant should be held:

- prior to any stripping of top soil, grading or any other construction activity;
- prior to construction commencing near tree management areas with the location of the temporary protective barrier approved;
- prior to rough grading of any lots/blocks that contain trees to be retained; and
- prior to assumption of the plan of subdivision.

At this time, consultation and site inspections with representatives from other Departments such as the Transportation and Public Works Department may be appropriate. Prior to release of the tree management security deposit, the final Tree Maintenance Report is to be completed by the recognized professional in tree management to determine any necessary remedial action to be undertaken by the owner/developer. The above process outlined in this section is summarized by a flow chart included as Appendix C.

5. CONCLUSION

The Tree Management Policies and Guidelines for New Developments will be a benefit to both the City of Cambridge and the development industry, however, some constraints must be recognized. These constraints include:

- some trees by reason of their species or health may not warrant protection;
- tree management cannot be regarded as an isolated entity and in some instances other necessary design considerations may take precedence; and
- the long term success of tree management strategies on privately held lands within a development will be dependent on the education and co-operation of future property owners.

Due to the fact that trees are living entities, there can be no guarantee of their sustained viability. However, serious, thoughtful, careful tree preservation efforts will greatly enhance the tree’s survivability prospects in a development situation. Whether or not trees should be preserved does not seem to be an issue, and most developers realize the benefits of having developments with mature trees. The challenge is to identify and ensure that quality vegetation is being preserved without causing undue hardship to the developer, builder, the City of Cambridge and ultimately the homeowner.
APPENDICES
### TREE DATA SHEET

TREE #S ARE REFERENCED TO #S ON LOT DEVELOPMENT PLAN

<table>
<thead>
<tr>
<th>TREE #</th>
<th>SPECIES (botanical name)</th>
<th>CALIPER (D.B.H.) (cm)</th>
<th>TREE CONDITION</th>
<th>ACTION</th>
<th>IF REMOVED - REASONS</th>
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<tbody>
<tr>
<td>1.</td>
<td>SUGAR MAPLE (Acer saccharum)</td>
<td>25.0</td>
<td>GOOD</td>
<td>REMAIN</td>
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<td>2.</td>
<td>BEECH (Fagus grandifolia)</td>
<td>25.0</td>
<td>FAIR</td>
<td>REMAIN</td>
<td></td>
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<tr>
<td>3.</td>
<td>SUGAR MAPLE (Acer Saccharum)</td>
<td>15.0</td>
<td>GOOD</td>
<td>RELOCATE</td>
<td>TO BE RELOCATED CONFLICT WITH BLDG.</td>
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<td>4.</td>
<td>CHERRY (Prunus serotina)</td>
<td>35.0</td>
<td>POOR</td>
<td>REMOVE</td>
<td>CONFLICT WITH BLDG.</td>
</tr>
<tr>
<td>5.</td>
<td>WHITE ASH (Fraxinus americana)</td>
<td>25.0</td>
<td>FAIR</td>
<td>REMOVE</td>
<td>CONFLICT WITH BLDG.</td>
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<tr>
<td>6.</td>
<td>BEECH (Fagus grandifolia)</td>
<td>45.0</td>
<td>FAIR</td>
<td>REMAIN</td>
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<td>7.</td>
<td>MIXED BUSH (see additional data sheet for species mix)</td>
<td>2.0-5.0</td>
<td>POOR - GOOD</td>
<td>REMAIN</td>
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CONSULTANT:  
ADDRESS:  
TELEPHONE #:  
FAX #:  
DATE OF INVENTORY:  
SIGNATURE:  

The Corporation of the City of Cambridge
CONCEPT SIGNAGE

TREE PRESERVATION AREA

NO

DUMPING
STORAGE OF MATERIALS
TREE REMOVAL
DISTURBANCE OF ANY KIND

BEYOND THIS POINT

DEVELOPERS NAME

DEVELOPERS TELEPHONE NUMBER

CONSULTANTS NAME

CONSULTANTS TELEPHONE NUMBER

CITY CONTACT NAME

CITY CONTACT TELEPHONE NUMBER

MOUNTED ON GATOR BOARD
MINIMUM SIZE 11" x 17"

SIGN TO BE PLACED 45M O.C. ALONG FENCE
SECURED WITH OUTDOOR PLASTIC LOCKING TIE-WRAPs
Appendix C: Tree Management Plan Subdivision Planning Process & Requirements

Pre-consultation meeting with Subdivision Co-ordinating Committee - which indicates studies required, issues to be addressed and timing.

Other Preconsultation Studies: ie. Stormwater Mgmt. Concept Site Visits

General Vegetation Inventory & Analysis: Tree inventory, analyze, managerial concept. Consultant to contact Forestry Technician on requirements and submit 6 copies to Planning Services Department to be stamped and signed when approved.

Additional Related Studies and Site Inspections: Consultations and site visit with Forestry Technician.

Developer submits Draft Plan Application and Studies

CSD Review and Comments: including review of and approvals of General Vegetation Inventory & Analysis

Review of Draft Plan Submission:
- Public Meetings
- Agencies
- Municipal Departments

Other Agency & Dept. Review ie. Engineering, Planning, Region

Revisions if necessary

Recommendations for Draft Approval to Planning & Development Committee and Council

Draft Approval of Plan with conditions by City and Region

Details resolved per conditions of Draft Plan Approval including submissions by Developer

Detailed Vegetation Management Plan:
To be submitted and approved (6 copies) by Forestry Technician (stamped & signed).

Detailed Grading, Drainage Storm Water Management to be submitted with Detailed Vegetation Management Plan.

Notification of installation of tree saving measures and verification of tree protection followed by written authorization from Forestry Technician to proceed with pre-grading per approved Detailed Vegetation Management Plan

Subdivision Agreement including security deposit or pre-grading approval with security deposit

Registration of Plan

Post-Grading Tree Maintenance Report

Tree Preservation/Compensation Plans where required

Building Permits

Final Release
Final Tree Maintenance Report or Lot Grading Certificate prior to final inspection and release of security deposits
STANDARD TREE MANAGEMENT CLAUSE FOR SUBDIVISION AGREEMENT

That in consideration of the wooded character of the subdivision lands and the City’s desire to minimize the impact of development on treed areas worth retaining, the Owner agrees to comply with the following process in the development of the subdivision in accordance with the City’s approved Tree Management Policies and Guidelines for New Developments.

a) That a security deposit fee in the amount of $___________ (maximum $50,000.00) be deposited with the City of Cambridge to ensure implementation of the approved Detailed Vegetation Management Plan on lands to come into public ownership.

b) That no area/rough grading shall occur on the lands until such time as all approved measures for protection of isolated trees, tree clusters and woodlands affected by such grading have been satisfactorily implemented, and the City has inspected these measures, or received written verification of same.

c) The Owner is to implement and be responsible for providing all information contained in the approved Detailed Vegetation Management Plan to all heirs, executors, administrators, successors and assigns in order to ensure the requirements outlined in said plan are carried out as specified.

d) A Tree Preservation/Compensation Plan will be required for those lots or blocks, prior to applying for or having issued any building permits, where the proposed building/structure is located deeper on the lot than that approved on the Detailed Vegetation Management Plan and/or revised grading will have an adverse effect on the Detailed Vegetation Plan.

e) In the event of construction causing minor tree damage, remedial measures such as trimming, dressing, or bark doctoring shall be implemented at the Owner’s cost and as directed by the Consultant who prepared the approved plan. In cases where major irreparable tree damage is done, liability is questionable, or the tree is judged to be unsafe in the opinion of the Subdivider’s Environmental Consultant and /or the City, each such tree shall be removed and replaced with at least one tree of equal value based on the tree value formula as set out in “Guide for Plant Appraisal” International Society of Arboriculture, Latest Edition. Tree replacements are to be located on the same lot or block as the tree requiring removal or to a location within the subdivision requiring enhancement. Furthermore, such remedial measures or tree replacement shall be approved by the Community Services Department and shall be satisfactorily implemented prior to occupancy of the unit or, due to weather conditions, by the next planting season.
Appendix E: Tree Preservation Compensation Plan

NOTE 1:
- TREE W/ TRUNK TREE WELL TO BE INSTALLED AROUND Drip Line.
- TEMPORARY FENCE WIRE FARM FENCE TO BE INSTALLED.
- TEMPORARY FENCE WIRE FARM FENCE TO BE INSTALLED ALONG DIPLINE OF TREES TO BE SAVED.

NOTE:
- GLACIER TO COMPLY WITH THE FOLLOWING REQUIREMENTS:
  1) PRIOR TO Pouring of CONCRETE TOP OF FOUNDATION GRDN TO BE SET ON SITE BY CONSULTANT.
  2) PRIOR TO SEEING, FINE GRADING AND DRAINAGE OF LIFT TO BE CERTIFIED BY CONSULTANT.

CITY OF CAMBRIDGE COMMUNITY SERVICES DEPARTMENT

EXAMPLE LOT-TREE PRESERVATION/COMPENSATION PLAN

Drawn by: E. Otten  Design: J. Bray  Approved by:
Date: JUNE 1996  Date: JUNE 1996

Scale: 1:200

Standard No. ST-27

Revised:
Appendix F: Glossary of Terms

canopy closure – percentage of ground included in a vertical projection of imaginary polygons drawn around the total natural spread of foliage of an individual species.

D.B.H. – tree diameter at breast height, 1.4 m above ground, measured in centimetres.

dripline – imagined line from a tree or plants outer foliage to the ground.

ecosystem functions – examples include energy fixation, chemical cycling (oxygen production by rainforests), soil generation and maintenance, groundwater recharge, water purification, flood protection.

recognized professional in tree management – examples include: International Society of Arboriculture Certified Arborist, a botanist with a science degree, a landscape architect certified by the Ontario Association of Landscape Architects, a professional forester, or as determined by the Commissioner of the Community Services Department of the City of Cambridge.

root zones – typically well beyond driplines of trees (up to 3.5 times the dripline radius) and are located predominantly within the top twelve inches of soil.

structural integrity – related to defects in a tree’s structure (eg. lean, co-dominant trunks, etc.)
APPENDIX “D”

CCTV Inspection Specifications
for
Sanitary and Storm
pipes and laterals
OVERVIEW

CCTV inspection of sanitary and storm pipes/lateral are intended to identify:
- structural and operational deficiencies
- location instances of infiltration and inflow
- map out service connections
- validate pipe material, sizes and flow directions
- confirm that new installations have been performed to specification
- Confirm that system is performing to expectations prior to acceptance by the City at start and end of the maintenance period.

The data, video, and photos captured will be provided to the City in digital format as described in this document. The information will contribute to the Asset Management information repository to be used for future reference, and system wide life-cycle management of the City’s assets. The information will also be a key input to the development of maintenance, rehabilitation, and replacement programs.

The pipeline inspection is expected to follow CSA PLUS 4012-10 – Visual inspection of sewer pipe (PACP Canadian Edition) inspection standards. Additionally, this document details specific digital delivery requirements of the inspection reports, data, video, and photographic records. All sanitary service (lateral) connections are to be inspected using lateral launching Camera using most current LACP standards published by NASSCO.

1 QUALIFICATIONS / EXPERIENCE

1.1 The Contractor must have a minimum of three (3) years related experience in sewer inspections.

1.2 At no time shall a field crew be composed of less than two (2) qualified technicians. One of which is required to be NASSCO/CSA certified in PACP Sewer Pipe inspection.

1.3 The technician(s) responsible for the data analysis and coding must have a minimum of five (5) years experience in this field and is required to be NASSCO/CSA certified in PACP Sewer Pipe inspection.

2 REQUIREMENTS

2.1 The contractor must furnish all personnel, equipment, and material necessary to complete the CCTV inspection of sanitary and storm pipes as per PACP coding, and provide the deliverables detailed in this document. Instructions provided in this document will prevail over PACP specifications.

2.2 Sanitary and Storm pipes will be cleaned prior to inspection. Flushing/cleaning associated with CCTV inspection shall be provided by the contractor/developer.
2.3 Water will be available for purchase at Public Works Department at Bishop St Yard water filling station only.

2.4 Water can not be used from any other location in the City.

2.5 Non-organic materials are to be removed from the sanitary system via vacuum or basket. These materials are to be kept separate from any materials removed from the storm system and arrangements for disposal must be made with the Region of Waterloo.

2.6 Debris in the storm system when found is to be removed and kept separate from any materials removed from the sanitary system (Unless there is evidence of cross contamination within the system). Disposal arrangements must be made with the Region of Waterloo.

2.7 Flushing pressure is to be monitored and adjusted to meet the minimum pressure required to suite the need. Contractor may be held liable for damages to private and public property due to use of excessive water pressure.

2.8 All pipe references and structure (manhole) references shall be made to City assigned asset identifiers. Prior to commencement of inspection, the Contractor shall contact Manager of Asset Management to obtain a map showing the identifiers for all structures within the inspection area to be utilized as pipe and manhole numbers.

2.9 End of maintenance inspections/cleaning must include a minimum of 100m of all downstream pipes beyond the limits of construction to ensure construction debris has been removed from the system.

3 DELIVERABLE REQUIREMENTS

The City has a process to import all inspection information into an asset information repository and will be utilized by staff for reference as well as city-wide system level asset management analysis. The following identifies requirements necessary to support this purpose:

3.1 Inspection data is to be provided in electronic format as detailed in CSA PLUS 4012-20 Visual Inspection of sewer pipe Appendix B. All inspection header, observations, video and photo files references are to be provided as per NASSCO PACP most current version in MS Access database (.mdb file).

3.2 Video files are to be provided on DVD media or USB drive in MPG or WMV format (other formats such as VOB will not be accepted). Each pipe and lateral inspected is expected to have a corresponding individual video file using the following file naming convention (Also defined in CSA PLUS 4012-10):

For Pipes

pipeID_StartStructureID_datetime.mpg
  • pipeID – pipe identifier as provided by municipality
City of Cambridge – Sanitary / Storm Pipe CCTV Specifications – Appendix D December 2011

- startStructureID – maintenance hole identifier as provided by municipality where the inspection is started from (could be upstream or down stream node of pipe)
- datetime – textural date representation in format YYYYMMDDHHMM for date of inspection
- example SP32313_SM23456_201105251420.mpg

For Laterals
LateraId_StartStructureID_distance_datetime.mpg
- LateraId – lateral identifier as provided by municipality
- startStructureID – maintenance hole identifier as provided by municipality where the inspection is started from (could be upstream or down stream node of pipe)
- distance – Distance of lateral connection from start structure in m (i.e 23.4m shall be recorded as 23_4, and 17m shall be recorded as 17_0)
- datetime – textural date representation in format YYYYMMDDHHMM for date of inspection
- example SS32313_SM23456_17_0_201105251420.mpg

3.3 Still pictures shall be captured for all structural/operational defects found during the inspection. File naming for pictures shall be as under
- pipeId_startSturctureID_photNum_datetime.jpg
- pipeID – pipe identifier as provided by municipality
- startStructureID – maintenance hole identifier as provided by municipality where the inspection is started from (could be upstream or down stream node of pipe)
- photoNum – sequential photo number for this particular inspection, or distance from start structure to observed defect.
- datetime – textural date representation in format YYYYMMDDHHMM for date of inspection
- example SP32313_SM23456_02_201105251420.mpg

3.4 Marked up maps showing any differences of structures found in the field including any additional structures with the identifiers assigned in the field. As-Built drawing shall be corrected, if any deviation from as-built drawing is found during CCTV inspection.

3.5 PDF Reports including:
  a) Detail Pipe Inspection Reports (one PDF file per Pipe)
  b) Summary of Pipes in need of repair or cleaning (sorted by priority/street)

3.6 The City’s quality control process will include:
- Data integrity checks for location, pipe material, size, manhole depths etc.
- Valid video file associated with each inspection.
- Validation of pipe and manhole numbers with City’s asset repository except where differences are noted and provided via marked-up maps as part of delivery.
3.7 Inspections that do not meet the specifications will be rejected and is the responsibility of the developer to resolve the issue and resubmit the inspection report.

4 TRAFFIC REQUIREMENTS

4.1 A Highway Occupancy Permit and Regional Work Permit must be completed prior to commencing work.

4.2 Maintain access to all streets at all times.

4.3 Inspections are not to interfere with any other approved Highway Occupancy, Regional Work or Special Event permits.

4.4 In general, local, delivery and emergency access must be maintained at all times.

4.5 Sidewalks must not be totally obstructed at any time. Satisfactory facilities for pedestrians crossing at corners must be provided.

4.6 All turning movements and sight lines at intersections shall be maintained at all times.

4.7 Wherever possible, GRT and school bus traffic shall be maintained at all times, including the provision for suitable, clean areas for bus stops.

4.8 The Proponent shall provide Traffic Protection Plans, as required, to meet all requirements of the Ministry of Labour and the Occupational Health and Safety Act.

4.9 Interference to the normal flow of traffic shall be kept to a minimum. Where possible, equipment shall be located so that a single lane of traffic is maintained at all times. No road is to be closed by a contractor. Qualified Traffic Control Person to guide pedestrian and vehicular traffic when required must also be provided.

4.10 Traffic control devices and procedures shall conform to Book 7 of the Ontario Traffic Manual (OTM), Temporary Conditions.

4.11 It shall be the contractor’s sole responsibility to erect and maintain all lights, signs, barricades, etc. necessary to protect the works, workers, and the general public during the course of the work.

5 SAFETY PRECAUTIONS

The Proponent shall obey all applicable regulations, standards, and operating procedures for this type of work. This will include, but is not limited to, verification of the presence of any explosive or hazardous gases in the manhole before the manhole lid is removed and continuously throughout the duration of the inspection.
6 PUBLIC RELATIONS

The Proponent must ensure that the personnel and equipment on site have a neat appearance and that all employees are polite and courteous under all circumstances. The Proponent must at all times keep the work area in a clean and orderly condition so that there is minimum disturbance to the surrounding area.
APPENDIX E

TRAFFIC CONTROL & PAVEMENT MARKINGS STANDARDS
This Traffic Control and Pavement Marking Standards Manual is prepared by the Transportation & Public Works Department for the information and use of the City of Cambridge Engineering & Public Works staff, consulting engineers, planners, developers, architects, and others involved in the design and installation of traffic control signage and pavement markings within the City of Cambridge. This manual applies to all new subdivisions, site plans, capital projects, reconstruction project and annual signage & pavement marking replacement programs and where deemed applicable by the City.

All traffic control devices must be designed, installed, operated and maintained in accordance with the Ontario Traffic Manuals and Highway Traffic Act.

The developer, builder and/or contractor shall not install any of the following unless indicated on the approved Traffic Control Plan or approved by the City:

- Regulatory, warning or information signs;
- All-way stop intersections;
- Roundabouts;
- Traffic Circles;
- Pavement markings.

**TRAFFIC SIGNAGE**

The developer is responsible for supplying, installing and maintaining all regulatory, warning and information (including street name and rural street number) signage, in accordance with the approved traffic control plan and City standards, and all costs associated therewith.

The developer may not install any regulatory, warning or information signage that is not on the approved traffic control plan.

Permanent street name signage must be installed prior to the commencement of the maintenance period. All other signage, including temporary street name signs, must be installed prior to the release of building permits.

All traffic control signage must be manufactured and installed by a contractor pre-approved by the City of Cambridge.

**Design**

**Stop Control Standards:**

- Stop signs are to be installed on all minor approaches to intersections.
- Oversized Stop signs (Ra-101) are to be used at roads intersecting collector and arterial roads.
- The City will determine if and where all-way stops controls are required. **All-way stops are NOT to be installed unless directed by the City of Cambridge.**

**On-Street Parking Standards:**

- On-street Parking will be prohibited on both sides of a road with a pavement width less than a width of 8.0 metres;
- On-street Parking will be prohibited on one side (adjacent to fire hydrants) on road with a pavement width of 8.0 metres to 10.0 metres.
- On-street Parking will be permitted on both sides of roads with a pavement width of 10.0 metres or greater;
- On-street parking will be prohibited on the inside of all horizontal curves;
- On-street Parking will be prohibited within 15 metres of either side of an access to a multi-use trail;
• No Parking and No Stopping signage must begin 15 to 20 metres from each intersection, with additional signs every 45 to 50 metres;
• On-Street Parking will be prohibited within 15 metres of an intersection; and within 30 metres of an intersection controlled by a traffic control signal or a roundabout;
• On-street Parking prohibitions are to be installed on the inner curve portion of a road;
• No Parking and No Stopping restrictions will be installed in the vicinity of elementary schools. No Stopping signage must specify 8:00 am – 5:00 pm, Monday – Friday, September 1 to June 30, unless directed otherwise by the City;

Speed Limit Standards:
• 50 km/h Speed Limit signs with Begins tab (where applicable) are to be installed on all roads leading away from arterial roads;
• Additional speed limit signage may be required in the vicinity of schools based on the Transportation Association of Canada (TAC) guidelines for School and Playground Areas and Zones: Guidelines for Application and Implementation.

A Traffic Control Plan combined with the on-street parking plan must be submitted for approval, showing the locations of all signage, pavement markings, street lights, fire hydrants and hydro poles to be installed in the subdivision. When approved by the City, all traffic calming devices must be shown on the plan.

STANDARD DRAWING TC-1 (TRAFFIC CONTROL PLAN) SHOWS THE TYPICAL LOCATIONS FOR SIGNAGE.

Standards and Specifications

General Guidelines:
• Hi-intensity and/or diamond grade sheeting will be used where required in accordance with the Ontario Traffic Manuals or where required by the City. All sheeting will conform to the most recent 3M specifications.
• Where possible, signs (excluding stop signs) are to be mounted on hydro and/or street light poles.
• Street name signage shall be mounted above stop signs where possible, using a crisscross bracket.

Street Name Guidelines:

Street name signs shall have hi-intensity sheeting and shall be green with white lettering. The font shall be ClearviewHwy-1-W font, using upper and lower case letters, both sides. Standard blades shall have a minimum height of 200 mm for local/local intersections and 250 mm for all other intersections. Sample street name signs must be submitted to the City for approval.

<table>
<thead>
<tr>
<th>Road Type/Sign Type</th>
<th>Sign Blank Size</th>
<th>Lettering Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Name</td>
</tr>
<tr>
<td>Local Standard</td>
<td>200 mm</td>
<td>150 mm</td>
</tr>
<tr>
<td>Arterial/Collector Standard</td>
<td>200 mm</td>
<td>150 mm</td>
</tr>
<tr>
<td>Mast Arm</td>
<td>450 mm x 2140 mm</td>
<td>250 mm</td>
</tr>
<tr>
<td>Rural Street Number</td>
<td>120 mm</td>
<td>100 mm</td>
</tr>
</tbody>
</table>
Where a City road intersects a Regional road, Regional standards apply. Street name signs for private roads shall conform to the City's standards, however, the background color is white and the lettering color is green.

Installation Guidelines:

Stop signs and street name signs are to be mounted on 3.7 metre (12 ft), 4" x 4" pressure treated wood post, complete with post cap.

Rural street name signs are to be mounted on 1.8 metre (6 ft) galvanized steel "U" channel posts at a height of 1.0 metres (3 ft) on private property, 1.0 metres (3 ft) behind the property line.

All other signs are to be mounted on 3.7 metre (12 ft) galvanized steel "U" channel posts, unless directed otherwise by the City. "U" channel traffic posts shall be 2.65 lbs/ft, hot rolled slag steel, 80,000 P.S.I., tensile strength, hot dipped galvanized, having 7/16" diameter holes punched on 2" centres with 60 holes per full length. Telespar tubing is not permitted.

Signage on “U” channel and wood posts will be installed at a height in accordance with the Ontario Traffic Manuals or as directed by the City (sign installation must be installed in accordance with City Standard drawings TC-2 to TC-18). Posts may not be cut and the remaining length must be installed below ground and encased in concrete.

City Standard Traffic Signing Control Drawings:

TC -2: Trail Crossing – Traffic Control Plan
TC -3: Stop Sign – All-way Stop Installation
TC -4: Stop Sign – Side Street Control Installation
TC -5: Parking Regulatory Signage Installation
TC -6: Regulatory Signage Installation
TC -7: Warning Signage Installation
TC -8: Warning Signage w/TAB Installation
TC -9: Street Name Signage Installation (Double)
TC -10: Street Name Signage Installation (Single)
TC -11: Street Name Signage Installation (Hydro Pole)
TC -12: Rural Street Number Signage
TC -13: Hydro Pole (Concrete) Signage Installation
TC -14: Hydro Pole (Wood) Signage Installation
TC -15: Street Name Sign Design
TC -16: Street Name Sign Design (Veteran)
TC -17: Trail Name Sign Design
**PAVEMENT MARKINGS**

The developer is responsible for supplying, installing and maintaining all permanent painted and durable pavement markings required by the City, in accordance with the approved traffic control plan and City standards.

The developer may not install any pavement markings that are not on the approved traffic control plan.

Painted pavement markings must be installed on base course asphalt prior to the release of building permits and reapplied annually. Durable pavement markings must be installed on surface asphalt prior to commencement of the maintenance period.

**Design**

Pavement markings will include the following at intersections:

<table>
<thead>
<tr>
<th>Type of Intersection</th>
<th>Traffic Control</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Road at Local Road</td>
<td>All-way Stop Control</td>
<td>- 60cm stop bar on all intersection legs &lt;br&gt;- Crosswalk on intersection legs with sidewalk connection &lt;br&gt;- 15m directional divided line on all legs where AADT &gt; 500 vehicles &lt;br&gt;- If warranted, auxiliary lanes painted as per OTM</td>
</tr>
<tr>
<td>Side Street Stop Control</td>
<td>- 60cm stop bar on stop controlled street &lt;br&gt;- Crosswalk on stop controlled street with sidewalk connection &lt;br&gt;- 15m directional divided line on stop controlled street where AADT &gt; 500 vehicles &lt;br&gt;- If warranted, auxiliary lanes painted as per OTM</td>
<td></td>
</tr>
<tr>
<td>Local Road at Arterial/Collector Road</td>
<td>All-way Stop Control</td>
<td>- 60cm stop bar on all intersection legs &lt;br&gt;- Crosswalk on all intersection legs &lt;br&gt;- 15m directional dividing line on local road (if centreline does not exist) &lt;br&gt;- If warranted, auxiliary lanes painted as per OTM &lt;br&gt;- If auxiliary lanes are not warranted but, the road width will accommodate auxiliary lane(s) they should be considered in order to use full width of road (particularly on the Arterial/Collector Road). Paint as per OTM</td>
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</tr>
<tr>
<td>Traffic Control Signal</td>
<td>- 60cm stop bar on all intersection legs &lt;br&gt;- Crosswalk on all intersection legs &lt;br&gt;- 30m directional divided line on local street &lt;br&gt;- If warranted, auxiliary lanes painted as per OTM &lt;br&gt;- If auxiliary lanes are not warranted but, the road width will accommodate auxiliary lane(s) they should be considered in order to use full width of road (particularly on the Arterial/Collector Road). Paint as per OTM</td>
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<td>Arterial/Collector Road to Arterial/Collector Road</td>
<td>All-way Stop Control</td>
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<tbody>
<tr>
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**Note:** Directional arrows or other markings may also be required at the discretion of the City.

The developer will install longitudinal centreline, lane delineators, and edge lines and bicycles lane markings as required by the City and shown on the approved traffic control plan.

- Centrelines are required on all arterial, collector and local roads with a peak hour volume equal to or greater than 250 vehicles;
- Edge lines are required on all roads with a rural cross section, at one-lane bridges or subways, at curves with an advisory speed less than the posted speed limit, in merging and diverging lanes, at pavement width transitions, in areas with unusual physical conditions, frequent occurrences of fog or obstructions on the shoulder and on all channelization lanes.

Where directed by the City, the developer will install Zebra and/or Ladder crosswalks, in accordance with City Standard Drawings PM1 and PM2.

A Traffic Control Plan combined with the on-street parking plan must be submitted for approval, showing the locations of all pavement markings, signage, street lights, fire hydrants and hydro poles to be installed in the subdivision. When approved by the City, all traffic calming devices must be shown on the plan.

**Standards and Specifications**

The developer shall contact the City for approval prior to commencing the first application of pavement markings. All roads shall be thoroughly flushed prior to each pavement marking application. Pavement markings shall only be applied on dry pavement when the temperature is above 10 degrees Celsius and as per the requirements of OPSS 710 standards (Construction Specification for Pavement Markings).

Water-Borne pavement markings must be installed on base course asphalt as per OPSS 1716 standards (Material Specification for Water-Borne Traffic Paint).
Durable pavement markings must be installed on surface asphalt as per OPSS 1714 standards (Material Specification for Field Reaction Polymeric Pavement Marking Materials), as supplied by a supplier approved by the City of Cambridge.

Painted pavement markings shall be applied with retro reflective glass beads. Glass beads shall be applied as per the requirements of OPSS 1750 standards (Material Specification for Traffic Paint Reflectorizing Glass Beads).

All pavement markings must be pre-marked. The developer shall contact the City for approval prior to commencing the first application of pavement markings. Pre-marking must be completely covered by the paint application.

Any work that does not comply with the requirements shall be corrected at the developer’s expense. It shall be the developer’s responsibility to ensure that newly applied lines are not tracked or smeared by the public, by protecting the lines with appropriate traffic control measures and to promptly correct any tracking situations that may occur.

City Standard Pavement Marking Drawings:

- PM -1: Ladder Crossing Detail
- PM -2: Zebra Crossing Detail
- PM -3: Trail Crossing Detail
- PM -4: Bicycle Sharrow Detail
- PM -5: Bicycle Super Sharrow Detail
- PM -6: Reserved Bicycle Lane Symbols
- PM -7: Direction Arrows Detail
- PM -8: Line Types
- PM -9: Railway Crossing Detail
- PM -10: Railway Crossing Symbol
NOTE B:
- All regulatory and warning signs to be placed as per the City of Cambridge Sign and Pavement Marking Standards and in accordance with OMT;
- Street name signs are to be installed on the same pole as the stop sign;
- Crosswalks are to be installed if sidewalk is present on stop control leg;
- Centre line tails only required on local streets where AADT is more than 500 vehicles/day;
- All dimensions are in meters unless otherwise noted.
Notes - The Trail Crossing Traffic Control Plan will be used at all locations where a multi-use trail crosses a City road where deemed appropriate by Transportation Engineering.

- Street Name signs as per Standard
- Trail Name signs as per Standard
- Pavement Markings as per Standard
- All signs sourced from the Ontario Traffic Manual unless otherwise noted.
NOTES:
- INSTALL ONLY ON CITY OF CAMBRIDGE PROPERTY;
- AVOID INSTALLING DIRECTLY IN FRONT OF HOMES (ESPECIALLY FRONT WINDOWS);
- AVOID INSTALLING BEHIND VEGETATION/HYDRO POLE WHICH MAY OBSTRUCT THE SIGN;
- DO NOT INSTALL WITHIN 1.0 METRE OF A DRIVEWAY;
- WHERE POSSIBLE INSTALL ON PROPERTY LINE

CITY OF CAMBRIDGE Transportation and Public Works Department
SIGN INSTALLATION – ALL-WAY STOP

Drawn By: D. Lopes
Date: March 2011

Scale: Not to Scale
Standard No.: TC - 3
Revised: March 2013
NOTES:
- INSTALL ONLY ON CITY OF CAMBRIDGE PROPERTY;
- AVOID INSTALLING DIRECTLY IN FRONT OF HOMES (ESPECIALLY FRONT WINDOWS);
- AVOID INSTALLING BEHIND VEGETATION WHICH MAY OBSTRUCT THE SIGN;
- DO NOT INSTALL WITHIN 1.0 METRE OF A DRIVEWAY;
- WHERE POSSIBLE INSTALL ON PROPERTY LINE
SIGN TO BE MOUNTED AT 30°-45° ANGLE TO THE ROAD

GALVANIZED STEEL U-CHANNEL POST
3.7 M (12 FT)

Curb face or edge of pavement

Ground level

Match to existing material

Concrete

30 cm - 2.0 m

2.0 m - 2.5 m

1.0 m (min)

30 cm (min)

Notes:
- Install only on City of Cambridge property;
- Avoid installing directly in front of homes (especially front windows);
- Avoid installing behind vegetation which may obstruct the sign;
- Do not install within 1.0 metre of a driveway;
- Where possible install on property line

City of Cambridge Transportation and Public Works Department

Sign Installation - Regulatory Signs (Parking)

Scale: Not to Scale
Standard No: TC - 5

Drawn By: D. Lopes
Date: March 2011

Date: March 2011
Revised: March 2013
MAXIMUM
50
BEGINS

30 cm - 2.0 m

2.0 m - 2.5 m

GALVANIZED STEEL
U-CHANNEL POST
3.7 M (12 FT)

CURB FACE OR EDGE
OF PAVEMENT

GROUND LEVEL

MATCH TO
EXISTING
MATERIAL

CONCRETE

30 cm (min)

1.0 m (min)

30 cm - 2.0 m

NOTES:- INSTALL ONLY ON CITY OF CAMBRIDGE PROPERTY;
- AVOID INSTALLING DIRECTLY IN FRONT OF HOMES (ESPECIALLY FRONT WINDOWS);
- AVOID INSTALLING BEHIND VEGETATION WHICH MAY OBSTRUCT THE SIGN;
- DO NOT INSTALL WITHIN 1.0 METRE OF A DRIVEWAY;
- WHERE POSSIBLE INSTALL ON PROPERTY LINE
GALVANIZED STEEL U-CHANNEL POST
3.7 M (12 FT)
Curb face or edge of pavement
Match to existing material
Concrete

Notes: - Install only on City of Cambridge property;
- Avoid installing directly in front of homes (especially front windows);
- Avoid installing behind vegetation which may obstruct the sign;
- Do not install within 1.0 metre of a driveway;

City of Cambridge Transportation and Public Works Department
Sign Installation – Warning Sign

Drawn By: D. Lopes
Standard No: TC - 7
Date: March 2011
Revised: March 2013
GALVANIZED STEEL U-CHANNEL POST
3.7 M (12 FT)
CURB FACE OR EDGE OF PAVEMENT

MATCH TO EXISTING MATERIAL
CONCRETE

GROUND LEVEL
30 cm – 2.0 m
2.0 m – 2.5 m
1.0 m (min)
30 cm (min)

NOTE S:- INSTALL ONLY ON CITY OF CAMBRIDGE PROPERTY;
- AVOID INSTALLING DIRECTLY IN FRONT OF HOMES (ESPECIALLY FRONT WINDOWS);
- AVOID INSTALLING BEHIND VEGETATION WHICH MAY OBSTRUCT THE SIGN;
- DO NOT INSTALL WITHIN 1.0 METRE OF A DRIVEWAY;
- WHERE POSSIBLE INSTALL ON PROPERTY LINE

CITY OF CAMBRIDGE
Transportation and Public Works Department
SIGN INSTALLATION – WARNING SIGN W/TAB

Scale: Not to Scale
Standard No: TC - 8

Drawn By: D. Lopes
Date: March 2011

Date: March 2011
Revised: March 2013
NOTES:- INSTALL ONLY ON CITY OF CAMBRIDGE PROPERTY;
- AVOID INSTALLING DIRECTLY IN FRONT OF HOMES (ESPECIALLY FRONT WINDOWS);
- AVOID INSTALLING BEHIND VEGETATION WHICH MAY OBSTRUCT THE SIGN;
- DO NOT INSTALL WITHIN 1.0 METRE OF A DRIVEWAY;
- WHERE POSSIBLE INSTALL ON PROPERTY LINE
Notes: - Install only on City of Cambridge property;
- Avoid installing directly in front of homes (especially front windows);
- Avoid installing behind vegetation which may obstruct the sign;
- Do not install within 1.0 metre of a driveway;

City of Cambridge
Transportation and Public Works Department

Sign Installation – Street Name Sign (Single)

Drawn By: D. Lopes
Date: March 2011
Standard No: TC - 10
Revision: March 2013
SIDE MOUNT BRACKET

½" BAND-IT BANDING (BREAKING STRENGTH 1500 LBS)

Curb face or edge of pavement

2.0 m - 3.0 m

GROUND LEVEL


1/2" BAND-IT BANDING
(BREAKING STRENGTH
1500 LBS)

MAXIMUM
50
km/h

30 cm - 2.0 m

CURB FACE OR EDGE
OF PAVEMENT

2.0 m - 2.5 m

GROUND LEVEL

CITY OF CAMBRIDGE Transportation and Public Works Department

SIGN INSTALLATION – HYDRO POLE (CONCRETE)

Scale: Not to Scale

Drawn By: D. Lopes
Standard No: TC - 13
Date: March 2011
Date: March 2011
Revised: March 2013
CITY OF CAMBRIDGE
Transportation and Public Works Department

SIGN INSTALLATION – HYDRO POLE (WOOD)

Drawn By: D. Lopes
Date: March 2011

Scale: Not to Scale
Standard No: TC - 14
Date: March 2011
Revised: March 2013
## SIGN AND LETTERING SIZES

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<th>Lettering Size</th>
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<td>100 mm</td>
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<td>450 mm x 2140 mm</td>
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</tr>
<tr>
<td>Rural Street Number</td>
<td>120 mm</td>
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## NOTES:
- GREEN HIGH INTENSITY GRADE BACKGROUND;
- STREET NAME = WHITE REFLECTIVE LETTERING USING UPPER CASE, CLEARVIEWHWY-1-W FONT;
- LETTERING ON BOTH SIDES OF THE BLANK;
- WHERE A CITY ROAD INTERSECTS A REGIONAL ROAD, REGION STANDARDS APPLY;
- STREET NAME SIGNS FOR PRIVATE ROADS SHALL CONFORM TO THE CITY’S STANDARDS, HOWEVER, THE BACKGROUND COLOR IS WHITE AND THE LETTERING COLOR IS GREEN;
- 3.1 MM THICK ALUMINUM.

---

**CITY OF CAMBRIDGE**  Transportation and Public Works Department

**STREET NAME SIGNS**

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SIGN AND LETTERING SIZES

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</tr>
<tr>
<td>Local Standard</td>
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<td>Rural Street Number</td>
<td>120 mm</td>
<td>100 mm</td>
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NOTES:
- GREEN HIGH INTENSITY GRADE BACKGROUND;
- STREET NAME - WHITE REFLECTIVE LETTERING USING UPPER CASE, CLEARVIEWHWY-1-W FONT;
- LETTERING ON BOTH SIDES OF THE BLANK;
- WHERE A CITY ROAD INTERSECTS A REGIONAL ROAD, REGION STANDARDS APPLY;
- STREET NAME SIGNS FOR PRIVATE ROADS SHALL CONFORM TO THE CITY’S STANDARDS, HOWEVER, THE BACKGROUND COLOR IS WHITE AND THE LETTERING COLOR IS GREEN;
- 3.1 MM THICK ALUMINUM.

CITY OF CAMBRIDGE Transportation and Public Works Department

STREET NAME SIGNS (VETERAN)

Drawn By: D. Lopes
Date: March 2011

Scale: Not to Scale
Standard No: TC - 16
Revised: March 2013
BREWSTER TRAIL

SIGN AND LETTERING SIZES

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<tr>
<td>200 mm</td>
<td>110 mm</td>
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<td>80 mm</td>
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NOTES:
- WHITE HIGH INTENSITY GRADE BACKGROUND;
- TRAIL NAME – GREEN REFLECTIVE LETTERING USING UPPERCASE, CLEARVIEWHWY-1-W FONT;
- LETTERING ON BOTH SIDES OF THE BLANK;
- 3.1 MM THICK ALUMINUM.

CITY OF CAMBRIDGE Transportation and Public Works Department

TRAIL NAME SIGN

<table>
<thead>
<tr>
<th>Drawn By</th>
<th>Standard No</th>
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<tr>
<td>J. Leach</td>
<td>TC -17</td>
</tr>
</tbody>
</table>

Date: December 2011  Date: December 2011  Revised: May 2013
Notes - Ladder crossings are to be used at controlled crossings where identified by the City of Cambridge.
- All dimensions are in centimeters unless otherwise noted.
- Dimensions at curb are taken from the edge of the asphalt.
- Motor vehicle lane width will vary depending on road type.

Colour - White.

CITY OF CAMBRIDGE Transportation and Public Works Department

LADDER CROSSING DETAIL

Scale: Not to Scale

Drawn By: J. Leach

Date: December 2011

Standard No: PM - 1

Date: December 2011

Revised: December 2011
Notes
- Zebra crossings are to be used at uncontrolled crossings where identified by the City of Cambridge.
- All dimensions are in centimeters unless otherwise noted.
- Dimensions at curb are taken from the edge of the asphalt.
- Motor vehicle lane width will vary depending on road type.

 Colour - White.

CITY OF CAMBRIDGE Transportation and Public Works Department
ZEBRA CROSSING DETAIL

Drawn By: J. Leach
Date: December 2011

Scale: Not to Scale
Standard No: PM - 2
Date: December 2011
Revised: December 2011
Notes
- This Trail Crossing treatment is to be used at uncontrolled mid-block trail crossings as identified by the City of Cambridge.
- All dimensions are in centimeters unless otherwise noted.
- Dimensions at curb are taken from the edge of the asphalt.
- Motor vehicle lane width will vary depending on road type.

Colour - White.

CITY OF CAMBRIDGE Transportation and Public Works Department

TRAIL CROSSING DETAIL

Drawn By: J. Leach
Date: December 2011

Scale: Not to Scale
Standard No: PM - 3
Date: December 2011
Revised: December 2011
Notes: The Sharrow symbol is used on wide-shared use lanes as identified in the Transportation Association of Canada Guidelines for the Design and Application of Bikeway Pavement Markings.


Colour: White.
DETAILS TO BE ADDED
**BICYCLE SYMBOLS**

The bicycle symbol is used to designate a Reserved Bicycle Lane and is to be located as per the Transportation Association of Canada, Bikeway Traffic Control Guidelines for Canada.

Source: Transportation Association of Canada, Bikeway Traffic Control Guidelines for Canada.

Colour: White reflective.

**DIAMOND SYMBOLS**

The diamond symbol is used to designate a Reserved Bicycle Lane and is to be placed as per the Transportation Association of Canada, Bikeway Traffic Control Guidelines for Canada.

Source: Transportation Association of Canada, Bikeway Traffic Control Guidelines for Canada.

Colour: White reflective.

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**CITY OF CAMBRIDGE**  Transportation and Public Works Department

**RESERVED BICYCLE LANE SYMBOLS**

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</tr>
</thead>
<tbody>
<tr>
<td>December 2011</td>
<td>PM - 6</td>
</tr>
</tbody>
</table>

Revised: December 2011
Notes - Direction Arrows are to be used in all turn lanes and other locations as identified by the City of Cambridge.

Source - Ontario Traffic Manual, Book 11
Pavement, Hazard and Delineation Markings.

Colour - White.
Solid, white, 10cm

Solid, yellow, 10cm

Broken (3m/6m/3m), white, 10cm

Broken (3m/6m/3m), yellow, 10cm

Broken (3m/3m/3m), white, 10cm

Broken (3m/3m/3m), white, 20cm

Broken (1m/1m/1m), white, 10cm

Standard Stop Bar

Solid, white, 60cm

Railway Crossing Stop Bar

Solid, white, (30cm/20cm/30cm)

Notes - Line types to be used as required by the City of Cambridge Engineering Standards and the Ontario Traffic Manual unless otherwise noted.
Stroke Width of "X" to be 300 mm to 500 mm.

Notes - The Railway Crossing Layout shown is to be used at all railway crossing approaches.

Source - Manual of Uniform Traffic Control Devices of Canada, June 2001 (Figure C1-5).

CITY OF CAMBRIDGE Transportation and Public Works Department

RAILWAY CROSSING DETAIL

Drawn By: J. Leach
Date: December 2011

Standard No: PM - 9

Scale: Not to Scale

Date: December 2011

Revised: December 2011
Notes: - The Railway Crossing symbol is to be used in each lane approaching a railway crossing and is to be located as per the City of Cambridge Railway Crossing Layout.

Source - Manual of Uniform Traffic Control Devices for Canada, June 2001 (Figure C1-5).

Colour - White.

CITY OF CAMBRIDGE  Transportation and Public Works Department

<table>
<thead>
<tr>
<th>RAILWAY CROSSING SYMBOL</th>
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<th>Not to Scale</th>
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<tr>
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<tr>
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