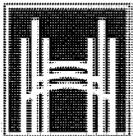


Engineering Guidelines for Servicing Land Under Development Applications

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 contributing to each manhole shall be clearly outlined and the area in hectares and population density in persons per hectare, shall be indicated on all drainage areas.
4. If the contributing area to a manhole is made up of areas with different population densities, the sub-areas showing the individual area in hectares and the population density shall be clearly shown.
5. If the external drainage area is large, it may necessitate the preparation of an external drainage area plan. External drainage area plans may be prepared at a smaller scale, but shall show the existing ground contours to beyond the limit of the drainage area. Planned street patterns (if available) shall be shown to determine the route of the future sewers.

2.4.1.7 Storm Drainage Area Plan

The Storm Drainage Area Plan shall be drawn at the same scale as the General Plan of Services and shall include the following:

1. All streets, lots, blocks, easements and other lands within the plan of subdivision.
2. Proposed storm sewers, including size, length and grade, manholes, manhole numbers, direction of flow, major over land flow routes, and details of the outlet sewer or receiving watercourse and/or stormwater management facility.
3. The drainage areas within the subdivision and the limits of external areas draining into the proposed system. The area contributing to each manhole shall be clearly outlined and the area in hectares and runoff coefficient shall be indicated on all drainage areas.
4. If the contributing area to a manhole is made up of areas with different runoff coefficients, the sub-areas showing the individual area in hectares and the runoff coefficient shall be clearly shown.

5. If the external drainage area is large, it may necessitate the preparation of an external drainage area plan. External drainage area plans may be prepared at a smaller scale, but shall show the existing ground contours to beyond the limit of the drainage area. Planned street patterns (if available) shall be shown to determine the route of the future sewers.

2.4.1.8 Other Plans

Detail drawings shall be prepared by the Engineer whenever necessary for special features not covered by the City's Standard Drawings or OPSD. These special details shall be drawn on standard sized sheets and included as part of the engineering drawings.

For lots fronting on existing roads, cross-sections showing existing conditions, temporary and permanent works shall be submitted as part of the engineering drawings.

2.4.1.9 Geotechnical Soils Report

Soil test borings shall be placed at intervals not exceeding one hundred and fifty (150m) metres and to a depth of not less than three and one half (3.5m) metres below the proposed pavement grade or refusal to rock.

Soil classification and water levels shall be recorded and noted on the plans and profiles submitted.

The geotechnical consultant shall provide recommendations on the proposed pavement structure, including confirming the minimum pavement design requirements outlined in Section 2.4.5.4.

One paper copy of the geotechnical report shall be submitted together with an electronic copy in PDF format.

2.4.1.10 Watermain Hydraulic Analysis Report

The Engineer shall submit a Watermain Hydraulic Analysis report, if required. The report shall include the watermain design in accordance with Ministry of Environment Design Guidelines for Drinking-Water Systems, 2008.

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

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

2.4.1.11 Hydro-geological Studies

In general, the report, prepared by a qualified professional shall address impacts of the proposed development in accordance with subwatershed and master drainage plan study recommendations on: ground water levels, flow paths, and recharge and discharge zones; karst features; and, water balance / water budget.

The report shall also provide recommendations to mitigate groundwater impacts, including monitoring, and a groundwater contingency plan to ensure that an appropriate mitigation strategy is available to be implemented in the cases where:

- i) an aquifer is breached during excavation;
- ii) groundwater is encountered during any construction within the subdivision, including but not limited to house construction;
- iii) sump pumps are found to be continuously running;
- iv) water supply and sewage disposal systems and any surface and groundwater related infrastructure are negatively impacted.

For rural areas, a hydro-geological report shall be submitted in accordance with City of Hamilton "Guidelines For Hydro-Geological Studies and Technical Standards For Private Services" dated January 2010.

2.4.1.12 Traffic Impact Studies

A traffic impact study shall be submitted, where required, in accordance with City of Hamilton "Traffic Impact Study Guidelines" July 2009.

Traffic impact studies assess potential impacts of traffic changes caused by proposed development on municipal roads and to identify any infrastructure improvements or mitigation measures needed to ensure the road network will operate acceptably and safely upon completion of the proposed development.

They may vary in scope and complexity depending on the type and size of the proposed development and typically consider all modes of travel including cars, trucks, transit, cyclists and pedestrians. Recommendations from a study shall be consistent with the City's goals as expressed in the Strategic Plan, Transportation Master Plan and other planning documents.

Generally, a traffic impact study will be required whenever a proposed development will generate more than 100 additional (new) peak hour, peak direction trips to or from the site during the adjacent roadway's peak hour or the development's peak hour.

A traffic impact study may also be required under one or more of the following conditions:

- The development is located in an area exhibiting high roadway congestion and/or a high rate of population or employment growth is anticipated.
- The proposed development requires an Official Plan Amendment.
- The proposed development, its accesses, or type of operation is not envisioned by transportation master plans, secondary or neighbourhood Plans.
- As part of the new development, a new traffic control signal or a roundabout is proposed to be constructed on a City road.
- If, in the opinion of the City, the proposed development has the potential to create adverse operational or safety impacts on the road network.

It is recommended that prior to commencing a traffic impact study the consultant meet with City of Hamilton Traffic Engineering staff to review the level of detail required, to confirm the scope, and to determine data requirements and their availability.

A traffic impact study will have a functional life of three years from the date on the study.

The consultant must be registered as a Professional Engineer in the Province of Ontario and a member of both the Transportation Association of Canada and the Institute of Transportation Engineers.

2.4.2 Sanitary Sewer Design Criteria

2.4.2.1 General Requirements

The following criteria are recommended minimum requirements for the design of sanitary sewers within the City. Sound engineering judgment of the Engineer shall always prevail in the actual design.

Sanitary sewers shall be designed to service the lands within the subdivision and any external drainage areas as may be required. Foundation drains, weeping tiles and roof drainage are not permitted to be discharged into the sanitary sewer. In the case where the outlet is a combined sewer, sewers within the development lands 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 the outlet for development is 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 the combined sewer system.

The Engineer shall submit sanitary sewer design sheets in accordance with the sample design sheet attached as Appendix 3. An electronic copy of the spread sheet in Excel format shall be submitted to the City upon approval of the design.

2.4.2.2 Location

Municipal sanitary sewers shall be located within the City's public right-of-ways. In the instance where a municipal sewer 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 and the sewer shall be located within an easement in favour of the City.

The sanitary sewer shall normally be centered within the road allowance or easement. When sanitary and storm sewers are constructed in a common trench, the storm sewer shall be constructed parallel to the sanitary sewer with 450mm minimum separation between the outside walls of the two pipes.

2.4.2.3 Depth of Sewer

The minimum depth of cover for sanitary sewers shall be 2.75m below the centerline elevation of the proposed road; however, the Engineer shall investigate the profile of the sanitary sewer to the upper reaches of the sanitary drainage area, taking into consideration potential conflicts with storm sewer crossovers and possible future road profiles along the route of the future sanitary sewer.

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

2.4.2.4 Design Flows

The design flow for sanitary sewers shall be based on the following formula:

$$\text{Design Flow} = \text{Average Dry weather flow} \times \text{Peak Factor} + \text{Infiltration Allowance}$$

Sanitary sewers shall be designed for 360 litres per day per capita. The average dry weather flows for sanitary sewers shall be based on the population densities of the area serviced by the sewer. The Engineer shall obtain the current neighbourhood secondary plans for the catchment area and assign densities based on the

designations for the lands in the neighbourhoods. 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 densities that reflect a probable development pattern for the future lands.

The following guidelines are provided for the use of the Engineer in assigning densities:

Single detached	60 ppha
Semi-detached	75 ppha
Townhouses and Maisonettes (30 upha)	110 ppha
Medium Density apartments (60 upha)	250 ppha
High Density apartments (100 upha)	varies (subject to detailed plans)
Parks	12 to 25 ppha
Schools and Institutional Uses	75 to 125 ppha
Commercial,	varies 125 to 750 ppha
Industrial and Central Business Districts	varies 125 to 750 ppha

2.4.2.5 Peak Sanitary Flow Factor

~~For residential~~ The peak factor shall be obtained using the Babbitt Formula:

$$M = \frac{5}{P^{0.2}}$$

where M = peak factor where $2 < M < 5$
P = number of persons in thousands contributing to the sewer

2.4.2.6 Infiltration Allowance

An allowance shall be made in the sanitary sewer design for infiltration into the sewer system.

For areas where the design of the storm sewers allows for deep gravity storm sewers, i.e. the storm sewer is below the weeping tiles of the dwellings, or where a separate foundation drain collector sewer is proposed, the infiltration factor shall be 0.4 litres per second per hectare.

For areas where there are no storm sewers or shallow storm sewers, i.e. where the weeping tiles of the dwellings are drained by sump pumps, the infiltration factor shall be 0.6 litres per second per hectare.

2.4.2.7 Capacities, Velocities and Sizes

Generally, sanitary sewers shall be designed to flow at a maximum of 75% 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 sanitary 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 (m ³ /sec)
V	=	Velocity (m/sec)
R	=	Hydraulic radius (m)
A	=	Cross-sectional Area of pipe (m ²)
P	=	Wetted perimeter (m)
S	=	Gradient of pipe (m/m)

and

n	=	Manning's factor = 0.015 for pipe sizes less than 600mm diameter
	=	0.013 for pipe sizes equal or greater than 600mm diameter

The minimum design velocity for the sanitary sewer shall be 0.75 m/sec flowing full and maximum velocity shall not exceed 2.75 m/sec. However, the Engineer shall investigate the **actual** velocity in the sewer for instances where the design flows are low (example: in cul-de-sacs), and make a reasonable attempt to obtain self-flushing velocities.

The minimum sanitary sewer size shall be 250mm diameter. A size of 200mm diameter may be permitted on the last run of sanitary sewer, where there will be no further upstream contribution, such as in cul-de-sacs or crescents. A minimum grade on a 200mm sanitary sewer shall be 0.75%.

For **Industrial or Commercial** applications the minimum size for the sanitary sewer shall be 375 mm.

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. The design of the sewers shall be such that there is no decrease in velocity and capacity from the upstream pipe to the downstream pipe. In cases where this is unavoidable, care should be taken to ensure that an appropriate drop is incorporated in the manhole to dissipate the excess energy.

2.4.2.8 Pipe Materials, Classification and Bedding

Acceptable material for sanitary 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.

Bedding requirements

The class, type of pipe and pipe bedding shall be indicated on the profile for each section of the sanitary sewer.

The class of pipe and the type of bedding shall be selected to suit loading and proposed construction conditions. Bedding as per OPSD 802.010, 013, and 014 for flexible pipe and OPSD 802.030, 031, 032, 033 and 034 for rigid pipe shall be used in all new construction and the class of pipe shall be selected to suit this bedding detail and characteristics.

Bedding and cover material to be granular A compacted to 95% SPMDD. Maximum depth of cover shall be in accordance with OPSD 806.06, 807.01, and 03.

Testing requirements

Infiltration/exfiltration testing will be carried out on all sanitary sewers, using either water or low air pressure in accordance with OPSS 410.07.15.02.

PVC sanitary sewers shall be subjected to a mandrel test at the time when the sewer is accepted as complete by the City. Maximum allowable deflection of the mainline sewer shall be 5%. A deformation gauge (PIG) test in accordance with OPSS 410.07.15.05 shall be carried out a minimum of thirty days after the sewer trench has been backfilled or prior to paving of roadways. The test shall also be repeated prior to final assumption of the sewer at the end of the maintenance period.

2.4.2.9 Manholes

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 distance between manholes has been reached. Generally, manholes shall not be located in road sags (low points); where necessary, a water-tight manhole frame and cover shall be used.

Generally, the maximum distance between manholes shall be as follows:

- 120m for pipe sizes 200mm to 1050mm diameter
- 150m for pipe sizes 1200mm diameter and larger.

The maximum change in direction from upstream to downstream pipes for pipe sizes 675mm and larger is 45°. 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. The size of the bulkhead shall be specified on the engineering drawings.

If the sanitary 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 sanitary sewer main line with a notation that it will be removed and relocated with the future extension of the sanitary 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.

Where possible, pre-benched manholes should be specified. 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 upstream pipe(s) invert shall generally not be lower than the pipe invert on the downstream side of the manhole.

Suitable drops shall be provided across manholes to compensate for loss in energy due to change in flow velocity and for the difference in 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:

<u>Alignment Change</u>	<u>Drop Required</u>
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;
t_c = 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:

and

$$Q = AV$$

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

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

where

Q	=	Capacity of the pipe flowing full (m ³ /sec)
V	=	Velocity (m/sec)
R	=	Hydraulic radius (m)
A	=	Cross-sectional Area of pipe (m ²)
P	=	Wetted perimeter (m)
S	=	Gradient of pipe (m/m)

and

n	=	Manning's factor	=	0.013
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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:

<u>Alignment Change</u>	<u>Drop required</u>
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 180° 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 FRP II 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 FRP II 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 is 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 than 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 of the roadways, based on the function of the proposed roadway within the neighbourhood as described above.

All roads within the urban boundary of the City of Hamilton shall be designed and constructed to urban standards with full municipal services: i.e. concrete curbs with subdrains, asphalt on granular pavement, concrete sidewalks, catchbasins, storm sewers and street lighting.

2.4.5.2 Road Allowance Widening and Daylight Triangles

The City has adopted through its Official Plan designated road allowance widths which accommodates space for vehicular, pedestrian, transit and cycling movements, and utilities. A road allowance widening is an acquisition of land

adjacent to an existing road when added to its present road allowance establishes its designated road allowance width as stated in the City's Official Plan. Land required for road allowances are typically a requirement of development approval as a condition of Site Plan, Consent, or Plan of Subdivision.

The Official Plan also requires the conveyance of property for appropriate daylight triangles and corner rounding on existing roads when a property is to be developed or redeveloped, as a condition of site plan approval, consent, or plan of subdivision approval. In accordance with City standards based on the intersecting roadways of the functional road classification, daylight triangles at intersections shall generally be as follows:

1. Local to local roads: 4.5m X 4.5m triangle or radius (4.57m imp. equiv.);
2. Collector to local or collector Roads: 9m x 9m triangle (9.14m imp. equiv.);
3. Arterial to collector or arterial (Urban): 12m x 12m triangle (12.19m imp. equiv.)

On various major road corridors 15m X 15m triangles are required; e.g. Mud Street.

2.4.5.3 Geometric Standards

The geometric design of municipal roads in the City of Hamilton shall conform generally with the standards set out in the latest edition of the "TAC" Manual on Geometric Design Guidelines, September 1999.

Arterial roads except for those roads under provincial jurisdiction are the responsibility of the City of Hamilton, and all geometric design elements should correspond to the TAC Geometric Design Guide for Canadian Roads. The City's Development Engineering Section should be contacted to verify design criteria for arterial roads.

Horizontal and vertical alignment shall conform to the minimum geometric standards outlined above; however, the design shall be checked for conformity with the TAC Geometric Design Guide for Canadian Roads.

Vertical curves are required for changes in grade greater than 2.0% for local roads and minor collector roads and 1.0% for major collector roads (except at the crown of the road through intersections and at the point where the crossfall of the through road meets with the grade of the intersecting stop street). The minimum length of each grade shall be 6 metres. Cul-de-sacs shall be designed such that there is a minimum 0.75% gutter grade around the longest curb.

For intersection grading, the 2% pavement cross-fall on the through roadway shall be maintained through the intersection. The crown and cross-fall on the intersecting

roadway shall match the projected gutter line pavement elevation of the through roadway. For intersections where both roads are either arterial or collector roads, a minimum cross-fall and crown shall be maintained on all approaches.

The minimum curb return radii at intersections shall be 9m. Larger radii may be required to accommodate transit and truck traffic at selected intersections.

The Engineer shall design road grades taking into consideration the existing (and/or proposed) grades of adjoining properties, lot grading patterns, existing and/or proposed sewer profiles, major overland flow routes and elevations of intersecting streets, etc.

As a requirement of final clearance, the Engineer may be required to incorporate traffic-calming methods in the design of the roadways. These shall be discussed on an individual basis with the City Planning and Economic Development Department prior to completing the final engineering drawings.

A summary of some of the design criteria is follows.

Geometric Detail	Local Road Urban Residential	Minor Collector Urban Residential	Major Collector Urban Residential
Min. ROW (m)	18	20	26
Design Speed (km/hr)	50	50	60
Posted Speed (km/hr)	50	50	60
Min. Visibility Curves in Sag (K)	12	12	15
Min. Visibility Curves on Crests (K)	8	8	12
Min. Horizontal centreline Road Radius (m) **	90	95	160
** except at 90o corners at crescents and courts.			
Min. curb radius at intersection (m)	9	9	12
Pavement asphalt Width (m)Residential	8.0	8.0	11.0
Sub-grade cross-fall	3%	3%	3%
Pavement cross-fall	2%	2%	2%
Min. Grade (%)	0.5%	0.5%	0.5%
Max. Grade (%)	6.0%	6.0%	5.0%
Max. Grade for Through Roads at Intersections (%)	3.5%	3.5%	3.0%
Max. Grade at Stop Roads at Intersections (%)	2.5%	2.5%	2.0%
Intersection Angle (degrees)	80 to 90	85 to 90	85 to 90
Min. Tangent Length approaching intersections **	20m	20m	30m

** from curb line of intersecting street

Cul-de-sacs	18.0 m Radius (with sidewalk required around bulb)
ROW	16.5m Radius (under exceptional cases if no sidewalk is required around bulb)
Pavement	13.0m Radius

Geometric Detail	Local Road Rural Residential Crescents and cul-de-sacs	Minor Collector Rural Residential Straight through roads	Major Collector Rural Residential
Min. ROW (m)	20	20	26
Design Speed (km/hr)	50	60 to 80	80 to 100
Posted Speed (km/hr)	50	50 to 70	60 to 80
Min. Visibility Curves in Sag (K)	12	18	25
Min. Visibility Curves on Crests (K)	130	175	250
Min. Horizontal centreline Road Radius (m) **	100	150	2000
** except at 90o corners at crescents and courts.			
Minimum edge of pavement radius at intersection (m)	9	12	15
Pavement asphalt Width (m) **	6.7 plus shoulders	6.7 plus shoulders	9.0 plus shoulders
** Rural roads to be designed with roadside ditches for drainage. No curb and gutter required.			
Sub-grade cross-fall	3%	3%	3%
Pavement cross-fall	2%	2%	2%
Min. Grade (%)	1.0%	1.0%	1.0%
Max. Grade (%)	6.0%	6.0%	5.0%
Max. Grade for Through Roads at Intersections (%)	3.5%	3.0%	3.0%
Max. Grade at Stop Roads at Intersections (%)	2.5%	2.0%	2.0%
Intersection Angle (degrees)	80 to 90	80 to 90	85 to 90
Min. Tangent Length approaching intersections	20	20	30
Cul-de-sacs			
ROW	18.0 m Radius		
Pavement	13.0m Radius		

Geometric Detail	Local Road Industrial/Commercial Crescents and cul-de-sacs	Minor Collector Industrial/Commercial	Major Collector Industrial/Commercial
Min. ROW (m)	26	26	26
Design Speed (km/hr)	60	60	60
Posted Speed (km/hr)	50	50	60
Min. Visibility Curves in Sag (K)	12	15	15
Min. Visibility Curves on Crests (K)	8	12	12
Min. Horizontal centreline Road Radius (m) **	110	160	160
** except at 90o corners at crescents and courts.			
Pavement asphalt Width (m)	9.25	11.0	14.0
Industrial			
Sub-grade cross-fall	3%	3%	3%
Pavement cross-fall	2%	2%	2%
Min. Grade (%)	0.5%	0.5%	0.5%
Max. Grade (%)	6.0%	6.0%	5.0%
Max. Grade for Through Roads at Intersections (%)	3.5%	3.5%	3.0%
Max. Grade at Stop Roads at Intersections (%)	2.0%	2.0%	1.5%
Intersection Angle (degrees)	80 to 90	80 to 90	85 to 90
Cul-de-sacs			
ROW	20.75 m Radius		
Pavement	15.0m Radius		
Sidewalks	Not required	Not required	One side only for commercial; not required for industrial

2.4.5.4 Pavement Design

The following table summarizes the minimum requirements for pavement structure for different road classifications:

Road Classification	Top Course Asphalt	Binder Course Asphalt	Granular "A"	Granular "B" (Type II 100% crushed aggregate)
Residential Roads				
Urban Local and Minor Collector	40mm HM-3	80mm HL-8	150mm	300mm
Urban Major Collector	40mm HM-3	100mm HL-8	150mm	300mm
Commercial/Industrial Roads				
Urban Local Commercial/Industrial	40mm HM-3	120mm HL-8	150mm	375mm
Urban Collector (Minor and Major)	40mm HL-1	120mm HL-8 (HS)	150mm	450mm
Rural Roads				
Rural Local Residential	40mm HM-3	80mm HL-8	150mm	300mm
Rural Collector Residential	40mm HM-3	100mm HL-8	150mm	300mm
Minor Arterial	40mm HM-3 (HD) ¹	120mm HL-8 (HS) ²	150mm	450mm
Major Arterial	40mm HL-1	120mm HL-8 (HS) ²	150mm	450mm

¹ Use HL-1 or HL-1 (Steel Slag) when Trucks > 10%

² Use HL-8 (HS) when AADT > 3000 and Trucks > 10%

All asphalt mixes shall be in conformity with the latest City of Hamilton Specifications Form 1300. Current approved suppliers list is available from the City upon request.

On roadways where underground services have been installed, the surface course asphalt shall not be placed immediately after the binder course asphalt.

The final asphalt course on any roadway shall not be placed until:

1. written approval from the Development Engineering Section is received; and
2. a minimum of one year has passed after the placement of the binder course asphalt; and
3. at least 80% of the dwellings in the land are constructed; and
4. deteriorated base asphalt and/or granular base and concrete curbs and gutters have been repaired and/or replaced to the satisfaction of the City; and
5. the base course shall be power swept and/or power flushed and free of mud and debris.

When the surface course is to be placed on a previously laid binder course a tack coat shall be applied immediately prior to placing the surface course asphalt.

Generally, surface course asphalt shall not be placed before the first day of May or later than the first day of November. Any deviation of this date shall require the prior approval of the Manager of Construction (Growth Management Division).

2.4.5.5 Roundabouts

The City's "Installation of Modern Roundabouts Policy, 2008" states that if new signals are being considered for an intersection, the potential for a roundabout must also be examined.

A roundabout is a type of circular intersection at which traffic enters a one-way stream around a central island incorporating splitter islands at each leg of the intersection. The splitter islands guide traffic into and out of the roundabout and provide a refuge for pedestrians. Its primary functions are for traffic calming, allocation of right-of-way and increased traffic capacity. Generally, roundabouts are used to connect collectors and/or arterial roads; however, in some instances they can be used at the junction of a local road with a collector or arterial road.

2.4.5.6 Adjustments of all Appurtenances

When the surface course asphalt is not placed immediately after the binder course asphalt, all adjustments of manholes, catch basins, and valve chambers shall be set to the binder course asphalt and re-adjusted when the surface course asphalt is placed.

The final adjustment of all manholes, catch basins, valve chambers shall be done using one continuous pour of 30 MPa concrete from the underside of the frame to 150mm below the top of the pre-cast structure on the outside. The minimum concrete thickness shall be 150mm.

Precast adjustment units may be used for temporary adjustments only. Prior to the placement of the final surface course asphalt, all temporary adjustment units shall be removed.

2.4.5.7 Curbs and Gutters and Subdrains

All roadways shall be constructed with barrier curb and gutter (OPSD 600.040 or OPSD 600.070) in accordance with current City Standards.

In the event that weather conditions do not permit concrete curb and gutter construction, a wider paved roadway will be permitted. The width of the roadway shall be extended a minimum of 0.5m on each side. The cross section of the widened pavement shall conform to the cross section of the roadway. Curb and gutters shall be constructed within one year of the completion of the binder course asphalt. A minimum of 1.0m of the paved roadway shall be removed upon installation of the curb and gutter (i.e. minimum 0.5m asphalt repair adjacent to curb and gutter) and binder asphalt placed to the specified thickness.

Curb depressions are required at every driveway and at each intersection for wheelchair ramps. Curbs shall not be cut by mechanical means to provide a curb depression. Temporary curb cuts provided during construction of dwellings using mechanical means shall be removed prior to installation of final asphalt course and replaced with a proper driveway curb depression. Should any driveway depressions be improperly located, then repairs may be made by removing those sections and replacing them with required curb and gutter sections. The concrete capping of a depressed curb shall not be permitted.

Subdrains shall be installed continuously below the curb unless soil conditions warrant otherwise. Any request for reduced subdrain installation shall be accompanied with a geotechnical report outlining the soil conditions and what impact the reduction of subdrains shall have on the life of the pavement.

Generally, concrete curbs and gutters shall not be placed after November 15th. Any deviation of this date shall require the prior approval of the Manager of Construction (Growth Management Division).

2.4.5.8 Sidewalks

Concrete sidewalks shall conform in details and dimensions to the current Ontario Provincial Standard. Concrete sidewalks, minimum 1.5m wide with maximum cross-fall of 2%, shall be installed as follows:

Arterial Roads:

Both sides of the road located 1.0m from the street property line where:

- there is no direct individual access from freehold units onto the road;
- there may be a joint access from a lay-bye (or service road parallel to the arterial);
- there is access from a block multi-family residential development; and
- there is access from a commercial or industrial development block.

Where there is direct access onto the arterial road from individual residential lots, sidewalks shall be located so as to provide a 3.0m wide boulevard between the back of the curb and the sidewalk.

Minor and Major Collectors

Both sides of the street, located 1.75m from the back of curb.

Local Urban Roads

One side of the street, located 1.75m from the back of curb.

Cul-de-sacs and Crescents

For the purposes of the City's sidewalk policy, a cul-de-sac is defined as a street with a permanent dead-end and a crescent is defined as a curvilinear street which is connected at each end to the same street and is generally not intersected by any other street.

Sidewalks are not generally required for cul-de-sacs which have 30 units or less or on crescents which have 60 units or less. If a development is serviced by a combination of cul-de-sacs off crescents the maximum number of units allowed on the combination is 110 before sidewalks are required on one side of the crescent. The corner entrance lots are not included in determining the number of units.

If the cul-de-sac or crescent connects to a pedestrian link or walkway to external community facilities such as schools, parks/open space, other residential areas, shopping areas or recreational areas, a sidewalk on one side of the street shall be required connecting to the pedestrian link/walkway.

There shall be no deviation from this policy except where transitions from older areas may merit an alternative configuration.

On continuation of existing streets where sidewalks have already been installed at a different location, the City's Development Engineering Section shall be consulted to determine the off-set from the curb and transition between walks.

Generally, concrete sidewalks shall not be placed after November 15th. Any deviation of this date shall require the prior approval of the Manager of Construction (Growth Management Division).

2.4.5.9 Wheelchair Ramps

In accordance with the City Of Hamilton Barrier – Free Design Guidelines, wherever possible, crosswalks shall have suitable wheelchair curb ramps at each end of the crosswalk as per OPSD 310.030.

The crosswalk shall not contain manhole covers, storm gratings or other obstacles that limit free movement and where catch basins are necessary they should be positioned wherever possible on the upstream side of the crosswalk.

2.4.5.10 Roadway Cross Sections

Typical road cross-sections with lane dimensions are provided in Appendix 5.

2.4.5.11 Driveway Approaches

Driveways shall be either asphalt or concrete, but shall be consistent through a subdivision.

Driveway curb depressions shall be built to accommodate the driveway width plus 0.45m on each side of the driveway measured at the gutter line. The maximum width of the curb depression, measured at the gutter line, shall be 4.5m for a single driveway and 7.0m for a double driveway.

The maximum permissible design grade for any driveway shall be 7.0%. The minimum driveway grade shall be 2.0%.

Residential driveway approaches shall have the following:

- Asphalt driveways approaches shall have 50 or 75mm HM3 on 75 or 100mm HL8 on 150mm Granular A as per RD-108
- Concrete driveway approaches shall have 125mm concrete on 150mm Granular A as per RD-109

Driveway entrances to multi-family blocks and commercial entrances shall be in accordance with City access permit requirements and shall be asphalt as per City Standard Drawings. Non-residential driveway approaches shall have the following:

- A depressed curb along the road and the entire width of the approach;
- Concrete curb returns on the sides of the asphalt approach are not permitted in the road allowance; and
- Minimum 6.0m curb return radius.

On arterial roads that have not been constructed to the ultimate urban cross-section at the time of approval of the engineering drawings, there shall be a provision for the installation of a driveway culvert at the roadside ditch. The minimum length of CSP driveway culvert shall be 9.0m for single driveways and 11.0m for double driveways and the minimum diameter shall be 450mm.

2.4.5.12 Boulevards

All boulevards areas will be sodded with No. 1 nursery sod including a minimum thickness of 150mm of topsoil. The topsoil shall be screened clear of all stones in excess of 25mm, debris and woody material and shall be free of noxious weeds, etc. to the satisfaction of the City. The topsoil overlaid with sod will provide a total topsoil/turf thickness of approximately 175 mm and maintain a 2% cross-fall within the boulevard.

Sod shall comprise Fine Fescue/Kentucky Bluegrass nursery sod containing 60%-70% Kentucky Bluegrass and 30%-40% Creeping Red, Chewings or Hard Fescue as specified by the Nursery Sod Growers Association of Ontario (NSGAO). Sod shall be placed with sufficient density such that surface soil is not visible and shall be placed to match existing adjacent elevations at all edges. All sod shall be machine rolled after placement.

2.4.5.13 Hydro and Street lighting

The Developer is responsible for arranging with Horizon Utilities (or Hydro One, depending on the jurisdiction) for the installation of underground hydro and street lighting on all streets within the plan of subdivision. The Developer shall enter into a separate agreement with Horizon Utilities (or Hydro One) for the design and installation of these works.

Securities for the installation of street lighting shall be lodged with the City of Hamilton. Horizon Utilities and Hydro One collect a separate security for payment of the underground component of the hydro works.

Horizon Utilities and Hydro One arrange for the installation of the works; however, rock excavation is not included in the normal installation provided by Horizon Utilities. The Engineer shall, therefore, make allowance in the construction tender for rock excavation for hydro and utilities and street lighting poles in rock. The Developer shall pay for these items.

In situations where the City cost-shares in the installation of street lighting, Horizon Utilities (or Hydro One) shall invoice the Developer for the cost of the street lighting and the City shall pay the Developer in accordance with the cost sharing arrangement in the subdivision agreement.

All street lighting shall be designed in accordance with the City's Sidewalk and Roadway Lighting Guideline.

Communication Light Poles are not permitted on City road allowances.

2.4.5.14 Bollards

Bollards, where required, shall be installed as per City Standard PK-1070.02 to discourage vehicular traffic.

2.4.5.15 Retaining Walls

Retaining walls are generally not considered acceptable as a first course of action in dealing with grade changes between new development and existing developed areas or open spaces areas (parks, SWM ponds, ESAs, etc.); however, should a retaining wall be required, the top of wall elevations shall be set 150mm above the proposed boundary swales. Along adjoining properties, grades shall meet existing or proposed elevations with sodded slopes (min 3:1 slope) and/or retaining walls as specified.

All retaining walls shall be placed a minimum of 0.45m off the property line.

All walls equal to or greater than 1.0m in height shall be designed by a qualified Professional Engineer. The installation shall be inspected during construction and certified in writing by the Engineer as to conformity to design and suitability for site conditions. The design shall reflect the appropriateness of the proposed wall for the project site and shall at a minimum, include the following design considerations:

- Geotechnical design parameters.
- Whether onsite materials will be acceptable for backfill between any proposed geogrids or tie-backs, or if soil import is needed for wall construction.
- Recommendations for minimum setbacks from the wall to adjacent structures based on the design parameters of the wall and the requirement for any restrictive easements.**
- Recommendations for restrictions on structures and improvements, including swimming pools, walls/fences and trees, within proximity of the retaining wall and the requirement for restrictive easements.**
- Retaining walls shall be constructed of inert materials only; i.e. timber retaining walls are not permitted.
- Walls equal to or greater than 0.6m in height shall have a safety rail or

fence constructed at the top of the wall and shall be considered in the wall design.

- ** Landscape easements should be established over subterranean retaining wall geogrids and tie-backs, and require minimum setbacks to allow for trees to be planted without diminishing the integrity of the geogrid, where necessary.

Areas with building restrictions related to proposed retaining walls shall be clearly identified on the engineering drawings plans and the appropriate warning clauses and restrictions shall be included in Development Agreements as required.

2.4.5.16 Traffic Signs and Street Name Signs

The City of Hamilton shall install all traffic signs and street name signs on all roads within the City. The Developer will be required to make a cash payment for signs in the subdivision agreement.

2.4.5.17 Catch Basins and Connections

Catch basins shall be designed to take into consideration the lot areas draining on to the roadway, the pavement widths, road grades and intersection drainage.

Catch basins shall be generally located upstream of any pedestrian sidewalk crossings, and if possible, should be avoided in driveway curb depressions. Double catch basins shall be installed at all the low points in a road. However, at intersections where the cross-fall of one road creates a low point on the other intersecting minor road, the back-fall shall be provided on the minor road to the end of the curb return radii to facilitate proper drainage of the intersection. Single catchbasins only shall be required at the end of the curb return for drainage in this case.

Catch basins spacing shall be determined as follows, unless prescribed otherwise by a detailed stormwater management design:

Pavement Width	Maximum Spacing
8.5m or less	90 m
9m to 11m	75m
11.5m or greater	60m

Where the road grades are between 3% and 5% the maximum spacing shall be reduced by 15% and for road grades between 5% and 6%, the maximum spacing shall be reduced by 30%.

Road catch basin connections shall be 250mm diameter PVC DR35 pipe in accordance with OPSD 400.100. All road catch basins shall be installed with goss traps in accordance with City Standard Drawing SCW-304.

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

For rear lot catch basins, the minimum size of the connection shall be 250mm and the minimum grade of 1.0%. If minimum grade cannot be maintained, the Engineer shall justify pipe design to the satisfaction of the Manager of Engineering Approvals.

The frame and cover for rear lot catch basins shall be have a square frame with bird cage grate as per OPSD 400.120. Rear lot catch basins are to be sumpless and a Goss trap connection is not be required.

2.4.5.18 Cul-de-Sacs

A permanent cul-de-sac shall be constructed in accordance with details shown in Appendix 5, providing for a 13m asphalt turning circle. The design road grade on the cul-de-sac shall be such that the drainage is directed away from the end of the cul-de-sac and towards the beginning of the bulb area.

2.4.5.19 Temporary Turning Circles

Temporary turning circles shall be considered whenever a road is to be continued in the future and the distance from the temporary dead-end to the centerline of the nearest intersection is greater than 45m.

Details of the temporary turning circles shall be submitted with the engineering submission and shall include a minimum 13m radius asphalt turning circle and shall be in accordance with City standards, see details PED-110.02.

Reduced radius temporary turning circles and hammerheads will be considered in exceptional circumstances. Specifically, a 12m radius will be permitted if it makes a material difference to the number of lots that would otherwise need to be sterilized if the 13m radius was used. Similarly, a reduced setback from the curb is also permitted if no utilities are to be located within the area behind the curb.

At the time when a temporary turning circle is no longer required by the City, then the closure for the portion of public highway beyond the width of the established road allowance shall be initiated by the developer initiating the removal of the circle. The request shall be made to the City's Planning and Economic Development Department, Growth Management Division in writing, accompanied by the appropriate fee. Development Engineering staff will verify that the additional lands for public highway can be closed and a request for road closure will be submitted to the City's Public Works Department.

2.4.5.20 Temporary Roads and Emergency Access requirements

The maximum number of dwelling units that will be allowed to be serviced with one road access is 100. If a proposed plan of subdivision is for more than 100 dwelling units (including potential units in multi-residential blocks), then a temporary road to full urban municipal standards providing secondary access shall be provided to the satisfaction of the City.

Emergency Accesses are not considered to be suitable secondary accesses.

2.4.5.21 Noise Barriers

Noise barriers shall be implemented as a condition of development approval and supported by the completion of an approved noise study in accordance with MOE requirements. Noise barriers can be constructed with earth berms (preferable), walls/fences, or a combination of the two. If the required height of the barrier exceeds 3m, it is recommended that a berm/wall combination be used. Material specifications for noise control require that the minimum surface density be 20kg/m³ be of continuous construction and be free of gaps and cracks within or at the ends.

Barriers required as a condition of development approval adjacent to the LINC or Red Hill Valley Expressway must be constructed using Durisol brand barriers if walls are being proposed; whereas walls adjacent to provincial freeways must be a concrete type of material. Noise barriers abutting other City roads can be made of wood.

Noise barrier design shall consider the materials used in adjacent developments along the corridor.

All noise barriers with the exception of barriers along the LINC and Red Hill Valley Expressway shall be placed on private property.

2.4.5.22 Street Trees

As a condition of development approval a Developer may be required to submit, at his expense, a Street Tree Planting Plan for road allowance trees prepared by a certified arborist or landscape architect to the City's Manager of Forestry for approval. The plan shall detail recommended planting specifications based on the site plan location. The plan shall adhere to the specifications as set out in the City' Tree Planting Policy for New Developments.

In general, the Developer is required to make a cash contribution for one tree along the frontage of each lot and an additional two trees along the flankage of each corner lot within a plan of subdivision. Notwithstanding, the Developer is financially responsible for installation of any Street Tree Planting Plan derived from an approved Urban Design Guideline or Secondary Plan document.

For reverse fronting lots, street trees shall also be provided in the boulevard at the rear of the lots at the same spacing interval required for the frontage.

Species of the boulevard trees shall be in accordance with City requirements and shall be subject to approval of the City's Manager of Forestry as part of the first engineering submission.

Consideration should be given to trees planted at intersections so that street signs are not obscured.

2.4.5.23 Tree Removals

All tree removals are subject to By-Law 06-151 to Regulate the Planting, Maintenance and Preservation of Trees on or Affecting the Public Right of Way as well as the City of Hamilton Reforestation Policy – Municipally Owned Lands; and the City of Hamilton Public Tree Removal Policy.

2.4.5.24 Fencing

Where required as a condition of development approval, the Developer shall construct a 1.5m high black vinyl coated heavy duty commercial grade (9 gauge metal) chain link fence adjacent to City owned property. The fence shall be installed so that the fence posts are located approximately 100mm within City owned property and shall be in accordance with OPSD 972.130 with a mesh size of 38mm where it abuts single family dwellings.

Fences required to provide a separation between private and public property include:

- Storm water management facilities;
- Parks, Open Space, Woodlots, ESAs, creek blocks, etc.;
- Walkways; and
- Pumping stations.

Privacy Fences

Privacy fencing shall generally be required as condition of ~~Site Plan~~ approval in accordance with City standards ~~RD-123.01 and RD-123.02~~ where:

- Residential lands abut commercial or industrial lands, or institutional developments; and
- Residential lands with reverse frontages or “window” roads abutting arterial roads.

2.4.5.25 Walkways

Public walkways shall be identified at the time of draft plan of subdivision and shall be conveyed to the City as a public highway. They shall be constructed within the limits of the project by the Developer. The minimum width of public walkway right-of-way shall be 6m.

Walkways typically shall consist of a 1.5m wide concrete sidewalk centered in the walkway right of way. Remaining portions between the sidewalk and fence shall be sodded. If the walkway also acts as a major overland flow route and/or access to a SWM facility, requirements, including right-of-way width, shall be to the satisfaction of the City.

All public walkways shall have a 1.5m high black vinyl coated heavy duty commercial grade (9 gauge metal) chain link fence placed along the City side of the property line, separating the walkway from private property, in accordance with OPSD 972.130 with a mesh size of 38mm where it abuts single family dwellings.

Bollards shall be installed at each end of the public walkway as per City Standard PK-1070.02 to discourage vehicular traffic through the walkway.

Walkway lighting, where required, shall be designed and installed in accordance with the City's Policy for Sidewalk and Roadway Lighting.

2.4.5.26 Parklands

When parkland is required to be conveyed as a condition of development approval, the land shall be conveyed to the City without charge or any encumbrances at the time of plan registration. Prior to conveyance, the City requires:

1. a Phase 1 Record of Site Condition confirming the lands are free of any environmental contaminants; and
2. that the site is fine graded, seeded or sodded and fenced to City specifications.

Parklands shall be fine graded in accordance with the approved grading plan and covered with a minimum of 150mm topsoil and hydraulic seed, or sod. The primary seed mixture for hydraulic seed and mulch shall be composed of the following:

- 40% Creeping Red Fescue
- 30% Chewings Fescue
- 30% Hard Fescue

Parklands shall be graded and seeded within two seeding seasons after the completion of the binder course asphalt road adjacent to the parklands and are to be guaranteed by the Developer until growth is established to the satisfaction of the City.

The provision of service connections (water, sanitary and storm) may be required for the parklands at the discretion of the City. No above-grade utility units such as super mailboxes, Bell pedestals, etc. will be permitted along the frontage of a City owned park.

2.4.5.27 Municipal Consent (MC) Procedures

The City of Hamilton MC procedure for new subdivisions is as follows:

1. Engineer prepares and submits first engineering submission to:
 - City of Hamilton (Development Engineering) for review
 - All utility companies for information.
2. City of Hamilton (Development Engineering Section) reviews the drawings and sends the comments back to the consultant.
3. Engineer completes and sends 2nd submission to the City and Hydro.
4. City reviews drawings.
5. Concurrently, Hydro prepares their design and circulates to all utility companies.
6. Utility companies prepare their designs in consultation with the Engineer.
7. Utility (including Hydro) companies send utility designs along with 2 copies of their MC application to the Engineer.
8. Engineer reviews utility design for conflicts, shows street furniture on lot grading plan and submits final lot grading design and 2 copies of all MC 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 to the City's Utility Right-of-Way Co-ordinator along with the approval of their locations.

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 than 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%. Reversed sloped driveways in new developments are not permitted.

- m) Each lot is to be independently drained. Drainage to a nearby street through the rear of an adjacent lot is not permitted, unless the adjacent lot is part of the same development. In areas where “zero lot line” zoning is permitted drainage to a nearby street through the rear of an adjacent lot is not allowed. See Sections 2.5.2.1 and 2.5.2.2 regarding infill and rural lot grading.
- n) Catch basins in rear yard swales shall be designated as “private” and shall drain not more than:
- i) a maximum 50m of a swale measured along the rear property lines;
 - ii) a maximum of four (4) lots on either side of a catchbasin on any side of the catch basin. Collection from both sides of the rear lot line is acceptable; and
 - iii) a maximum residential area of 3600 m².
- o) All slopes shall be 3:1 or flatter.
- p) Provisions shall be made to prevent disruption of the natural surface drainage pattern on lands bordering the development both during and after construction.
- q) 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.
- r) Where a lot is lower in the rear than in the front, a split drainage grading design will be used in order to drain a portion of the lot to street catch basins. No front to rear drainage will be permitted.

2.5.2.1 Design Criteria for Infill Developments or Lots of Record

Grading of single or multi-family residential lots that are developed through severance applications shall demonstrate that the proposed development will not adversely affect existing buildings, significantly alter existing drainage patterns, or adversely affect neighbouring properties.

- Positive drainage away from building should be provided at all times.
- Side and rear yard swales to be located entirely within the infill/severed property, unless permission from the adjacent homeowner is granted to improve and modify existing drainage on both lots, i.e.; proposed swales must be contained within the land parcel being developed.
- In some cases, side and rear yard slopes less than 2% may be acceptable, but must be reviewed and approved by City staff on a case-by-case basis.

2.5.2.2 Design Criteria for Low Impact Developments and Rural Lot Grading

Grading for rural estate lots which are part of a Plan of Subdivision, or rural lots created under severance, shall conform to the City of Hamilton design criteria outlined in Section 2.5.2. Every attempt shall be made to implement the grading criteria outlined in this section. Elements which cannot conform to the standard criteria shall be reviewed with the City for agreement on approach; such as, culvert extensions, finished floor elevations that are lower than the existing roadways, and minimum grades that may not be achievable.

If a proper/acceptable outlet cannot be provided due to topographical or other physical constraints, then the proponent is to consider and implement other practices to retain the water on site (ie. infiltration gallery, bioswales, water harvesting, etc.) and ensure that surface runoff does not adversely impact neighbouring properties.

Notwithstanding the above, grading design of low impact developments; such as, rural severances or freehold townhouses fronting a City's right-of-way, should be reviewed on a case-by-case basis with the design engineer and the City's plan reviewer. The proponent would need to demonstrate that alternative grading designs, from urban design requirements, provide a better grading solution to match the existing grading conditions.

2.5.3 Acceptable Lot Grading

Lot grading shall be acceptable to the City if:

- a) No portion of any side swale has a grade of less than 1.5%, unless mitigation measures have been put into place or specified on an approved grading plan.
- b) The "as-built" grading does not impede the intent of the approved overall grading plan. Deviation in excess of 150mm at lot corners will be justified on the final grading certificate.
- c) No portion of any backyard has a finished grade of less than 1.0% once the lot has been fully sodded. This includes the rear and side yards as well as the front yard, except for areas designated as a driveway.
- d) A Professional Engineer provides certification, including an as-built plot plan, of lot grading after at least one (1) winter has passed and the sodding of the lots is complete.

The subdivision agreement shall remain on title to the lots and blocks within a development in order to ensure that the Developer and subsequent owners of the lots and blocks within a development shall not be released from the restrictive covenants regarding lot grading and discharge of roof leaders onto the ground.

2.5.4 Grading Standards

2.5.4.1 Overall Grading Plan

The overall grading plan shall be prepared on a standard metric A1 size sheet or an Imperial 24" x 36" sheet at a scale of 1:500, stamped and signed by a professional engineer and shall show the following:

- a) All lots and blocks of the lands to be developed as well as adjoining lands for a minimum of 15 metres beyond the limit of the lands to be developed and further if necessary to determine future and proposed drainage patterns.
- b) Existing contours at 0.5 metre intervals over the entire development including sufficient area of adjacent lands to establish the overall drainage pattern. If the parcel is flat or 0.5m contours do not adequately show topography, 0.25m contour spacing should be provided.
- c) Proposed elevations at the corners of each lot and block and at intermediate point of change in grade.
- d) Proposed elevations at 15 metre spacing along the frontage of large blocks and at a reasonable spacing along the sides and rear of the block.
- e) Proposed centre line road elevations at:
 - i) all changes in grade, and
 - ii) opposite lot corners of the lands to be developed.
- f) The location of all existing trees, septic tanks and tile fields, wells, above ground utility structures (street furniture) and other structures as necessary.
- g) The location of existing and proposed retaining walls with proposed top and bottom elevations at appropriate intervals with sections.
- h) The location of drainage ponds or swales, and direction of surface drainage on each proposed lot and block and on all adjoining lands.
- i) The location of rear yard catch basins and inlets and top of grate elevations.
- j) Proposed building envelopes with the following information:
 - i) front of house apron elevation (garage floor elevation);
 - ii) back of house apron elevation, if different from front.
 - iii) minimum basement floor elevation (shall be calculated based on the elevation of the sanitary private drain). Roof leaders shall discharge

onto splash pads, satisfactory to the City Engineer and then to a grassed or landscaped area at a minimum distance of 0.60 metres away from the building face.

- k) Adjacent lots having a combined side-yard setback totaling 2.0m or less shall have roof leaders restricted to front or rear yard discharge locations to minimize erosion and ponding.
- l) A key plan showing the proposed development and, for larger subdivisions, the location of the lots on the sheet in relation to the overall development.
- m) Description of the nearest geodetic benchmark.

2.5.4.2 Grading Plan Objectives

The overall grading plan shall be prepared in accordance with the following objectives:

- a) The whole drainage for the development shall be self contained and directed to a suitable outlet.
- b) The lot grading plan shall accommodate any external drainage, which is tributary to the development and must prevent ponding on adjacent lands bordering the subdivision.
- c) The establishment of independent and adequate drainage for each lot (this can be provided by either “back to front” drainage (recommended) or “split” drainage intercepted by a rear yard swale).
- d) The establishment of lot and house grades which are generally compatible with existing topography and surrounding development, existing trees etc., without steep slopes or abrupt changes in grade with minimum terraces.

2.5.4.3 Plot Plan for Each Lot

The plot plan for each lot shall be stamped and signed by either a Professional Engineer, Ontario Land Surveyor, Architect or Landscape Architect for approval by the Director of Building and Licensing prior to issuing a building permit and shall show the following:

- a) Proposed elevations at the lot corners, which must conform to elevations on the approved grading plan.
- b) Elevations of the proposed sidewalk adjacent to the lot, and where no sidewalk is proposed, then the corresponding proposed back of curb elevation and the proposed centreline road elevation. (For infill lots, existing elevations should be provided if no new road-works are proposed.)

- c) The elevation, design and basis of design of all retaining walls required.
- d) Ground elevations on all sides of the proposed building and the driveway gradient and elevation at the house.
- e) Elevations of all swales on the lot, the gradient of the required backyard apron and arrows showing flow to or from adjacent lands.
- f) Existing and/or proposed private catchbasins, road catchbasins, hydrants, streetlights, hydro transformers, telephone and cable boxes.
- g) Top of footing AND top of foundation wall elevations are to be clearly indicated on each plot plan.
- h) For infill grading plans and plot plans, the following additional information will be provided:
 - i) Existing elevations, at 5m intervals, shall be indicated for one adjacent lot width or at least 15m beyond the property line boundaries to illustrate the drainage of the lot in relation to the surrounding lands and buildings;
 - ii) Top of foundation wall and garage floor elevation of adjacent buildings/dwellings;
 - iii) Additional information may be required depending on the specific characteristics of the site. It is the responsibility of the Designer submitting the plan to ensure that information shown adequately depicts the existing and proposed conditions.
- i) Grading for rural estate lots which are part of a Plan of Subdivision should conform to the City of Hamilton design criteria outlined in Section 2.5.2. In addition, for rural developments, the following shall be shown on the lot grading plans and plot plans (if applicable):
 - i) Existing elevations, at 5m intervals, shall be indicated at least 30m beyond the property line boundaries to illustrate the drainage of the lot in relation to the surrounding lands and buildings;
 - ii) Location of private sewage disposal systems;
 - iii) Location of any private water supply system;
 - iv) Driveway entrance culverts, including size, length and location;
 - v) If no positive storm outlet is available, storm runoff retention areas shall be shown;
 - vi) Ditch elevation details, including bottom of ditch, top of banks, and general flow direction;
 - vii) Location of existing creeks and watercourses.

2.5.5 Grading Certificate for Lot Grading

A lot grading certificate shall be submitted by a Professional Engineer, on a form acceptable to the City, including an As-Built Plot Plan, and shall contain either of the following wording:

STANDARD GRADING CERTIFICATE

We have reviewed the final lot grading for the above mentioned lot and taken elevations where necessary to confirm direction and grade of surface drainage as shown on the as-built plot plan. We therefore certify that the works have been completed in the field and that they conform to the approved overall and detailed grading plans for the subdivision and the City's standards.

GRADING CERTIFICATE – DEVIATION

This is to certify that we have reviewed the final lot grading for the above mentioned lot and taken elevations where necessary to confirm the direction of surface drainage, as shown on the as-built plot plan. While the final lot elevations do not match exactly the proposed lot grading plan, the basic lot drainage pattern has been adhered to and the intent of the approved overall grading plan has been met. No drainage problems were evident at the time of inspection.

Lots in which grading certificates are submitted will be eligible for reduction of securities collected under 'First Stage' amounts with the initial application approval process, detailed in Section 2.5.1.

2.5.6 Lot Grading Approval Process

The City's of Hamilton's approval process to achieve final approval and release of securities held for the lot grading involves the following procedures:

- a) Plot Plans are prepared by an Ontario Land Surveyor, Architect, Landscape Architect or Engineer in accordance with the approved subdivision grading plan as part of the building permit process.
- b) Once footings have been placed or formed, an Ontario Land Surveyor shall certify in a suitable form, and make available to the City, that:
 - i) the top of footing elevation(s) conforms with the top of footing elevation(s) shown on the approved Plot Plans;
 - ii) the foundations are sited entirely on the correct lot;
 - iii) the building setbacks conform to the zoning by-law.

- c) Foundation elevations will be considered 'non-conforming' if they differ from design elevations by more than 150mm. Non-conforming foundation elevations shall be brought to the attention of the City for further direction/discussion prior to proceeding with any further construction.
- d) After at least one (1) winter has passed and the lots have been sodded, an Engineer shall submit an as-built plot plan and certify in writing, that the lots are in general conformance with the overall grading shown on the approved grading plan, in accordance with Section 2.5.5. Following certification, the City inspector provides new homeowners with an information package including the Lot Grading and Drainage Brochure and the Grading Policy Notification Sticker.
- e) Following certification of all lots, a security reduction request can be submitted for reduction of securities collected under 'First Stage' amounts with the initial application approval process, in accordance with Section 2.5.1.
- f) For Lots which cannot be certified due to poor grading or changes in house style, the Engineer will notify the City, Developer, and Builder in writing. An engineer, on behalf of the developer, will prepare a new over-all grading plan to address the lots which have not been built according to the original plan, and will submit a revised plan to the City with the required review fees.
- g) An Engineer will re-inspect any deficient lots or for those lots which cannot be certified by a visual inspection and prepare a revised as-built grading plan, in order to obtain lot certification. If necessary, the builder will be instructed to address any deficiencies in order to have the particular lots certified. If the builder will not correct the work as instructed by the engineer, this responsibility will fall directly upon the developer.
- h) The 'Stage 2' 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.
- i) Following and/or during the final inspection, the City inspector provides a Final Grading Approval notice to each lot in the development, reminding them of their responsibilities under the City By-Laws.
- j) All remaining grading securities are released in accordance with the conditions of the Development Agreement.

Note: Notwithstanding meeting the requirements of lot grading, approval of a grading plan is subject to the Engineer demonstrating that stormwater can be directed to a suitable outlet.

2.6 Construction of Municipal Services

2.6.1 Servicing

Before construction may commence, a developer is required to enter into a standard form, Subdivision Agreement with the City as well as meet required financial and insurance obligations specified in the agreement.

Stripping of topsoil and site grading works may commence before final approval of the detailed engineering design is obtained subject to the following:

- a) an erosion and sedimentation control plan has been approved by the City and the Conservation Authority
- b) all erosion and sedimentation controls are in place prior to any earthworks on the site, and
- c) a Tree Preservation Plan, if required, has been approved by the appropriate agency and safeguards are in place.
- d) Archaeological clearance of the lands has been obtained (if required as a condition of draft plan approval).
- e) The Owner has satisfied all other conditions relevant to the proposed works which are identified through the draft plan process.

Construction of the municipal services in the subdivision can only start once the following conditions have been satisfied:

- a) approval from the City and, where required, approval from the Conservation Authority of engineering design drawings for the works to be constructed to service the subdivision, including receipt of MOE certificates and approval of an erosion and sedimentation control plan
- b) approval by the City of the proposed final plan of subdivision for zoning compliance and road pattern and alignment
- c) approval of a Tree Preservation Plan by the appropriate agency, when such plan is required, including implementation of all necessary safeguards
- d) verification that all erosion and sedimentation controls are in place prior to any earthworks on the site
- e) submission of a signed Subdivision Agreement with the City of Hamilton and deposited cash and security (75% estimated construction cost) as required under the agreement
- f) submission of originally signed certificates of insurance for the Developer and the contractor as proof that both Developer and contractor have obtained

adequate insurance coverage in accordance with the City's Subdivision Agreement

- g) payment of Stage 3 processing fees in accordance with the City's current User Fee By-law
- h) written verification that an archaeological survey has been conducted and the site is free and clear for construction, when the requirement for an archaeological survey is a condition of draft plan approval
- i) written verification that the subdivision lands have been decommissioned, when the requirement for decommissioning is a condition of draft plan approval
- j) completion of a pre-blast survey of residences within 100 metres and notification of residents of blasting within 200 metres of the subdivision lands, where blasting of rock is proposed
- k) arrangement for all required site inspections and materials testing for the works to be constructed to service the subdivision
- l) arrangement for a pre-construction meeting for construction of the works to service the subdivision

2.6.2 Requirements for Tendering

The Engineer shall call tenders for the works (if requested by the City) and shall analyse the bids received and make recommendations to the Developer and the City regarding the awarding of the works to the Contractor.

Where the City of Hamilton is responsible for the payment of items that include a "City Share" of the cost that is not based on a "Flat Rate" basis for sanitary and storm sewers and watermains and the "New Roads Servicing Rate" for roadworks, the following tendering procedure shall be used:

Any project where the City's share of the cost is in excess of \$50,000.00 + HST shall be tendered by an open tender (i.e. public notice in the Spectator and at the Hamilton Construction Association, etc.). Where there is a City share component for the project the Developer should not tender the Works subject to the funding by the City until given authorization by the Development Engineering Section. The City will not pay for increase in costs arising from incomplete designs.

The tenders shall close at the Consultant's office (if local) or at City Hall if the Consultant is from out of town. The out-of-town Consultant shall make arrangements to book a room at City Hall for the tender opening. A City representative will be present at the opening of the tenders to witness the bids received and shall be provided with copies of the Schedule of Quantities of the three low bidders

immediately.

The Developer may select the Contractor of his choice for the project, but the City will pay for its share of the works only on the basis of the overall low bidder (unless there is a justified reason to choose another bid e.g. disqualification of bidder due to no bid bond, known bad track record, etc.)

The Engineer will certify on the Statements of City's Share of the Works that the City's share is based on the prices submitted by the low bidder that has been accepted by the City and shall provide supporting documentation where necessary.

2.6.3 Pre-Construction Meeting

The Engineer shall arrange for a pre-construction meeting to be held prior to start of construction. A checklist of items to be covered at the pre-construction meeting shall be provided. At this time, the City shall be provided with the following documents:

- a) One priced and signed copy of the contract documents and Form of Tender
- b) One blank copy of the contract documents and Form of Tender (without prices)
- c) Two (2) copies of the General Plan of Services
- d) Three (3) complete sets of construction drawings
- e) An electronic copy of approved engineering drawings (in .DWG/DXF format).

The Engineer shall obtain a Construction Schedule from the Contractor and provide the City with a copy. The City shall be regularly informed as to the progress of construction and of any deviation from the original schedule.

2.6.4 Construction on Existing Roads

Where servicing must be carried out on existing roads, traffic shall be maintained wherever possible. In the event that a road closure has been approved previously by the City's General Manager of Public Works, the Engineer shall provide a minimum of two weeks written notice to the City's Senior Project Manager, Development Engineering Section, to co-ordinate a road closure. The City Traffic Operations will establish and sign the detour route and notify all emergency services and school board transportation services. The Developer's Contractor will be responsible to post and maintain traffic control signage on site.

All costs associated with road closures and detour routes shall be paid for by the Developer.

A written notice shall be prepared by the City and/or the Engineer and shall be hand delivered by the Engineer to all abutting properties advising of the road closure.

2.6.5 Inspection Services

2.6.5.1 General Inspection

The Developer's Engineer has full responsibility for the actions of the Contractor and the quality of the work. The Developer's Engineer is responsible for providing full time inspection services during the construction of all municipal services in the project.

City staff shall only provide a part-time monitoring of the construction activities to ensure general conformance to the subdivision agreement and the City's policies and standards.

The following inspection and testing works shall be carried out during and after construction of both municipal services and private services intended to service multi-unit developments:

Sewer Mains

- a) Sieve analysis of pipe bedding material for compliance with the specifications. Representative samples are to be obtained by the Geotechnical consultant during sewer operations. Pipe bedding material supplier shall be approved by the City prior to use.
- b) Compaction tests shall be performed to assure that pipe bedding and backfill material has been compacted properly.
- c) Regular inspection of work in progress of the sewer installation and noted defects corrected immediately.
- d) All sewers and manholes must be flushed and cleaned prior to testing. A mandrel test shall be performed on all flexible pipe sewer mains in accordance with OPSS 410 which consists of a successful pass of the "pig" pulled through the main.
- e) Infiltration/exfiltration testing conducted on all sanitary sewers using low air pressure or water in accordance with OPSS 410.07.15.02 to assure joints and manholes are properly sealed.
- f) Video inspection of all sewer mains to assure no defects exist.
- g) After the completion of the roadworks (minimum base course asphalt) an initial visual inspection of the sewer works shall be completed with the

contractor, Engineer and City. A report outlining deficiencies shall be provided by the City.

- h) Prior to the expiration of the Guaranteed Maintenance Period a final visual inspection of the sewer works shall be completed.*
- i) Second mandrel test (and flushing) will be required prior to assumption.*
- j) The City may arrange for a second TV camera inspection if deemed necessary.
- k) A video inspection of all rear yard catch-basin leads will be required prior to assumption.

Watermains

- a) Sieve analysis of pipe bedding material for compliance with the specifications. Representative samples are to be obtained by the Geotechnical consultant during sewer operations. Pipe bedding material supplier shall be approved by the City prior to use.
- b) Compaction tests shall be performed to assure that pipe bedding and backfill material has been compacted properly.
- c) Regular inspection of work in progress of the watermain installation and noted defects corrected immediately.
- d) Ensuring that hydrants that are not fully operational are black-bagged.
- e) Hydrostatic pressure and leakage testing of the watermain.
- f) Swabbing of the watermains.
- g) Main disinfection and bacteriological sampling.
- h) A conductivity test shall be performed on all PVC watermain installations.
- i) After the completion of the roadworks (minimum base course asphalt) an initial visual inspection of the watermain works shall be completed with the Contractor, Engineer and City. A report outlining deficiencies shall be provided by the City.
- j) Prior to acceptance and/or release of permits all water quality interim measures are in place.
- k) Prior to the expiration of the Guaranteed Maintenance Period a final visual inspection of the watermain works shall be completed. A pre-inspection by the Engineer of the water valves and dewatering of valve chambers is necessary, before the City will inspect the works.

Road Works

- a) Sieve analysis of granular base material for compliance with specifications. Granular base course material supplier shall be approved by the City prior to use.
- b) Compaction tests on the sub-grade, granular base courses and asphalt courses to assure satisfactory compaction has been achieved. Asphalt mix designs and supplier shall be approved by the City prior to use.
- c) Confirmation of the sub-grade elevations prior to construction of road base. No base course material shall be placed on the sub-grade until approval is given by the City. Such approval will only be given when:
 - The degree of compaction has been achieved as per City of Hamilton Form 900 in the "Construction and Material Specification Manual"
 - The sub-grade has been graded to within 30 mm of the proposed cross-section.
 - The developer's consultant has taken sufficient elevations and provided written certification for grades and for all area compaction levels to the City.
- d) "Proof rolling" of the sub-grade prior to the placement of the granular road base courses. All soft and spongy sections shall be excavated and filled with suitable material. Upon completion of excavation and grading operations, the sub grade shall be thoroughly rolled with a loaded tri-axle or an alternative as recommended by the Geotechnical Consultant. Any minor irregularities or depressions developing under such rolling shall be corrected at the contractor's expense.
- e) Concrete tests (air, slump, and compressive strength) shall be performed to assure concrete meets specifications. Concrete supplier shall be approved by the City prior to use.
- f) Initial visual inspection of the road works.
- g) A final visual inspection of the road works prior to the expiration of the Guaranteed Maintenance Period.

Notwithstanding the aforementioned requirements, the Engineer shall not be relieved in any way from full responsibility to carry out any further tests which may be required to assure services meet specifications.

Upon substantial completion and satisfactory inspection of the sewer and water systems, the City shall release sewer and water permits for the lots and blocks serviced under the development application.

2.6.5.2 Compaction and Material Testing

Compaction testing for trench backfill, road sub-grade, granular courses and asphalt including material testing of concrete, asphalt, granular materials etc., is required for all development projects in the City of Hamilton. It shall be the Developer's responsibility to provide material and compaction testing by a qualified geotechnical testing company.

The geotechnical consultant shall certify to the City that works have been carried out as specified. In the event of a deviation from specifications, the geotechnical consultant shall provide an explanation and make recommendations to the City for either acceptance or any mitigation measures that could be carried out.

In cases where blast rock is proposed as a backfill material, for which test results cannot be obtained, the Developer shall engage a qualified geotechnical soils consultant to be present on a full-time basis to monitor the compaction procedures during backfill, and provide the City with a written certificate at the completion of backfill operations that an equivalent of 95% Standard Proctor Density has been achieved for the backfill of the trenches.

All imported fill to a site shall meet the MOE Table F requirements for residential sites.

2.6.5.3 Video Camera Inspection

The Developer is responsible to initiate and pay the full cost for video inspection of the sanitary sewers and storm sewers only upon receiving notification from the Contractor that the sewers and manholes are complete, the manholes cleaned and there is suitable access to the site. The City shall be provided with 48 hours notice as to when the video inspection is being carried out so that they may witness the video inspection.

The video inspection shall be carried out using City guidelines. A copy of the initial video inspection and deficiency list, if any, shall be made available to the Engineer and the City when the testing company has completed the video inspection. The Engineer shall take the necessary steps to have any deficiencies rectified.

Prior to the expiration of the Guaranteed Maintenance Period, the City may request additional video inspection of the sanitary and storm sewers; however, all rear lot catch basin leads shall be video inspected at the time of grading certification. All re-inspection costs of the sewer system, for the purposes of confirming the correction of deficiencies, will be at the Developer's expense.

2.6.5.4 Watermain Testing

The Engineer shall ensure that the Contractor assists City staff in the testing of the watermain. The Contractor is to provide all materials, equipment and personnel for pressure and leakage testing, swabbing, and disinfection and bacteriological testing of the watermains. City staff shall arrange for water samples to be collected and tested for potability at the City Lab.

2.6.5.5 Initial and Final Visual Inspections

The initial visual inspection of the sewers shall consist of inspecting of all manholes and catch basins to assure the structures are complete (i.e. ladder rungs, correct frame and cover, temporary bulkheads removed, silt controls in catch basins,), and free of debris.

The initial visual inspection of the watermains shall consist of the inspection and operation of all main valves, hydrants and secondary valves. All valves and hydrants shall be left in the "open" position, unless noted otherwise. Valves 400mm and larger shall be operated by the City Waterworks Section.

Prior to assumption of the watermain and sewer works by the City, a final visual inspection shall be conducted.

The final visual inspection of the watermain works shall consist of inspecting and operating all main valves, hydrants and secondary valves, and curb stops. Valves 400mm and larger shall be operated by the City Waterworks Section. The Contractor and Engineer shall satisfy themselves that all curb stops are located and operable prior to requesting the final visual inspection with the City.

The final visual inspection of the sewers shall consist of inspecting all manhole and catch basins and their adjustments.

The final visual inspection of the above ground works shall consist of, but not limited to, the curbs and gutters, sidewalks, approaches, surface asphalt and boulevard sodding.

The initial and final visual inspections shall be conducted by the Contractor, accompanied by the Engineer and the City.

The City will provide one (1) field inspection after the final visual inspection to inspect and to confirm correction of deficiencies, however subsequent inspections may be invoiced to the Developer on an hourly basis.

2.6.6 Substantial Completion of Works

The Engineer shall certify substantial performance of the Contract of Works and shall supply the Contractor with the necessary information for publication in accordance with the Construction Lien Act, 1983 or latest revision. Satisfactory evidence shall be provided to the City that it has been published, before the City will reduce the securities it holds for performance of the works.

2.6.7 Acceptance of Works - Start of Maintenance Periods

The "Start of Maintenance" date shall be established and the services placed on the maintenance period providing the following conditions have been satisfied:

- a) the plan of subdivision has been registered
- b) the construction of services has been certified as substantially complete
- c) geotechnical reports confirming acceptable compaction testing
- d) the Engineer has submitted as-constructed information in a form satisfactory to the Growth Management Division
- e) the required inspections reveal that there are no major deficiencies in the sewer and watermain systems constructed under the subdivision agreement.

Maintenance periods will be established for the following phases of construction:

- a) completion of all below ground services (sewer and watermain)
- b) completion of above ground works (after placement of the surface course asphalt)

The Developer shall maintain all below ground services (sewer and watermain works) for a period of not less than two (2) years from the date of "Acceptance of Works" as issued by the City. Should the Developer be required to repair or replace a portion of the under ground works, the full two (2) year period will commence from the date of the accepted repair or replacement.

The Developer shall maintain all above ground works (roadways, curbs and gutters, sidewalks, driveway approaches) for a period of not less than one (1) year from the date of "Acceptance of Works" as issued by the City. The one year maintenance period shall not commence until the placement of the surface course asphalt.

The Developer shall maintain all landscaping within the road allowance for a period of not less than two (2) years from the date of "Acceptance of Works" as issued by the City.

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 than 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 undevelopable 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

A Developer shall pay the initial front-end cost of all works constructed under the City's Subdivision Agreement, less over-sizing, adjacent to land that is not owned by that Developer, excluding lands owned by the City as defined by Section 3.2.2 of this policy.

The Developer's Engineer shall calculate the estimated cost of the front-end works and identify the abutting lands not owned by the Developer, adjacent to the front-end works. The City shall include the estimated cost of the front-end works and the abutting properties in the City's Subdivision Agreement as a "Best Efforts" recovery for the Developer in the future.

3.3.2 Cost Calculation for “Best Efforts” Recoveries

Upon completion of the front-end works, the Engineer shall certify to the City the actual cost of the completed works and provide the City with a detailed breakdown of the cost. The City shall review the cost breakdown and advise the Engineer if the costs are satisfactory. Once the Engineer and City agree to the actual costs to be recovered for the front-end works, a rate for the “Best Efforts” recovery shall be set by the City and applied to the frontage and/or flankage of the abutting lands.

In the instance where development of the abutting lands takes place prior to completion of the front-end works then the cost calculation for a “Best Efforts” recovery of the front-end works shall be based on the unit cost of the signed tender document for the works.

The City will carry out its “Best Efforts” obligation under the Subdivision Agreement to collect the adjacent landowner’s share of the cost of the works, as a condition of development approval and reimburse the front-ending Developer for its initial up front cost of those works, in accordance with the City’s approved Cost Recovery Policies.

3.4 Cost Recovery Policies

3.4.1 0.3m Reserves along the Open-side of Road Allowances (new roads only)

Where new roads are constructed adjacent to undeveloped land, the portion of a road allowance abutting the undeveloped land shall be referred to as the open side of a road allowance. The City shall establish a 0.30 metre reserve along the open side of a road allowance to ensure that all outstanding requirements of the City with respect to the front-end cost of the road and development of the adjacent lands are fulfilled by the abutting landowner.

When development of lands abutting the open side of a road allowance occurs then, prior to removal of a 0.30 metre reserve by the City, an abutting landowner shall:

- a) satisfy all outstanding requirements of the City related to development of the lands abutting the reserve; and,
- b) prepare and register on title, at the Developer’s expense, a surveyor’s reference plan identifying the portion of the existing reserve to be lifted which is adjacent to the lands to be developed.

Upon fulfilment of all conditions of development approval, which have been imposed as a result of a development application on lands abutting the open side of a road

allowance, the City will pass a By-law to have the 0.30 metre reserve incorporated into the public road allowance.

3.4.2 Front-ending by Developer - “Best Efforts”

Where the City has agreed, through its “Best Efforts” obligation under the Subdivision Agreement, to recover the cost of works on behalf of a front-ending Developer, the cost to be recovered shall be the actual cost of the works, which abut the adjacent lands, less the portion identified as over-sizing. The actual cost, less over-sizing, shall be adjusted by the Canadata Construction Cost Index from the month in which the works were constructed to the month the recovery is due.

3.4.2.1 New Roads

If an application is received by the City for development of lands along the open side of a road allowance where services have been constructed by a front-ending Developer under the “Best Efforts” provision of the subdivision agreement, then the City will use its authority under the Planning Act to collect the adjacent landowner’s share of the front-end service costs prior to final approval of the application. Monies collected by the City in fulfillment of its “Best Efforts” obligation under the subdivision agreement will be forwarded to the front-ending Developer.

3.4.2.2 Existing Roads

Where a Developer is required to front-end the construction of services along an existing municipal road under the “Best Efforts” provision of the City’s Subdivision Agreement in order to service the lands to be developed, then the City will pass a Municipal Act By-law for the purpose of assessing and rating each property for the cost of the front-end servicing by a Developer.

Cost recoveries from adjacent properties for front-end servicing by a Developer on an existing municipal street; will occur in either one or both of the following ways:

If a request is made by a landowner to connect to the front-end service, then the City will use its authority under the Municipal Act By-law to recover the adjacent owner’s share of the servicing cost; or,

If an application is received by the City for development of lands adjacent to the front-end works, then the City will use its authority under the Planning Act to recover the adjacent landowner’s share of the front-end service costs. The City will collect cost recoveries for lands under development application prior to final approval of the application.

All monies collected by the City in fulfillment of its “Best Efforts” obligation under the

subdivision agreement will be forwarded to the front-ending Developer. Where lands are developed with reverse frontage single or semi-detached lots that have been mandated by the City, then no recovery will be made by the City for front-end works along the rear portion of the reverse frontage lots.

3.4.3 Front-ending By the City

3.4.3.1 Aboveground Works

Where the City has paid for construction of aboveground works along 0.30 metre reserves under previous subdivision agreements the City shall recover that cost, less the portion identified as over-sizing, from an abutting landowner prior to removal of the reserve. The City shall use the “New Roads Servicing Rate”, in force at the time of final approval for a development application, multiplied by the length of the 0.30 metre reserve adjacent to the lands to be developed. The sum shall be collected by the City as a recovery for the above ground works.

3.4.3.2 Underground Works

In the past the City has installed sewers and watermains within some existing public road allowance under the Local Improvement Act. The City has assessed those properties abutting the Local Improvement works based on a Local Improvement Rate approved in the year a project was constructed. In most cases the assessed Local Improvement Rate did not represent the full cost of the project after over-sizing cost is deducted. Thus, each project included a non-rated component, which was paid by the municipality.

Recovery of the non-rated portion of a project cost has occurred in one of two ways. Firstly, where the non-rated portion of the project cost has been identified as a Development Charge capital project cost, the recovery has occurred through payment of the City’s Development Charge. Secondly, where the non-rated portion of the project cost has not been identified as a Development Charge capital project cost, the City has recovered this portion as a condition of Plan of Subdivision or Consent approval when the land abuts the existing works and derives benefit from the service. This non-rated portion of a project cost is generally referred to as the “Subdivider’s Share” of the cost.

The non-rated portion of a Local Improvement Project cost typically referred to as the “Subdivider’s Share” shall be collected by the City as a condition of subdivision or Consent approval where such outstanding project costs apply to lands abutting and benefiting from the service.

The City shall adjust the “Subdivider’s Share” of the project cost by the Canadata Cost Index from the month when the works were constructed to the month when the cost recovery is due.

Payment of the adjusted amount shall be made to the City prior to final approval of a Subdivision or Consent application.

3.4.4 Payment for Future Works (above and below ground works)

The City shall collect a security deposit through its Subdivision Agreement from a Developer for payment of the Developer's share of future roads and services, which will abut the proposed development when constructed in the future. Security for future aboveground works shall be based on the New Roads Servicing Rate applied to the frontage and/or flankage of the development adjacent to the future works whereas security for underground works shall be estimated based on pipe sizes of the future underground services.

3.4.5 Payment for Future Urbanization of Existing Rural Roads within the Urban Boundary

Where development of land creates lots or blocks, abutting an existing road of rural cross section which is within the Urban Area Boundary as defined by the Official Plan, then the City shall collect a cash payment from the Developer. The cash payment represents the Developer's share of the cost to urbanize the existing rural road and will be collected as a condition of development approval based on the New Roads Servicing Rate applied to the frontage and/or flankage of the development adjacent to the existing rural road.

3.4.6 Exemptions from Cost Recovery

Where the City has mandated the development of land with reverse frontage lots for single, semi-detached or multiple dwellings with freehold single lots (i.e. street townhousing), along existing collector or arterial streets, then there shall be no payment by a Developer to the City for existing or future works along the frontage of the rear portion of the reverse frontage lots created by the development.

Where the City has mandated that direct access from freehold lots is not permitted to an existing roadway but access is required by means of a joint access along a shared service roadway, then there shall be no payment by a Developer to the City for existing or future above-ground works along the frontage of the lots created by the development. The Developer shall, however, be responsible for his share of the construction of below-ground infrastructure. For freehold lots created along a new roadway proposed within the same development, the Developer will be responsible for all costs, less oversizing, for the frontage of the freehold lots along the new road.

3.4.7 Timing of Funding from City

The timing of payment for the City's share of servicing costs eligible for each development shall be subject to the availability of funding approved and allocated in the City's Annual Capital Budget.

Any Developer requesting payment for City cost-sharing funding shall do so, in writing to the City's General Manager of Planning and Economic Development, prior to October 1st of each calendar year. Such requests can apply to completed works or imminently proposed works.

Any development requiring the City's share of works to be paid beyond the approved Capital Budget amount for that year shall require the approval of City Council. The Senior Director of Growth Management may authorize funding to be paid during the year for completed eligible projects not initially allocated funds during the Capital Budget process, subject to the availability of reserved monies funded that year.

In the case of works financed through Development Charges, the Developer may request the City to allow the Developer to front-end the growth-related costs in exchange for a credit towards future Development Charge payments.

Table 3.1
Rates for Over-sized Works
Constructed Under Subdivision Agreements 2010

WATERMAINS		
Pipe Size	Rate Per Metre of Pipe	Rate Per Valve Chamber
300mm Ø	- NIL -	- NIL -
400mm Ø	\$ 95.00	\$ 12,840.00
NOTES:		
1. For 400mm Ø air valve/blow-off chambers, the unit price per chamber is \$8,423.00.		
2. The City's contribution towards the over-sized portion of the pipe cost for sizes over 400mm Ø shall be negotiated at the time of approval of the engineering design by the City.		

Table 3.1 continued

SANITARY SEWERS	
Pipe Size	Rate Per Metre of Pipe
450mm Ø	- NIL-
525mm Ø	\$ 32.00
600mm Ø	\$ 79.00
675mm Ø	\$ 181.00
750mm Ø	\$ 263.00
825mm Ø	\$ 337.00
900mm Ø	\$ 415.00
975mm Ø	\$ 588.00
1050mm Ø	\$ 760.00
1200mm Ø	\$ 914.00

SANITARY MANHOLES	
Manhole Size	Rate Per Manhole
1200mm Ø	- NIL -
1500mm Ø	\$ 1,880.00
1800mm Ø	\$ 2,980.00
2400mm Ø	\$ 6,895.00
<p>Note: The City will only cost share for over-sized manholes that are used in combination with over-sized sewer pipe.</p>	

Table 3.1 continued

STORM SEWERS	
Pipe Size	Rate Per Metre of Pipe
1200mm Ø	- NIL -
1350mm Ø	\$ 271.00
1500mm Ø	\$ 600.00
1650mm Ø	\$ 959.00
1800mm Ø	\$ 1,409.00
1950mm Ø	\$ 1,826.00
2100mm Ø	\$2,273.00

STORM MANHOLES	
Manhole Size	Rate Per Manhole
2400mm Ø	- NIL -
3000mm Ø	\$ 4,006.00
3600mm Ø	\$ 31,500.00
<p>Note: The City will only cost share for over-sized manholes that are used in combination with over-sized sewer pipe.</p>	

Table 3.1 continued

ROADWORKS		
Item	Rate Per m2	Description
Binder Asphalt and Granular Base	\$ 43.24	Extra WIDTH over 8.0m of: 150mm Granular "A" 300mm Granular "B" 80mm HL-8 Binder Asphalt
Surface Asphalt	\$ 12.55	Extra WIDTH over 8.0m of: 40mm HM-3 Surface Asphalt
	\$ 1.02	Full WIDTH of: HL-1 Surface Asphalt
Binder Asphalt	\$ 5.98	Extra DEPTH for: 100mm HL-8/HL-8HS Binder Asphalt
	\$ 14.98	Extra DEPTH for: 120mm HL-8 (HS) Binder Asphalt
Granular Base	\$ 5.50	Extra DEPTH for: 450 mm Granular "B" Base

Table 3.2
2010 New Roads Servicing Rates for Road Works
 Constructed Under Subdivision Agreements

ITEM	Rate Per Metre Of Property Frontage
Curbs and Subdrains	\$ 56.45
Street catchbasins and connections	\$31.50
Asphalt pavement (up to binder course asphalt)	\$172.00
Asphalt pavement (surface course asphalt)	\$36.30
Sidewalks (both sides)	\$81.40
Sidewalk (one side only)	\$40.70
Street lighting	\$20.50
Utility trenching	\$12.50
Local Storm Sewer	\$ 101.00

Notes:

The City shall pay 4% Construction Inspection fees, Consulting Engineering fees plus 13% HST in addition to the rates described above as detailed in the cost estimate schedules.

New Roads Servicing Rate for Cost Sharing of Road Construction

(represents road cost per metre of property frontage with no storm sewer component)

New Roads Servicing Rate	Flat Rate with No Overhead
Sidewalks both sides =	\$ 410.65
Sidewalk one sides =	\$ 369.95
No Sidewalk =	\$ 329.25

Table 3.2 continued

Notes:

Flat Rate with no overhead should be used under Schedule "F" of the City's subdivision agreement to determine the City's share of the net construction cost for each item identified with City Share in the schedules. The overhead for City share will be added on the Schedule "F" summary page in the same way as all other items in Schedule "F".

New Roads Servicing Rate for Cost Recovery

(represents road cost per metre of property frontage including local storm sewer component)

New Roads Servicing Rate	Flat Rate with No Overhead	Flat Rate with 30.56% Overhead
Sidewalks both sides =	\$ 511.65	\$ 668.01
Sidewalk one sides =	\$ 470.95	\$ 614.87
No Sidewalk =	\$ 430.25	\$ 561.73

Notes:

1. Overhead on New Roads Servicing Rate (30.56%) represents 13% HST, 4% Construction Inspection and an average of 12% Consulting Engineering Fees, 13% HST on Consulting Engineering Fee.
2. Flat Rate with 30.56% overhead included represents the rate to be used for all cost recoveries.

3.4.8 Protocol for Payment of City Share

The payment of the City's share of the cost of municipal works to be constructed under a development agreement are subject to the following:

- a) Council approved capital budget for the works;
- b) the development agreement must be registered on title of the subject lands;
- c) there shall be no outstanding liens related to the works that are subject to payment of the City's share; and
- d) a formal requisition of payment prepared by the developer's consulting engineer, who shall be a professional engineer licensed to practice in Ontario, submitted to the City, complete with:
 - i) A letter of request for payment of the City's share of construction costs for the related development certified by the consulting engineer.
 - ii) A progress payment certificate to the City broken down in the same format as the approved "Schedule of Works" related to the agreement with each request for payment of the City share of construction. The payment certificate shall show the approved as-constructed cost of completed works which require payment by the City.

The Engineer shall inspect and confirm the actual construction for each item approved for payment. Where the City share of costs is based on unit prices, the units or quantities shall also be confirmed with actual measurements and made available on request.

- iii) Proof of payment from the contractor(s) who installed the works that are subject to payment by the City.

Appendices

Appendix 1 – Standard Subdivision Notes

A ~ SEWERS

1. Sanitary and Storm Sewers

- a) Construction of sanitary & storm sewers & private drains shall be in accordance with City standards & specifications (latest edition) and Ministry of Environment (MOE) Guidelines (latest edition).
- b) Cover and bedding material for concrete pipe shall be Granular 'A' material as per OPSD 802.030 or 802.033, Class 'B' bedding.
- c) Cover and bedding material for PVC pipe shall be Granular 'A' material as per OPSD 802.010 or 802.013.
- d) PVC pipe will require special construction procedures as per City specifications.
- e) All sewers to be flushed prior to video inspection.
- f) Manhole frames and covers shall be as per OPSD 401.010 (Storm-open, Sanitary-closed).
- g) Sanitary sewer (200mm to 375mm dia) shall be PVC pipe, CSA B182.2, SDR-35.
- h) Storm sewer (300mm to 600mm dia.) shall be PVC pipe, CSA B182.2, SDR-35.
- i) Storm sewer > 600mm dia. shall be concrete pipe, CSA A257.2 (as specified)
- j) PVC (sanitary and storm) sewers are to be tested for deflection (mandrel passage) after installation. Sanitary sewers shall also be tested for leakage (low air pressure). Prior to assumption by the City, pipe deflection testing shall be repeated.
- k) Alternate materials may be acceptable provided approval has first been obtained from the City/Engineer.

2. Private Drains

- a) 'S' denotes single sanitary private drain connection. 'D' denotes dual private drain connection (sanitary & storm).
- b) To be located 1.5m on right side of centerline of lot or as detailed and extended 1.0m beyond the street line. The storm service shall be installed to the north or east of the sanitary service.

- c) Private drains to be 150mm dia. PVC pipe, CSA B182.1 M-1983, SDR 28 as per RHW Form 1407. Storm pipe shall be white and sanitary shall be any colour other than white. Wood marking at end of sanitary private drain shall be painted red.
- d) Cover and bedding material for private drains shall be Granular 'A' installed as per OPSD 802.010 or 802.013.
- e) Minimum fall for private drains to be 2.0%.
- f) Top of sanitary private drains at street line to be 2.2m (min.) below centerline road elevation at that point or as detailed.
- g) Top of storm private drains at street line to be 1.2m (min.) below centerline road elevation at that point or as detailed.
- h) Building rainwater leaders shall not be connected to the storm private drain but shall discharge onto the ground surface via splash pads.
- i) Sump pumps with check valves shall be installed in each dwelling to pump the building weeping tiles to the storm private drains. The sump outlet pipe shall extend a minimum of 150mm above the proposed grade at the dwelling (basement ceiling) prior to discharging to the storm private drain.

B ~ WATERMAINS AND WATER SERVICES

1. Watermains

- a) Construction of watermains & private services shall be in accordance with City standards & specifications (latest edition) and Ministry of Environment (MOE) Guidelines (latest edition).
- b) To be installed to a minimum depth of **1.80m** below proposed centerline road grade on all roads except on (*name of road*) where the minimum depth is 1.6m.
- c) PVC pipe in sizes 100mm through 300mm shall be Class 150 DR18 conforming to AWWA C900. For 400mm, see Section 7: Special Notes.
- d) Tracer wire shall be installed with PVC pipe in accordance with RHW FORM 1600. It shall be 12 gauge TW75, TWU75 or RW90XLPE coated copper and shall be positioned along the top of the pipe and fastened at 6 metre intervals. The wire is to be installed between each valve and/or the end of the new PVC watermain. Joints in the wire between valves are not permitted. At each gate valve a loop wire is to be brought up inside the valve box to the cap. The tracer wire shall be brought to the surface at the secondary valve on all fire hydrants. The tracer wire shall also be connected to the cathodic protection system as required.
- e) Molded PVC fittings for pipe sizes 100mm to 300mm shall conform to AWWA C900 and certified to CSA B137.2.

- f) Fabricated fittings 250mm and 300mm shall be manufactured from segments of AWWA C900, Class 150 (DR18) PVC pipe, bonded together and over-wrapped with fibreglass-reinforced polyester to meet the requirements of CSA B137.3.
- g) Where metal fittings are to be used on PVC mains sufficient cathodic protection must be provided as per the following requirements:
 - i. minimum of one 11kg zinc anode shall be installed for every 1000m of tracer wire;
 - ii. one 11kg zinc anode shall be installed for each copper water service connection;
 - iii. one 11kg zinc anode shall be installed on every valve, hydrant, bend, tee, sleeve, reducer, plug, cap, joint restraint, coupling, etc., connected to the PVC pipe.
- h) Bedding and backfill as per RWS.500 Granular 'A' material for mains and services greater than 50mm.
- i) Watermain deflection for PVC pipe:
 - i. maximum allowable deflection of 1.5 degrees per joint up to 250mm diameter (160mm per 6.1m pipe length) and 1.2 degrees for 300mm diameter (128mm per 6.1m pipe length) shall not be exceeded.
 - ii. all joints shall be deflected an equal amount.

2. Flushing, swabbing and testing

- a) All new watermains are to be swabbed in accordance with City specifications.
- b) A reduced pressure zone Backflow Preventer (WATTS SERIES 909 or approved equal) is required on the temporary supply lines used for filling and flushing or swabbing of watermains.
- c) Upon completion of installation, the Contractor shall perform a pressure test on the watermains as per RHW.304. Watermain is to be tested prior to connection to existing watermains using temporary caps or plugs. Pipe closures, where required, are to be supplied by the Contractor. The Contractor will also supply and install all adaptor pieces in order to connect to existing watermains.

3. Water Services

- a) 'W' denotes water service connection (20mm dia. Type 'K' soft copper) as per RWS.700, Sht. 2 (Rev.84) or as detailed.
- b) To be located 1.0m on left side of center line of lot opposite sanitary private drain or as detailed, with curb stop adjacent to the street line.

- c) Granular bedding as per RWS.500, Sht. 1 to be Granular 'D' as per RHW Form 1000.

4. Valves & Valve Boxes

- a) All valve boxes to be set to proposed grades.
- b) 100mm to 300mm gate valve & valve boxes as per RWS.309.

5. Anchor Blocks

- a) For 100mm to 300mm watermains standard concrete anchor blocks as per RWS.400.

6. Hydrants

- a) To be installed with secondary valves as per RWS.600 or .604 as detailed. They shall open counter-clockwise (left) and have a 'L' painted on the barrel section. The 100mm pumper 'Storz' connection shall face the roadway and be painted black.
- b) All fire hydrants shall conform to the City of Hamilton (municipality) Fire Department's requirements and shall be of same manufacture.

7. SPECIAL NOTES – for 400mm dia. Watermain

- a) To be D.I. Class 52, cement-lined with cement-lined fittings or concrete pressure pipe as per AWWA C-301 or C-303.
- b) Bedding as per RWS.500, Sht. 1 or Sht. 2. (Gran. 'A', RHW Form 1100).
- c) Standard concrete anchor blocks as per RWS.401 for 11¼° and 22½° bends, RWS.402 for 45° bends, RWS.404 for tees and RWS.411 for plugs.
- d) For D.I. pipe use 400 x 150mm hydrant tee and anchor block as per RWS.400
- e) For concrete pressure pipe, at hydrants use concentric plain-end branch and anchor block as per RWS.400.
- f) Watermain deflection per pipe length.
 - i) Ductile Iron - maximum allowable deflection of 2.5° shall not be exceeded (266mm per 6.1m pipe length).
 - ii) Concrete - maximum allowable deflections of 1.6° shall not be exceeded (170mm per 6.1m pipe length).All joints shall be deflected an equal amount.
- g) Watermain to be tested prior to connection to existing watermains using temporary caps or plugs. Pipe closures, where required, to be supplied by contractor. Contractor to supply and install all adapter pieces as required in order to connect to the existing watermain.

C ~ ROADWORKS

1. General

- a) Construction of roadways & related works shall be in accordance with City standards and specifications (latest edition).
- b) Following the installation of sewers, all roadways shall be rough graded to sub-grade for the installation of watermains & utilities.

2. Preliminary Notes

- a) No preliminary roads to be installed.

3. Catch Basins

- a) Catch basin connections to be 250mm dia. PVC pipe CSA B182.2, SDR-35 unless otherwise noted.
- b) Single/double street catch basins as per OPSD 705.010/705.020 respectively with goss traps (RSS 410).
- c) Private rear yard catch basins as per OPSD 705.010 (no goss traps).
- d) Street CB grates as per OPSD 400.020 (flat) and rear yard CB grates to be Beehive type grate and cover.

4. Final Roadways

- a) Cross-fall to be 2.0%.
- b) Standard deep strength pavement (40mm HM 3, 80mm HL 8 on 150mm Granular 'A' & 300mm Granular 'B', Type II 100% crushed aggregate) for typical urban residential streets.
- c) For major collector roads (*name of roads*) typical pavement profile shall be 40mm HM 3(HD), 100mm HL 8(HS) on 150mm Granular 'A' & 300mm Granular 'B', Type II 100% crushed aggregate.
- d) Manholes and catch basins shall be installed flush with the base course asphalt (HL 8).
- e) Manholes to be adjusted to match final lift of asphalt.
- f) For manhole and catch basin top adjustments, all permanent adjustments are to be poured in place.
- g) Final asphalt course (HM 3) shall be placed a min. of one year after the installation of the asphalt binder course.

5. Sidewalks and Curbs & Gutters

- a) Concrete curb and gutter as per OPSD 600.040 – (barrier type), min. 30 MPa strength. A 50mm key is required for all locations.

- 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)