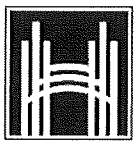
Engineering Guidelines for Servicing Land Under Development Applications

December, 2012



Hamilton

City of Hamilton

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Introduction

1.1 General

In order to complete the land development process in the City of Hamilton, ("City"), it will be necessary for the Developer to engage the services of a qualified professional engineer, ("Engineer"), to address municipal engineering requirements of the City to service land under development applications.

This guideline is intended to be a guide in assisting developers, land owners, municipal engineers, planners, architects and all others involved in the land development process to evaluate the criteria for any engineering submission required in support of a development proposal.

The information provided in this guideline is general in nature and is not intended to relieve the Developer or the Engineer of their responsibility to submit a finished product of competent engineering design and construction. For any form of consideration made to deviate from City standards, the Engineer shall submit a detailed proposal outlining the deviation, with the necessary justification and analysis, for consideration by the City prior to formal engineering submissions.

1.2 City's Jurisdiction

The City has jurisdiction over and is responsible for engineering requirements related to:

- sanitary sewers and wastewater treatment;
- storm sewers and storm water management;
- watermains and water supply;
- roadways, including asphalt pavement, curbs, subdrains, sidewalks, walkways, retaining walls, fencing, and noise barriers;
- tree planting, sodding of boulevards;

- lot grading; and
- street lighting and municipal consent ("MC") for construction of utilities.

Engineering submissions shall be made to:

City of Hamilton
Growth Management Division
Planning and Economic Development Department
71 Main Street West
5th Floor
Hamilton, Ontario
L8P 4Y5

Attn: Manager, Engineering Approvals – Development Engineering

All developers and their engineers are encouraged to meet with the Development Engineering Section, as early as possible, in the process, to clarify the City's requirements for the scope of engineering submissions required on individual projects, and to discuss any site-specific requirements that may be identified and to identify cost sharing and financial policies that may be applicable.

Developers may also have to address requirements of provincial ministries and other agencies depending on the location and/or scope of work being proposed. These include:

1. Ministry of Transportation (MTO)
2. Ministry of Environment (MOE)
3. Ministry of Natural Resources (MNR)
4. Local Conservation Authorities:
   - Hamilton Conservation Authority
   - Niagara Peninsula Conservation Authority
   - Grand River Conservation Authority
   - Conservation Halton
5. Niagara Escarpment Commission

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Municipal Servicing

2.1 General

This section deals with the steps required in the preparation and submission of a detailed engineering design to service land under development applications with municipal works. This would also involve entering into an agreement with the City for the purpose of constructing the municipal services.

2.2 Engineering Services

The Developer shall retain a Professional Engineer, ("Engineer"), licensed to practice in the Province of Ontario, who is experienced in the design and execution of land development projects, to provide the following engineering services, to the satisfaction of the City:

1. Preliminary investigation
2. Layout drawings
3. Estimate of cost
4. Design methodology with associated calculations
5. Contract drawings and specifications
6. Application to the Ministry of Environment for approval of sewage works and storm water management facilities (if applicable)
7. Application for Municipal Drinking Water Permit under MOE's Municipal Drinking Water Licensing Program
8. Calling of tenders, if so requested by the City
9. Analysis of bids and recommendation to the Developer and the City
10. Setting out of the work
11. General administration of Contracts (as per P.E.O.)
12. Resident Supervision of Construction (as per P.E.O.)
13. Certification of completed Works
14. Preparation of As-constructed Drawings

2.3 Preliminary Engineering

During the Formal Consultation process, as described in the City's Development Guide to Planning Applications, the need for a Preliminary Engineering Report (also Functional Servicing Report) will be identified.

The Engineer shall review and reference any existing servicing studies, traffic studies, secondary plans class EA documents, master servicing plans, master drainage plans, watershed and sub-watershed studies that pertain to the project. A complete up-to-date listing shall be provided by the City upon written request.

A Preliminary Engineering Report, if required, shall be submitted to the City Planning and Economic Development Department with the relevant application. It shall include, but not be limited to, the following:

a) Contour Plan

- existing ground contours at sufficient intervals to permit assessment of surface drainage patterns. This plan should be at a scale not smaller than 1:1000, and in the case of a subdivision application, can be combined with a draft plan of subdivision

b) Sanitary Sewer System

- existing sanitary sewer outlet information (size, slope, location)
- drainage areas complete with existing ground contours at sufficient intervals to permit assessment of surface drainage patterns.
- proposed flows and functional design of sanitary sewers
- identification of potential constraints, if any, and how they have been addressed. Any mitigation measures proposed shall be detailed

c) Storm Drainage System

- existing storm sewer outlet information (size, slope, location)
- drainage areas complete with existing ground contours at sufficient intervals to permit assessment of surface drainage patterns to a minimum of 15m beyond the limits of the subject lands
- proposed flows and functional design of storm sewers
- designation of major and minor drainage systems, assessment of any storm water management facilities together with functional design
- identification of potential constraints, if any, and how they have been addressed. Any mitigation measures proposed shall be detailed.

d) Watermain Distribution System

- existing watermain information (sizes, locations, looping, pressure boundaries)
- functional watermain distribution system design
- identification of potential constraints, if any, and how they have been addressed

e) Roadways

- identification of collector roads where additional pavement widths and special pavement design is warranted
- the need for assessment of the impact of the development on any adjacent roads
- location of sidewalks
- road geometry at key location (horizontal and vertical)
- identification of potential constraints, if any

f) On-Street Parking Plan

- the location of driveways, driveway ramps and curb openings for all lots
- the location of utilities: concrete transit pads, community mailboxes pads, and fire hydrants; where the location has been determined by the appropriate authorities
- ~~the pairing of driveways, exceptions are to be approved by the City; and~~
- where lots in the subdivision abut a park entrance or a public walkway, driveways shall be located on the furthest side of the lot.

g) Special Reports

- Shall be generally requested by the City at the pre-consultation stage.
- Studies may include but not limited to:
  - Storm Water Management Study
  - Traffic Impact Study
  - Noise and Vibration Report
  - Archaeological Assessment
  - Environmental Impact Study (adjacent to ESAs)

- Tree Preservation Plan
- Hydro-geological study – impact of construction on existing wells
- Phase 1 Environmental Report and Record of Site Condition
- Parking Analysis/Study
- Karst study

For development in rural areas, where private or communal services are being proposed, the City will require special hydro-geological studies to be conducted to evaluate the potential for development of the lands.

Before commencing on any special reports, it is recommended that the terms of reference for the special study be submitted for approval by the City.

Four (4) copies of the Preliminary Engineering Report shall be submitted with an application to:

City of Hamilton
Planning and Economic Development Department
Planning Division, Development Planning Section
5th Floor, 71 Main Street West
Hamilton, Ontario L8P 4Y5

Attn: Manager, Development Planning

2.4 Detailed Engineering Design

Once the Developer has obtained approval for a development application where municipal services are required, a detailed engineering submission can be made to:

City of Hamilton
Planning and Economic Development Department
Growth Management Division, Development Engineering Section
5th Floor, 71 Main Street West
Hamilton, Ontario L8P 4Y5

Attn: Manager, Engineering Approvals – Development Engineering

The first engineering submission shall consist of:

a) two (2) copies of the final survey plan

b) three (3) sets of detailed engineering drawings

c) two (2) sets of sanitary sewer and storm sewer calculation sheets

d) three (3) copies of a stormwater management report and a digital copy of the model (if applicable)

e) two (2) paper copies of the Watermain Hydraulic Analysis

f) one (1) paper copy and one electronic copy (.pdf format) of a geotechnical report

g) two (2) copies of any other relevant reports or drawings (traffic impact, noise impact, archaeological assessment, tree preservation, EIS, hydro-G, etc.)

h) two (2) sets of street lighting drawings

i) a draft copy of the engineering cost estimates, (Schedule "F")

j) a checklist showing how the draft plan conditions have been addressed, and

k) payment of Stage 2 City Subdivision Processing Fees, based on current fee at the time of engineering submission (see User Fee Bylaw).

l) schedule in Gantt chart format outlining expected timelines for approval and servicing

m) other plans that may be required through the process such as SWM facility landscape and streetscape plans – three (3) sets

The design of municipal services shall be based upon the specifications and standards in effect at the time the engineering drawings are approved. The City's Planning and Economic Development Department, Development Engineering Section, shall approve all engineering drawings but such approval shall in no way relieve the Engineer of the responsibility to design adequate and safe services.

All sanitary sewers, storm sewers, watermains and their appurtenances and all roadways being constructed within the City of Hamilton, shall conform to the City of Hamilton Standard Specifications (latest edition) which is available from the City's Public Works Department.

Overall drainage area maps of trunk sanitary sewers and trunk storm sewers are available for viewing in the Development Engineering Section of the City's Planning and Economic Development Department. Overall watermain distribution maps are also available for viewing and for use as a guide in the design of watermains within the project.

Upon review of the first submission of engineering drawings and cost schedules by the City, the Engineer shall amend the drawings and schedules to incorporate the comments and shall resubmit two (2) sets of the detailed engineering drawings for final approval. The cost schedules shall be amended, if necessary, and resubmitted to the City for final approval in electronic form (MS Word, Excel, or alternate format acceptable to the City).

Municipal Consent Process for New Roads

The Engineer is also required to co-ordinate the municipal consent process for utility installation on new roads. See Section 2.4.5.29 for the Municipal Consent procedure. Generally, at the time of initial engineering submission to the City, the engineer shall notify the utility companies of the proposed development. Upon the second submission to the City, the Engineer shall provide Hydro with a set of engineering drawings. Hydro will complete their plant design and circulate to the other utility companies so that their plant design can be added.

The utility companies shall forward their completed plant design to the Engineer, who shall check for any conflicts. The aboveground utility plant shall be shown on the Lot Grading Plan for submission to the City for final approval. The Engineer shall sign the Municipal Consent form, certifying that there are no conflicts, and forward the utility plans to the City for approval. No above grade utility units such as super mailboxes, bell utility buildings, etc. will be permitted along the frontage of a City owned park.

MOE Applications for Sewers

The Engineer shall submit MOE application forms for Environmental Compliance Approval for sanitary sewers and storm sewers. Two additional sets of engineering

drawings, individually folded, shall be provided to the City to accompany the MOE application through the Transfer of Review Program between the City and the MOE.

Projects that involve stormwater management facilities are direct submission to MOE; i.e. they are not processed through the Transfer of Review Program; however the application forms shall be submitted to the City for signature as the operating authority. The Developer shall be responsible for any fees payable to the MOE for this review.

For more information and requirements on this program please visit the Ministry of Environment website at the following link:

http://www.ene.gov.on.ca/environment/en/resources/

MOE's Municipal Drinking Water Licensing Program

Water servicing approvals are processed under the MOE's Municipal Drinking Water Licensing Program.

Under provincial license the system provides the municipality with a Municipal Drinking Water Permit from which the municipality issues Drinking Water Works Permit Amendments for the works to be constructed by the developer.

For more information and requirements on this program please visit the Ministry of Environment website at the following link:

http://www.ene.gov.on.ca/environment/dwo/en/approvals/

Subdivision Agreement

Upon approval of lands through a Draft Plan of Subdivision, the Development Engineering Section shall, upon request from the Developer, prepare the City of Hamilton Subdivision Agreement. To assist in the preparation of these agreements, the Developer shall submit the following to the Development Engineering Section:

a) A legal description of the draft approved lands.

b) The complete name of the registered owner(s) of the land along with mailing address and the names and position (if applicable) of the signing officers for the owner.

c) Where there is a mortgagee on the lands, confirmation as to whether or not the mortgagee will sign the subdivision agreement. If so, please provide the full name of the owner's mortgagee and mailing address as well as names of the signing officers for the mortgagee.

2.4.1 Engineering Drawings

The detailed engineering drawings submitted by the Developer's Engineer shall be subject to the following:

a) All drawings shall be in metric and shall be neat, legible and completed in ink.

b) Lettering shall be done using a lettering template with a minimum font size of 8pt.

c) Sheet size shall be metric A1 (594mm x 841mm) or Imperial (24"x36"). External sanitary and storm drainage area plans for overall catchment areas may be submitted on larger size sheets for convenience of presentation.

d) Plan-profile drawings shall be to a scale of 1:500 horizontal and 1:100 vertical, except when drawings for existing roadways are required, when a larger scale would be more suitable.

e) All drawings shall contain a key plan, north arrow, title block showing the name of the Engineer together with the sheet title and current revision status.

f) All drawings shall be sealed, signed and dated by the Engineer responsible for the design.

g) All elevations are to relate to a geodetic datum acceptable to the City, and the bench mark shall be described on all the drawings.

The detailed engineering drawings shall consist of the following:

a) Title Sheet

b) Plan of Services

c) Lot Grading Plan

d) Erosion and Sedimentation Control Plan

e) Plan-Profile Drawings

f) Sanitary Drainage Area Plan

g) Storm Drainage Area Plan

h) Other drawings as required; e.g.: tree preservation plan, street tree planting plan, parking plan, SWM facility details, roundabout details

2.4.1.1 Title Sheet

A Title Sheet shall be included for every subdivision that includes more than one street that is being constructed as part of the plan of subdivision. All Title Sheets

shall contain the following information:

a) Name of Municipality (City of Hamilton)

b) Key Plan showing the location of the proposed development

c) Name of the Development

d) Name of the Owner

e) Name of the Engineer

f) List of drawings

2.4.1.2 General Plan of Services

A General Plan of Services shall be prepared for every engineering submission that includes construction of more than one street as part of a development application.

If possible, the plan should be presented on one page, ideally at a scale of 1:500 shall be used. For larger subdivisions, an appropriate scale shall be selected, but in no case shall the scale be smaller than 1:1000.

The following information shall be shown on the General Plan of Services:

a) All road allowances, lots and blocks in the plan of subdivision and those immediately neighbouring the subdivision.

b) Proposed sanitary and storm sewers including diameter of pipe and direction of flow, manholes, culverts, road catchbasins and rear yard catchbasins (if applicable).

c) Proposed watermains (including diameter of pipe) and appurtenances.

d) Proposed curbs and sidewalks.

e) Existing services surrounding the subdivision, including length, size and type, and their relation to the proposed work.

f) Description of the nearest geodetic benchmark. Site benchmarks should also be shown and described.

g) General Notes describing the construction of services. For larger subdivisions it is preferable to have the notes on a separate page. A sample of the General and Standard Notes to be used on a subdivision is included as Appendix 1. These notes are constantly being updated and the Engineer should use only the notes applicable to the subdivision that are current at the time of design and construction. The most recent OPSD and City Specifications shall be referenced in the notes.

h) Typical road cross-sections with pavement design.

2.4.1.3 Grading Plan

Final lot grading plans shall be drawn to a minimum scale of 1:500 and shall be fitted on a standard metric A1 sheet or imperial 24" x 36" sheet. Additional sheets with appropriate match lines shall be used if the development lands do not fit on a single sheet.

The following information shall be shown on all final lot grading plans:

a) Existing ground contours at 0.5m intervals over the entire subdivision and sufficient area of adjacent lands to establish the overall drainage pattern.

b) Along the perimeter of the development lands, existing ground elevations obtained by an actual field survey, shall be shown at the lot corners of all existing abutting properties and along 2 additional lines parallel to the subdivision perimeter lot line, (at approx. 3.5m and 7.5m from the perimeter lot line), into the adjoining property.

   If the adjoining property is large, then existing ground elevations along the common property line and along 3 parallel lines, (distant 5m, 10m and 15m from the common property line), within the adjoining property, taken at a minimum spacing of 15m shall be shown, as well as at all locations where the ground topography changes abruptly.

   The Engineer shall determine if there is an approved development application on adjacent vacant lands and shall co-ordinate the grading with the engineer of the adjacent development, so as to match proposed and existing grades.

c) The location of all existing trees, septic tanks and tile fields, wells, existing above ground utility structures and other structures as necessary.

d) Proposed ground elevations at all lot corners and at intermediate points for change in grade. On large blocks, proposed ground elevations at 15m spacing along the frontage of the block and at reasonable spacing along the sides and rear of the block shall be shown.

e) Proposed ground elevation at the front of all dwellings on the proposed lots. For split type drainage patterns where the elevation at the rear (or side) of the dwelling shall vary by more than 0.4m from the elevation at the front of the dwelling, the proposed ground elevation at the rear (or side) of the dwelling shall also be specified.

f) Minimum basement floor elevations of the proposed dwellings. Minimum basement floor elevations shall be calculated based on the elevation of the sanitary (and/or storm) private drains. For all practical purposes, and unless the design of the services indicates special consideration for the private

drains, the generally accepted practice is that the minimum basement floor elevation is 1.7m lower than the centerline of the road at the location of the private drain.

g) Proposed road centerline elevations at all changes in grade, at all intersections and opposite each proposed lot and block corner. If the frontage of the blocks is large, proposed centerline road elevations at 15m spacing shall be provided.

h) Direction of surface drainage on all lots and blocks.

i) Location of any proposed private rear yard catchbasins and the top of grate elevations.

j) Location of any proposed retaining walls with proposed top of wall elevation and ground elevation at bottom of wall at appropriate intervals with sections. Where any major retaining walls are proposed that exceed 2m in height and 50m in length, the Engineer should provide a cross section of the wall and provide construction details on a separate drawing.

k) All existing and proposed slopes and embankments showing top and bottom of slope/embankment elevations and degree of slope (e.g. 3:1).

l) Existing and proposed curb and sidewalks.

m) Typical sections for all proposed drainage courses and swales.

n) Typical details of proposed drainage types of houses and lots.

o) Location of all road catchbasins, hydrants, street lights and hydro transformers, telephone and cable boxes.

p) All existing and proposed easements within the subdivision.

q) Standard Lot Grading Notes (see Appendix 2).

r) Key Plan showing the proposed development and, for larger subdivisions, the location of the lots on the sheet in relation to the overall development.

s) Any additional plans, sections and details for drainage courses and erosion protection, irregular or steep topography, and screening and noise abatement features as may be required.

t) Description of the nearest geodetic bench-mark and site bench marks.

2.4.1.4 Erosion and Sedimentation Control Plan

The Erosion and Sedimentation Control Plan prepared in accordance with the "Erosion & Sediment Control Guideline for Urban Construction" dated December 2006 may be submitted with the Final Grading Plan or as a separate plan; however, it is required for any pre-grading works.

It shall show details of controls for road and rear yard catch basins and location of sediment control fencing.

Any special measures required on a site specific basis to mitigate sediment contamination of affected creeks, adjacent properties, storm sewer systems and storm water management facilities shall be detailed. Consultation with the Conservation Authority is recommended when draining surface run-off to areas regulated under the Conservation Authorities Act.

2.4.1.5 Plan-Profile Drawings

Plan profile drawings shall be prepared for all existing and proposed streets, walkways and easements where sewers, watermains and/or road construction is required as a consequence of the proposed development.

The following guidelines shall be used in the preparation of Plan-Profile drawings for submission to the Development Engineering Section of the City Planning and Economic Development Department:

1) General

1. All plan-profile sheets for proposed streets shall be drawn at a scale of 1:500 horizontal and 1:100 vertical.
2. Plan-profile sheets for reconstruction or construction on existing roads within an urban area may be drawn at a scale of 1:250 horizontal and 1:50 vertical, at the discretion of the Engineer, depending on the detail required to be shown on the drawing.
3. The profile portion of the drawing shall be a vertical projection of the plan portion, wherever possible.
4. All road allowances, lots, blocks, easements, reserves are to be shown and identified in accordance with the notation on the Final Survey Plan. Lot and Block frontages and bearings are to be shown and must correspond with the Final Survey Plan.
5. Dimensions of the road allowance and at least one set of dimensions from the property lines to proposed curbs, sidewalks, sewers, and watermains shall be shown on each sheet.

6. A key plan identifying the land to be developed and the relationship of the proposed street within the land shall be provided.

7. Two short streets may be shown on one plan-profile drawing.

2) Plan view requirements

1. The street name or easement number shall be prominently centered over the top of the plan portion of the drawing.

2. Generally, the plan view shall be drawn such that the north arrow is pointing towards the top of the page and/or to the right of the page.

3. All existing sewers, watermains, curbs, sidewalks, etc. shall be shown and labeled as "existing". All proposed sewers, watermains, curbs, sidewalks, etc. need not be labeled as "proposed" but shall be distinguished from the existing services by line type and size/style of lettering.

4. Only the size and type of the proposed and existing sewer and watermain shall be labeled (e.g. 250mm Sanitary).

5. Where intersecting streets (or easements) are shown in plan view, only the size and type of sewer and direction of flow of the intersecting sewers shall be shown.

6. All sewer manholes shall be numbered. Sanitary manhole numbers shall be distinguished from storm manholes by the prefix "A", (e.g. MH A2).

7. Road catchbasins and connections shall be shown. Rear yard catchbasins and connections shall be shown with adequate details regarding top of grate elevation, location of catchbasins and connection in relation to rear and side property lines, standard drawing detail, inverts, length and grade of connection.

8. Hydrants, valves and other appurtenances on the watermain shall be shown and labeled with details regarding standard drawing details and location.

9. Locations of sanitary private drains and storm private drains (if applicable) and private water services for each lot and block created by the development application shall be shown.

10. Details and specifications for the proposed curbs and sidewalks shall be shown. All transitions from different types shall be properly labeled and dimensioned. Curb radii at intersections shall be shown and curb radius and angle of intersection of other horizontal curves shall be adequately indicated.

11. Match lines for continuation of the street shall be clearly marked.

12. Borehole locations and numbers shall be shown.
13. Cross reference drawing numbers of adjoining plans.
14. Cross reference to general notes drawing number.

3) Profile view requirements

1. The following profiles shall be shown:
    i) Existing ground over centerline of road/easement
    ii) Proposed centerline road/easement
    iii) Sanitary and storm sewers
    iv) Watermains
2. Proposed sewers shall be detailed for each section including size and type of sewer, length and grade, pipe material specifications and class of bedding.
3. Manholes shall be numbered and distinguished to correspond to the numbering in plan view. Manhole details such as standard drawing number and any required information such as diameter of base, top of grate elevation, drop-pipe requirements, safety gratings shall be shown. Construction details are to be referred to the applicable City of Hamilton Drawings or Ontario Provincial Standard Drawings (OPSD).
4. Proposed watermains 300mm diameter and smaller shall include all related appurtenances, and shall specify size and pipe material. For 400mm diameter and larger mains, chainages, invert, length and grade of each section, size, pipe material and a schematic detail of each valve chamber showing the orientation of appurtenances shall be provided. (note duplicate statement re large watermain removed below)
5. All sewer inverts at manholes shall be given and adequately described.
6. Proposed centerline road grade, chainages of P.V.I.s, intersections, and vertical curve data shall be adequately shown and described.
7. Borehole logs shall be plotted with brief description of soils and water level, as well as rock elevations (if applicable). If the borehole log interferes with other details such as a manhole, the exact location of the borehole may be altered sufficiently for clarity.
8. 100 year hydraulic grade line (HGL) elevation shall be plotted on the profile and noted on the plan at each rear lot catchbasin location.

2.4.1.6 Sanitary Drainage Area Plan

The Sanitary Drainage Area Plan shall be drawn at the same scale as the General Plan of Services. It shall include the following information:

1. All streets, lots, blocks, easements and other lands within the plan of subdivision.

2. Proposed sanitary sewers, including size, length and grade, manholes, manhole numbers, direction of flow, and details of the receiving sewer.

3. The drainage areas within the lands to be subdivided or developed and the limits of external areas draining into the proposed system. The area

non-standard cases shall be detailed on the plan-profile sheets. Generally, the benching shall be brought to the spring line of the outlet pipe in accordance with OPSD 202.021.

The upstream pipe(s) obvert shall generally not be lower than the pipe obvert on the downstream side of the manhole.

Suitable drops shall be provided across manholes to compensate for loss in energy

The minimum drops across manholes shall be as follows:

Alignment Change	Drop Required
0°	grade of sewer
1° to 45°	0.03m
45° to 90°	0.06m

The maximum drop allowed across a manhole is 0.6 m calculated from the invert of the upstream pipe to the invert of the downstream pipe (in accordance with OPSD 1003.01). In junction manholes where there is a pipe entering the side of the manhole, the drop shall be calculated from the invert of the higher pipe to the top of the benching in the manhole. For drops greater than 0.60m a drop structure is required as per OPSD 1003.01. Generally, the size of the drop pipe shall be one size smaller than the connecting sewer with a minimum size of 200mm and a maximum size of 300mm. The invert of the drop pipe shall be shown on the plan-profile sheet and shall be a min. of 0.06m higher than the invert of the lowest pipe.

Safety gratings shall be installed in manholes that are greater than 5.0m in depth from the top of the manhole grate to the lowest invert and shall conform to OPSD 404.020.

Manhole frames and covers shall conform to OPSD 401.010 (closed cover).

2.4.2.10 Sanitary Private Drains

All sanitary sewer service connections shall be individual services. Shared sanitary private drains within the road allowance shall not be permitted. The services shall be located 1.5m to the right of the centre of a single detached residential lot. Locations for semi detached, street townhouses, and maisonettes units shall be specified by the Engineer. Typical locations are shown in Appendix 5. Private drains for Blocks on a plan of subdivision (for commercial, institutional, industrial or multiple residential block townhouses) shall be designed by the Engineer.

The connection to the mainline sewer shall be made with an approved prefabricated wye or an approved saddle for larger diameter sewers. For connections required to an existing sanitary mainline sewer, the main sewer shall be cored and an approved saddle used.

The minimum size for sanitary private drains shall be 150mm diameter Service connections for multiple residential, commercial, industrial and institutional blocks shall be sized individually.

The sanitary private drain shall be extended from the mainline sewer to 1m beyond the street property line. A stake, painted black, shall be placed at the end of the sanitary private drain, extending 1.0m above grade.

The colour of the sanitary private drain shall be any colour except white. (White shall be used for storm private drains only).

The top of the sanitary private drain at the street line shall be minimum 2.2m below the centerline elevation of the road at that point.

In cases where dual (i.e. sanitary and storm) private drains are installed, the storm private drain shall be located north or east of the sanitary private drain.

In cases where the main line sewer is a combined sewer, dual private drain connections shall be installed as specified in SEW-301.

Bedding and cover for PVC private drains shall be granular A as per SEW-302. For sewers deeper than 3.7m, a riser shall be installed to an elevation of 2.75m below the final road elevation in accordance with SEW-300. The riser shall be encased in 15 MPa wet concrete to a height of 1 metre above the main sewer.

2.4.3 Storm Sewer Design Criteria

2.4.3.1 General Requirements

Storm sewer systems in the City of Hamilton shall be designed and constructed in accordance with the City's "Criteria and Guidelines for Stormwater Infrastructure Design, 2007".

Storm sewers shall be designed to service all the lands within a proposed development as well as any external drainage areas that are dependent on the sewers within the proposed development.

In the case where the outlet sewer is a combined sewer, the development shall be designed for separate sanitary and storm sewers and an inter-connection shall be made at the limit of the development. In all instances where a development discharges into a combined sewer, the Engineer shall contact the City Planning and Economic Development Department during the preliminary engineering stage to determine the constraints, if any, that may limit discharge into a combined sewer system.

The Engineer shall submit storm sewer design sheets in accordance with the sample design sheets attached as Appendix 4A. An electronic copy of the spread sheet in Excel format shall be submitted to the City upon approval of the design.

2.4.3.2 Location

Storm sewers shall normally be constructed in a common trench with the sanitary sewer and shall be located parallel to and to the north and west of the sanitary sewer wherever possible, with minimum 450mm separation between the outside walls of the two pipes; however, the Engineer may deviate from this standard location if it can be shown that it is beneficial to the overall design.

2.4.3.3 Depth of Sewer

The cover of storm sewers shall be dependent on the storm sewer outlet. Generally, unless specified otherwise in the preliminary engineering report, the minimum depth of cover over the storm sewer shall be 2.75m below the centerline of the proposed road elevation, for storm sewers designed to provide standard urban servicing.

However, as in the case with the sanitary sewer design, the Engineer shall investigate the profile of the storm sewer to the upper reaches of the storm sewer catchment area, taking into consideration potential conflicts with sanitary sewer crossovers and possible future road profiles along the route of the storm sewer.

If the profile of the storm sewer necessitates the placement of fill in excess of 0.6m on lands outside the development, the Engineer shall be required to demonstrate that reasonable care has been taken to ensure that the design of the storm sewer has been optimized so as to minimize the impact of fill on those lands.

2.4.3.4 Design Flows

The design flow, in each manhole length of sewer, shall be computed on the standard City of Hamilton design sheet according to the Rational Method equation as follows:

$$Q = \frac{CiA}{360}$$

Where

Q = Peak rate of runoff (m3/s)
C = Runoff Coefficient*
i = Rainfall Intensity (mm/hr)
A = Drainage Area (ha)

* An empirical coefficient representing the relationship between rainfall and run-off.

Under special circumstances, computer simulations shall be acceptable for estimating storm run-off provided the methodology and parameters used have been tested and deemed acceptable by the City.

The **Drainage Area** (A) shall be determined from the largest scale contour maps available for the area. The Engineer shall obtain from the City's Planning and Economic Development Department, the overall storm drainage area maps that were used for the design of the trunk storm sewer systems. These maps shall then be refined based on existing development patterns that have evolved since the trunks were installed and on any additional detailed information available for the area.

Additional information regarding the basis of design is provided below.

The ***Intensity of Rainfall (i)*** shall be based on the 5 year IDF relationship for the Mount Hope rainfall gauge, (ref. Appendix 4B). The rainfall intensity is to be determined using:

$$i = \frac{A}{(t_c + B)^C}$$

Where

A, B,C = constants provided within Appendix 4A;
tc = time of concentration in minutes.
I = rainfall intensity (mm/hr)

The ***Initial Time of Concentration*** t_c shall be 10 minutes, and the time for conveyance of storm flows shall be based on full pipe flow velocities. To calculate the initial external time of concentration for external lands that are scheduled for future development, the Engineer shall obtain the current neighbourhood secondary plans for the catchment area and determine the proposed street pattern and the most probable route of the storm sewer.

The top end of the storm sewer system shall then be assigned an initial time of concentration of 10 minutes and the time for conveyance of the storm flows shall be determined using an average velocity in the storm sewers system of 2 m/sec. unless circumstances require a higher velocity.

All external areas shall be designed on the basis of developed conditions unless otherwise advised by the City's Planning and Economic Development Department.

Run-off Coefficients shall be determined from the types of land uses within the drainage area. Recommended values are as follows:

Land Use	Recommended Coefficient
Parks	0.25
Single Family Residential	0.50 – 0.65
Semi Detached Residential	0.65
Townhouses, Maisonettes, Row Houses, Apartments etc.	0.75
Institutional	0.75
Industrial and Central Business District	0.80
Commercial	0.90
Paved Areas	0.90 to 1.00

The run-off coefficient values provided above are recommended values; however, the Developer's Engineer should determine appropriate coefficient of imperviousness based on the actual permitted uses identified in the zoning by-law.

For Blocks of land within a plan of subdivision where a site plan has not been proposed at the time of design, the Engineer shall use a conservative assumption for the land use and coefficient of imperviousness.

For external areas, the Engineer shall assign coefficients of imperviousness based on the current neighbourhood secondary plans. If no secondary plans are available for future external areas, the Engineer shall, in consultation with the City Planning and Economic Development Department, assign average coefficients of imperviousness that reflect a probable development pattern for the external area.

Sound engineering judgement shall always prevail in the actual design.

2.4.3.5 Storm Sewer Pipe Design

New storm sewers shall be designed to flow at a maximum of 85% full design capacity of the pipe. Pipes shall be designed to capture all external catchment areas.

Manning's formula shall be used in determining the capacity of the storm sewers as follows:

$$Q = AV$$

and

$$V = \frac{1}{n} R^{\frac{2}{3}} S^{\frac{1}{2}}$$

$$R = \frac{A}{P}$$

where	Q	=	Capacity of the pipe flowing full (m3/sec)	
	V	=	Velocity (m/sec)	
	R	=	Hydraulic radius (m)	
	A	=	Cross-sectional Area of pipe (m2)	
	P	=	Wetted perimeter (m)	
	S	=	Gradient of pipe (m/m)	
and				
	n	=	Manning's factor =	0.013

The minimum design velocity for the storm sewer shall be 0.9 m/sec flowing full and maximum velocity shall not exceed 3.65 m/sec.

The minimum size of the storm sewer main shall be 300mm diameter.

A minimum separation of 150mm will be required between sanitary and storm sewer pipes where one sewer pipe crosses over the other.

Generally, no decrease of pipe size from a larger upstream pipe to a smaller downstream pipe shall be allowed, regardless of increase in grade, velocity and capacity.

2.4.3.6 Pipe Materials, Classification and Bedding

Acceptable material for storm sewers shall be in accordance with the current City of Hamilton "Construction and Materials Specification Manual - Approved Products List".

Substitution of pipe material from the approved drawings must be approved by the City and Engineer prior to use.

Transition from one pipe material to another must be made at a manhole or with an approved coupler at the discretion of the City.

2.4.3.7 Manholes and Catch Basins

Manholes shall be provided at each change in pipe alignment (vertical and horizontal), and at any change in pipe size or material and where the maximum spacing for a pipe run has been reached.

Generally, the maximum spacing for manholes shall be as follows:

- 120m for pipe sizes 300mm to 1050mm diameter
- 150m for pipe sizes 1200mm and larger.

The maximum change in direction from upstream to downstream pipes for pipe sizes 675mm and larger is 45°. For 675mm and larger size of pipes where the change in direction is greater than 45°, additional manholes shall be required to reduce the angle.

For manholes constructed at the end of a line that is to be extended in the future, proper bulkheads shall be designed and the size of the bulkhead shall be specified on the engineering drawings.

If the storm sewer is intended to be extended in the future and the spacing of the manholes does not allow for the optimum use of the manholes, then a temporary manhole shall be constructed at the end of the storm sewer main line with a notation that it will be removed and relocated with the future extension of the storm sewer.

Manholes may be constructed with either precast or poured in place concrete. The size of the manholes shall be based on the pipe size, the deflection angle of the pipes and the number of pipes at the junction manhole (see OPSD 701.021). When any dimension of a manhole differs from the standards, the manhole shall be individually designed and detailed.

Benching details for non-standard cases shall be detailed on the plan-profile sheets. Generally, the benching shall be brought to the spring line of the outlet pipe in accordance with OPSD 202.021.

The obvert of the upstream pipe(s) shall generally not be lower than the obvert of the pipe on the downstream side of the manhole. If the cover over the storm main is being compromised because of this rule, then the design shall be on the basis of the 0.8 x diameter of the pipes are at the same elevation.

Suitable drops shall be provided across manholes 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 Engineer shall try to restrict the change in velocity between the inlet and outlet pipes to less than 0.6 m/sec.

The minimum drops across manholes shall be as follows:

Alignment Change	Drop required
0°	grade of sewer
1° to 45°	0.03m
45° to 90°	0.06m

The maximum drop allowed across a manhole is 0.6 m calculated from the invert of the upstream pipe to the invert of the downstream pipe (in accordance with OPSD 1003.01). In junction manholes where there is a pipe entering the side of the manhole, the drop shall be calculated from the invert of the higher pipe to the top of the benching in the manhole. For drops greater than 0.60m a drop structure is required as per OPSD 1003.01. Generally, the size of the drop pipe shall be one size smaller than the connecting sewer with a minimum size of 200mm and a maximum size of 300mm. The invert of the drop pipe shall be shown on the plan-profile sheet and shall be a min. of 0.06m higher than the invert of the lowest pipe.

Safety gratings shall be installed in manholes that are greater than 5.0m in depth from the top of the manhole grate to the lowest invert and shall conform to OPSD 404.020.

Manhole frames and covers shall conform to OPSD 401.010 (open cover).

Catch basin frames and covers shall conform to OPSD 400.020 for local and collector roads and OPSD 400.070 for arterial roads.

2.4.3.8 Roof water Leaders Discharge

All single-detached and semi-detached residential dwellings shall have roof water leaders that discharge to the ground via splash pads unless otherwise directed by the City.

2.4.3.9 Storm Private Drains

Storm private drains in the City of Hamilton shall be subject to the same criteria as sanitary private drains, as detailed in Section 2.4.2.10, unless otherwise approved by the City's Development Engineering Section.

The minimum size of storm private drains shall be 150 mm diameter All storm sewer service connections shall be individual services. Shared storm private drains within the road allowance shall not be permitted.

The services shall be located in the same trench as the sanitary private drain (i.e. 1.5m to the right of the centre of a single detached residential lot) with the storm private drain located to the north or east of the sanitary private drain.

Locations for semi detached, street townhouse and maisonette units shall be specified by the Engineer. Typical locations are shown in Appendix 5.

Private drains for blocks within a plan of subdivision (for commercial, institutional, industrial or multi-family block townhouses) shall be designed by the Engineer based on the specific land use of the block.

Freehold housing units in townhouse blocks or similar shall have individual private storm drains.

Storm private drains shall be white in colour to distinguish them from sanitary private drains, which can be any colour except white.

All underside footing elevations must be located a minimum of 0.30m above the 100 year hydraulic grade line. In cases where the above criteria cannot be met, sump pumps shall be specified for each lot so affected. Foundation drains that connect into sump pumps shall discharge directly into the storm sewer.

The hydraulic grade line shall be plotted on all plan and profile drawings. Also refer to the City's "Criteria and Guidelines for Stormwater Infrastructure Design, 2007 - Section 2.1.4".

2.4.4 Watermain Design Criteria

2.4.4.1 General Requirements

The Engineer shall submit (1) one copy of Watermain Hydraulic Analysis report in accordance with MOE's watermain design criteria along with duly filled "Watermain Design Checklist" available from the City's Public Works Department. The Consulting Engineer shall also complete Part 2 of Form.

All watermains and appurtenances shall be designed and constructed in accordance with the current City standards, MOE guidelines, Ontario Provincial Standards and Specifications and American Water Works Association standards and specifications.

Available information regarding existing pressures and flows at key nodes in the neighbourhood shall be made available to the Engineer by the City. A request for this information shall be made to the Development Engineering Section.

It is recommended that all developments, and phases of developments, shall be encouraged to provide two watermain feeds where practical. Generally, if more than 100 lots are serviced by one watermain feed, a second watermain feed shall be required. The watermain distribution layout shall be discussed with the City's Development Engineering Section prior to finalizing the engineering submission. The City may waive this requirement where two watermain feeds are not practical

(or cost prohibitive). Subject to the location of the project within the City, a detailed analysis of water demands and fire flows may be required.

The report shall also identify and put in place interim procedures to maintain water quality prior to full build out. The procedures may consist of the following:

- temporary looping
- temporary flushing station
- maintenance flushing program

2.4.4.2 Location

Generally, watermains shall be located in the pavement 1.0m from the edge of asphalt. Property line off-set for watermains shall be as indicated in the City's standard road cross-section. For road allowances wider than 20m, the Engineer shall discuss with the City's Development Engineering Section to determine the preferred location.

In all normal cases, the watermain should be located such that there is a minimum of 2.5m horizontal separation from the nearest sewer.

Under unusual conditions, where a significant portion of a watermain will be in rock, or where it is anticipated that severe dewatering will occur or where congestion with other utilities will prevent a clear horizontal separation of 2.5m from a sewer, the City's Development Engineering Section should be consulted to obtain permission to install the watermain closer to the sewer and to confirm process for approval. Under such conditions, the elevation of the crown of the sewer must be a minimum of 0.5m below the invert of the watermain. Where this vertical separation cannot be obtained, the sewer shall be constructed of materials and joints that are equivalent to watermain standards of construction and shall be pressure tested in accordance with Section 2.4.4.14.

2.4.4.3 Depth of Cover

The minimum depth of cover for all new watermains shall be 1.6m measured from the top of the pipe to the centerline of the road elevation from urban road cross-sections. For rural cross-sections, where the watermain may be located near the roadside ditch, the design shall be reviewed to ensure that there is a minimum of 1.6m cover over the watermain. The maximum depth of cover allowed for existing or proposed watermains is 3.0m. Depth of cover at valves shall be reviewed on an individual basis to ensure that the operation of the valves is not compromised by excessive depth.

2.4.4.4 Sewer Conflicts and Crossings

Generally, the watermain shall cross above sewers with sufficient vertical separation to allow for proper bedding and structural support of the watermain, (500mm minimum).

When there is conflict with the elevation of the sewer and the watermain such that the watermain cannot pass over the sewer, then the watermain shall be designed such that it passes under the sewer subject to the following conditions:

a) There shall be a minimum vertical separation of 0.5m between the bottom of the sewer pipe and the top of the watermain,

b) The watermain shall be lowered below the sewer using vertical thrust blocks and restraining joints,

c) The length of the watermain pipe shall be centred at the point of crossing so that the joints are equidistant and as far as possible from the sewer, and

d) The sewer shall be adequately supported to prevent joint deflection and settling.

2.4.4.5 Hydrants

All hydrants shall be 3-way hydrants and shall generally be spaced approximately 150m apart on streets with low density development, and at 110m spacing on collector streets, high density residential streets, commercial and industrial streets. On cul-de-sacs, the fire hydrant shall be located within 75m of the dwelling lot furthest from the street entrance.

On rural roads hydrants shall be spaced at 150m. Hydrant connections (with secondary valves and blind flanges) may be installed only where the lands have not been developed.

Hydrants shall be located within the City's road allowance at the extension of the lot line between two lots to avoid potential conflicts with driveways. If the location of driveways has been determined in advance, the hydrant location shall be reviewed in conjunction with any driveway locations to ensure that conflicts do not occur. All hydrants shall:

- be in accordance with the approved watermain materials list
- be 3-way, two nozzles which are 180o to each other and parallel to the street and a 100mm pumper "STORZ" connection facing the street
- open counter-clockwise (left). All new hydrants that open left shall be painted with a black "L" symbol on the bonnet.
- have a 25mm top operating nut size

- be painted red (barrel, bonnet and hose nozzle caps) and the "STORZ" connection painted black
- be controlled by a secondary valve close-coupled to the hydrant
- be installed plumb in accordance with the City standard drawing WM-203.01

If an extension is required to adjust the length of the barrel, it shall be placed between the lower section of the barrel and the boot connection.

2.4.4.6 Valves

The number of gate valves required shall be based on the layout of the development. At an intersection, the number of gate valves required is generally one less than the intersecting watermains, i.e. if there is a 4-way cross, at least 3 valves shall be installed. On long stretches of watermain without intersections, a valve should be installed for every 100 units serviced or with maximum distance between two valves being no more than 600m which ever is greater, and shall be located on the projection of a lot line. At intersections, the valve shall be located at the projection of the intersecting street line. All gate valves shall:

- be in accordance with the approved watermain materials list;
- open clockwise (right) in the Hamilton District;
- open counter-clockwise (left) in the Ancaster, Dundas, Flamborough, Glanbrook and Stoney Creek Districts;
- be installed in chambers if 400mm and larger; and,
- have a 25mm operating nut size in Hamilton district and 50mm in the Ancaster, Dundas, Flamborough, Glanbrook and Stoney Creek.

Chambers are not required for main line gate valves and tapping valves off mains smaller than 400mm diameter (even if located within the road pavement). All gate valves 400mm and larger and tapping valves off mains 400mm and greater shall be installed in a concrete chamber in conformity with current City standards.

Air valves and blow-off valves shall be installed in a chamber, regardless of size.

Valve chambers shall contain a sump and drained by a 150mm diameter storm drain to the storm sewer, where possible. An approved backwater valve or approved equivalent shall be installed on the storm drain. If there are no storm sewers or where the storm sewer is not deep enough to drain the valve chamber, a 600 mm diameter sump shall be installed in the bottom of the valve chamber.

The top of valve boxes and valve chamber covers shall be set flush with the finished grade. For chambers and valve boxes located in shoulders of roads, an asphalt

paved shoulder shall be constructed in accordance with RD-111.

2.4.4.7 Tapping Valves and Sleeves

Connection of a new watermain to the existing water distribution system shall be made using a tee and sleeve. In the event that the water distribution system cannot be taken out of service a tapping valve and tapping sleeve shall be utilized, subject to approval by the City. The City's Development Engineering section shall confirm if the water distribution system can be taken out of service.

Tapping valve and tapping sleeve shall be in accordance with the approved watermain materials list.

2.4.4.8 Backflow Prevention

In accordance with the City of Hamilton Backflow Prevention By-law 10-103, a backflow prevention device must be installed and maintained on all existing and/or proposed water services to industrial, commercial, institutional and multi-residential buildings to prevent the flow of contaminants into the municipal drinking water system.

Selection of the required backflow prevention device, specific to a property, is to be determined through a "Cross Connection Survey", carried out by a qualified individual, under the terms and timelines, as described within the By-law.

Backflow prevention devices must be installed no more than 3.0 m downstream of a properties water meter, or in the case of a fire protection system, where the fire protection service enters the building and in a location acceptable to the City. Where a water meter is installed with an underground chamber, due to Water By-law requirements, the backflow preventer must also be located within the 3.0 m maximum spacing which may necessitate the installation of an additional chamber or secure structure to house the device. It must be noted where a "reduced pressure" type backflow device is specified for use, through the survey process, it must not be located within a chamber due to its workings.

Where a fire protection system exists or is proposed within a building, the service must also be protected against backflow in accordance with the CSA standards, and the backflow device must be either a double check detector assembly or a reduced pressure detector assembly with a detector meter which is capable of measurements in cubic meters.

Proposed backflow prevention devices to be installed within buildings will be reviewed and approved under a Permit issued by the City of Hamilton Building Department. Installation of devices within chambers etc., outside the building structure, will be approved under the Water Permit issued by the Growth Management Division.

All Backflow Prevention Devices must be selected, and maintained in accordance with the City of Hamilton's Backflow Prevention By-law # 10-103 the manufacturer's specifications and the guidelines set out in the most recent version's of the AWWA Canadian Cross Connection Control manual and the CSA. B64.10 / 07 / B64. 10.1-07 Standards. A general note to this effect should be included on all plans submitted for Water Permit issuance through the Growth Management Division.

The following backflow preventer valves are acceptable:

• Watts 009	16mm to 50mm
• Watts 909	75mm to 200mm
• Hersey FRPII	19mm to 50mm
• Hersey 6CM	75mm to 100mm

2.4.4.10 Cul-de-sac and Dead-end Mains

Permanent cul-de-sacs shall provide for looping of the watermain in accordance with details shown in Appendix 5. It is recommended that fire hydrants are located at the end of temporary dead-end mains; however, a 50mm blow-off is an acceptable alternate.

2.4.4.11 Pipe Material and Bedding

Acceptable material for watermains shall be in accordance with current City of Hamilton "Construction and Materials Specifications Manual – Approved Products List".

For PVC mains a continuous #12 gauge TWU tracer wire must be supplied along the full length of the pipe to provide electrical continuity for purposes of locating the main and cathodic protection of metallic fittings in accordance with Form 400.

Substitution of pipe material from the approved drawings must be approved by the City and Engineer prior to use.

Transition from one pipe material to another must be made with an approved coupler.

Bedding requirements

• Ductile Iron or Hyprotec Ductile Iron	Granular A, WM-200.02
• PVC	Granular A, WM-200.01
• Copper, Type K Soft	Granular D, WM-200.01

2.4.4.12 Thrust Blocks and Mechanical Joint Restrainers

All horizontal and vertical bends, tees and plugs shall be restrained with concrete thrust blocks in accordance with City Standard drawings.

Concrete for thrust blocks shall be 30 MPa laid to undisturbed ground. Where thrust blocks cannot be laid to undisturbed ground due to excessive sewer excavation or fill conditions, mechanical joint restrainers may be used in conjunction with concrete thrust blocks.

Any section of watermain that is not pressure tested against thrust blocks (e.g. connection pieces), shall be required to use mechanical joint restrainers at the tee connections in addition to the concrete thrust block.

2.4.4.13 Private Water Services

Private water services for single detached residential lots shall be a minimum of 20mm dia, Type K copper pipe, located 1m to the left of the centerline of the lot. Water services shall be separated from sanitary and storm private drains by a minimum distance of 2.5m.

All private water services shall be connected to a main stop at the watermain and shall be terminated at the street line with a curb stop and box, all in compliance with the Waterworks By-Law No. R84-026.

Water services shall be installed perpendicular to the watermain, where possible.

2.4.4.14 Charging and Testing of New Watermains

All new watermains shall be tested prior to connection to existing watermains, using temporary caps or plugs.

All connection points between the new watermain and the existing water distribution system must be kept physically separated until the watermain has successfully passed bacteriological tests.

Temporary charging of new watermains

A reduced pressure zone backflow preventer is required on the temporary supply line used for filling and flushing of all watermains. The following backflow preventer valves are approved:

- Watts 009 16mm to 50mm
- Watts 909 75mm to 200mm
- Hersey FRPII 19mm to 50mm
- Hersey 6CM 75mm to 100mm

Testing of new watermains

New watermains shall be tested in the following sequence:

1. pressure and leakage test;
2. swabbing; and,
3. disinfection and bacteriological testing

to the satisfaction of the City prior to connection to existing watermains.

Pressure and Leakage Testing

Prior to the pressure and leakage test, the contractor may elect to swab the main to assist in the removal of air pockets.

The test pressure shall not be less than 1035 KPa (150 psi) for ductile iron and PVC pipe.
The leakage allowance shall be less than 1.85 L/mm of pipe diameter/km of pipe/day within the shortest valved section. The duration of the pressure test shall not be less than two (2) hours.

Swabbing

All new watermains shall be cleaned by passing a minimum of three (3) polyethylene swabs through the pipe. Additional swabbing will be required if the water in not clear after the third swab.

Disinfection and Bacteriological Testing

After pressure and leakage testing, and swabbing of the new main, disinfection of the new main shall proceed. Sodium hypochlorite or other approved chlorine compound in sufficient quantity to obtain an initial free chlorine residual of minimum 50 mg/L and a minimum of 25 mg/L 24 hours after introduction into the pipe.

After successfully disinfection, the main shall be flushed. Chlorinated water may be discharged into the sanitary sewer system. In rural areas where no sanitary sewers are available, chlorinated water must be de-chlorinated and tested prior to discharging into a ditch or watercourse.

After final flushing and a "sitting period" of 18 hours, water samples for bacteriological testing will be collected by the City and submitted for testing by the City Laboratory at Woodward Avenue. Samples will only be accepted by the Lab Monday through Friday from 8:30 a.m. to 3:30 p.m.

Samples shall be collected at the end of each branch or stub, at 350m intervals, and

a minimum of two (2) samples taken for each main twice, 24 hours apart. When the samples prove satisfactory, the mains may be placed in service and connection to the existing water distribution system can be arranged.

The Engineer shall co-ordinate connection of new watermains to the water distribution system with the City. All affected properties must be given a minimum of 48 hours advance notice by the Engineer prior to the disruption of the water distribution system.

2.4.5 Roadways

2.4.5.1 Road Classification

For development purposes, the following definition of road types apply:

Arterial Road describes a road, which functions as a strategic link in the overall road network of the City. Arterial roads carry relatively large volumes of short and long distance traffic in and through the City and provide some access to abutting properties

Collector Road describes a road whose function is to provide a connecting road link between arterial and local roads. Collector roads generally carry lower traffic volumes then arterial roads and may provide direct access to abutting properties

Local Road provides direct access to abutting properties and carries traffic predominantly of a local nature

Classification of roads as major or minor collectors and local residential roads shall be identified in the City's Official Plan or the Secondary Plan for each planning neighbourhood. Where no Secondary Plan has been prepared, the General Manager of Planning and Economic Development shall determine the classification

applications to the City (Development Engineering) for review or approval. Engineer has to include a statement of conformance of utility design. The MC approval for all utilities shall be submitted to the City at the same time.

9. City reviews lot grading plan. If additional revision(s) are required, the Engineer must contact the utility companies to work out their designs.

10. Additional submissions as required.

11. The Development Engineering Section forwards 2 copies of all the MC forms

12. City's Utility Right-of-Way Co-ordinator returns approved MCs to appropriate utility companies.

13. All utility companies must be represented at the pre-construction meeting unless the utility company acknowledges (in writing) that its attendance is not warranted.

14. Road construction may not proceed until such time as all the MCs have been approved.

15. Each of the drawings attached for the MC has to be signed off by the Engineer indicating that all conflicts have been noted and eliminated.

16. The following note, signed and dated by the Engineer, shall be present on all development related utility drawings submitted for MC approval:

"This certifies that we have reviewed the drawings and the proposed utility locations are in accordance with City of Hamilton Standards. There are no conflicts."

_____ _____

Engineer Date

2.4.5.28 Asphalt Overlays on Existing Roads

If multiple road cuts are required on existing roadways for construction of underground services, the Developer can expect to provide full reconstruction of the road base as a condition of development approval, unless it can be demonstrated that servicing can be completed without adversely affecting the service life of the road. As a minimum, a full width overlay of asphalt will be required to a maximum of three service trenches including rear lot catch basin leads.

When overlaying an existing road then the roadway shall be overlaid from 1m past the first cut to 1m past the last cut.

If a service trench is required for a service parallel to the road, then the entire road shall be overlaid from 1m past the start of the service trench to 1m past the end of the service trench. If the service being installed is off-set from the centerline of the road such that the service trench affects only a portion of the road, then the City may, at its discretion, allow half the road to be overlaid. For extra wide roads, the minimum asphalt overlay shall be one lane width.

The decision to reconstruct or mill the entire roadway or to put an asphalt overlay shall be site specific depending on the grade and condition of the existing road.

2.4.5.29 Road and Lane Closures

Any anticipated road and lane closures required for underground or above ground works shall be identified by the Engineer at the initial submission of the engineering drawings.

The Development Engineering Section shall confirm the feasibility of road and lane closures and any requirements that are necessary, including temporary works, the preparation of detour routes and sign boards, and notification. The approval of a road closure is subject to the approval of the General Manager, Public Works. The cost of implementing a road closure shall be borne by the developer.

2.4.5.30 Pavement Markings and Signalization

Unless otherwise agreed to by the City, the Developer is responsible for all costs associated with design (base road surveying, engineering, traffic signal design and pavement marking) and construction of intersections controls for development related projects. The consultant retained shall be to the satisfaction of the City's Public Works Department and will be responsible to complete the design submission to approximately 85% completion at which point the City staff will finalize the design.

The City's Traffic Signals Systems staff, will supply and install signal hardware including signal utility poles, signal heads, arms, controller, wiring, pavement markings and signs. The cost of this labour and materials is the applicant's responsibility.

2.4.6 Erosion and Sedimentation Control

A plan, which shall include a report and drawings, shall be prepared at the design stage incorporating the requirements for erosion and sedimentation in accordance with "Erosion & Sediment Control Guideline for Urban Construction" dated December 2006. The format of the report shall follow "Table 2" of the above referenced guidelines.

It is recognized that topsoil and other vegetation shall be removed from the site to accommodate grading, construction of sanitary and storm sewers, watermains, and other municipal services. The resulting areas of stripped ground will require sedimentation control measures to prevent silt from reaching the receiving storm sewer and downstream watercourses. The following minimum measures will be implemented during the construction phase of the development:

a) silt traps in the form of single filter cloth barriers shall be installed along the site boundaries that are susceptible to siltation;

b) vehicle tracking controls to be constructed at all points of site access;

c) sediment traps consisting of filter cloth barriers shall be installed at all rear yard catchbasins. For roadway catchbasins, the filter cloth shall be folded in half, hung across the outlet pipe and weighed down with rebar;

d) of building activity does not commence within 45 days after construction is completed, arrangements shall be made to seed any stripped areas and topsoil stockpiles that are not covered by vegetation and maintain them until ground cover is established; and

e) maintenance of all siltation control measures will be required to prevent them from being clogged including replacement of filter cloth as required.

Sedimentation control measures shall be kept in place until satisfactory ground cover has been established and all building activity has been completed.

Requirements of the respective Conservation Authorities shall be taken into account in the preparation of the Erosion and Sediment Control Plan.

2.4.7 Easements

As a general principle, the City discourages installation of municipal works on private property through easements. In the instance where a municipal sewer or watermain must be located on private property, the Engineer shall obtain approval, for such alternative location, from the City's Planning and Economic Development Department during the preliminary engineering stage of development. The sewer or watermain shall be located within an easement in favour of the City and the developer shall carry out all steps necessary to transfer the easement to the City.

The minimum easement width required is:

- 9 metres for one sewer (sewer centered on the easement)
- 12 metres for dual sewer installation
- 6 metres for a watermain (watermain centered on the easement)
- 10 metres for one sewer with a watermain (3m easement limit to watermain, 2.5m clearance between watermain and sewer and 4.5m sewer to easement)
- 12 metres for dual sewer installation with a watermain.
- Minimum of 4.5m for significant swales (refer to Criteria and Guidelines for Stormwater Infrastructure Design 2007)

The above easement widths are minimum requirements and may be increased depending on the depth and size of the pipes within the easement and/or soil conditions, topography or operational needs.

Where special circumstances warrant, exceptions to reduce minimum easement requirements may be considered during pre-engineering submissions, requests to reduce these requirements will be considered by the City's Senior Director of Growth Management.

In general, the City shall not require easements for private catch basin connections or private sewers and watermains.

2.4.8 On-Street Parking

New residential development shall provide adequate, convenient on-street parking within the right-of-way for all residences with direct access, while ensuring road safety, in accordance with the following criteria.

The Developer shall submit an On-Street Parking Plan for all lots or blocks within the plan intended for street-fronting residential development. Submission of the On-Street Parking plans are subject to the following timing:

- Prior to Draft Approval (part of what's deemed as a Complete Submission)
- Post Draft Approval (the final parking plan is approved as part of approval of the engineering submission)

2.4.8.1 The On-Street Parking Plan

The On-Street Parking Plan shall show the following:

a) the location and width of driveways, driveway ramps and curb openings for all lots and blocks; and

b) the location of approved above-ground utilities (street furniture): concrete transit pads, community mailboxes pads, and fire hydrants (where the location has been determined by the appropriate authorities).

2.4.8.2 On-Street Parking Spaces

a) Number of On-Street Parking Spaces

The number of parking spaces shall reflect land use efficiency. It shall be of a minimum ratio of 0.4 parallel on-street parking spaces for every one (1) residential unit, while providing reasonable walking distance.

b) Location of On-Street Parking Spaces

Parking spaces should be located at the prescribed ratio in accordance with the following to ensure road safety and efficient land use:

i) within the street block containing the units and/or on either side of an abutting intersection street within the flankage of the corner lot;

ii) on one side of the street only;

iii) a minimum of 0.5 metres setback from either side of the driveway ramp/curb opening;

iv) a minimum of 9m from an intersection (15m where there are traffic signals), as measured from the point of intersection formed by the projection of the curb lines or edges of pavement where there is no curb;

v) not permitted across from a "T" intersection;

vi) not permitted within 15m of a bus stop;

vii) not permitted within 3m of a fire hydrant;

viii) not permitted along school frontages;

ix) not permitted along park frontages; and,

x) not permitted in front of a midblock pedestrian walkway or trail which continues on the opposite side of the street.

c) Size of On-Street Parking Spaces

On-Street parking spaces shall be shown in accordance with the following:

i) the width of each parking space shall be 2.4 m;

ii) where there are two (2) or less tandem parking spaces provided, the length of each on-street parking space shall be 5.5 m;

iii) where there more than two (2) tandem parking spaces provided, the length of each internal on-street parking spaces shall be 6.7 m.

Alternatives to the Provision of On-Street Parking

In cases where the required parking cannot be achieved, the following alternatives will be taken in consideration:

a) increasing lot size

b) increasing the length of driveways (may include lots with detached garages)

c) more high-density development with its own parking facilities

d) proximity to transit

e) walkability

2.4.9 Standing Water By-Law

City of Hamilton By-Law 03-173 prohibits and regulates the accumulation of standing water at specified times of the year. Standing water on construction sites is an area of concern by the City and all development projects will be monitored by the City for compliance of the By-Law.

Developers should ensure that standing water does not accumulate on the land between April 1 and October 31 of each year.

2.5 City of Hamilton Lot Grading Policy, Criteria and Standards

Lot grading for single detached and semi-detached lots created through development
applications in the City of Hamilton shall be subject to the following policy.

2.5.1 Grading Policy

Security for lot grading under Subdivision Agreements and Consent Agreements will be administered according to the following procedure.

2.5.1.1 Grading Security for Lots Created Under a Subdivision Agreement

Subdivision agreements will show a line item for:

a) First Stage Fees: Security Collected under Initial Application Approval Process

i) Pre-grading of lots

Security for pre-grading will be collected through the City's subdivision agreement based on $1,000 per lot created by the plan and will be released following receipt of a grading certificate from the developer's engineer certifying that pre-grading has been completed.

ii) Overall Grading and Drainage

A lump sum security deposit will be collected through the City's subdivision agreement to ensure completion of overall grading and drainage and sodding; should a problem arise with the overall grading in a development, which cannot be rectified by modification to any single lot within that development.

Security amounts for final lot grading will be based on a sliding scale according to the size of the development as follows:

- $ 10,000 for plans up to 25 lots
- $ 15,000 for plans over 25 lots up to 50 lots
- $ 20,000 for plans over 50 lots up to 100 lots
- $ 25,000 for plans over 100 lots

The security held by the City under the subdivision agreement for the overall grading and drainage will be released upon acceptance of grading certificates by the City for all lots within a plan of subdivision in accordance with the sliding scale amounts indicated above.

Notwithstanding the above, the value secured on any subdivision will not be reduced to less than $5,000 per uncertified lot.

b) Second Stage Fees: Security Collected under Building Permit Application

A cash security deposit of $1,500 will be collected as a condition of building permit application from the owner of each lot within a development. The security deposit will be retained by the City to ensure completion of final lot grading and sodding. The security will only be released upon the City's acceptance of a final lot grading certificate, including an as-built plot plan, in accordance with the approved grading and plot plans. (Refer to Section 2.5.6 for details).

2.5.1.2 Grading Security for Lots Created under Severance Application

a) First Stage Fees: Security Collected under Initial Application Approval Process

A lump security deposit of $10,000 will be collected from the developer under the appropriate development agreement (i.e. Consent Agreement).

The security deposit will be retained by the City to ensure completion of final lot grading and sodding and will only be released upon both the City's acceptance of a final lot grading certificate, including an as-built plot plan, in accordance with the approved grading and plot plans and a mandatory grading inspection.

b) Second Stage Fees: Security Collected under Building Permit Application

A cash security deposit of $1,500 per lot will be collected from the owner of each lot within a development as a condition of building permit application. The security deposit will be retained by the City to ensure completion of final lot grading and sodding and will only be released upon the City's acceptance of a final lot grading certificate, including an as-built plot plan, in accordance with the approved grading and plot plans. (Refer to Section 2.5.6 for details)

2.5.2 Design Criteria

Design Criteria for grading lots with single detached and semi-detached housing in new developments within the City of Hamilton are as follows:

a) "Required backyard" shall mean the lesser of the distance regulated by the Zoning By-law or 6.0 metres.

b) The maximum slope in the backyard adjacent to the building for a distance equal to the required backyard shall be 5% except as set out in Items (c), (d), (f) and (g).

c) The 5% restriction shall not apply to the sides of a swale along the sides or back of a lot, providing the total width of a swale does not exceed one (1) metre on each lot.

d) Where the 5% restriction on the backyard's grades results in elevation differences between adjacent properties, retaining wall shall be constructed along the sides and back of the lot.

e) Generally, slopes shall be placed on the lower lot, whereas retaining walls shall be placed on the higher lands.

f) The 5% restriction does not preclude retaining walls in the required backyards providing the terraces are maintained to the 5% grade as set out in Item (b). The intention of this provision is to provide for flexibility of house construction.

g) Guards for retaining walls shall be designed and constructed in accordance with the requirements for exterior guards as contained in the Ontario Building Code.

h) Slopes of swales for both "back to front" and "split" drainage shall be no less than 2.0% grade and no greater that 33% grade (3:1 slope).

i) Back to front drainage shall only be permitted where the combined side yard setback is 2.0m or more, providing a minimum of 2.0m between foundation walls for drainage swales. A 1.2m setback is required on the garage side of the lot.

j) When matching to existing properties where 2% slope cannot be achieved, then a 1.5% slope is permitted provided a 150 mm sub-drain is installed below the bottom of the swale and drained to a suitable outlet, with a minimum of 0.30 metre cover over the sub-drain or other mitigation measures.

k) Minimum slopes for a "wrap around" swale in the back yard shall be 1.0%.

l) Driveway slopes shall not be less than 2.0% and not more than 7%.

2.6.8 Repairs

The Developer shall make repairs in a manner satisfactory to the City, to any and all damage to the works during construction and during the maintenance period.

2.6.9 Assumption of Works – End of Maintenance

Prior to the "end of the maintenance" period for the below ground works, the Engineer shall submit a request for a final visual inspection of the sewers and watermains with the City. In addition, a mandrel test shall be performed by the Contractor on all PVC sewers (sanitary and storm) in accordance with OPSS 410.07.15.05. When all identified deficiencies have been completed to the satisfaction of the City, a certificate of completion and final acceptance will be established.

Prior to the "end of the maintenance" period for the above ground works, the Engineer shall request a final visual inspection with the City. When all deficiencies have been corrected to the satisfaction of the City, a final assumption date will be established.

Prior to the City assuming any services, the Developer shall:

- submit a declaration that the Developer has paid all accounts in connection with the installation and maintenance of the said works and that there are no outstanding claims; and
- all repairs have been corrected to the satisfaction of the City.

2.6.10 Security Reductions

The Developer may apply for a reduction in securities held by the City, once the works have been constructed. Each request for security reduction will be accompanied by a Certificate from the Engineer, outlining the value of the completed works as well as the value of incomplete works. The value of the incomplete works shall be estimated on the basis of the signed Contract of Works for the project.

Any interim requests for reduction in securities shall be accompanied by a proof of payment to the Contractor based on the latest payment Certificate issued by the Engineer to certify the value of incomplete works.

A security reduction processing fee will be applied after the third security reduction.

A copy of the standard format to be used for requests for reduction in securities is available from the City upon request.

2.6.11 Service Locates in New Subdivisions

The Developer shall be responsible for providing all "in-field" locates of services constructed under a plan of subdivision when requested under the "Ontario One Call" or equivalent system, and shall assume all liability associated with service locates that are required to be provided any time from the start of construction of sewers and watermains, up to the time the Developer (or his Engineer) has submitted, in a form satisfactory to the City, preliminary "as-built" information on the services installed by the Developer's Contractor.

This preliminary "as-built" information shall be submitted as soon as possible upon completion of construction in a form of prints of as-constructed engineering drawings.

Initially, the City shall retain securities in the amount of $5,000.00 per plan-profile sheet of the engineering drawing or part thereof, to ensure that the preliminary as-built information is made available in a timely manner. Thereafter, the securities shall be reduced to $1000.00 per plan-profile sheet to ensure that the final as-constructed mylar engineering drawings are submitted.

If the City has not been provided with the preliminary as-built information, then any requests to provide service locates under the Ontario One Call system will be directed to the Developer who shall provide the necessary field locates.

2.7 As-Constructed Drawings

All engineering drawings included in the final design drawings (except lot grading plans) shall be updated to incorporate the following As-Constructed information:

Sewers

- sewer length measured from centreline to centreline of manhole cover;
- percent grade of sewer;
- invert elevations at manholes, plugs and bulkheads; and,
- manhole cover elevation

Private Drains

- location of private drain at main sewer dimensioned (chainage) from a manhole;
- location of private drain at streetline referenced by a measurement

from a lot corner; and

- where risers are used indicate with 'R'

Watermains

- chainage of watermain appurtenances (tees, bends, reducers, hydrants, etc.) starting with 0+00 at a main valve or from a hydrant if no main valve; and

- specify manufacturer's name and model number for all valves and hydrants

Water Services

- location of all private water service at the main (mainstop) to be indicated by chainage; and

- location of curb stop to be referenced by a measurement from a lot corner

General

- rock profile, where applicable;

- all references to "proposed" to remain on drawings, unless the works were not constructed and the corresponding notes shall be crossed out (it will be assumed that all works were constructed unless otherwise noted); and

- a certificate to be added to each drawing

"This certifies that the work shown on this drawing related to underground works has been completed in the field as required by the City of Hamilton subdivision agreement. All underground services shown are as-constructed."

_____ _____

Date Engineer

One copy of the as-constructed drawings shall be submitted to the City for review. Upon acceptance of the information on the drawings, the Engineer shall certify the drawings and provide mylar copies of all drawings (including a copy of the original lot grading plan and detail sheets) to the City for its permanent record.
The Engineer shall also provide the drawings in electronic file format (*.DWG or *.DXF), if available.

2.8 Building Permits

For houses in new subdivisions, building permits will not be issued by the City for any lot, block, unit or severed parcel within the Land by the City:

a) until the Plan of Subdivision, if any, has been registered on title;

b) until the required Subdivision Agreement has been registered on title;

c) until such time as the Engineer has certified that watermains, including fully serviceable and operative fire hydrants, together with a roadway, which includes granular base and base asphalt, have been installed in accordance with municipal standards to the satisfaction of the City;

d) until such time as the Engineer has certified that the lots, blocks, units or severed parcels have been pre-graded in accordance with the requirements of the Subdivision Agreement for pre-grading;

e) until a Detailed Grading Plan indicating the site of the building, the main floor and top of foundation wall elevations, and the proposed grading according to the Overall Grading Plan has been prepared by an Ontario Land Surveyor or a qualified Professional Engineer and filed with the Director of Building Services, or designate;

f) all trees to be preserved on the lot, block, unit or severed parcel have been satisfactorily protected in accordance with the standards established by the City; and

g) unless otherwise prescribed in the Subdivision Agreement.

Notwithstanding the forgoing provisions of this section, a building permit may be issued in accordance with the Model Home By-Law 03-163, provided the Engineer certifies that:

a) an approved grading plan;

b) an existing charged hydrant is located within 150 metres; and,

c) an acceptable street access has been provided to within 90 metres, of the construction site's property boundary.

3

Financial Policies

3.1 Over-sizing of Infrastructure

The term "over-sizing" in the context of this policy refers to sewers or watermains or roadways whose size has been increased (over-sized) beyond the size of a local service, as listed under sections 3.1.1 & 3.1.2 (below), and is therefore intended to service an area over and above the development proposed. The City's contribution towards over-sized services constructed under subdivision agreements is based on the principle that no single Developer should pay the up-grade cost of municipal infrastructure which is intended to benefit and service all of development. Contribution by the City towards the cost of over-sized services constructed under subdivision agreements under this policy is funded from revenues collected by the City through its Development Charge.

3.1.1 Sanitary Sewers, Storm Sewers and Watermains

A Developer is required to pay the full cost for the installation of sanitary sewers and manholes, storm sewers and manholes and watermains, valves and chambers up to and including the following sizes:

Sanitary Sewer	450mm diameter
Storm Sewer	1200mm diameter
Watermain	300mm diameter

The City shall contribute towards the cost to install sanitary and storm sewers and watermains, which exceed the sizes listed above and are considered over-sized, on a "Flat Rate" basis in accordance with the rates shown in Table 3.1, plus engineering and overhead fees and HST.

Over-sizing rates under Table 3.1 shall be adjusted annually by the City each November using the September issue of the Canadata Construction Cost Index (Ontario Series) for that year.

3.1.2 Roadworks

Under this policy the following road classifications shall again apply:

Arterial Road describes a road, which functions as a strategic link in the overall road network of the City. Arterial roads carry relatively large volumes of short and long distance traffic in and through the City and provide some access to abutting properties.

Collector Road describes a road whose function is to provide a connecting road link between Arterial and Local roads. Collector roads generally carry lower traffic volumes then Arterial roads and may provide direct access to abutting properties.

Local Road provides direct access to abutting properties and carry traffic predominantly of a local nature.

A Developer is required to pay the full cost for installation of an 8.0m wide (local) roadway with deep strength asphalt pavement, consisting of 150mm Granular "A" and 300mm Granular "B" bases, 80mm base course (HL8) asphalt and 40mm final course (HM3) asphalt constructed under subdivision agreements.

The City of Hamilton shall contribute towards the cost of over-sized roads, which may be required on collector and arterial streets constructed under subdivision agreements. Over-sized roads are roads for which the design standard is greater than 8.0 metres in width and/or where the design requires extra depth pavement consisting of additional base course (HL8) asphalt and/or granular bases over the standard requirements of a local road due to traffic considerations. Extra asphalt or granular bases required during the construction stage due to sub-soil conditions and/or method of construction shall not be compensated by the City.

Contribution by the City toward the cost of over-sized roads shall be on a "Flat Rate" basis in accordance with the rates shown in Table 3.1.

3.2 Cost Sharing for Frontage

In this policy, aboveground works refers to and includes all of the following:

- asphalt road on a granular base,
- concrete curb and gutter, including sub-drain,
- sidewalk,
- catch basins and connections,

- street lighting; and
- utility trenching

Underground works refers to and includes all of the following:

- storm and sanitary sewers, including manholes,
- storm and sanitary private drain connections, and
- watermains, valves and chambers and water service connections

3.2.1 New Roads Servicing Rate

All cost sharing by the City or cost recoveries as a result of previous front-ending by the City for aboveground works shall be based on a flat rate system referred to as the "New Roads Servicing Rate".

The New Roads Servicing Rate represents the average cost of aboveground works constructed under Subdivision Agreements, less the portion of the cost related to over-sizing, but does not include an overhead for engineering and administration fees or HST, which shall be payable in addition to the Servicing Rate. The City shall set the New Roads Servicing Rate annually at the beginning of each year (See Table 3.2).

All costs collected by the City from Developers as a result of previous front-ending by the City for existing or future aboveground works shall be based on the New Roads Servicing Rate. The length of property frontage and/or flankage of the lands to be developed, which abut the existing or future works, shall be multiplied by the New Roads Servicing Rate and the sum shall be paid to the City prior to final approval of the lands to be developed.

If it can be demonstrated that the abutting property has previously paid for the aboveground works (or part thereof), the Manager, Engineering, Design and Construction shall adjust the rate accordingly.

3.2.2 City lands

The City shall pay its share of the cost of aboveground and underground works constructed adjacent to:

a) land that has been conveyed, or, is to be conveyed to the City to satisfy the requirement for parkland under the Planning Act. The City's share of servicing cost for above and below ground works to be paid at the time of completion of construction.

b) the frontage of a storm water management pond which is greater than 8.0 metres when the requirement for additional frontage beyond 8.0 metres is mandated by the City. The City's share for above and below ground works to be paid following completion of construction.

c) vacant land owned by the City, which lands do not include any un-developable lands such as environmentally sensitive areas, open space lands, woodlands, creeks, and other hazard lands. The City's share of servicing cost shall be paid upon development of the vacant land or when the vacant land takes direct benefit of the service.

Land currently used for the operation of the City such as fire halls, public works yards, arenas or community centres. This does not include land of an existing road allowance, which may abut front-end works. The City's share of servicing cost for aboveground works shall be paid following completion of construction. The City share of underground works shall be paid at the time when the land takes direct benefit of the underground service.
For aboveground works the City's share shall be based on the New Roads Servicing Rate.

For underground works the City's share shall be based on the length of the frontage of the City lands as a percentage of the total length of frontage of all the lands within the limit of the works constructed along the road. The percentage calculated from the frontage of the City lands shall be applied to the actual cost of the works along the road to determine the City's share of the cost.

In all cases allocation of the City's share of servicing costs in any year for works constructed under subdivision agreements is subject to the availability of funding in the Capital Budget as approved by the City for that year.

The City shall finance these costs through the Unsubdivided Land Reserve.

3.2.3 Fencing Adjacent to City Lands

Where a development abuts City lands or lands to be conveyed to the City as a condition of development approval, and a Developer is required to install a fence to separate the developed lands from City lands, then the Developer shall pay the full cost of the fence installation. For lands conveyed to the City to fulfil the requirement for Parkland under the Planning Act, the cost of the fence installation shall be shared equally between the Developer and the City based on the cost of a 1.50 metre high chain link fence.

The City shall finance the cost of these works from the Parks Trust Fence account.

3.2.4 Identification of Cost sharing in the Subdivision Agreement

The Engineer shall prepare a cost schedule for inclusion in the City's Subdivision Agreement (Schedule "F" - Estimate of Costs and Description of Works to be carried out by the Owner). This cost schedule shall identify all the works required to service a Developer's proposed plan, the estimated cost of the works and the City's share of that cost in accordance with the City's approved Financial Policies.

3.2.5 Value of Land for Road Allowances

Where a Developer is required to dedicate more than 13 metres of land to establish road allowance width, measured from one side of the centerline of the ultimate road allowance width to its limit, then the City shall compensate the Developer for the value of land dedicated beyond 13m on that side of the road allowance, for the length of the conveyance.

Daylight triangles are not to be included in the calculation for the over-contribution of land for road allowances.

The value of the over contribution of land shall be the lower of two estimates made by independent appraisers, approved by the City. The Developer shall pay the appraisal fees.

The City shall fund the cost of the over dedication of land through the Development Charge Reserve.

3.3 Best Efforts Obligation

3.3.1 Identification of "Best Efforts" in the Subdivision Agreement

b) Curb depression at driveways as per OPSD 600.040 and OPSD 310-050.

c) 1.5m wide concrete sidewalk as per OPSD 310.010 (125mm thickness, min. 30 MPa strength with Granular 'A' base as required to provide a leveling course for the concrete. At driveways, concrete depth to be min. 175mm.

d) Wheelchair ramps required at all intersections as per OPSD 310.030.

e) Asphalt ramping shall be placed to suit the wheelchair ramps if surface course asphalt is not installed at the same time. These ramps are to be removed just prior to placement of surface course asphalt.

6. Road Subdrains

a) 100mm filter wrapped corrugated subdrains to be installed continuously below the curb and gutter and connected to the CBs.

D ~ COMPACTION REQUIREMENTS

a) All bedding and backfill material, road sub-grades and generally all material used for lot grading and fill sections, etc., shall be compacted to min. 95% SPD (unless otherwise recommended by the geotechnical engineer). All material shall be placed in layers not exceeding 300mm lifts.

b) All granular road base materials shall be compacted to 95% SPD.

c) For all sewers and watermains in fill sections, the compaction shall be certified by a geotechnical engineer prior to laying of pipe.

E ~ SILTATION AND EROSION CONTROL

a) Siltation control barriers shall be placed as detailed.

b) All siltation control measures shall be cleaned and maintained after each rainfall as directed and to the satisfaction of the City of Hamilton.

c) Additional silt control locations may be required as determined by the City of Hamilton.

Appendix 2 – Standard Lot Grading Notes

General Grading Notes

1. Along adjoining properties grade to meet existing or proposed elevations with sodded slopes (min. 3H to 1V) and/or retaining walls as specified
2. All retaining walls, walkways, curbs, etc., shall be placed a min. of 0.45m off the property line. All walls 1.0m or higher shall be designed by a P.Eng.
3. Should a retaining wall be required, the top of wall elevations shall be set 150mm above the proposed side yard swales
4. Retaining walls 0.6m in height or greater require construction of a fence or guard rail at the top of the rear of the wall. Guards for retaining walls shall be designed and constructed in accordance with the requirements of exterior guards as contained in the Ontario Building Code
5. Slopes of swales for both "back to front" and "split" drainage shall be no less than 2.0% grade and no greater than 33% grade (3:1 slopes)
6. When matching to existing properties where a 2.0% grade cannot be achieved, a 1.5% grade is permitted provided a 150mm sub-drain is installed below the bottom of the swale and drained to a suitable outlet, (with a minimum 0.3m cover over the sub-drain), or other mitigation measures
7. Minimum grade for a wrap-around swale in the backyard shall be 1.0%
8. Unless otherwise noted, the ground between proposed elevations on side lots shall be graded as a straight line
9. Top of foundation walls for buildings shall be 150mm (min) above finished grade
10. Driveway slopes shall not be less than 2% and not more than 7.0%. Reversed sloped driveways in new developments are not permitted
11. Garage floor elev. to be set minimum 0.3m higher than back of walk, unless otherwise specified
12. All fill placed on lots shall be compacted to a minimum 95% SPD (unless otherwise recommended by the geotechnical engineer). All material shall be placed in layers not exceeding 300mm lifts
13. For delineation of tree protection zones, buffers, removals and protection schematics, etc., refer to Tree Protection Plan
14. Lot grading for all lots in the subdivision shall conform strictly with this plan. Any changes, unless approved prior to construction by the City, shall result in non acceptance of the subdivision by the City

15. If grading is required on lands adjacent to the development which are not owned by the developer, then the developer must obtain written permission from the adjacent property owner to allow the developer to grade on the adjacent lands, otherwise retaining walls must be used
16. The written permission required from the adjacent landowner shall be obtained prior to entering the lands. Should permission not be obtained or is withdrawn prior to commencing the work, then the developer shall limit his activities to the limits of the development site.
17. Driveway and driveway approaches shall be located such that hydro vaults and other street furniture are a min. of 1.2m from the projections of the outside garage walls.

Backyard Grading Notes

a. Definition: "Required back yard" shall mean the lesser of the distance regulated by the zoning by-law or 6m

b. The maximum slope in the back yard adjacent to the building for a distance equal to the required back yard shall be 5%, except as set out in items below

c. The 5% restriction shall not apply to the sides of a swale along the sides or back of the lot, providing the total width of the swale shall not exceed one (1) metre on each lot

d. Where the 5% restriction on the backyard grades results in elevation differences between different properties, retaining walls shall be constructed along the sides and the back of the lot. Slopes with a maximum of three horizontal to one vertical may replace the walls where the difference in elevation is less than 0.3m e. Generally, slopes shall be placed on the lower lot, whereas retaining walls shall be placed on the higher lands

f. The 5% restriction does not preclude retaining walls in the required backyards providing the terraces are maintained to the 5% grade as set out in Item b) above. The intention of this provision is to provide for flexibility of house construction

g. There is no control on the steepness of the slopes in side yards, front yards and back yards, outside the area defined in a) above, providing the slopes are stable for the soils of the area (minimum 3H:1V)

Roofwater Leaders

All roofwater leaders shall discharge onto splash pads and then to grassed or landscaped areas a min. of 0.6m from the building face.

Sump Pumps

Sump pumps with check valves are to be installed in each dwelling to pump the weeping tiles to the storm private drain. The sump outlet shall extend a minimum of 150mm above the proposed grade at the dwelling (basement ceiling) prior to discharging to the storm private drain.

Appendix 3 – Sanitary Sewer Design

Sanitary Sewer Design Calculation Sheet

Appendix 4 – Storm Sewer Design

Storm Sewer Design Calculation Sheet
Storm Sewer Design Tables (aCi v/s time)

Appendix 5 – Standard Details

PED-100.01 - Local Urban Residential – 20.0m ROW

PED-100.02 - Local Urban Residential – 18.0m ROW

PED-100.03 - Local Urban Residential – 18.0m ROW without sidewalk and for cul-de-sacs

PED-110.01 - Permanent Cul-de-sac for Local Residential Streets 18.0m ROW

PED-110.02 - Temporary Turning Circle (20.0m ROW)

PED-120.01 - Typical Dead End Barricade

PED-200.01 - Servicing for Townhouse Complex

PED-200.02 - Servicing for Institutional, Commercial and Industrial Sites

PED-200.03 - Servicing for Multiple Building Institutional, Commercial and Industrial Sites (Separate Frontages)

PED-200.04 - Servicing of Multiple Building Commercial and Industrial Sites (Partial Frontages)

PED-310.01 - 50mm Watermain Looping in cul-de-sacs (18m ROW)