Township of King
Regional Municipality of York

Design Criteria
and
Standard Detail Drawings

January 2026

Record of Revisions

Revision	Date	Description
1	April 2015	General Update
2	June 8, 2015	Council Approval
3	November 2015	Revisions and Updates
4	May 2016	Updates to various Standard Drawings, including index
5	October 2016	Miscellaneous text revisions, updates to select appendices, including various Standard Drawings
6	February 2017	Miscellaneous text revisions, revised various standard drawings, added new standards (KS-171, KS-211 and KS-820), etc.
7	March 2017	Revisions to road standards and polices to be in conformity with Transportation Master Plan
8	August 2017	Revisions to text related to rail corridors, street light fixtures, traffic calming, CCTV protocol, etc.
9	March 2018	Revisions to text and standards related to sidewalks, cul-de-sacs, pavement markings, check valves, CCTV of laterals, manhole lids & water proofing, etc.
10	January 2019	Revisions to miscellaneous text and sewer system water proofing; updated watermain materials, etc.
11	January 2026	Comprehensive revisions, CLI-ECA requirements, York Region sanitary sewer requirements, Section M - Residential Infill Development, updated appendices and Standard Drawings

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Reference Table

Where applicable, the following may be referenced within these design criteria as noted below:

The Township of King	the Township
The Regional Municipality of York	the Region
Toronto and Region Conservation Authority	TRCA
Lake Simcoe Region Conservation Authority	LSRCA
Ministry of the Environment Conservation and Parks	MECP
Ministry of Natural Resources	MNR
Developer's Consulting Engineer*	Consulting Engineer

*Consulting Engineer means a competent professional engineer or firm of engineers employed by the Developer, and skilled and experienced in municipal work and land development projects and registered with the Association of Professional Engineers of the Province of Ontario, possessing a current certificate of authorization to practice professional engineering as required by the Professional Engineers Act.

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General Information

Township of King
Design Criteria and Standard Detail Drawings

SECTION A General Information

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A1.00 General

The material presented herein is intended as a guideline in the production of designs for roads and services for all land development projects within the Corporation of the Township of King ("the Township"). While specific design guidelines are provided herein, the **Ontario Provincial Standard Drawings and Specifications** supply the basis for much of the construction activity and shall be adhered to at all times unless directed otherwise by these design guidelines.

The design of all municipal services in the Township is to be based upon the specifications and standards in effect at the time of submission. It is incumbent upon the Developer's Consulting Engineer to ensure the latest specifications are being utilized. All plans are to be accepted by the Township before they are used for the construction of services; however, such acceptance in no way relieves the Developer's Consulting Engineer from providing an adequate and safe design.

The design and construction of roads and services is to be completed in full accordance with any and all by-laws as may exist within the Township. It is incumbent upon the applicants, developers and consultants to be aware of all by-laws and other regulations which may otherwise affect the works as described within this manual.

A1.01 Familiarization

Prior to commencement of the Engineering design, the Consultant shall obtain current copies of the Township of King "Design Criteria and Standard Detail Drawings" to become familiarized with the requirements of design in the Township of King. The subject design criteria and standard detail drawings will apply to all developments in the Township regardless of type (i.e., subdivisions, plan of condominium, site plans, severances, individual lots, improvements, etc.).

Pre-Consultation meetings shall be held with the Township staff to discuss areas of preliminary concern and other issues prior to commencement of the engineering design (see Section 1.05).

All design work shall adhere to the approval principles as determined through the functional reports provided and adopted during the Draft Plan Approval stage of the process.

A1.02 Regional Municipality of York

The Regional Municipality of York is generally responsible for all trunk sanitary sewers, forcemains, and trunk watermains that are constructed within the Region of York. (There are currently no trunk sanitary sewers, as so defined, within the Township.)

The Region is responsible for all Regional (arterial) roads.

The Consulting Engineer shall contact the Region's Environmental Services Department to obtain copies of the Regional Design Standards for trunk sewers and trunk watermains, if/when applicable.

A1.03 Other Approvals

The Consulting Engineer shall be required to make all submissions and representations necessary to obtain approval from all other authorities affected (Ministry of Natural Resources, Ministry of Transportation of Ontario, Conservation Authorities, Canada Post Corporation, Medical Officer of Health, Transport Canada, etc.). The Township shall be kept informed of the progress of these submissions by copies of all correspondence.

A1.04 Railway Corridors

The Developer and his Consulting Engineer shall be required to make all submissions and representations necessary to obtain comments and approvals, as may be necessary, for developments in proximity to rail corridors. Relevant information is contained in the *Guidelines for New Development in Proximity to Railway Operations (May 2013)* as produced for the Federation of Canadian Municipalities and the Railway Association of Canada.

The document deals with some common issues (i.e., safety, noise, vibration) surrounding such intersections and provides guidelines to address these concerns. These include:

- Principles for mitigation and consultation requirements;
- Setbacks from rail corridors;
- Noise issues and mitigation measures;
- Noise berms (typical setbacks);
- Safety barriers, crash berms/walls;
- Building construction techniques;
- Security fencing;
- Storm drainage issues and mitigation;
- Use of warning clauses and other provisions; and,
- Construction considerations.

All proposed development adjacent to or in proximity to railway corridors shall be based on the implementation of the recommendations of the required noise and vibration studies. This shall include the provision of appropriate safety measures such as setbacks, berms and security fencing, mitigating measures, and notices on title to the satisfaction of the approval authority in consultation with the appropriate rail authority.

The proponent shall submit any correspondence with the rail authority to the Township for their records and confirmation of final acceptance. Specific provisions may also be included as conditions of approval at the time of Draft Plan Approval.

A1.05 Engineering Requirements for Draft Plan Approval

The following technical material and studies should be provided at a minimum for Draft Plan application consideration:

- Draft Plan Drawing;
- Topographic Survey;
- Functional Servicing Report, including analysis on servicing capacity;
- Preliminary Servicing Plan;
- Preliminary Grading Plan;
- Preliminary Stormwater Management Report;
- Traffic Impact Study;
- Environmental Assessment Study;
- Natural Heritage Study/Environmental Impact Study;
- Geotechnical Investigation Study;
- Hydrogeological Investigation Study; and,
- Preliminary Noise Study.

The following material and studies should be provided for background information:

- Planning Justification Report;
- Arborist Report;
- Information on existing registered easements on property;
- Urban Design Brief, including a discussion for Streetscape;
- Archaeological Assessments; and,
- Hydraulic Assessment, for any bridge crossing or watercourse modifications.

The material should be comprehensive, presented in a readable manner and completed by the appropriate qualified Professional.

A1.06 Climate Change

In accordance with the principles and guidelines outlined in the Official Plan, it is important to contribute to curbing climate change where possible by promoting restoration to the environment and reducing the carbon footprint. Designs must commit to building more resilient infrastructure.

The design of infrastructure should be undertaken with a view to potential negative impacts due to climate change within development applications and promote resiliency of ecosystems, manage the risks associated with climate change and provide sustainable natural environmental services.

Considerations shall include, but are not limited to:

- Promoting energy efficient design;
- Promoting transit use where available and promoting walking and cycling through development design to reduce automobile trips;
- Use of green infrastructure;
- Promoting designs that maximize energy efficiency and conservation including consideration of the mitigating effects of vegetation;
- Design that maximizes opportunities for the use of renewable and alternative energy sources and systems;
- Identification, avoidance and mitigation of existing hazards which may be compounded or aggravated by climate change, including flood prone areas;
- Identification, protection and restoration/enhancement of natural heritage features that have become more sensitive to development pressures due to climate change;
- Innovative stormwater management practices and establishing high targets for pervious surfaces and minimize changes to water balance between pre- and post-development conditions; and,
- Assessment of infrastructure vulnerability through municipal asset management planning and other processes.

The Township's review of development applications and related infrastructure may result in:

- More stringent requirements for stormwater management and flood abatement;
- Provisions to increase the resilience of power and data grids;
- Establishing more stringent standards for infrastructure;
- Identification of pedestrian-oriented design which promotes reduced automobile use;
- The use of energy sources that reduce or avoid greenhouse gas emissions and the use of passive solar design principles; and,

- Use of net-zero design principles to reduce or eliminate energy demand by built infrastructure.

A2.00 Submissions

Following the approval of the Draft Plan of Subdivision, an engineering submission and eventual acceptance will be required for the detailed engineering design, leading to a Subdivision Agreement. The subdivision engineering submission is to be made directly to the appropriate internal department as directed by the Township. The Owner is responsible for submitting directly to other agencies having jurisdiction, such as York Region, TRCA, LSRCA, Metrolinx, MECP, etc., directly to obtain their approval of the proposed detailed design and clearing of Draft Plan Conditions.

A2.01 First Submission to the Township of King

The initial submission of engineering drawings to the Township shall contain the following information:

1. Approved Draft Plan and Draft Plan Conditions.

2. The preliminary plan for registration (i.e., M-Plan) showing all lot and block numbering and dimensioning.

3. All proposed Reference Plans for any proposed easements.

4. A declaration from the Consulting Engineer indication that he has been retained to design and supervise the construction of the work in the subdivision according to the terms of the Subdivision Agreement.

5. Complete set of engineering drawings, including but not limited to the following:
    a) General Plan of Services.
    b) Grading Plan.
    c) Area Rough Grading Plan.
    d) Storm Drainage Plan.
    e) Sanitary Drainage Plan.
    f) Water Servicing Plan.
    g) Plan and Profile Drawings.
    h) All detail drawings other than the Township of King Standard Detail Drawings.
    i) All drawings pertinent to the design.
    j) Utility Co-ordination Plans.
    k) Pavement Marking and Signage Plan.

l) Staged Erosion and Sediment Control Plans.

m) Stormwater Management Facility Design Drawings.

n) Digital Excel storm and sanitary sewer design sheets using Township of King templates (see Appendix 6).

6. All other calculations that are necessary to check the design.

7. Geotechnical Report for confirmation of the groundwater conditions, support of the SWM facility design, pavement design, servicing design, etc. prepared by a qualified Soils Consulting Engineer.

8. Stormwater Management Detailed Design Report.

9. Street Lighting designs and photometric calculations.

10. Noise Attenuation and Vibration reports.

11. Streetscape/landscape/tree planting plans for boulevards.

See Section A6.00 for further details. Also see and complete the submission checklist form in Appendix 4. The Township may reject any submission which is deemed to be incomplete or does not meet the required minimum standards for a full and complete submission.

All of the submission materials are to be accompanied by digital copies of the materials (PDF, Excel formats). Hard copy might be required upon request.

All CAD drawing files are to be prepared in accordance with Region of York standards, using ACAD-Version 14, or as may be updated from time to time. All such plans are to be geo-referenced to UTM coordinates and shall not include externally linked documents (i.e., “x-refs”) within the files.

The above information will be reviewed, and one set of drawings and calculations will be returned to the Consulting Engineer with the required revisions noted.

A2.02 Subsequent Submissions

Subsequent submissions of drawings, calculations and reports shall be made until the engineering drawings and design is acceptable to the Township. The design of the underground electrical distribution system shall be completed by Ontario Hydro. This design shall be submitted to the Township and shall be approved prior to the final approval of the engineering drawings. The design of the telephone system, cable T.V. system and gas mains shall follow the same format as the Ontario Hydro requirements. All utility information is to be shown on a utility coordination plan, prepared by the Consulting Engineer.

A2.03 Consolidated Linear Infrastructure – Environmental Compliance Approval Applications (CLI-ECAs) and Drinking Water Works Permits (DWWPs)

The Township's Consolidated Linear Infrastructure Environmental Compliance Approvals (CLI-ECAs) authorize the Township to approve certain municipal sewage collection systems (i.e., storm sewer, sanitary sewer, and sanitary pumping station) and municipal stormwater management systems as prescribed in the CLI-ECA. These systems are typically non-complex and less environmentally sensitive. For proposed works that fall within the prescribed CLI-ECA authority, once the engineering design is mature the Developer is to submit the corresponding Forms (i.e., Form A1, CS1, SS1, SS2, SW1, SW2, or SW3) and all required documents, to the Township for review and process. The following ECA numbers issued to the Township are provided for reference in completing the application forms:

- ECA Number: 121-W601 for a Sewage Collection System.
- ECA Number: 121-S701 for a Stormwater Management System.

Any work that does not fall within the CLI-ECA prescribed authority, the Developer is responsible in obtaining the required ECAs or any other approvals from the Ministry.

The Township owns and operates municipal drinking water systems in accordance with four MECP Drinking Water Works Permits (DWWPs) for the communities of King City, Nobleton, Schomberg and Ansnorveldt. For municipal watermain system alterations (i.e., new watermain construction for subdivision expanding the existing municipal water system), once the design is mature, the Developer is to submit Form 1 – Record of Watermains Authorized as a Future Alteration and all required documents, for review and processing. See Appendix 2 for further information and background related to water system infrastructure including the DWWP details.

A2.04 Original Drawings

After all approvals have been received from all affected parties and the Developer has entered into a Subdivision Agreement with the Township, the original drawings shall be submitted to the Township for signing. These drawings will be signed and dated and returned to the Consulting Engineer for further printing and distribution. Subsequent changes or revisions to the drawings must be formally submitted to the Township for approval and shall be detailed in the drawing title blocks as revision items.

If, one year after the date of the signing of the engineering drawings by the Township, the Developer fails to commence construction, the Township reserves the right to revoke any/or all approvals related to the engineering drawings.

A2.05 Infrastructure Attribute Data and AutoCAD Drawings

The Township requires georeferenced shapefiles, using the NAD1983 UTM Zone 17N projection. The shapefiles will be subject to acceptance of the Township's GIS team and will be required prior to the Township's acceptance of the "Issued For Construction" drawing set.

As part of the submission of design drawings, it is necessary to supply all GIS attribute data (i.e., "Asset ID") to the Township in a format as may be described from time to time. The asset data for various infrastructure items is summarized in the Asset Identifier Tracking Sheet (sample provided in Appendix 9). The data formatting and definitions requirements are provided in the Township's "Asset ID Nomenclature Guide" document. A complete list of assets included on the Asset Identifier Tracking Sheet and which may be required to be identified is to be obtained from the Township's web site: *https://www.king.ca/designcriteria*

The data must also include geo-referenced coordinates for the development site and all asset items contained therein. The data shall also be provided to the Township in accordance with the standards and specifications for preparation of CAD produced drawings. The Consulting Engineer must review and adhere to the Township policy entitled ***CAD Conversion Standards, for the production of AutoCAD Drawings*** (provided in Appendix 13).

A2.06 Preparation of Subdivision Agreement

The draft of the Subdivision Agreement will be prepared by the Township and forwarded to the Council for approval and execution of the Agreement.

The Township must be in a position to clear **all** Conditions of the Draft Plan Approval (especially those conditions of the Ministries of Natural Resources and Environment, Conservation and Parks) prior to the preparation of the draft Subdivision Agreement Schedules.

Prior to commencement of preparation of the Subdivision Agreement, the Developer's Consulting Engineer shall provide the Township with the following:

1. A matrix identifying how all Draft Plan Conditions have been addressed.

2. Ministry of the Environment certificates of approval for Township services to be constructed for the proposed subdivision.

3. The name of the person and/or company and Mortgagees with whom the Subdivision Agreement will be executed. The Developer's address and telephone number shall be provided.

4. The name, address and telephone number of the Developer's lawyer.

5. A breakdown of the number of units proposed within the subdivision:

    a) Single family units.

    b) Semi-detached units.

    c) Townhouse units.

    d) Apartment units.

6. Reference Plan for the subdivision.

7. Legal description of the subdivision, based on the Reference Plan.

8. The proposed final plan for registration (M-Plan) complete with the street names, lot numbers, surveyor's certificate, owner's certificate and all other pertinent information required by the registry office.

9. Reference Plans (65R-) for any easements and conveyances to be granted to the Township.

10. Electronic copies of all engineering drawings and landscaping plans acceptable to the Township (including digital files).

11. Two copies of the "M" and "R" Plans reduced to legal size.

12. An O.L.S. Certificate in tabular form identifying all lot numbers and corresponding frontages, depths and areas, in compliance with the appropriate Zoning By-law.

13. A detailed cost estimate of services to be constructed for the subdivision. The cost estimate shall be signed and sealed by a Professional Engineer.

14. The estimated cost of services shall be detailed to show individual items of construction. The total estimated cost of services shall include the following:

    a) Detailed cost of services.

    b) The actual estimated cost of the Hydro underground distribution system and street lighting.

    c) Any other miscellaneous expenditures required by the Subdivision Agreement as the Developer's obligation, such as part equipment, park landscaping, development of open space, etc.

d) Allowances for contingencies and engineering in accordance with the following:

Table A-1: Contingencies and Engineering Cost Allowances

Estimated Cost of Services (Items a, b and c)	Contingencies	Engineering
First $500,000.00	15%	15%
amount over $500,000.00	10%	10%

This estimate will be used as a basis for calculation of the security to be posted for the development.

15. The Developer shall provide the Township with confirmation from the following utility authorities that satisfactory arrangements have been made for the installation of underground services in the proposed subdivision:

- Hydro One;
- Bell Canada;
- Enbridge;
- Appropriate cable company;
- Canada Post; and,
- Any other authority where required.

In addition to the above, Location Approvals shall also be submitted by the appropriate utility authorities.

16. Proposed timetable for construction of services.

17. Proposed staging plans.

A2.07 Requirements Prior to Commencement of Construction

Prior to construction, the following is to be undertaken:

1. A Site Alteration and Fill Management Plan report is to be prepared to the Township's acceptance. The report should address how Excess Soil regulations and other construction management matters will be complied with. The scope and detail will be greatly dependent on the size and scope of the proposed development, the characteristics of the subject property, and its relation to adjacent land uses and activities. See the Township's separate document titled "Site Alteration & Fill Management Plan Requirements" for details.

2. Prior to commencement of construction, the Developer's Consulting Engineer shall convene a Pre-Construction meeting with all relevant parties in attendance. The

Consultant shall submit the following information to the Township for approval (allow at least two weeks for approval):

a) All construction specifications.

b) The names of the proposed contractor and subcontractors.

c) The contractor's list of suppliers.

d) One copy of the signed Contract Documents, complete with unit prices.

e) All other information specified in the Subdivision Agreement as a requirement prior to commencement of construction or other information required by the Township.

f) Permits from the Conservation Authority for erosion and sediment control measures proposed.

A2.08 Requirements for a Construction Management Plan

Prior to commencement of construction, the Developer's Consulting Engineer shall prepare a Construction Management Plan (CMP) report. The Township reviews Construction Management Plans to ensure safe and efficient traffic operations during construction activity. The following is a general outline of the traffic management and construction scheduling details that should be included in a CMP.

General Information

1. Project Address.

2. Date.

3. Involved Parties:

   The following parties should be identified and their respective contact information listed:

   - Owner and Owner's Representative;
   - General Contractor;
   - Sub-Contractors; and,
   - Engineers.

4. Project Description:

   Provide a brief statement of the goals and objectives of the CMP. A brief description is to be provided including project area, number of housing units, length of roads, and proposed uses of the development.

5. Schedule:
    - Dates of overall construction;
    - Dates of external construction; and,
    - Details of any work being done to sidewalks and/or streets.
6. Emergency Contacts:

    Include a list of parties to be contacted in the event of an on-site emergency.

Detailed Information

The following components with detailed explanations should be identified and included in the Plan drawing and/or report:

1. Construction Phasing.
2. Working Days/Hours.
3. Delivery and Truck Routes.
4. Location of Site Office – Worker Access and Parking.
5. Health and Safety Initiatives.
6. Haul Route.
7. Truck Unloading/Staging Areas.
8. Construction Site Signs, Route Notices, etc.
9. On-Street Parking Occupancy.
10. Pedestrian Access, Sidewalk Obstructions.
11. Siltation and Erosion Controls, stormwater control.
12. Topsoil stockpiles.
13. Air, Noise, Dust Controls.
14. Street cleaning.
15. Material Handling, Storage and Recycling.

A3.00 Engineering Drawings Requirements

All drawing submissions are to be made in compliance with the following details:

1. All engineering drawings shall be prepared in metric and in a neat and legible fashion. The design information presented on these drawings shall be completed to meet with the Region's requirements for filing.

2. All information shown on the engineering drawings shall be prepared in accordance with the Region of York standards and layers for CAD drawings.

3. The standard Township of King title block as shown in the General Notes standard drawing shall be used on all engineering drawings. A title sheet which includes a Key Map showing the site location and the subdivision Draft Plan file number is required on engineering drawings.

4. All General Plans, Lot Grading Plans, Area Rough Grading Plans, Plan and Profile Drawings, and Detail Drawings, shall be prepared on standard A1 sheets.

5. The lot numbering and block identification on all engineering drawings shall be the same as shown on the Registered Plan for the area.

6. All elevations shown on the engineering drawings are to be of geodetic origin. Need to show benchmark reference. Aerial photo interpretation methods of securing existing contours and elevations will not be accepted by the Township for base plan information on Engineering Drawings.

7. All plan and profile drawings are to be prepared so that each street can be filed separately. The street names shall be identified on the Plan portion of the Drawings.

8. When streets are of a length that requires more than one drawing, match lines are to be used with no overlapping of information.

9. The reference drawing numbers for all intersecting streets and match lines shall be shown on all Plan and Profile Drawings.

10. A north arrow shall be provided on all drawings.

11. All engineering drawings shall be stamped by a Professional Engineer. The Engineer's stamp must be signed and dated, prior to the issuance of drawings for tendering and signing by the Township, in accordance with the requirements of Section A2.04.

12. All infrastructure (including maintenance holes, valves, catchbasins, hydrants, street lights, etc.) is to be labelled with an alpha-numeric identifier based on the Township's

GIS database. Refer to Sections A2.05 and A8.05 regarding this requirement for "Issued for Construction" and "Record Drawings", respectively.

A4.00 General Plan of Services

1. A “General Plan of Services” drawing shall be prepared for all developments at a maximum scale of 1:1,000.

2. When more than one “General Plan of Services” drawing is required for any development, then the division of drawings shall reflect the limits of the Registered Plans as closely as possible. Where more than one plan is prepared, a supplementary “General Plan of Services” at a small scale shall be prepared to show the entire plan of subdivision on one drawing.

3. The reference Geodetic Benchmark and the Site Benchmarks to be used for construction shall be identified on the General Plan of Services.

4. A Key Plan at a scale of 1:10,000 shall be shown on all “General Plan of Services” drawings, and the area covered by the drawing shall be clearly identified.

5. A drawing index shall be shown on all “General Plans of Services” to identify the Plan and Profile Drawing number for each street or easement shown.

6. All road allowances, lots, blocks, easements and reserves are to be shown and are to be identified in the same manner as shown on the Registered Plan.

7. All exiting services, utilities and abutting properties are to be shown in dotted lines.

8. All services to be constructed are to be shown on the “General Plan of Services” in solid lines.

9. All storm and sanitary sewers are to be shown. It is not necessary to show the length, grade and the sewer material on the “General Plan of Services”; however, the sizing, direction of flow, and type of the sewer must be shown.

10. All maintenance holes will be shown and are to be numbered in accordance with the design drawings.

11. All catchbasins are to be shown.

12. A Watermain System drawing is required which shows all watermains, valves and hydrants are to be shown. Watermains are to be identified only by sizing and material. This plan is to accompany the application for approval of Form 1 – Record of Watermains.

13. All curbs and sidewalks are to be shown.

14. All fencing is to be indicated by height, material and type.

15. Dimensioning of utilities and roadways is not required on the “General Plan of Services”.

16. All sites for parks, schools, churches, commercial and industrial development must be shown.

17. If a subdivision encroaches on an existing floodplain, the approved fill line restrictions must be shown, as specified by the local conservation authority.

18. The proposed locations of Community Mail Boxes and the associated number of units shall be shown on the “General Plan of Services”.

A5.00 Plan and Profile Drawings

1. All Plan and Profile Drawings shall be prepared at a scale of 1:500 horizontally, and 1:50 vertically. A complete legend shall be provided on all Plan and Profile Drawings.

2. Plan and Profile Drawings are required for: all roadways, blocks and easements where services are proposed within the development; for all outfalls beyond the development to the permanent outlet; for all boundary roadways abutting the development and for other areas where utilities are being installed below the grade.

3. All existing or future services, utilities and abutting properties are to be shown in dotted or dashed lines.

4. All road allowances, lots, blocks, easements and reserves are to be shown and are to be identified in the same manner as the Registered Plan. Lot and block frontages are to be shown.

5. All curb and gutter and sidewalks shall be shown and dimensioned on the Plan portion of the drawing.

6. All sanitary and storm sewers shall be shown and dimensioned on the Plan and shall also be plotted on the Profile of the drawings. The sewers shall be described only by size, direction of flow and type in the Plan portion, but shall have a complete description on the Profile portion of the drawing, including length, grade, material, class of pipe, usage and bedding requirements. The size of the pipe shall be plotted to full scale on the profile. The resulting hydraulic grade line for the 1:100 storm event shall also be plotted on the Profile portion of the drawing.

7. All maintenance holes shall be shown on the Plan and on the Profile portion of the drawing. The maintenance holes shall be identified by chainage, number on the Plan and on the Profile, and shall also be referred to the applicable Township of King Standard Detail Drawing or to a special detail on the Profile portion of the drawing. All invert elevations shall be shown on the Profile, with each invert having reference to compass directions.

8. All catchbasins and catchbasin connections shall be shown. Catchbasins are to be numbered for easy reference.

9. All storm sewer maintenance holes which have safety platforms are to be noted, including the proposed safety platform elevations.

10. All drop connections are to be noted and referred to the Township of King Standard Detail Drawing.

11. All rim and sewer invert elevations for rear lot catchbasins are to be shown.

12. Maintenance hole benching details are to be shown at a scale of 1:25 whenever the Township of King Standard Detail Drawings are not applicable.

13. All watermains, hydrants, valves, etc. shall be shown, described and dimensioned on the Plan portion of the drawing. In addition, the watermain shall be plotted to true scale size on the Profile portion of the drawing and shall be described.

14. The location of all storm, water, and sanitary service connections shall be shown on both the Plan and the Profile portion of the drawing using different symbols for each service. These services need only be dimensioned when the location differs from the standard location as shown on the Township of King Standard Detail Drawings. The connections to all blocks in the development shall be fully described and dimensioned (size length, grade, invert elevations, materials, class of pipe, bedding, etc.).

15. The centreline of construction with the 20 m stations noted by a small cross shall be shown on the Plan portion of the drawing.

16. The original ground at centreline and the proposed centreline road grade shall be plotted on the Profile. The proposed centreline road grade shall be fully described (length, grade, P.I. elevations, vertical curve data, high point chainages, low point chainages, etc.).

17. Details of the gutter grades around all 90-degree crescents, intersections and turning circles shall be provided on the plan portion of the drawing as a separate detail at a scale of 1:100.

18. Special notes necessary to detail construction procedures or requirements are to be shown.

19. Chainages for the centreline of construction are to be shown on the Profile portion of the drawing. The P.I., B.H.C., E.H.C., B.V.C. and E.V.C. chainages are to be noted.

20. The proposed pavement structure design shall be noted on the Plan portion of the drawing.

21. The basement elevation of all existing dwellings on streets where sewers are to be constructed shall be noted on the Profile. The resulting hydraulic grade line for the 1:100 storm event shall also be plotted.

22. All existing services, utilities and features are to be shown on the Plan portion of the drawing. Those services and utilities below grade that are critical to the new construction shall also be shown in the Profile. Test holes may be required to determine actual elevation of these services and utilities.

23. The curb radii at all intersections shall be shown on the Plan portion of the drawing.

24. Profiles of roadways shall be produced sufficiently beyond the limits of the proposed roads, to confirm the feasibility of possible future extensions.

25. The location of all luminaire poles shall be clearly shown on the Plan portion of the drawings.

26. The proposed location and type of all street name and traffic control signs shall be shown on the Plan portion of the drawings.

27. Proposed locations and types of all trees to be shown on the Plan portion of the drawing.

28. Soil stratigraphy (i.e., borehole) information including the geodetic ground elevation and seasonal high groundwater elevation should be shown in the Profile. The location of borehole and test pits should be shown on the Plan view.

A6.00 Other Drawings

A6.01 Lot Grading Plans and Area Rough Grading Plans

All lot grading plans and area rough grading plans shall be prepared in accordance with the criteria given in Section F of this document.

A6.02 Storm and Sanitary Drainage Plans

All drainage plans for storm and sanitary sewer design shall be prepared in accordance with the criteria given in the appropriate sections of this document.

A6.03 Water System Plans

Plans are to be provided for the water system design and layout and shall be prepared in accordance with the format for the “General Plan of Services” and shall clearly show all existing and proposed water system components. (This plan(s) is to be provided with the application for approval of “Form 1” for the water system alteration.)

A6.04 Utility Co-ordination Plan

Utility Co-ordination Plans shall be prepared in the same format as “General Plan of Services” and shall clearly show all existing and proposed utility plants. Specific information related to telephone, hydro, street lights, gas and cable T.V. and community mailboxes are to be shown. Street trees are also to be shown.

A6.05 Street Lighting Plans

All street lighting plans shall be prepared in accordance with the criteria given in Section J of this document and should accompany the Composite Utility Plan drawings. These are generally prepared at 1:1000 scale (or per the General Plan scale).

A6.06 Erosion and Sediment Control Plans

All the plans for erosion and sediment controls shall be prepared at 1:1000 scale (or per the General Plan). They shall provide for all controls as typical for such purposes and to the satisfaction of the Township and/or Conservation Authority. Guidance for the design and submission of plans/specifications acceptable to the Township can be found in the LSRCA Technical Guidelines for Stormwater Management Submissions and the Erosion and Sediment Control Guide for Urban Construction (2019). Also refer to Section C2.03.

A6.07 Tree Inventory, Preservation and Compensation Plans

Where required as a condition of approval, such plans are to be provided for the protection of all trees and vegetation and shall clearly show all existing trees as proposed for removal or retention. (Said plans are to be provided in conjunction with the ESC drawings.)

A Tree Preservation Plan should contain the following information:

1. Location of existing vegetation to be retained or removed (identified via a survey plan).
2. Trees/vegetation within 15 m of the subject property.
3. Identify all trees with a minimum caliper of 60 mm and group together masses of vegetation by outlining the canopy.
4. Location and type of protection measures for the existing vegetation to be retained.
5. Location of all the existing natural features such as top of bank and/or watercourse features.
6. Layout of the proposed site development.
7. Location of above and below ground utilities (including lighting facilities).
8. Proposed grades, existing grades along the property lines and elevations at the base of trees to remain.
9. Plant list showing index, quantity, species, size (diameter at breast height), health, etc.
10. After care of trees to be preserved should be identified.

A Tree Compensation Plan, as may be requested by the Township, and cost contribution is to be prepared for review and acceptance by the Township. Trees to be removed are to be compensated in accordance with the following guidelines, unless superseded by any other regulation or by-law in effect at the time of development:

1. Owners of lands subject to development shall be required to submit a Tree Preservation Plan and Arborist's Report for tableland forest units, or individual trees, within or adjoining the lands. Tree Preservation Plans and Arborist's reports shall clearly indicate the specific measures and practices required for the effective preservation of trees identified for practical preservation in the post-development scenario.
2. The Township will adopt the following methods for tree compensation, which may be amended from time to time:
    - Native or desirable trees: Replaced at a 3:1 ratio; and,

- Invasive or non-desirable trees: Replaced at a 1:1 ratio.

This standard applies to any removed municipal tree that is up to 20 cm DBH. For trees larger than 20 cm DBH, the Township adopts the compensation formula from the York Region's Street Tree and Forest Preservation Guidelines (2016), as amended. The Township will apply a calculated approach based on the tree caliper and the tree inventory and protection plan required.

3. All submissions and related activities will be required to follow the most current Tree Compensation Policy, as amended. The minimum size for any replacement/compensation trees is to be 50 mm caliper, or 1.8 m height in the case of coniferous trees, if applicable.

4. Any trees to be planted shall be on non-invasive, native species as agreeable to the Township.

5. Street trees that are required as a standard condition of approval, or trees that are required within stormwater management blocks, do not qualify in the count of 'compensation' trees. In some cases, it may be possible to increase tree density to partially compensate for tree removals.

6. The Township will request or require that trees removed or damaged be compensated within public initiatives for re-forestation and rehabilitation of natural landscape areas within the Township. Where it is not feasible to plant the compensation trees within the site limits, the Township may elect to receive a cash payment in lieu of same. In this case, the value per compensated tree will be $900 per deciduous tree and $825 per coniferous tree. These rates may be reviewed by the Township annually and indexed based on increasing costs, where applicable or warranted.

A6.08 Streetscaping and Landscaping Plans

All such plans shall be prepared in accordance with the criteria given in Section H of this document and should comply with any standards provided in the Parks Development Standards. Such plans shall have regard for any documents/reports as prepared for the subject development in respect of Urban Design Guidelines as may be required by the Township.

A6.09 Detail Drawings

The Township of King Standard Detail Drawings shall be used whenever applicable. The use of the latest revision of the Ontario Provincial Standard Drawings may be used when approved by the Township. These drawings shall be reproduced as part of the engineering drawings for the development and must be referred to by number on the affected Plan and Profile Drawings. The Consulting Engineer shall be responsible for checking the suitability of the details provided on these Standard Drawings for the application proposed. Individual details shall be provided

by the Consulting Engineer for all special features not covered by the Township of King Standard Drawings. These special details shall be drawn on standard-sized sheets and shall be included as part of the engineering drawings. The minimum scale to be used for any special maintenance hole or sewer detail shall be 1:25.

A7.00 Maintenance Period and Final Acceptance (Assumption) Requirements

A7.01 Maintenance Period

When the services are completed and cleaned to the satisfaction of the Consulting Engineer, the Consulting Engineer shall advise the Township (in writing) that the work is completed and shall request an inspection by the Township of King. The Township shall carry out their inspections and shall advise the Consulting Engineer of any items of work requiring further rectification. When all deficiencies have been corrected to the satisfaction of the Township, a letter shall be issued setting out the date for the commencement of the Maintenance Period.

A7.02 Permanent Benchmark Installation

Prior to Final Acceptance, the Developer shall construct a permanent geodetic benchmark within each phase of the subdivision, at the Township's discretion, and located within the municipal right of way or on other acceptable Township-owned property that is accessible to the public. Benchmarks shall not be placed on private property. The benchmark must be a **Second Order** monument suitable for both horizontal and vertical control. The construction and documentation of all new benchmarks shall comply with the Ministry of Natural Resources and Forestry (MNRF) requirements for registration in the **COSINE** database of benchmarks. Where digital leveling is utilized, the Developer shall follow the most current *"MNRF Provisional Digital Levelling Specifications"* guideline is required.

The Developer is to receive confirmation from the Township as to the appropriate benchmark datum that will apply to the installations prior to retaining an Ontario Land Surveyor (OLS). The OLS is to contact MNRF staff prior to starting field work to obtain assigned benchmark identification numbers and confirm requirements to ensure acceptance of the work in the COSINE database. The Developer is to forward the identification numbers and the MNRF instructions to the Township for review and comment. The OLS is to supply and arrange for stamping of brass caps which should be completed before installation of the caps on the foundation. Refer to Standard Drawing KS-900 for construction details. Following the installation, the Developer is to provide the certification of registration of the benchmark in the COSINE database to the Township.

The constructed geodetic benchmark location and information are to be shown on Record Drawings and As-Constructed Drawings and provided as part of the Final Acceptance process.

A7.03 Final Acceptance (Assumption)

The term "Acceptance" is used to describe when all the services are complete and acceptable for use by the Township of King, subject to the maintenance requirements pursuant to the Subdivision Agreement. The Township will not accept a consultant's recommendation for

Acceptance for any works between October 31 and April 1 of any given year. “Assumption” is the terminology used to describe when the Developer’s maintenance requirements have been fulfilled and the services are ready to be assumed by the Township of King. Final Acceptance of the subdivision shall be the date on which the Council of the Township of King agrees (by By-law) that all the conditions of the Subdivision Agreement have been fulfilled, and all maintenance requirements have been addressed.

The Acceptance and Assumption processes must be initiated by a request (in writing) by the Developer. The dates for Acceptance and Assumption of the services in the development shall be established by the Township.

Near the end of the Maintenance Period the services shall be re-inspected by the Consulting Engineer and all deficiencies found shall be corrected. When the Consulting Engineer is satisfied that the work is complete and acceptable, he shall advise the Township and shall request a final inspection by the Township. When all work is completed to the satisfaction of the Township, a report shall be forwarded to the Council recommending Assumption of the works.

A8.00 Record Drawings, As-Constructed Drawings and Stormwater Facilities Certification

A8.01 General

The Record Drawings for construction of works undertaken through a development agreement with the Township constitute the original (design) engineering drawings which were accepted by the Township and which have been amended to incorporate the construction changes and variances in order to provide accurate information on the works as installed in the development.

The requirement to provide Record Drawings or As-Constructed Drawings for capital works projects or other works commissioned by the Township of King shall be in accordance with the terms of the contract which govern the engineering services provided.

Submission of record drawing information shall be accompanied by revised sewer design sheets and hydraulic gradeline calculations which confirm the capacity and hydraulic conditions of the constructed sewers. As noted below, additional record information is to be submitted with respect to stormwater management and LID facilities. The Township may require submission of other revised design calculations or analysis based on variations in the completed works.

The CLI-ECA and Drinking Water Works Permit (DWWP) include mandated timelines for the Township to update its documentation of approved works which are in service. Approved services which are operational are typically independent of the timing of Final Acceptance or Assumption. All Record Drawings, inspection reports and testing results, material test reports, certifications, and any other supporting documentation shall be submitted to the Township. The submission is to be provided within six months of the Township's acceptance of the first certification of any system (i.e., roadways, water supply or watermain, storm sewer or stormwater management or sanitary sewer system) which is part of an approved project being placed into service. In cases where drawings are not final, a "preliminary as-constructed" drawing set is required. Once the submission is accepted by the Township, the associated records may be updated. Where the works are approved under the CLI ECA and Post Construction Verification by Owner for Inspection is required, all associated documentation and inspection/testing results shall also be submitted within the same six-month period.

Record Drawings and design sheets shall be prepared in accordance with PEO guidelines including being signed and stamped by a Professional Engineer.

CAD drawings, shapefiles, and PDF version are to be provided. Hard copy may be required upon request.

The Registered Plan number and any Certificate of Approval or Environmental Compliance Approval (MECP) number for the subdivision must be clearly shown on all Record Drawing "Cover Sheet" and "General Plan of Services" drawings.

A8.02 Record Field Survey

The revision of design-approved drawings to Record Drawings shall incorporate a final geodetic and topographic survey of all the subdivision services and the Consulting Engineer's construction records. The survey of the subdivision services shall include a final check of the following items:

- Location, top elevation and all pipe invert elevations of all sewer maintenance holes, headwalls and outfalls.
- Distances between all sewer maintenance holes.
- Location of all roadway catchbasins.
- Location, rim and invert elevations for all rearyard and lot catchbasins.
- Location and dimensions of stormwater ponds and LIDs including control structures or devices and elevations of control surfaces.
- Location of culverts.
- Location of all sidewalks and curbs.
- Location and ties to all valve boxes and valve chambers.
- Location of all hydrants.
- Location and ties to all special watermain appurtenances.
- Road centerline elevations.
- Site benchmarks.
- Location of all service connections to all lots and blocks and location of connection from nearest downstream maintenance hole (i.e., +023).
- Sewer and watermain pipe sizes and material.
- Location of all fencing constructed as part of the subdivision services.
- Actual planted street tree locations.

A8.03 Drawing Revisions

The original drawings shall be revised to incorporate all changes and variances found during the field survey to readily locate all underground services using the GPS coordinate system.

The approved design information should remain on the drawings shown in a strike-through format, with the recorded constructed information shown in boxes. The following information is also to be included:

- The Registered Plan number and any Certificate of Approval or Environmental Compliance Approval (MECP) number for the subdivision must be clearly shown on all Record Drawing "Cover Sheet" and the "General Plan of Services".
- The Record Drawing revision note(s) shall be placed on all drawings in the revision block and dated based on the date of the surveys. The title sheet of the Engineering Drawings shall be clearly marked with "Record Drawings" in large print.
- The Contract, the date of commencement of construction, and the date of completion, shall be noted on the "General Plan of Services" drawings only.
- The location, description and data associated with the geodetic benchmarks constructed by the Developer and registered with COSINE are to be shown on Record Drawings and As-Constructed Drawings.
- The centerline of road profile is to be shown based on topographic surveys. All sewer and road grades are to be recalculated to two decimal places.
- All street line invert elevations of storm and sanitary house connections to each block shall be noted on the drawing.
- All house numbers or municipal addresses are to be indicated on the Record Drawings.
- All street names, lot numbering and block identification shall be checked against the Registered Plan and corrected if required.

A8.04 Tolerances

A maximum vertical plotting tolerance of 0.2 m on the 1:50 vertical profile portion of the drawings and a maximum horizontal plotting tolerance of 1 m on the 1:500 scale drawing shall be considered acceptable without re-plotting.

All sewer lengths are to be shown to the nearest 0.15 m.

The information shown on the Record Drawings may be checked by the Township at any time up to two years after final acceptance of the subdivision, and if discrepancies are found between the information shown on the drawings and the field conditions, then the drawings will be returned to the Consultant for rechecking and further revision.

The Consultant shall be required to explain in writing any major difference between the design and the "As-constructed" data, and to provide verification that alteration does not adversely affect the design of the subdivision services.

A8.05 Infrastructure Attribute Data

As part of the submission of as-built data, it is necessary to supply all GIS attribute data to the Township in a format as may be described from time to time. The data must also include

geo-referenced to coordinates for the development site and all items contained therein. The data is to be provided to the Township in a spreadsheet format that will allow importation to their GIS system. (Sample spreadsheets and datasets are included in Appendix 9 for this purpose.)

A8.06 Stormwater Management Facilities

The performance of completed stormwater management ponds and LIDs shall be confirmed as meeting the design requirements. Actual storage volumes and controlled outflow rates are to be determined based on the record field survey to the same level of detail as the submitted design report. The hydrologic and/or hydraulic models used in design are to be updated based on the record data and the results compared to the approved design. A letter-report is to be submitted to the Township with revised calculations, the digital model input and output files and the SWM facility's Record Drawings. The letter-report is to include a certification signed and stamped by a Professional Engineer that the facilities will operate as per the Township's approval.

A8.07 Submissions

Upon completion of all construction work and the Record Drawings revisions, the original AutoCAD drawings shall be submitted to the Township for their permanent records. The timing of the drawing and supporting documentation submission shall be as noted in Section A8.01.

The Consulting Engineer shall provide a written declaration to the Township stating that all subdivision works have been constructed in accordance with the terms of the Subdivision Agreement, approved Engineering Drawings, and the Township's Design Criteria, prior to "Final Acceptance".

SECTION B

Roadways

SECTION B Roadways

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B1.00 Classifications

All roadways in new developments shall be classified in accordance with the Corporation of the Township of King's ("the Township") current Official Plan which includes the following:

- Arterial Roads (generally all Region of York roads);
- Collector Roads; and,
- Local Roads.

The proposed classification of all streets planned in new development areas shall be confirmed with the Township prior to the commencement of the design. Roadways within urban areas are to be designed and constructed to urban cross-sections. Roadways supporting industrial, commercial and institutional land uses are also to be built to commercial/institutional urban design standards.

The road classifications and resulting designs shall be in conformity with the policies and guidelines contained within the ***Township of King – Transportation Master Plan (December 2025)*** and any subsequent updates. This is particularly important when considering the characteristics of the roadway function and the desire to construct "Complete Streets", which impacts on road widths, bike lanes, sidewalks, etc.

B1.01 Official Plan Guidelines

New streets should be designed to provide linkages to existing neighbourhoods to promote the efficient movement of people and vehicles in a variety of patterns and foster well-connected neighbourhoods. New streets and development blocks shall be designed to preserve or create views and vistas to natural areas and other important features where feasible.

Roads should be located to implement York Region policy 7.2.61 (*Transportation Mobility Plan Guidelines for Development Applications, November 2016)* to plan and implement continuous collector streets in both east-west and north-south directions in each concession block in all new urban developments.

The use of continuous streets is encouraged, and the number of cul-de-sacs should be limited, where the land can be effectively serviced by the continued extension of the road system.

Road networks are to be designed to integrate and connect neighbourhoods to enable more efficient local traffic movement and contribute to the creation of an overall grid network. Where road connectivity opportunities exist, new development will connect to the existing road network where possible.

Proponents shall provide for context-sensitive active transportation facilities in the construction of roads and bridges, ensuring that lands for such facilities are included with the land

requirements for roads. The resulting facilities are to be located to facilitate safe operations of all modes within the road right-of-way.

B1.02 Supporting Traffic Studies

Prior to or at the time of Draft Plan Approval, the Township will require the proponent to prepare and submit supporting traffic studies, for the Township's approval. The first portion of the study consists of a broad-based external transportation and traffic impact study (TIS), which will examine the property boundary conditions and interconnections with adjacent properties (including signalization issues), assessed under existing and future conditions. The study must recommend the phasing of traffic signals/controls and arterial road widenings to match development. The traffic study must conform to the ***Township of King – Transportation Master Plan (December 2025)*** and if any of the roads being considered in the study are under the jurisdiction of the Region of York, to the Region's Transportation Mobility Plan Guidelines (2016), Access Guidelines (November 2020) and Transportation Master Plan (2022). It should be noted that the Township may take ownership of infrastructure assets on Regional roads, the extent to which will be determined on a project-specific basis. Proponents are required to meet the requirements of both the Township and the Region in this regard.

The second portion of the analysis consists of a Functional Internal Traffic Study (FITS) which balances appropriate urban design guidelines with a detailed assessment of internal transportation and traffic geometric design, on-street parking restrictions, off-street or driveway parking issues, signalization warrants, stop sign warrants, roadway capacity and classification, lane configurations, boulevard requirements (i.e., snow storage and utility corridors), transit and pedestrian requirements, vehicle decision making criteria and intersection vehicle sight lines.

The FITS will address, to the satisfaction of the Township, the compatibility of the roadway function and the adjacent proposed land uses. Specifically, appropriate building forms are required adjacent to and in the vicinity of collector/collector road and collector/arterial road intersections. The traffic study will also verify that sufficient on-street and off-street parking can be provided without impacting driveways, safety and road operations.

The study/studies as noted above are subject to the Township's approval prior to acceptance of the proposed Draft Plan. (See Appendices 7 and 8.)

B2.00 Geometric Design Elements

All grade changes of more than 1.0% shall be designed with a vertical curve. The minimum tangent length between vertical curves shall be 9 m.

The minimum gutter grade shall be 0.7%, except for bulbs, turning circles and curb radii where it shall be 1.0%.

Arterial Roads – York Region may require greater road allowance requirements for the implementation of their policies (i.e., HOV lanes, bicycle lanes, or rapid transit). Input is required from the Region for such matters.

Typical road cross-sections for various roads are included in Township of King Standard Drawings (Appendix 1).

Table B-1: Geometric Design Elements

Geometric Detail	Rural Local or Collector*	Urban Local	Urban Collector	Rural Arterial
Operating Speed (km/h)	50-60	40-50	40-60	50-60
Road Allowance Width**	20.0-26.0	20.0	26.0	Up to 36.0
Pavement Width (m) (face to face)	6.7	8.5	12.5	7.0
Maximum Grade (%)	6	6	6	5
Pavement Cross-fall (%)	2-4	2-4	2-4	2-4
Minimum Horizontal Radius (m)	90	90	115	250
Minimum Visibility Curves in Sag (K Values)	8	8	12	15
Minimum Visibility Curves on Crests (K Values)	8	8	15	20
Minimum Tangent Length between Reverse Curves (m)	30	30	50	60
Intersection Angle (degrees)	85-95	85-95	85-95	85-95
Minimum Tangent Length required at stop-controlled intersections (m) from intersecting road center line	45	30	50	50

* Rural category applies to existing rural roads, not proposed roads.

** Wider road allowances may be required in localized areas to accommodate turning lanes, drainage requirements, topographic constraints, etc.

Note: Deviations from the above criteria may be permitted if supported by calculations prepared by an Engineer specializing in Transportation.

B3.00 Design Elements

B3.01 Typical Road Cross-Sections

The typical road cross-section to be used shall comply with the Urban Design Guidelines for the subdivision, as established at the time of Draft Plan Approval.

B3.02 Horizontal Curves

Horizontal alignment is to conform to the requirements as outlined in Table B-1. In general, “right angle bends” will not be permitted on local streets, except in the case of “Courts” or “Crescents” serving no more than 50 residential lots. Where permitted, these bends must not have a deflection angle greater than 110 degrees.

B3.03 Vertical Curves

All points of grade change more than 1.5% shall be designed with vertical curves as outlined in the current Ministry of Transportation of Ontario publications. The minimum visibility curves to be used are outlined in the geometric details for each roadway classification. The minimum tangent length of any road grade shall be 9 m.

B3.04 Backfall at Intersecting Streets

At all street intersections, the normal crossfall of the major street shall not be interrupted by the crown line of the minor street. Normally a 2% backfall shall be provided on the minor street at all street intersections. This backfall shall continue to the end of the curb return radii to facilitate proper drainage of the intersection. The overland flow route of storm drainage through the intersection must be maintained.

B3.05 Curb Return Radii at Intersections

The curb return radii at street intersections shall conform to the following dimensions:

Table B-2: Curb Return Radii at Intersections

	Residential	Industrial
Local to Local	9 m	12 m
Local to Collector	10 m	12 m
Collector to Collector	10 m	15 m
Collector to Arterial	15 m	15 m

B3.06 Daylighting Requirements at Intersections

Daylighting at all intersection quadrants shall be included in the road allowances and noted on the proposed plan for registration (M-Plan) and on all engineering drawings. Daylighting shall conform to the following requirements:

Table B-3: Daylighting Requirements at Intersections

	Residential	Industrial
Local to Local	5 m x 5 m	10 m x 10 m
Local to Collector	10 m x 10 m	12 m x 12 m
Collector to Collector	15 m x 15 m	15 m x 15 m
Collector to Arterial*	15 m x 15 m	15 m x 15 m

* Requirements subject to York Region review/approval.

B3.07 Cul-de-Sac, Bulbs and Roundabouts

Cul-de-sacs should be avoided wherever possible. When deemed appropriate by the Township (and Draft Plan approved) they shall be constructed in accordance with the details provided in the Standard Drawings. Minimum gutter grades of 1% shall be maintained along the flow line of all gutters around the feature. The maximum permissible downgradient into a cul-de-sac is 4%. The maximum length of a cul-de-sac shall generally be 150 m and/or to service a maximum of 25 dwellings.

B3.08 Temporary Turning Circles

Temporary turning circles will be considered whenever a road is to be continued in the future. Details for the requirements of temporary turning circles are provided in Township of King Standard Detail Drawing KS-220. The street line and curb radius requirements for temporary cul-de-sacs are the same as for permanent cul-de-sacs. When temporary turning circles are required within the subdivision limits, the land within the temporary right-of-way limit must be conveyed to the Township or easements must be provided in favour of the Township. The temporary turning circle is to have complete services to the street line. Signage is to be erected at the terminus of the cul-de-sac indicating that the road will be extended in the future and a “dead-end” barricade and sign shall be erected in accordance with OPSD 912.532.

B4.00 Pavement Design

The pavement design for all roads shall be per Township requirements (as a minimum standard) or as recommended by a qualified Geotechnical Consultant. The design is to consider analysis of the subgrade material, frost susceptibility, drainage characteristics and (future predicted) traffic volumes and truck loading. The Geotechnical Report shall be submitted as part of the Engineering Drawing Submission Package.

The minimum pavement design for all streets in new subdivisions shall be as follows:

Table B-4: Minimum Pavement Design

Local Road	Collector Road	Arterial Road	High Truck Volume Road
40 mm HL3	40 mm HL1	40 mm HL1	40 mm HL1
50 mm HL8	80 mm HL8	100 mm HL8-HS	100 mm HL8-HS
150 mm Granular “A”	150 mm Granular “A”	150 mm Granular “A”	150 mm Granular “A”
300 mm Granular “B”	450 mm Granular “B”	450 mm Granular “B”	450 mm Granular “B”

Notes: All depths noted are compacted depths.
19 mm and 50 mm crusher run limestone may be substituted for Granular “A” and “B”, respectively.

All materials shall be compacted as follows:

Table B-5: Minimum Compaction Requirements

Item	Minimum Compaction Required (% of Standard Proctor Density (SPD) or % of Maximum Relative Density (MRD))
HL3 Asphalt	Minimum 92% MRD
HL8 Asphalt	Minimum 92% MRD
HL1 Asphalt	Minimum 92% MRD
HL8-HS Asphalt	Minimum 91% MRD
Granular “A”	Minimum 100% SPD
Granular “B”	Minimum 100% SPD
Backfill and Subgrade	Minimum 98% SPD

Granular materials to be spread and compacted in layers with a maximum depth of 200 mm.

All asphalt and granular materials are to be manufactured, supplied and placed in accordance with OPSS 310 and 1150 specifications. Hot Mix Asphalt (HMA) base layers may contain reclaimed (RAP) materials; however, surface layers shall be constituted of virgin material with no added RAP.

OPSS 1150: The use of up to 30% by mass of RAP shall be permitted for HL 4, HL 8, and medium duty binder mixes. OPSS 1150 is modified to preclude the use of any amount of RAP for surface course mixes.

A qualified Soils Consultant shall be engaged by the Developer to provide sampling and testing services during construction and to provide confirmation that all roads have been constructed in accordance with the design standards.

Testing and approval of all granular materials at the designated pits prior to placement and subsequent in-situ verification tests shall be performed by the Developer's Geotechnical Consultant.

Prior to the placement of asphalt pavement, the Consulting Engineer must submit the asphalt pavement mix designs to the Township for approval.

B5.00 Construction Requirements

B5.01 Clearing and Grubbing and Area Rough Grading

The road allowance shall be cleared of all trees and shrubs which are not included in the final landscaping, and of all other obstructions for such widths as are required for the proper installation of roads, services, and other works. Rough grading shall be done to bring the travelled portion of the road to the necessary grade and in conformity with the cross-section shown on the drawings. Stripped areas must be stabilized within 6 months and must be graded to within a maximum of 0.6 m of finished grade and have regard to eliminating ponding. The sub-grade for all roads shall be properly shaped and compacted to minimum 95% Standard Proctor Density, prior to any application of granular base course materials. In all cases, topsoil shall be stripped for the complete width of the road allowance and stockpiled at locations approved by the Township. All topsoil which has been stripped shall remain on-site to be used within the limits of the subdivision. Topsoil shall not be sold and removed from the site.

For fill removed from the construction site to a disposal site within the Township of King, a current and valid Fill Permit must be in place, and in accordance with the Fill By-law as may be amended from time to time.

B5.02 Road Sub-Drains

In general, 150 mm diameter perforated, filter cloth-wrapped plastic corrugated sub-drains, will be required to run continuous along both sides of all roads with curb and gutter. The sub-drains shall be trenched and have Granular “A” surround. The Township reserves the right to require video inspection of sub-drains.

B5.03 Placing of Final Surface Course Asphalt

The placement of surface course asphalt shall not commence in any area until all the following conditions are met:

1. A minimum period of one year (and two winter seasons) has expired from the completion date for the placement of the base course asphalt.

2. 85% of the units have been granted occupancy.

3. All undeveloped lots and blocks are rough graded in accordance with the approved lot grading plans.

4. All service connections for multiple-family, commercial, institutional or other blocks are installed.

5. Grades have been confirmed in writing by the Consulting Engineer to ensure that they are in general conformance with the design, they meet the Township's criteria and all deficiencies and settlements have been repaired.

6. Favourable weather conditions are present, as defined by the OPS specifications.

7. The approval of the Township is obtained in writing.

B5.04 Other Requirements

Whenever it is necessary to install underground services under an existing Township road, the Developer's Contractor will be required to use trenchless methods to cross the road. The plans, details and specifications of which are to be approved well in advance of the commencement of the work.

Whenever it is necessary to excavate services on an existing Township road, the Developer's Contractor will be responsible for properly compacting the backfill material and restoring the surface pavement to its original condition immediately upon completion of backfilling operations.

Before making detours, permission is required from the Township. Where the road is not part of the Township road system, approval from the appropriate road authority will also be necessary. In all cases, fire, police, and ambulance services, and school bus companies, must be notified in writing 72 hours prior to work by the Developer or his Contractor.

All work will be done in accordance with ordinances and By-laws of the Township of King. A Road Occupancy Permit (ROP) is required for all activities within the municipal right-of-way. The right-of-way includes the road, sidewalk and boulevard (from property line to property line). Reference should be made to the Township's website (https://www.king.ca/rop) for a complete description of ROP requirements.

B5.05 Snow Clearing

Snow clearing operations prior to Final Assumption may be carried out by the Township if so requested in writing by the Developer at the Developer's cost. The Developer is obligated to notify the Township in writing of the schedule of home occupancies relative to the potential start of snow clearing operations within the development.

B6.00 Concrete Curb and Gutter

Concrete curb and gutter conforming to OPSD 600.040 (for single stage) or OPSD 600.070 (for two stage) shall be used on all new urban subdivision roads. Concrete strength is to be specified as 32 MPa, C2 (per CSA A23.1).

The minimum gutter grade shall be 0.7%, except for bulbs, turning circles and curb radii where it shall be 1.0%. Where 1.0% cannot be achieved in bulbs or turning circles, catchbasins shall be placed at the direction of the Township.

Driveway depressions shall be formed in the curb according to the location shown on the engineering drawings and as detailed per OPSD 351.010. A mechanical curb cutting machine is not permitted to saw-cut driveway depressions prior to assumption of the subdivision. If the driveway depression should be improperly located, then that section of depressed curb which is improperly located shall be broken out and shall be replaced with a normal curb and gutter section. The concrete capping of a depressed curb shall not be permitted.

For multiple-family, commercial, industrial, apartment and other entrances, the existing curb and gutter shall be completely removed and replaced with a steel reinforced depressed curb section.

The Developer is responsible for ensuring that all curb and gutter on-site is protected from damage from heavy equipment and vehicles by construction operations (i.e., site servicing and home building). All damaged curbs will be replaced at the Developer’s cost prior to assumption of the subdivision works.

B7.00 Sidewalks

Sidewalks are required on both sides of all arterial and collector roadways, and at least one side of all local streets. For local roadways, the locations of schools, parks, churches, commercial establishments, etc., the length of street, traffic volume expected, and the number of dwelling units serviced will be used as criteria in determining whether sidewalks are required on one or two sides of the street. Multi-Use Paths (MUPs) may be required on Collector and Regional roads, subject to approval from the Township and Region of York.

The sidewalk shall conform in details and dimensions to the current Township of King Standard Detail Drawings and shall be installed at locations as shown on the typical road cross-sections. Special treatment related to urbanization of roads is to be considered per existing Township design standards and policies. Sidewalks shall have a minimum crossfall of 2% and not more than 5%.

The location of sidewalks and community mailboxes shall be coordinated to ensure that all community mailboxes have direct sidewalk access wherever practical. Prior approval from the Township will be required for any mailboxes proposed without a direct sidewalk connection. The location and installation of community mailboxes shall be subject to approval from Canada Post.

Sidewalks shall be provided at the locations identified in the Typical Road Cross Sections. The standard sidewalk width for all street classifications shall be 1.8 m. For local streets only, reductions to the standard width to 1.5m may be considered on an individual basis, subject to evaluation of site-specific conditions and projected pedestrian demand. A uniform or blanket approach to width reduction shall not be permitted.

Sidewalks are generally not required on cul-de-sacs unless they serve 25 dwelling units or more, or where they are necessary to maintain continuity within the pedestrian network, such as providing connections to designated walkways or adjacent facilities.

Construction shall comply with Standard Drawing KS-231 and the depth of concrete shall be a minimum thickness of 150 mm and increased to 180 mm at all driveway locations. Full depth expansion joints shall be installed between every third sidewalk bay. Sidewalks through driveways should be maintained at a 2% preferred or 4% maximum crossfall. Driveway aprons in the area of driveways should not be dipped at the driveway crossings, unless the boulevard is very narrow or the sidewalk is integral to the curb. Concrete used in sidewalks is to be specified as 32 MPa, C2 (per CSA A23.1). Contraction joints shall be saw cut and not trowelled.

When a sidewalk is constructed adjacent to a curb and gutter, a keyway shall be provided along the back of the curb to support the sidewalk, all in accordance with the details shown on the Township of King Standard Detail Drawing. This type of construction is to be minimized wherever possible.

The design of all sidewalks, trails and walkways is to consider the initiatives outlined in the documents and Regulations related to the AODA, including width of sidewalks, trails and walkways, maximum slopes, landings, railings, etc. At street intersections, the curb and the sidewalk shall be depressed to meet the roadway elevation and include tactile plates per OPSD 310.033. The treatment of sidewalks ramps at major intersections should be completed in accordance with standards as implemented by the Region of York.

B8.00 Driveways

The Developer is responsible for the grading, gravelling and paving of all driveways from the curb to the front of the dwellings. Refer to Standard Drawing KS-341 for typical residential driveway details.

Heated residential driveways on private property are strongly discouraged and would only be permissible if it would not result in icing conditions within the municipal road allowance, including the gutter, boulevard, and sidewalk. Heat tracing of driveways within the road allowance is not permissible.

B8.01 Minimum Sight Distance

The location of driveway entrances on Township roads must be such that the minimum sight distance is maintained on the Township's road in both directions. The following criteria will apply to new driveway entrances:

Table B-6: Minimum Driveway Sight Distance

Posted Speed Limit (km/h)	Minimum Sight Distance (m)
40	45
50	65
60	90
70	120
80	150

B8.02 Minimum Driveway Design

The more stringent of the following minimum consolidated depth requirements for the granular base, sub-base and asphalt materials in driveways or as recommended by a Geotechnical Engineer shall apply:

a) Single Family Residential:

- Asphalt 80 mm of HL3A asphalt (2 lifts); Alternative: initial 50 mm HL8 with 30 mm HL3A top asphalt
- Granular 150 mm Granular "A"

b) Commercial, Light Industrial and Apartments:

- Asphalt 40 mm HL3 surface course
  50 mm HL8 base course

- Granular 150 mm Granular “A”
  300 mm Granular “B”

c) Heavy Industrial Driveways:

- Asphalt 40 mm HL3 surface course
  75 mm HL8 base course
- Granular 150 mm Granular “A”
  300 mm Granular “B”

The use of a crusher run limestone granular equivalent to the granular materials is subject to the Township’s acceptance of a recommendation by a Geotechnical Engineer.

Alternate types of driveways (i.e., paving stones, concrete pads, etc.) will be subject to approval by the Township. However, the Township does not maintain the driveway aprons within the right-of-way, nor replace alternate paving types in future works.

B8.03 Driveway Grades

Driveways in Urban Village areas are to provide a continuous slope down from the front of the garage to the back of sidewalk or curb or edge of pavement. The maximum and minimum design grades for any driveway on private lands shall be 6.0% and 2.0%, respectively, which allows for construction tolerances. The “as-built” maximum and minimum grade for any driveway on private lands shall be 8.0% and 1.0%, respectively.

Reverse slope driveways or ramps in Urban Village areas will not be permitted unless receiving written permission from the Township. Refer to Section M7.03 6. of these Design Criteria which outlines requirements for making an application for approval for a reverse slope driveway.

B8.04 Driveway Depressions

Residential Driveways

1. For a residential driveway, servicing a single-family dwelling, the minimum width shall be 3.0 m and the maximum width shall not exceed 50% of the lot frontage to a maximum of 9.0 m.

2. For a residential driveway, servicing a townhouse dwelling, the minimum width shall be 3.0 m and the maximum width shall not exceed 75% of the lot frontage to a maximum of 5.5 m.

3. All driveways shall be located a minimum of 1.0 m from light poles, catchbasins, watermain valves, telephone manholes, telephone and cable T.V. junction boxes, water

service valve boxes, side lot lines and other driveways, 1.5 m from boulevard trees and Hydro transformers and 3.0 m from hydrants and Community Mailboxes.

4. Notwithstanding where driveway width is fixed by an existing executed Subdivision Agreement or Site Plan Agreement, the Township may apply the criteria noted in Sections 1, 2 and 3, to allow for a larger driveway width on a case specific basis.

5. In no case will the number of driveway lanes exceed the number of garage lanes (i.e., single car garage/single driveway, double car garage/double driveway, etc.).

In no case shall a driveway be located less than 6.0 m from an intersection, or within a daylight triangle, or as required by the Township's Zoning By-law or Entrance Permit requirements, where applicable.

B8.05 Driveway Culverts

1. Driveway culverts are to be a minimum 400 mm diameter. Where required by the Township, a hydrologic study and hydraulic culvert analysis is to be prepared to determine design flows and confirm the necessary culvert size.

2. Driveway culverts are to be installed in accordance with Standard Drawing KS-340.

B9.00 Boulevards

All boulevard areas are to be graded according to the details shown on the Township's standard drawings and to the satisfaction of the Township. The final grade of the sod shall match the finished grade of the top of the concrete curb and sidewalk.

All debris and construction materials shall be removed from the boulevard area upon completion of the base course asphalt and shall be maintained in a clean state until the roadway section is completed.

Clean, weed free topsoil shall be placed on all boulevard areas that are to be sodded. The minimum depth of topsoil shall be 200 mm. No. 1 Nursery Sod shall be used for all areas that are to be sodded.

On all rural roads, the side slopes and the ditch bottoms are to be graded in accordance with the typical road sections and approved drawings. Slopes and ditches are to be completed with a minimum depth of topsoil of 150 mm and No. 1 Nursery Sod which shall be staked as required.

SECTION C

Storm Drainage and Stormwater Management

Township of King
Design Criteria and Standard Detail Drawings

SECTION C Storm Drainage and Stormwater Management

Table of Contents

C1.00 Drainage Policies

The Corporation of the Township of King ("the Township") has prepared a detailed set of design criteria and applicable parameters for the design of minor and major storm drainage systems and stormwater management (SWM) and Low Impact Development (LID) facilities. These policies are to be adhered to in the planning, design and construction of these services.

The objectives of the Township's drainage policy are provided as follows:

- Prevent loss of life and minimize property damage and health hazards.
- Minimize inconvenience from surface ponding and flooding.
- Minimize adverse impacts on the local groundwater systems and base flows in receiving watercourses.
- Minimize downstream flooding and erosion.
- Minimize pollution discharges to watercourses.
- Minimize soil losses and sediments to sewer systems and water bodies from construction activity.
- Minimize impairment of aquatic life and habitat.
- Promote orderly development in a cost-effective manner.
- To encourage a treatment train approach, introducing a hierarchy of source, lot-level, conveyance and end-of-pipe controls.

The following sections dealing with the design of SWM and LID facilities are provided here for convenience. In any case where the SWM and LID facilities are governed by permits and approvals from a Conservation Authority, the guidelines and policies of that Authority will take precedence. The Township guidelines and criteria will apply in any other instances.

C2.00 Attainment of Drainage Objectives

C2.01 Stormwater Management (SWM) Planning and Policies

The Township requires that proponents of development applications or changes in land use address issues associated with stormwater quality and quantity control, potential groundwater impacts, stream erosion, watershed sedimentation and erosion potential and integration with the surrounding natural environment.

The 2019 Official Plan contains the Township's policies for stormwater management which include the following:

a) To minimize or prevent increases in water contamination and protect water quality; to maintain groundwater quality and quantity; to minimize changes in water balance; to minimize disruption of pre-existing (natural) drainage patterns; to prevent increases in stream channel erosion; to prevent increases in flood risk and to protect aquatic species and their habitat.

b) To require applications for "major development" as defined in the Oak Ridges Moraine Conservation Plan Area to be based on water, wastewater and stormwater management plans that are acceptable to the Township of King.

c) To encourage a treatment train approach, introducing a hierarchy of source, lot-level, conveyance and end-of-pipe controls.

d) To encourage innovative stormwater management approaches including low impact development approaches. Proposals for development or redevelopment shall consider, and where feasible, provide for a LID approach to stormwater management which may include techniques such as rainwater harvesting, phosphorus reduction, clean water collection systems, and the preservation and enhancement of native vegetation cover.

e) To require rainwater harvesting systems as part of all new multiple residential buildings. These systems should also be considered for residential infill development or redevelopment.

f) That LID approaches should be utilized in the public realm, wherever possible.

g) That a preliminary phosphorous budget may be required by the Township as part of a functional servicing report or other study for major development, including development or re-development greater than 500 m^2 in impervious surface area.

C2.02 Township of King Stormwater System CLI-ECA

The Township regulates its storm drainage and stormwater management infrastructure through the Consolidated Linear Infrastructure Environmental Compliance Certificate (CLI-ECA) issued to the municipality by the Ministry of Environment, Conservation and Parks (MECP). New, altered or re-constructed services are to be designed, constructed, certified and documented in accordance with the requirements of the CLI-ECA. Proponents are to review the CLI-ECA to ensure the "additional approved works" being applied for approval from the Township comply with the CLI-ECA regulation. The Township may from time to time amend these Design Criteria to ensure compatibility of designs with the CLI-ECA.

C2.03 Stormwater Management Design Criteria

The Township requires that a development plan is to consider a SWM pond as the first alternative for end-of-pipe facilities. The proponent is to obtain specific approval from the Township before considering buried SWM facilities (i.e., tanks, chambers, pipes, etc.) as alternatives.

The number of municipally owned SWM and LID facilities should be minimized. Independent on-site SWM facilities are discouraged for individual lots and blocks in a Draft Plan. Stormwater quality, quantity and volume controls in new development areas are to be provided in Township-owned municipal blocks.

The proponent of a development application is to discuss the planning and design approach for source water protection and SWM with the Township and relevant Conservation Authority early in the planning process. Design criteria and approvals required from other relevant ministries or agencies (i.e., Ministry of Transportation, Ministry of Natural Resources and Forestry, Department of Fisheries and Oceans, etc.) may also apply.

The Township generally concedes the overall design requirements to the most recent provincial direction, as is acceptable to the TRCA and the LSRCA. Exceptions where the Township may accept or reject the selection of the type of SWM facility, invoke additional or alternative release rate stipulations and design requirements required by other agencies, are in circumstances that involve:

- Matters of public safety and aesthetics;
- Stormwater quality control;
- Maintenance requirements;
- Protecting the riparian rights of private landowners;
- Protection of municipal infrastructure and maintaining an acceptable level of protection to residents whose homes drain into a municipal drainage system; and,
- Conflicts with land use.

The most current version of the following guidelines, policies and standards apply to the design of storm drainage facilities in the Township of King:

- Oak Ridges Moraine Conservation Plan (2017) Ontario;
- Lake Simcoe Protection Plan (2019);
- "Guidance: Water Balance Assessments", CTC Source Protection Region (April 19, 2018);
- South Georgian Bay Lake Simcoe Source Protection Region – Approved Source Protection Plan (January 26, 2015);
- Stormwater Management Planning and Design Manual (2003) MECP;
- Stormwater Management Criteria (2012) TRCA;
- Technical Guidelines for Stormwater Management Submissions (2022) LSRCA;
- Approaches to Manage Regulatory Event Flow Increases Resulting From Urban Development (2016) TRCA;
- Low Impact Development Stormwater Management, Planning and Design Guide (2010) TRCA/CVC;
- Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under Environmental Compliance Approval (2023) MECP; and,
- Erosion and Sediment Control Guide for Urban Construction (2019) TRCA.

C2.04 Quantity Control

The level of quantity control required will be as per watershed or sub-watershed studies completed and approved by the Conservation Authority. In some cases, peak flows and SWM facilities release rates may require overcontrol to the satisfaction of the Township and/or Conservation Authority as noted in Section C2.03.

The most current unit flow equations for the Humber River drainage areas published by the TRCA are to be used. In the case of small sites where the level of control may be impractical, the reduction of post-development peak flows to pre-development flow rates is to be provided.

Where there is no watershed or sub-watershed study prepared, the minimum level of quantity control is the reduction of post-development peak flows to pre-development flow rates per the MECP (2003). External drainage areas in both pre-development and post-development conditions are to be identified and the flows quantified. The extent of peak flow analysis downstream of the application is to be acceptable to the Township and the appropriate Conservation Authority.

C2.05 Quality Control

The minimum level of quality control to be provided is the "enhanced" level of protection defined as 80% long-term total suspended solids (TSS) removal as noted in the MECP Planning and Design Manual, unless specifically approved otherwise by the Township and the Conservation Authority.

In addition to end-of-pipe quality control SWM facilities, the Township requires measures at storm sewer inlet structures and private service connections to the storm sewer system as outlined in Section C6.04. These measures reduce the effort and expense of sediment removal and restoration operations and ensure compliance with the Township's Sewer Use By-law.

A preliminary phosphorous budget may be required by the Township and the LSRCA as part of a functional servicing report or other study for major development, including development greater than 500 m^2 in impervious surface area. The analysis is to demonstrate that the phosphorous load from the development will not exceed pre-development phosphorous loading, or such criteria as required by the Conservation Authority. Where a development cannot meet the pre-development phosphorous loading target, the Township and Authority may require phosphorous offsetting through a development agreement, conditions of approval or other mechanisms. Refer to the current version of the LSRCA Phosphorous Offsetting Policy.

C2.06 Stream Erosion Control

Where existing watercourse erosion is noted to be occurring on or downstream of a development application, the Township will require a stream geomorphic analysis of the drainage system as described in Section C5.03. Measures to minimize and mitigate stream erosion as determined in the study and accepted by the Township and/or the Conservation Authority are to be implemented by the Applicant.

The most current Conservation Authority requirements regarding stream erosion control criteria are also to be consulted which may also result in a stream erosion analysis.

a) In the TRCA jurisdiction, a minimum on-site volume retention of 5 mm over the total impervious area is the minimum requirement for erosion control.

b) In the LSRCA jurisdiction for a site under 2.0 ha, an erosion control study may not be necessary; however, detention of the runoff from a 25 mm, 4-hour Chicago distribution for a minimum 24 hours is required. The LSRCA should be consulted to confirm the applicable criteria on a site-specific basis.

C2.07 Water Balance and Runoff Volume Control

Stormwater volume control requires retaining a portion of the runoff on the site, typically in depressed areas, ponds, galleries or tanks below the outlet elevation from the feature or facility.

The stormwater may be re-used on the site (i.e., irrigation or in a grey-water system subject to Building Department approval), and/or held for evaporation or infiltration into the groundwater system. The design is also to meet other Township's Design Criteria (i.e., lot grading).

The proponent is to pre-consult with the Township and the relevant Conservation Authority to confirm if a water balance study and/or a hydrogeological assessment for the site is required to verify the volume control criteria. Submission requirements are based on the type of planning application (i.e., Subdivision, Site Plan, Infill Development, etc.), the site location and proposed impervious area including the ground floor area of buildings.

C.2.07.1 Major Development

The following definitions of "major development" in environmental areas (i.e., Oak Ridges Moraine and Source Water Protection areas) determine volume control requirements and should be confirmed early in the application process. Where sites are covered by more than one legislation, the most stringent of the "major development" definitions applies. Excerpts of maps from the Official Plan maps which show the approximate areas covered by the legislation are included in Appendix 11. Township staff will confirm during the screening process the legislation that applies to a particular site.

Table C-1: Major Development Definitions

Conservation Authority	"Major Development" Definition			
	ORMCP	**WHPA-Q2**	**SGRA**	**All Remaining Watershed Areas**
TRCA	Creation of four or more lots (i.e., Subdivision, Site Plan) OR Construction of building(s) with total ground floor area equal to or greater than 500 m^2.	Creation of four or more lots (i.e., Subdivision, Site Plan) OR Construction of more than one single family dwelling [1].	Creation of four or more lots (i.e., Subdivision, Site Plan) OR Construction of building(s) with total ground floor area equal to or greater than 500 m^2 [2].	N/A
LSRCA	Creation of four or more lots (i.e., Subdivision, Site Plan) OR Construction of pavement and	Creation of four or more lots (i.e., Subdivision, Site Plan) OR Construction of pavement and	Creation of four or more lots (i.e., Subdivision, Site Plan) OR Construction of building(s) with	Creation of four or more lots (i.e., Subdivision, Site Plan) OR Construction of building(s) with

Conservation Authority	"Major Development" Definition			
	ORMCP	**WHPA-Q2**	**SGRA**	**All Remaining Watershed Areas**
	building(s) ground floor area combined is equal to or greater than 500 m^2 [3].	building(s) ground floor area combined is equal to or greater than 500 m^2 [3].	total ground floor area equal to or greater than 500 m^2 [4].	total ground floor area equal to or greater than 500 m^2 [5].

Notes: ORMCP – Oak Ridges Moraine Conservation Plan (2017).
WHPA-Q2 – Well Head Protection Area (quantity concern due to increased imperviousness).
SGRA – Significant Groundwater Recharge Area.
[1] CTC Source Protection Plan Policy REC-1 document "Guidance: Water Balance Assessments, April 19, 2018".
[2] Region of York Official Plan 2022, Office Consolidation June 2024.
[3] South Georgian Bay Lake Simcoe Source Protection Policy (SGBLSSPP), Land Use Policy 12 (LUP-12).
[4] Lake Simcoe Protection Plan (LSPP) Recharge Policy 6.4-DP.
[5] Lake Simcoe Protection Plan (LSPP) SWM Policy 4.8-DP.

Where applications do not meet the definition of "major development", typically a "best efforts" approach (e.g., lot level LIDs that retain runoff from roof downspouts, vegetated areas and pre-treated runoff from residential driveways or parking areas) is to be applied. The proposed measures are also to be consistent with the balance of the Township's Design Criteria (e.g., lot grading, lot servicing, etc.).

"Major development" shall provide sufficient on-site retention volume to ensure there is no infiltration deficit in the post-development condition. The LSRCA also requires a minimum retention volume of the runoff volume from a 25 mm rainfall over the impervious area of the site.

For "major development" where the site has restrictions of high groundwater or low soil permeability, reduced retention volumes, off-site compensation measures or monetary contributions to the Township or Conservation Authority programs to maintain groundwater quantity may be required. Requirements for sites with restrictions are to be discussed with the approval authority (i.e., Township and/or Conservation Authority).

C.2.07.2 Submission Requirements and Design Criteria

Volume control submission requirements and design criteria are provided in the following table:

Table C-2: Volume Control Submission Requirements and Design Criteria Based on Site Location

Conservation Authority Jurisdiction	Type of Development	Within ORMCP				Within WHPA-Q2				Within SGRA				Other Areas	
		Supporting Studies Required	Design Measures to Maintain Pre-Development Recharge [1]	Best Efforts to Maintain Water Balance [2]	Minimum Volume Control Criteria Apply [3,4]	Supporting Studies Required	Design Measures to Maintain Pre-Development Recharge [1]	Best Efforts to Maintain Water [2]	Minimum Volume Control Criteria Apply [3,4]	Supporting Studies Required	Design Measures to Maintain Pre-Development Recharge [1]	Best Efforts to Maintain Water Balance [2]	Minimum Volume Control Criteria Apply [3,4]	Supporting Studies Required	Best Efforts to Maintain Water Balance [2,5]
TRCA	Non-Major	X	X	✓	X	X	X	✓	X	X	X	✓	X	X	✓
	Major	WBS & HA	✓	X	✓	WBS & HA	✓	X	✓	WBS & HA	✓	X	✓	X	✓
LSRCA	Non-Major	X	X	✓	X	X	X	✓	X	X	X	✓	X	X	✓
	Major	WBS & HA	✓	X	✓	WBS & HA	✓	X	✓	WBS & HA	✓	X	✓	WBS & HA	✓

Notes: WBS – Water Balance Study required.
HA – scoped Hydrogeological Assessment (i.e., depth to seasonally high groundwater and soil infiltration rate determinations) for LIDs design (i.e., see Schedule C of the LID Design Guide).
X – not required.
✓ – required.
[1] Maintain pre-development recharge based on the Water Balance Study or to the greatest extent possible due to site restrictions.

[2] Where a Water Balance Study has not been completed, "best efforts" includes lot level LIDs that retain runoff from roof downspouts and vegetated areas to address water quality.
[3] For all applications within the TRCA, a minimum volume for water balance is not required; however, as noted in Section C2.06, a 5 mm volume over all impervious surfaces is to be retained on-site for stream erosion control purposes.
[4] For major development within the LSRCA, the minimum volume to be retained for sites without restrictions is the runoff volume from a 25 mm rainfall over all new and/or reconstructed impervious surfaces. For sites that may have restrictions as defined by the LSRCA, refer to the latest LSRCA Technical Guidelines for reduced requirements.
[5] Where a Water Balance Study per LSPP Policy 4.8-DP has been completed, "best efforts" are to maintain pre-development recharge or to the greatest extent possible due to site restrictions.

C.2.07.3 Water Balance

Where required for "major development" applications, proponents are to prepare and submit a water balance study using a methodology acceptable to the Township and the relevant Conservation Authority. The analysis is to determine the infiltration deficit resulting from increased impervious area on the site.

For "major development" sites within the TRCA watershed, the TRSPA Water Balance Tool available on the following website, provides annual precipitation and evapotranspiration values under existing conditions for site specific locations.

https://trca.ca/conservation/drinking-water-source-protection/trspa-water-balance-tool/

The total TRSPA Water Balance Tool values may not balance for small site areas (i.e., generally Infill developments). However, the precipitation and evapotranspiration values are considered reasonable and may be used as part of a water budget analysis for small sites. An acceptable methodology (i.e., Table 3.1 MECP infiltration factors) may then to be chosen by the Designer to estimate the annual infiltration portion of the existing conditions water budget for small sites.

Appendix 11 of the Township's Design Criteria includes a figure which relates a percentage of annual rainfall to a daily rainfall amount (i.e., Figure 1a from the City of Toronto Wet Weather Flow Management Guidelines, November 2006). This figure may be used to relate the annual infiltration deficit, as a percentage of annual rainfall depth to a daily rainfall amount. The daily rainfall depth at the calculated percentage is the design value for volume control LIDs that will meet the water balance requirements for the site.

In the LSRCA watershed, the volume control criteria for "major development" of 22.5 mm over the site impervious area (i.e., runoff from a 25 mm rainfall) correlates to an infiltration ratio of 92% of the average annual rainfall. Unless the infiltration deficit exceeds 92% of the average

annual rainfall amount, this volume control criteria applies to sites which do not have restrictions as outlined in the LSRCA design criteria.

C.2.07.4 Scoped Hydrogeological Assessment

A 'major development" is to undertake a scoped Hydrogeological Assessment to confirm if native or imported soil permeability and the depth to seasonally high groundwater at the infiltration LIDs site is restrictive in meeting water balance requirements. Refer to Section C3.01 a) and b) which describe the requirements of establishing these site conditions.

Section C3.01 further outlines design requirements for LIDs to meet pre-development groundwater recharge volumes. For sites with restrictions, refer to Section C2.07.02 above.

C2.08 Stormwater Conveyance Levels of Service

The level of service to be provided by the stormwater conveyance infrastructure is listed in the following table, unless stipulated otherwise. The planning of access routes for emergency services (i.e., police, fire, ambulance) may result in higher levels of service as determined by the Township. The minimum design for minor water courses, associated culverts including roadway cross culverts and structures is to be based on a 25 year storm frequency unless otherwise directed by the Township or Conservation Authority.

Table C-3: Levels of Service for Major and Minor Systems

Item	Level of Service	Comments
Storm Sewers	1:5 year storm (typical)	• use catchbasin inlet controls (as required) • 1:10 year level of service may be required for some commercial areas
Hydraulic Grade Line	1:100 year storm	• subject to pre-design confirmation with Township staff, no less than 0.6 m between 1:100 year storm hydraulic grade line and finished basement floor elevations

Item	Level of Service	Comments
Major System	Greater of the 1:100 year storm or Hurricane Hazel	• drainage areas may require classification as a floodplain using Regulatory storm criteria (TRCA and LSRCA) • overland flow cannot exceed width or flow capacity of the right-of-way, municipal block or easement
Culverts	Per MTO Directive B-100 or as directed by the Township or Conservation Authority	• see following Table C-4

Table C-4: Minimum Level of Service for Bridges and Culverts (per Township Criteria & MTO Directive B-100)

Road Classification	Up to 6 m Span	Over 6 m span
Urban Arterial Road	1:50 year	1:100 year
Rural Arterial Road Urban Collector Road	1:25 year	1:50 year
Local Road	1:25 year	1:25 year
Driveways	1:5 year	1:10 year

C2.09 Submission Requirements

The Township requires complete and comprehensive documentation related to the planning, design, maintenance and operation of storm drainage and stormwater management facilities as outlined below all dated, signed and stamped by a Professional Engineer.

1. Report Formats

   All reports shall be bound with front/back covers. The planning file number shall be included on the front covers. Plans included within the reports shall be folded and bound into the report. In addition, separate digital copies of the report shall be provided, including the requisite SWM files.

2. Functional Servicing – Development Area Studies (FS-DAS)

   The Township requires that proponents of development applications prepare Functional Servicing – Development Area Studies (FS-DAS) at the Secondary Plan stage of land use planning. The FS-DAS is to include a comprehensive stormwater management analysis and preliminary design meeting the Township's Design Criteria and the planning and design requirements noted in Sections C2.01 and C2.02 above. The scope of the FS-DAS is to be discussed with the Township and relevant agencies by the

proponent prior to undertaking the study and will also require the integration of natural environment issues with development of the stormwater management strategy.

3. Stormwater Management (SWM) Design Reports

The following is a list of documentation which should be included within SWM design reports submitted to the Township of King for review. These reports are submitted to support the final design of quality and/or quantity control facilities. These reports shall clearly identify how applicable recommendations from FS-DAS, Geotechnical, Environmental or Hydrogeological reports have been incorporated into the final design of the facility.

Site Location Plan:

a) Existing and proposed catchment area plan which delineates internal/external drainage areas and labels areas and catchment reference numbers.

b) Engineering plans for stormwater and LID facilities which should identify the following:

- Permanent, extended detention, highest water levels on plan view and include all ponding levels for various return periods in tabular form.
- Section/details of major overland flow routes.
- Section/details of maintenance access roads.
- Section/details of erosion protection at inlet/outlet structure and on spillways.
- Fencing limits.
- Location of facility signage.
- Borehole locations and seasonally high groundwater elevation.
- Existing and proposed grading elevations and transition slopes.
- Sediment forebay details including lining and separation berm.
- Details of sediment drying area and/or by-pass pipe for cleaning purposes.
- Section/details of inlet/outlet structures.
- LID-specific plans, cross-sections details and specifications.

c) Landscaping/restoration plans and details.

d) Erosion and sediment control plans and details.

e) Excerpts from Master and Functional Studies which outline requirements for quantity/quality control and any facility design requirements.

f) Identify any deviations from the Township Design Criteria including an explanation based on site specific conditions.

g) Pre- and post-development hydrologic modeling schematic to illustrate all components of each model.

h) Table summarizing pre and post-development catchment parameters (i.e., catchment number, area, percent impervious, CN value, etc.).

i) Table summarizing stage, storage and discharge characteristics of the facility.

j) Table summarizing pre and post-development peak flows and storage volumes based on output from hydrologic modeling or comparison to volumes and target peak flows identified in Master and Functional Servicing Studies.

k) Table to summarize and compare required permanent pool and extended detention storage requirements to volumes provided in the facility.

l) Table to compare calculated 100 year hydraulic grade line elevations within storm sewer system to estimated underside of basement floor slab elevations.

m) Sample or supporting calculations for the following:

- Extended detention drain-down time (hours).
- Major system overland flow and velocity to confirm conveyance within R.O.W. and/or defined flow routes.
- 100 year hydraulic grade line to confirm basements will be protected.
- Erosion control sizing and flow velocity at inlet/outlet structures and spillways.
- Sediment forebay length and width in conformance with MOE manual.
- Major system inlet grating sizing (assuming 50% blockage).
- LID sizing calculations (detention and/or retention design volumes, total LID volume, design soil infiltration rate, detention time, maximum depth, base area required, depth of cover, etc.).

n) Digital copies of input/output files from hydrologic and hydraulic modeling including spreadsheets (i.e., Modified Rational Method). Hard copies are to be provided upon request.

o) Identify erosion and sediment control methods to be implemented before, during, and after municipal servicing construction up to the end of servicing maintenance period, including schedule for implementation/decommissioning and maintenance requirements.

4. Operations and Maintenance Manual

Municipal facilities:

A SWM Facility Operations and Maintenance Manual is to be prepared for the Township by proponents of new SWM facilities. The manual is to describe how each facility operates and the short term and long-term inspection and maintenance requirements of the facilities. Any collection system SWM components, such as manufactured treatment devices (including oil and grit separators), infiltration galleries or infiltration trenches, etc., are to be included in the manual. The manual is to focus on the expected frequency and method of maintenance that will be required in the following specific areas:

- Facility inspection/monitoring program (outline seasonal and annual tasks based on FS-DAS studies or SWM Design or Draft Plan Approval Conditions);
- Grass cutting;
- Weed control;
- Plantings;
- Trash removal;
- Measurement of sediment depth and sediment quality testing;
- Recommended methods to complete facility dewatering including discharge management and sediment removal and disposal, including permitting as necessary;
- Where applicable: Excavation, modification, replacement of LID soil/media/aggregate/geotextile and restoration for LIDs such as infiltration galleries, bioretention cells, green roofs, permeable pavement, etc.

The SWM facility Operations and Maintenance Manual is also to include cost estimates (including labour, equipment and materials) for the operations and activities described above.

Private facilities:

Given the growing complexity of on-site stormwater management and low impact development systems, a SWM/LID Facility Operations and Maintenance Manual or Brief should be prepared for private facilities. The manual is to be written with the future property owner and maintenance personnel or company as audience. The manual should provide a description of the stormwater management system, its components and their function. The manual should also advise on the frequency and methods of inspection maintenance and potential replacement of LIDs that will be required. The Operations and Maintenance Manual is to be acceptable to the Township.

5. Restrictive covenants may be required over SWM and LID facilities proposed on private property to ensure that the system will not be altered or decommissioned and will be maintained as outlined in the approved Maintenance Manual. The Applicant should consult with Township staff prior to proposing SWM and LID facilities in subdivision residential lots. Draft copies of restrictive covenants for LIDs proposed on private property are to be submitted to the Township for review and approval prior to registration and issuing to property owners.

C2.10 Hydrology and Hydrologic Modelling

The estimation of peak design flow rates can be done using the Modified Rational Method or computer model simulation. The Modified Rational Method is typically used to design storm sewers and estimate peak flow rates from small urban areas. Its application should be limited where the time of concentration (Tc) is less than approximately 30 minutes. Designers should consult Conservation Authority requirements, where applicable, to assist in determining the most appropriate method to calculate Tc. In cases where undeveloped lands dictate the time of concentration used in Modified Rational Method design, the urban time of concentration (usually smaller) shall be used and the contributing rural area reduced to a factor of:

$(\text{Tc urban} / \text{Tc rural})^{0.5}$

Computer analyses are best suited to large urban areas, rural areas and designing municipal SWM facilities. Whenever possible, a model shall be properly calibrated using field monitored flow and precipitation data before its actual application in design. It is also advisable to validate the results from one model by using different models.

The minimum and maximum duration of theoretical design storms are 4 hours and 24 hours, respectively, and should be based on the following storm events:

- 24-hour SCS;
- 4-hour Chicago distribution; and,
- 24-hour Chicago distribution (where requested).

The Township, TRCA or LSRCA may request other design storm lengths and distributions, for example the 6-hour and 12-hour Atmospheric Environment Service (AES) storms for evaluation during the pre-consultation process. The Regional storm which applies to all areas within the Township of King is the Hurricane Hazel event. As directed by the Township and relevant Conservation Authority, the more critical result of the 100 year storm or the Regional storm shall be used to establish floodlines and design of the major drainage system.

Rainfall data selected for design of the Township's storm drainage facilities was obtained from the Toronto City EC Station 6158355 (formerly known as the Bloor Street station). The period of record for the available data set from this station is from 1940 to 2021.

The rainfall data has been modified to represent potential future conditions in accordance with the principles noted in the Official Plan. The Official Plan principles are based on managing risks to stormwater-related grading and infrastructure due to climate change. A 15% increase has been applied to the "A" parameter in the 3-parameter intensity-duration-frequency (IDF) equation and a corresponding change reflected in the 24-hour rainfall amount. The following are the values of the modified 24-hour rainfall volumes and the A, B and C parameters in the equation: Intensity = A / (t+B) ^C.

Table C-5: Intensity-Duration-Frequency Parameters and Rainfall Amounts

Return Period	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
A	752.527	1,184.300	1,436.940	1,774.210	2,127.480	2,355.880
B	4.875	6.094	6.376	6.753	7.500	7.500
C	0.796	0.825	0.832	0.839	0.851	0.852
24-hour rainfall (mm)	54.1	69.6	79.8	92.8	102.4	111.9

C3.00 Low Impact Development Techniques

Stormwater Low Impact Development (LID) measures for subdivisions should be reviewed where applicable in the FSR/SWM and appropriate measures provided. For site plans or other forms of development, LID design and characteristics in the design criteria listed in Section C2.03 should be followed.

C3.01 Design Requirements

LID designs shall be based on criteria included in the MECP SWM Design Manual (2003) and the LID Design Guide (2010) including but not limited to:

a) Establishing the seasonal groundwater level monitoring using monitoring wells or test pits at the proposed LID location to determine the seasonally high groundwater elevation. The preferred separation distance between the bottom of infiltration LIDs and seasonally high groundwater is 1 m.

b) Determine the existing and design soil infiltration rates of soils at the LID site through soil sampling and grain size analysis, on-site percolation tests (per Appendix C of the LID Design Guide) or from soil type descriptions (Table 4.4, MECP SWM Guidelines, 2003) including:

- Table C-1 to relate percolation time (min/cm) to infiltration rate (mm/hr).
- Table 4.4 to estimate percolation rate (mm/hr) based on on-site soils investigations.
- Table C-2 to determine the Safety Correction Factor to establish the design infiltration rate.

The on-site soils test results or soils classification and the design infiltration rate determinations are to be signed and stamped by a Professional Engineer.

c) Maximum soak-away pit depth based on Equation 4.2 (MECP SWM Guidelines, 2003).

d) Required soil cover for trenches, per Figure 4.4 (MECP SWM Guidelines, 2003).

e) Infiltration trench bottom area based on Equation 4.3 (MECP SWM Guidelines, 2003).

f) Upstream collection system sizing calculations (i.e., sewers, rainwater leaders, swales, channels, etc.)

g) LID sizing calculations including required volume versus capacity provided, detention time, discharge rate, etc.

h) LID construction details.

i) Outfall system capacities and details.

j) Designed overflows or by-pass systems to surface grading or pipe systems with adequate capacity for overflows once the design LID volume is full.

k) Supplier information for any proposed manufactured conveyance, storage, flow control or treatment products.

C3.02 Subdivisions

The relatively clean runoff from rooftops or vegetated areas should be considered as input to infiltration LIDs at the subdivision planning stage. A third pipe collector leading to an appropriate LID may provide the required volume of clean runoff to address water balance and/or erosion control requirements. Refer to Section C6.03 for additional criteria regarding third pipe systems.

The treated effluent from SWM ponds or high-capacity treatment MTDs designed to the enhanced level of water quality control may also be appropriate as inflow to LIDs.

It is preferred that such LID facilities are installed within the public realm; however, certain LID techniques are not considered suitable within road allowances. There is concern that implementing infiltration LIDs along roadways may lead to contamination of groundwater resources (due to the risk of sodium and chloride contamination because of winter maintenance practices). Only with specific approval by the Township may these features be located in parks, open spaces, buffer blocks, etc. LID features are to be in public lands to facilitate operation and maintenance and ensure the features will continue to function as designed.

Except for multi-unit residential and individual residential infill developments, infiltration devices on private residential lots are strongly discouraged. The proponent is encouraged to consult with Township staff early in the development planning process as this matter can affect the layout of the roads and services.

A full description of the LID techniques to be employed within the development are to be outlined and described in detail within a section of the FSR/SWM report prepared in support of the Draft Plan approval. It should contain locations and details, including pictorial descriptors as appropriate for the various techniques to be employed.

Any LID that requires maintenance by the Township will be subject to review and satisfactory acceptance of the Township.

C3.03 Multi-Unit Residential Building Site Plans

Stormwater quality control is to be provided on-site using a mechanical treatment device (MTD) such as an oil-grit separator. The MTD is to achieve 80% removal of total suspended solids and retain hydrocarbons.

Rainwater harvesting system is required where site constraint permits. Other infiltration-type or retention-type LID measures and green roof options should also be reviewed.

As noted in the Submission Requirements section, restrictive covenants as approved by the Township may be required to be registered on title over SWM and LID facilities constructed on private property.

C3.04 Other Development Plans

Similar to multi-unit site plans, opportunities for rainwater harvesting, infiltration and/or retention type LID measures should be reviewed and implemented where appropriate. Refer to design criteria in Section C2.01 and Section M for single house construction, re-developments or infill development.

C4.00 SWM Storage Facilities Design and Features

C4.01 General Requirements

As noted in the Stormwater Management Design Criteria section, the Township requires that a development plan is to consider a SWM pond as the first alternative for end-of-pipe facilities. The proponent is to obtain specific approval from the Township before considering buried SWM facilities (i.e., tanks, chambers, pipes, etc.) as alternatives.

C4.02 Stormwater Pond General Requirements

End-of-pipe facilities are acceptable to the Township when the designs are safe, significantly visible from public spaces, accessible, maintainable, integrated with the surrounding landscape, and aesthetically pleasing.

In the detailed design of storage structures, it is recommended that operation be checked for spring flood due to combined snowmelt and rain. Wet ponds should be checked for evaporative losses in very dry years. Temperature data should be collected when snowmelt and evaporation are to be estimated. Operation of storage facilities should also be checked to verify that a sequence of storms may not be more critical than a design storm.

The Township requires integration of stormwater pond grading design with the surrounding landscape. The design is to consist of varied contour grading to ensure public safety, provide improved aesthetics, support of a variety of plantings and vegetation and provide passive recreational activities (i.e., walking trails, bike paths, vistas, etc.).

Safety aspects must be given special consideration. This includes identifying the use of gentle slopes in areas where passive recreation takes place and an increasing density of appropriate plantings and vegetation on steeper slopes. Ontario Building Code (OBC) compliant guards are required at headwalls and structures which are accessible by the public where a vertical drop of 1.0 m or greater exists. CLI-ECA compliant education and warning signs provided by the Township to Developers, at the Developer's cost, for installation on each side of the pond and at access points will inform of the function and potential hazards of SWM ponds.

Stormwater management pond design criteria are summarized in the following table:

Table C-6: Stormwater Pond Design Criteria

Permanent Pool	Maximum Slopes	6:1 for 0.5 m drop in elevation below normal water level (NWL).
	Maximum Slopes	3:1 from 0.5 m below NWL to bottom of pond.
	Average Depth	1.0 to 2.0 m
	Maximum Depth	2.5 m

Extended Detention	Maximum Slopes	6:1 for 0.5 m rise in elevation above NWL.
	Maximum Slopes	5:1 to top of extended detention.
	Maximum Depth	1.0 m
Flood Storage	Maximum Slopes	4:1 above the maximum extended detention level up to 2 m beyond the high water level (HWL).
	Maximum Depth	2.0 m for combined Extended Detention and Flood Storage.
Other	Maximum Slopes	3:1 from 2.0 m beyond HWL as required.
	Design of sediment forebays at each inlet to the pond, meeting MECP design guidelines to maximize sedimentation in the forebays.	
	A minimum 3.0 m wide platform at a maximum cross-slope of 4% provided around the property boundary of the SWM block for the purposes of grass cutting.	
	A horizontal terrace of 3.0 m required for continuous slope changes in elevation greater than 3.0 m.	
	Freeboard to top of pond of 0.3 m above the HWL (based on routing of Regional Storm flow). (HWL = maximum water level to convey the Regulatory event through pond).	
	Emergency overflow weir to pass the Hurricane Hazel storm presuming no flow through the low and high flow control outlet devices (i.e., fully blocked outlet conditions). The emergency weir invert shall be set at or above the ponding elevation of the most critical storm requiring control to a design release rate. The emergency weir is to have a capacity of no less than 0.1 m^3/s/ha.	
	Clay core berms with slope toe drains required if NWL is higher than surrounding grade.	
	The Township's warning/education signs specific to each type of facility and meeting the Township's CLI-ECA requirements will be provided by the Township to the Developer, at the Developer's cost, for installation on-site. Signs are to be located near points of access to the pond block or easement area with a minimum of one sign located on each side of the pond.	
	Lockable bollards or gates to discourage vehicular access to the maintenance road.	
	Pond inlet and outlet pipes are to be supported by concrete headwalls and equipped with grates all per the OPSDs.	
	Any accessible headwall, retaining wall or structure with a grade differential of 0.6 m or more from one side to the other side of the structure is to have a guard which meets the requirements of the Ontario Building Code installed at the top of the wall.	
	Maintenance vehicle access roads suitable to support municipal equipment but also designed to support vegetation growth on the surface of the roadway.	

	Berms constructed of suitable material, inspected by a geotechnical engineer and compacted to a minimum 95% Standard Proctor density.

C4.03 Stormwater Pond Safety Features

The Township prefers not to unnecessarily require fencing around pond blocks, but instead to allow for casual public access. Accordingly, public safety must be kept paramount in the design of SWM facilities. The parameters listed in Table C-4 are safety-related and are to be adhered to in the design of SWM ponds.

The Township will provide, at the Applicant's cost, specific SWM facility warning/education signs to be installed at each facility as noted in the table above. The signs have been designed to meet the requirements of the CLI-ECA.

The Township may elect to require fencing at the rear of lots backing onto stormwater facilities. However, fencing around the perimeter of pond blocks will only be considered by the Township when reviewing submissions where there are extenuating circumstances which prevent the above requirements from being met. Specific approval will be required from the Township for consideration of fenced facilities. Where approval for fencing stormwater ponds is given by the Township, 1.8 m high black vinyl-coated fencing, posts and hardware shall be used per corresponding Township standard detail.

C4.04 Stormwater Pond Operations and Maintenance Features

The SWM pond designs are to incorporate features that allow the Township to operate and maintain the facility. It is strongly recommended that the Design Engineer arrange a pre-consultation meeting with the Township once a preliminary pond design has been prepared to discuss maintenance operations and features, specifically clean-out procedures and sediment management and removal. These features include:

a) Provide a primary maintenance access around the facility (minimum 8 m in width between adjacent properties) with ramps to the normal water level as noted below, suitable for municipal and heavy equipment.

b) Maintenance vehicle access roads and turn-around areas at sediment forebays, outlet pools and control structures having a maximum gradient of 10%, minimum width of 4 m, a minimum inside turning radius of 10 m and including a 10 m long loading platform at the forebay and outlet pool locations. Maintenance roads may be required to other locations with the pond block as determined by the Township. Maintenance roads should have maximum cross-fall of 2%.

c) All maintenance vehicle access roads construction shall be structurally designed to support municipal and heavy equipment. The Township may require either a granular finished

surface material or an asphalt surface for access roads. Consultation with the Township is required to determine the requirement on a case-by-case basis.

d) Provision of a drain-down pipe leading from the permanent pool to a maintenance hole with de-watering sump, if a gravity outlet is not available.

e) To facilitate sediment removal operations, either of the following may be proposed and are subject to review and approval of the overall approach to sediment management and removal:

- Provision of a sediment drying space for each forebay, suitable to contain the volume of sediment and water remaining in the forebay (after completing pond drain-down procedures) located adjacent to each sediment forebay and higher than the maximum extended detention water level; or
- Provision of a pond by-pass sewer (sized based on the minor system design criteria) between the inlet and the outlet in order to divert incoming flows around the pond for the duration of clean-out operations (allows for sediment drying in-situ).

f) The sediment drying space noted above is to be designed based on approximately 2.5 m^2/m^3 of sediment and a maximum depth of 0.4 m. A limited tile or under-drain system in the sediment drying area is required to promote de-watering.

g) A minimum 3 m wide platform at a maximum cross slope of 4% is to be provided around the property boundary of the stormwater block for the purposes of grass cutting.

h) Use of a reverse-sloped control pipe, which reduces thermal impacts (wet pond application).

i) Provision of flow control devices in maintenance hole structures located in a berm for easy access, maintenance and cleaning as opposed to a vertical pipe structure located in the pond.

j) Minimum orifice size of 75 mm diameter. Use of a screened orifice plate or weir plate fixed to a permanent structure to achieve extended detention.

k) A gate valve to enable the normal pond outlet to be closed in case of chemical spills.

C4.05 Retaining Walls

Any retaining wall or structure for stormwater ponds, headwalls, culverts, roadways or grade separations are to consist of pre-engineered, precast large stone or patterned concrete systems, as opposed to rip rap or gabion baskets, and are to include an engineering drawing or shop drawing stamped by a licensed Professional Engineer for any structure not covered under Ontario Provincial Standard Drawings. Building permits for the construction of retaining walls that fall into the category of designated structures within the scope of the Ontario Building Code are required.

Guards meeting Ontario Building Code requirements are to be provided where a grade difference exists between the top to the bottom of the structure as outlined in the OBC.

The use of rip rap as a means for erosion control is subject to specific review and approval by the Township. All rip rap or retaining wall systems are to include appropriate filter fabric, sub-drainage or weeping tile systems as recommended by manufacturers or design engineers.

Also see applicable design, construction, and certification requirements discussed in Section F3.07.

C4.06 Landscaping

Landscaping shall be used to enhance the safety, aesthetics and functional aspects of stormwater ponds. Native, non-invasive trees, shrubs, and ground cover are required in a low maintenance landscape design. TRCA or LSRCA policies are to be consulted for a listing of acceptable planting species.

A planting and landscaping plan prepared by a registered landscape architect is to be submitted to the Township and the TRCA or LSRCA for review and approval. The design is to ensure a minimum 3 m separation from the edge of trails or walkways to trees or shrubs. The plan is to address the following objectives:

- Provide shade to areas of the permanent pool (minimize thermal impacts).
- Proposes vegetation which has high nutrient up-take capability and is planted in shallow ponding areas in the extended detention zones.
- Provide outlooks or viewing features with space suitable for installation of benches and use of gravel paths to link viewing areas with local walkway or trail systems.
- Provide a low maintenance ground cover that minimizes the area to be mowed on a regular basis.

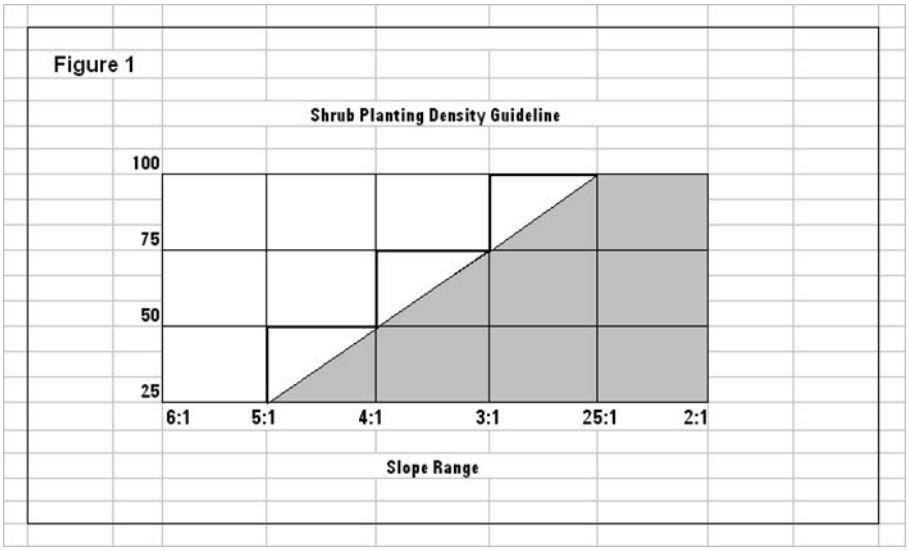
The Township requires the following minimum standards for trees and shrubs:

- Deciduous trees – minimum 60 mm diameter caliper.
- Coniferous trees – minimum 1.8 m in height.
- Deciduous or coniferous shrubs – minimum 0.9 m in height.

Where tree planting is required, the density of planting is to be such that there is a minimum of one tree per 50 m^2. The selection of shrub species and the proposed density of plantings shall be used to discourage public access where appropriate. These locations include areas of steeper slopes around the edge of the permanent pool and around retaining walls or headwalls. The basis of Figure C-1 is that 100% shrub density equals one shrub per 1 m^2 and 25% density equals one shrub per 4 m^2. The purpose of the chart is not to encourage repetitive landscaping

design, but to provide a guide for the relationship between planning densities and the relative pond side slope.

Figure C-1: Shrub Planting Density Guideline



C4.07 Underground Storage

Underground storage facilities are to be considered only with the approval of the Township. The Township requires a stormwater management pond as the first alternative for end-of-pipe facilities.

Underground storage systems provide stormwater quantity and/or quality control, and include features such as oversized superpipes, chambers and cisterns. These systems may include an infiltration component where feasible. Where underground storage systems are approved by the Township to be considered in the SWM plan, the following design considerations are required:

- Pre-treatment of surface runoff for trash and debris shall be provided at each catchbasin in the drainage area upstream of the storage system using “EnviroBasin” catchbasin filter devices. An oil/grit separator sized for 80% total suspended solids removal and hydrocarbon removal is to be located immediately upstream of the storage structure.
- Hydrogeological and Geotechnical supporting studies to confirm soil conditions, seasonally high groundwater separation, address uplift concerns, infiltration and exfiltration issues, liner requirements, compaction requirements, etc.
- Manufacturer’s and Geotechnical Engineer’s recommendations for minimum and maximum cover are to be followed.
- A sufficient number of maintenance points are to be provided based on the nature of the facility. Maintenance points are to be adequately sized and easily accessed for the function

they are to provide. Operation and maintenance documentation is to be provided. A demonstration is to be provided of how the tanks are to be maintained.

- Detailed drawings, including cross-sections, are to be provided.
- Manufactured treatment devices for quality control, such as oil/grit separators and isolator rows, etc. are to be verified through ETV Canada.

C5.00 Major Drainage System

C5.01 General

Urban stormwater conveyance systems may include open channels and swales, storm sewers, maintenance holes and catchbasins, third pipe collection system, roadways and road allowances. Third pipe collector systems are described further under the Minor Drainage System design criteria. The design of stormwater conveyance systems shall follow “dual drainage” principles consisting of a minor (typically a storm sewer) and major (road allowances or channels) drainage facilities.

C5.02 Hazard Lands and Floodlines

Development proponents are to consult with the relevant Conservation Authority to confirm the extent of Regulated Areas and the requirements to delineate hazard lands, environmental areas and floodlines. Stormwater management facilities are to be designed and constructed outside of the Regional storm floodline and environmentally sensitive areas as directed by the Township and/or the relevant Conservation Authority.

C5.03 Watercourse Erosion and Channel Bank Stability

Where stream erosion or bank instability is already evident in an area to be developed or redeveloped, the Township requires that an erosion analysis study be completed by a qualified Stream Geomorphologist or Geotechnical Engineer. The report will be peer reviewed by the Township to assess the potential impact of the development application. Subject to Township and Conservation Authority approval, the situation may be stabilized by appropriate remedial measures such as extended stormwater detention specific to stream erosion potential, bio-engineering measures, natural channel design and interim and long-term erosion and sedimentation controls as part of the servicing works.

C5.04 Channels and Spillways

The proposed criteria for an open channel design shall be submitted to the Township for review and approval, prior to the actual design being undertaken. The Consulting Engineer shall be responsible for obtaining the approval of the design from the MECP, the local Conservation Authority and the MNRF to determine if the open channel concept is favourably considered.

Overflow weirs and spillways typically form part of the major overland drainage system. These facilities are to be designed for the greater of the 100 year storm or the Regional storm peak flow with a minimum freeboard of 0.3 m above the depth of flow for the design storm, as noted in Table C-6.

The use of erosion protection measures which encourage vegetation cover while withstanding the design velocity and remaining stable during the design storm will be considered. Channel lining materials will be subject to MNRF review and comment with respect to fisheries habitat in addition to the Township's review. Engineered channels may be subject to natural channel design and bio-engineering methods. The use of rip rap as a means for erosion control is subject to specific review and approval by the Township. All rip rap applications are to be based on hydraulic design principles and are to include appropriate filter fabric as recommended by Design Engineers. Gabion structures are not acceptable.

C5.05 Major System Design Criteria

An overland flow drainage route is to be identified on the engineering drawings and grading plans. The grading design is to accommodate a continuous above ground flow path. The reliance on piped systems to capture and convey major storm flows is not acceptable where an overland flow alternative is reasonable feasible.

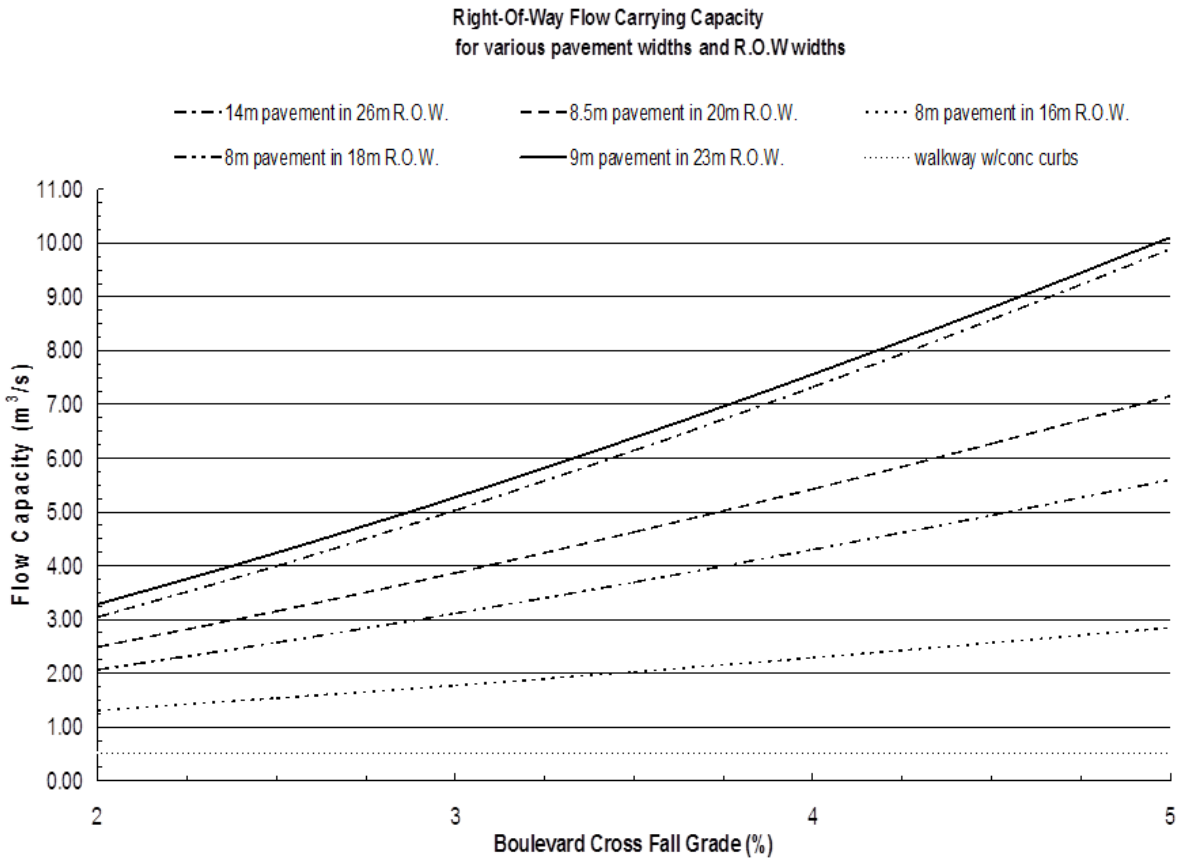
Fences, garden sheds and other flow impediments significantly reduce the flow carrying capacity of swales on private property. Overland flow from public property must be limited to road rights-of-way and walkways and easements, free of fences and other impediments to flow and demonstrated to have the necessary hydraulic capacity. The use of drainage easements on private property are subject to specific approval by the Township.

The extent of any overland ponding at low points is also to be shown on the grading plans. The maximum allowable depth of flow or ponding where vehicle or pedestrian traffic takes place or may be expected is 0.30 m. Any inlet grating associated with the major drainage system is to include a 50% blockage factor in its design.

The design of the major system shall be such that the greater peak flow of the Hurricane Hazel storm or the 100 year storm is conveyed within the boundaries of municipal road allowances, blocks or easements.

Figure C-2 provides the maximum road allowance carrying capacity for overland flow for various pavement and road allowance widths. This table shall be used to confirm the capacity of the overland conveyance system relative to the expected design flows.

Figure C-2: Right-of-Way Flow Carrying Capacity



C6.00 Minor Drainage System

C6.01 General

Urban stormwater conveyance systems may include open channels and swales, storm sewers, maintenance holes and catchbasins, third pipe collection system, roadways and road allowances. The design of stormwater conveyance systems shall follow “dual drainage” principles consisting of a minor (typically a storm sewer) and major (road allowances or channels) drainage facilities.

C6.02 Design Criteria

Residential roof leader downspouts shall discharge to splash pads on grassed or vegetated surfaces or to dedicated roof drain collector (RDC) sewers with an overflow at the surface, as approved. Residential roof leader downspouts shall not outlet onto driveways or be connected to storm sewers which collect road allowance and foundation drainage. The architectural design of townhouse blocks shall specifically address roof design, eavestrough locations and roof leader downspout locations to meet the above criteria. Non-residential developments shall locate and provide roof leader downspout outlets as noted on approved Site Plans.

The minor storm sewer system design shall be based on a minimum 5-year design storm capacity. The system shall include capacity for connection of foundation drains or weeping tiles and the storm sewers shall be at an appropriate depth to provide connection to foundation drains. The use of sump pumps in new development is not permitted. A hydraulic gradeline (HGL) analysis of the minor system shall be completed and submitted to the Township for review and approval.

C6.03 Third Pipe Collection Systems

As an alternative to connecting foundation drains or weeping tiles to the storm sewer, a Foundation Drain Collector (FDC) sewer system may be considered by the Township. The FDC shall be dedicated to collecting drainage only from weeping tiles around the foundation of structures constructed above the seasonally high groundwater table. The required conveyance flows are to be confirmed through a hydrogeological assessment. The typical minimum sewer depth of cover 2.7 m is to be verified based on the site grading and architectural building designs. The FDC system is to be designed with a free flow outlet above the 100 year hydraulic gradeline of the receiving stream, SWM facility or LID facility to ensure basement flooding protection.

A Roof Drain Collector (RDC) system shall include dedicated service connections and a separate sewer system to collect runoff from roof downspouts. This system may be a source of relatively “clean water” that may not require extensive pre-treatment before discharging to a receiver. These systems may assist in meeting water balance or runoff volume control in

combination with end-of-pipe LIDs approved by the Township. The RDC conveyance flows shall be determined through a water balance and hydrogeological study for the proposed development and LID facility design. Where specifically approved by the Township, a minimum frost cover of 1.4 m may be provided for a RDC system provided that appropriate servicing lateral crossings without conflicts can be demonstrated.

The following additional design requirements for an FDC or RDC apply:

- Minimum diameter of a third pipe system shall be 150 mm.
- Minimum slope of a third pipe system shall be 1%.
- Maintenance holes are to be provided, with spacing not exceeding 95 m.

The Developer should be aware that the Township will require a financial contribution for the long-term maintenance of a third pipe system.

C6.04 Minor System Quality Control

Mechanical treatment devices (MTDs) are required where directed by the Township as part of a water quality treatment train approach.

MTDs are to be designed and installed upstream of municipal underground storage systems where maintenance or replacement effort and cost are higher than an open, at-grade pond facility. Each catchbasin shall have “EnviroBasin” filter devices or an approved alternative installed for trash and debris removal. An oil/grit separator MTD sized for 80% total suspended solids removal is also to be provided immediately upstream of underground storage structures.

Where there is the potential for hydrocarbon, oils or grease sources entering the sewer system an oil/grit separator MTD shall be provided within the site. Where directed by the Township, goss traps shall also be required in catchbasins on private property.

For multiple-unit private residential development, high density residential and non-residential development blocks, the Township requires an oil-grit separator MTD sized to provide 80% TSS removal installed on private property to ensure compliance with the Township’s Sewer Use By-law. The MTD is to be installed near the connection to the storm service lateral. Units rated for “high-capacity” hydrocarbon removal shall be specified for locations where hydrocarbons are used (i.e., gas station, filling station, auto repair shop, food services, etc.) or may exist. The MTDs are to be provided to reduce downstream oil and sediment loading notwithstanding existing or proposed municipal facilities.

All proposed MTDs are subject to review and acceptance by the Township and shall have a completed performance verification through Environmental Technology Verification (ETV) Canada.

C6.05 Runoff Quantity

The design of the minor storm sewer system shall provide un-surcharged conditions up to the 1:5 year storm. Where directed by the Township, the minor system design criteria for downtown business or high value commercial development areas may be the 1:10 year storm. The Township may require on-site peak flow control of storm events up to the 1:100 year frequency from these catchment areas to ensure un-surcharged conditions in the receiving storm sewers.

The design of the storm sewers shall be computed on the Township's standard 5 year frequency Storm Sewer Design Sheet unless otherwise directed.

1. All storm sewers shall be designed according to the Rational Method formula:

$$Q = 2.778\ (ACi)$$

Where, Q = Runoff quantity in m^3/sec.
A = Area in hectares (ha)
C = Runoff coefficient
i = Average rainfall intensity in mm/hr.

2. The value for rainfall intensity (i) shall be calculated in accordance with the values as provided in Section C2.01. The equation for the 5 year storm is indicated as the following with the value of time (t) in minutes:

$$i = 1{,}184.299 / (t+6.094)^{0.825}$$

C6.06 Run-Off Coefficients and Land Use Imperviousness

Composite runoff coefficients (i.e., C values) are to be calculated for the land use and coverage of each design as a function of both total imperviousness and storm return period. The initial Time of Concentration (Tc) is also to be determined on a site-specific basis given the overland flow distance and conditions. Typical runoff coefficients and Tc values which may be applied in early planning stages of development as a function of the imperviousness of the catchment are as follows:

Table C-7: Land Use Imperviousness and Runoff Coefficients (C Values)

Land Use	C Values/ Imperviousness*	Return Period			Initial Tc (Minutes)
		1:5	1:25	1:100	
	$C_{PERVIOUS\ AREAS}$	0.20	0.30	0.40	
	$C_{IMPERVIOUS\ AREA}$	0.90	0.95	1.00	
	Typical Total Imperviousness	**Composite C Values**			
Parks	10%	0.27	0.37	0.46	14.0

Land Use	C Values/ Imperviousness*	Return Period			Initial Tc (Minutes)
		1:5	1:25	1:100	
	$C_{PERVIOUS\ AREAS}$	0.20	0.30	0.40	
	$C_{IMPERVIOUS\ AREA}$	0.90	0.95	1.00	
	Typical Total Imperviousness	**Composite C Values**			
Estate Residential	35%	0.45	0.53	0.61	9.5
Single Family Residential	55%	0.59	0.66	0.73	7.5
Semi-Detached Residential	65%	0.66	0.72	0.79	7.0
Townhouses	75%	0.73	0.79	0.85	6.5
Apartments	75%	0.73	0.79	0.85	6.5
School	60%	0.62	0.69	0.76	7.0
Other institutional	70%	0.69	0.76	0.82	6.5
Industrial	80%	0.76	0.82	0.88	6.0
Commercial	90%	0.83	0.89	0.94	6.0

*Permeable paving stones are included as “hardscaping” under the Township’s By-law based on many types of alternative products and variable construction practices which may not be effective. Therefore, C values of 0.90, 0.95 and 1.00 are to be assigned for paving stone areas.

The total imperviousness ratios listed in the table above are the typical minimum acceptable value and actual weighted imperviousness ratios and runoff coefficients are to be calculated on a site-specific basis for all designs.

An appropriate runoff coefficient may also be determined from the following:

$$C = 0.2 (1-I) + 0.9 (I)$$

Where “I” is the site imperviousness ratio.

C6.07 Storm Sewer Design

Table C-8 provides the relevant design parameters for the minor storm sewer drainage system. This table shall be used to determine the maximum and minimum designs for storm sewers.

Although the Manning’s formula is to be used as a basis for sewer design, the values listed in Table C-8 will supersede the results of Manning’s calculations where applicable.

Pipe Capacity

The sewers will be designed according to the Manning equation:

$$Q = \frac{1.00 \times R^{2/3} \times S^{1/2} \times A}{n}$$

and

$$V = \frac{1.00 \times R^{2/3} \times S^{1/2}}{n}$$

Where,

Q = flow m^3/sec.

A = nominal cross-sectional area of the sewer (m^2)

R = hydraulic radius (m)

S = slope of pipe (m/m)

n = roughness coefficient as noted below

Manning's formula shall be used in determining the capacity of all storm sewers. The capacity of the sewer shall be determined on the basis of the pipe flowing full.

The value of the roughness coefficient "n" used in the Manning's formula shall be as follows:

Concrete pipe – all sizes	n = 0.013
Concrete box culverts	n = 0.013

Table C-8: Allowable Storm Sewer Capacities and Gradients

Diameter (mm)	Q Max (m^3/s)	Slope Min* (%)	Slope Critical (%)	Slope Max (%)
300	0.12	0.40	1.34	10.8
375	0.20	0.40	1.25	8.0
450	0.32	0.30	1.17	6.3
525	0.47	0.30	1.12	5.1
600	0.66	0.20	1.07	4.3
675	0.88	0.20	1.03	3.6
750	1.1	0.20	0.99	3.1
825	1.5	0.20	0.96	2.8
900	1.8	0.20	0.93	2.5
975	2.2	0.20	0.91	2.2

Diameter (mm)	Q Max (m^3/s)	Slope Min* (%)	Slope Critical (%)	Slope Max (%)
1,050	2.7	0.20	0.89	2.0
1,200	3.7	0.15	0.85	1.7
1,350	5.0	0.15	0.81	1.4
1,500	6.5	0.15	0.79	1.2
1,650	8.2	0.15	0.76	1.1
1,800	10	0.15	0.74	0.99
1,950	12	0.15	0.72	0.89
2,100	14	0.15	0.70	0.80
2,250	16	0.15	0.69	0.73
2,400	19	0.15	0.67	0.67
2,700	24	0.15	0.65	0.57
3,000	29	0.15	0.62	0.50
Based on the following criteria:				
	Velocity min	Velocity max		
	0.75 m/s	4.5 m/s		
*Minimum design grades for pipe storm sewers, regardless of flow velocities obtained.				

C6.08 Hydraulic Gradeline Analysis

A hydraulic gradeline (HGL) analysis of the minor system shall be completed and submitted to the Township for review and approval. The analysis shall determine the type, quantity and location of storm sewer inlet control devices (ICDs) required to ensure protection against basement flooding by maintaining the HGL for the 100 year storm event below basement elevations. The manufacturer and model of ICDs proposed is subject to approval of the Township. The separation required between the 100 year storm HGL and basement elevations is to be confirmed with Township staff during pre-design consultations; however, it shall be no less than 0.6 m.

The Design Engineer shall prepare and submit an operational hydraulic gradeline digital model (Excel, PCSWMM, SWM5, etc.) based on 100 year design storm sewer flow rates. The model is to account for the total head loss including pipe friction head loss, maintenance hole entrance/exit losses and bend losses at maintenance holes in determining water surface elevations. The submission shall detail for each sewer length the critical design finished centerline of road elevation, the design depth below centerline of road to the finished basement floor elevation and identify the calculated separation between the basement floor and the 100 year hydraulic gradeline elevations for comparison to the minimum requirement. The analysis is to conclude for each sewer length if the design criteria has been met.

Table C-9: Storm Sewer Head Loss Components

Pipe Head Losses*	
Pipe friction losses calculated based on Manning's equation: $h_f = ((19.6 * n^2 * L) / (R^{1.33})) * (V^2/2g)$ Where: h_f = head loss due to friction, m n = Mannings roughness coefficient L = length of pipe, m R = hydraulic radius V = flow velocity, m/s	
Maintenance Hole Head Loss Components**	**Coefficient (K)**
Entrance and exit losses: Straight through maintenance hole with only one inlet and one outlet pipe: $h_m = K * (V_2^2 / 2g)$, where V_2 is the outflow velocity (m/s)	0.05
Junctions: Junction maintenance holes where one or more lateral pipes connect to a maintenance hole in addition to the incoming and outgoing main pipes, based on the angle of the lateral pipes to the mainline: $h_m = K * (V_2^2 / 2g)$, where V_2 is the outflow velocity (m/s) 90 degree lateral pipe(s) 60 degree lateral pipes(s) 45 degree lateral pipes(s) 22.5 degree lateral pipes(s)	 0.75 0.65 0.50 0.25
Bend Losses: In addition to entrance and exit losses and junction losses, head loss due to changes in direction at maintenance holes is to be calculated: $H_b = K * (V_2^2 / 2g)$, where V_2 is the outflow velocity (m/s) 90 degree bend 60 degree bend 45 degree bend 22.5 degree bend	 0.50 0.43 0.35 0.20

*Per: Drainage Management Manual, Chapter 8, Ontario Ministry of Transportation

**Per: "Design and Construction of Urban Stormwater Management Systems", ASCED5.04 Run-off Quantity

C6.09 Minimum Sizes

The minimum size for a municipal storm sewer main shall be 300 mm.

C6.10 Minimum Cover

Typically a minimum cover of 2.7 m (from future road grade) is required to the top outside edge of the pipe barrel for the storm sewer. However, where specifically approved by the Township, minimum frost cover of 1.4 m may be provided on storm sewers where servicing limitations exist, or where third pipe collection systems are used.

The maximum depth of sewers with direct lateral connections shall be 8.0 m (measured from finished centerline of road elevation to invert of sewer). In cases where deeper sewers are required these shall be considered trunk sewers and no direct lateral connections will be permitted. Separate local sewers constructed above the trunk sewers will be required for connection of laterals. Maintenance holes are to be common wherever possible with drop structures.

C6.11 Location

The storm sewers shall be located as shown on the Township standard road cross-section drawings. This standard location shall be generally 1.5 m south or west of the centreline of the road allowance. In the case of crescents, looped and curvilinear streets, this standard location may be varied to the extent that the storm sewer remains on the same side of the centreline of the street (i.e., left or right) to avoid crossing the sanitary sewer trenches at the changes in direction of the street.

All storm sewers are to have a minimum horizontal separation of 2.5 m and a vertical clearance of 0.5 m from watermains in accordance with MECP regulations.

C6.12 Sewer Alignment

All storm sewers shall be laid in a straight line between maintenance holes, unless radial pipe has been specified.

Radial pipe can be considered on a case-by-case basis for all storm sewers 1,050 mm in diameter and larger, provided that a maintenance hole is located at the beginning or at the end of the radial section. The minimum centreline radius allowable shall be as per manufacturers' recommendation or as directed by the Township.

C6.13 Limits

All sewers shall be terminated at the subdivision limits when external drainage areas are considered in the design, with suitable provision in the design of the terminal maintenance holes to allow for the future extension of the sewer.

When external areas are not included in the sewer design, the sewer shall extend at least one-half way across the frontage and/or flankage of any lot or block in the subdivision.

C6.14 Pipe Crossings

A minimum clearance of 0.3 m shall be provided between the outside of the pipe barrel at the point of crossing for storm and sanitary sewers. A minimum clearance of 0.5 m shall be provided for all sewer and watermain crossings.

In the event the minimum clearances cannot be obtained, the designs must adhere to MECP policies. In addition, the pipes shall be concrete encased to ensure that the pipes are properly bedded.

In cases where the storm sewer crosses a recent utility trench at an elevation higher than the elevation of the utility, a support system shall be designed to prevent settlements of the storm sewer, or alternatively, the original trench will be re-excavated to the top of the utility and shall be backfilled with compacted crushed stone or concrete to adequately support the storm sewer. When the storm sewer passes under an existing utility, adequate support shall be provided for the utility during and after construction to prevent damage to that utility.

C6.15 Changes in Pipe Size

No decrease of pipe size from a larger upstream to a smaller size downstream will be allowed regardless of the increase in grade. The only exception being where a superpipe is used for storage, a smaller pipe downstream of the control structure may be considered.

C7.00 Sewer Pipe

C7.01 Materials

The type and classification of all storm sewer pipe and the sewer bedding type shall be clearly indicated on all profile drawings for each sewer length. Concrete or plastic pipe will be permitted for storm sewers 375 mm in diameter and smaller. All storm sewer mains 500 mm diameter and over shall be constructed with reinforced concrete pipe.

Concrete pipe shall conform to the requirements of CSA Specification A257-M 1982 for the particular classes as shown below:

- Pipes up to 375 mm – Non-Reinforced Concrete Pipe, CSA Standard A257.1 M1982, Classes 1, 2 and 3.
- Pipes 450 mm or greater – Reinforced Concrete Pipe, CSA Standard A257.2-M1982, Strength Classification 50-D, 65-D, 100-D and 140-D.

Polyvinyl Chloride (PVC) pipe is permitted for sewers up to 375 mm diameter.

Externally ribbed pipe products will not be permitted.

PVC products shall conform to the requirements of CSA B182.2, B182.3, B182.4, ASTM D3034, F679 and F794. The pipe must be manufactured with factory assembled spigot gasket and integral bell joints. PVC pipe for storm sewers shall be any colour except green.

High density polyethylene (HDPE) pipe shall conform to the requirements of CSA Specification B182.6 and shall have a smooth inside wall and corrugated outside wall (such as HDPE BOSS Poly-Tite or equivalent) with minimum stiffness of 300 kPa.

Storm sewer leads from catchbasins shall be constructed with PVC SDR35 or BOSS Poly-tite HDPE pipe.

Watertight bell and spigot connections will be required for all pipe joints.

C7.02 Pipe Bedding and Backfill

The class of pipe and the type of bedding shall be selected to suit loading and proposed construction conditions. Details of the types of bedding are illustrated in OPSD 802.010 and 802.030 the Township Standard Drawings. In general, the Type “2” bedding (20 mm crusher run limestone) shall be used for storm sewers in new developments, and the class of pipe will be selected to sit this bedding detail. Alternate granular materials for pipe bedding may be specified, subject to the approval of the Township; however, clear stone bedding will not be permitted. The width of trench at the top of the pipe must be carefully controlled to ensure that the maximum trench width is not exceeded unless additional bedding or higher strength pipe is

used. The recommendations of a Geotechnical Engineer will be required in determining strength of pipe required and construction methods to be used.

C7.03 Video Record

All newly constructed storm sewers shall be CCTV inspected upon satisfactory completion of all other testing, prior to the issuance of Building Permits. Additional CCTV inspections of storm sewers are to be completed prior to “Final Acceptance”.

The Professional Engineer shall review the results of all CCTV inspections, direct repairs or corrections as required and coordinate re-inspection of the services if necessary. A certification is to be signed and stamped by the Professional Engineer once all inspections meet the Township’s requirements and are acceptable. All CCTV digital records and written reports are to be submitted to the Township in a format acceptable to the Township.

All sewers are to be inspected by CCTV methods in accordance with NASSCO guidelines (PACP and MACP) and OPSS 409, except as may be modified herein. All work is to be completed by NAASCO certified operators which are to be approved by the Township prior to the video inspection being undertaken.

C8.00 Maintenance Holes

C8.01 Location

Maintenance holes shall be constructed at the following locations:

- At changes in pipe size;
- At pipe junctions;
- At changes in pipe slope;
- At changes in pipe alignment;
- At changes of pipe material (e.g., PVC to concrete);
- At either the beginning or end of radial pipe sections; and,
- Where directed by the Township, adjacent to municipal property where a private storm sewer servicing commercial, industrial or institutional lands connects to a municipal storm service for inspection, monitoring and maintenance purposes.

The outside wall of any maintenance hole structure located within the roadway shall not be located closer than 1.5 m to a curb. The maintenance holes shall be oriented in such a way that the access cover is offset towards the centerline of the road.

C8.02 Maximum Spacing

The maximum spacing between maintenance holes shall be as follows:

Table C-10: Maximum Storm Maintenance Hole Spacing

Pipe Size	Maximum Spacing
300 mm	95 m
375 mm to 750 mm	100 m
825 mm to 1,200 mm	125 m
1,350 mm and over	150 m

C8.03 Maintenance Hole Types

Maintenance holes shall be constructed of precast concrete. Although the Standard Drawings provide details for maintenance holes up to certain maximum depths and sizes, the Consulting Engineer shall analyze, individually, each application of the standards related to soil conditions, loading and other pertinent factors to determine structural suitability. In all cases where the Standard Drawings are not applicable, the maintenance holes shall be individually designed and detailed.

A reference shall be made on all profile drawings to the type and size of all storm maintenance holes.

Precast maintenance holes shall conform to ASTM specifications C478 M latest revision.

Maintenance hole covers shall be as per OPSD 401.010 Type “A” (Closed).

C8.04 Maintenance Design

1. All maintenance hole chamber access openings shall be located on the side of the maintenance hole parallel to the flow for straight run maintenance holes, or on the upstream side of the maintenance holes at all junctions.

2. The direction of flow in any maintenance hole shall not be permitted at acute interior angles.

3. Safety gratings shall be provided in all maintenance holes when the depth of the maintenance hole exceeds 5 m. The maximum spacing between safety gratings shall not exceed 4.5 m. Where practical, safety gratings shall be located 0.5 m above any drop structure inlet pipe.

4. The obverts on the upstream side of maintenance holes shall not be lower than the obvert of the outlet pipe.

5. The maximum change in direction of flow in maintenance holes, for sewer sizes 900 mm diameter and over, shall be 45°.

6. Where the difference in elevation between the obvert of the inlet and outlet pipes exceeds 0.9 m, a drop structure shall be placed on the inlet pipe.

7. All storm sewer maintenance holes shall be benched to the obvert of the outlet pipe on a vertical projection from the spring line of the sewer, all in accordance with the Standard Detail Drawing.

8. The minimum width of benching in all maintenance holes shall be 230 mm.

9. Maintenance holes in boulevards shall be located, wherever possible, a minimum of 1.5 m distance from the face of curb or other service.

10. Minimum size of any maintenance hole stack shall be 685 mm square.

11. The maintenance hole shall be centered on the sewer main.

C8.05 Grades for Maintenance Hole Frames and Covers

All maintenance holes, located within the travelled portion of a roadway, shall have the rim elevation set flush with the surface of the base course asphalt. The concreting and setting of the frame and cover shall be completed in accordance with the details provided in the Standard Drawing. A maximum of 300 mm of modular rings shall be permitted on maintenance holes in new subdivisions. No concrete shall extend over the edge of the maintenance hole.

Prior to the placement of the final lift of asphalt, maintenance hole frames shall be reset to final grade.

C8.06 Drop Structures

Drop structures shall be used when invert levels of inlet and outlet sewers differ by 0.9 m or more. Wherever feasible, sewer systems should be designed to avoid the use of drop structures. Internal drop structures shall not be permitted unless the structure provides adequate space and the Township grants approval for a specific, justified purpose. Precast drop structures are permitted. All external drop structures shall be designed and constructed in accordance with KS 171. Any proposed internal drop structure design shall be submitted to the Township for approval on a structure-specific basis. All internal drop structures shall be constructed in accordance with KS-171.

C8.07 Head Losses

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

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

Hydraulic calculations shall be submitted for all junction and transition maintenance holes on sewers where the outlet pipe is 1,050 mm or greater. In addition, hydraulic calculations may be required for maintenance holes where the outlet pipe is less than 1,050 mm diameter if, in the opinion of the Township, there is insufficient invert drop provided across any maintenance hole.

Regardless of the invert drop across a maintenance hole as required by calculations, the obvert of the outlet pipe shall not be higher than the obvert of the inlet pipe at any maintenance hole location.

The minimum drops across maintenance holes shall be as follows:

Table C-11: Minimum Drop Across Storm Maintenance Holes

Change of Direction	Minimum Drop (mm)
0	30
1° to 45°	50
46° to 90°	80

C9.00 Catchbasins

C9.01 Location and Spacing

Catchbasins shall be selected, located and spaced in accordance with the conditions of design. The design of the catchbasin location and type shall take into consideration the lot areas, the lot grades, pavement widths, road grades and intersection locations.

Catchbasins are to be placed at the beginning of the bulb of residential cul-de-sacs per the Standard Detail Drawings.

The hydraulic capture capacity of the catchbasins is given in the Ministry of Transportation Drainage Manual design charts. To ensure that the capture or inlet capacity matches that of the storm sewer, the spacing of catchbasins on streets may be varied. Refer to Section C6.08 regarding hydraulic gradeline analysis requirements, which may determine specific catchbasin locations, spacing or capacity including if inlet control devices are necessary. The maximum allowable drainage path to a catchbasin is as follows:

Table C-12: Maximum Road Catchbasin Spacing

Pavement Width	Maximum Spacing
8.5 m	90 m
10.0 m	80 m
12.8 m	65 m
15.0 m	60 m

All catchbasins and their leads shall be of the single, double or backyard type, as set out in the Standard Drawings.

Since reduction in the size of the standard catchbasin covers is not desirable, an orifice plate or hooded inlet can be located in the catchbasin.

Catchbasins shall be generally located upstream of sidewalk crossings at intersections, and upstream of all pedestrian crossings. Catchbasins shall not be located in driveway curb depressions. Double catchbasins shall be normally required when the catchbasin intercepts flow from more than one direction. Single catchbasins may be used in the case where the total length of drainage of the catchbasin, from both directions, is less than 95 m, subject to the analysis of the major-minor system.

Catchbasin inlet control devices are to be PVC with “diamond” orifices and bolted to the catchbasin side.

Rear lot catchbasins and connections shall be located as outlined in the lot grading criteria. In general, the catchbasin and the catchbasin connections shall be located entirely on one lot.

C9.02 Catchbasin Types

Catchbasins must be of the precast type as shown on the OPSD 705.010 or 705.020.

Rear lot catchbasins shall be sumpless. Positive drainage shall be provided within the structure to prevent the ponding of water or accumulation of sediment and debris.

Special catchbasins and inlet structures shall be fully designed and detailed by the Consulting Engineer. High capacity “super catchbasin” grates are typically not permitted in municipal use and a series of conventional catchbasin is preferred.

C9.03 Catchbasin Connections

In general, catchbasins located in close proximity to a maintenance hole shall have their leads connected to the maintenance hole.

Catchbasin lead pipes shall be connected to the sewer mains with factory installed tees and as noted on the Standard Drawings.

Catchbasin lead pipe sizes are noted in the following table:

Table C-13: Catchbasin Lead Pipes

Type	Minimum Size of Connection	Minimum Grade of Connection
Single Catchbasin	250 mm	1%
Double Catchbasin	300 mm	1%
Rear Lot Catchbasin	*250 mm	1%

*All rear lot catchbasin leads shall be encased in concrete from the catchbasin to the street line.

C9.04 Catchbasin Frame and Covers

Frame and cover for road catchbasins shall be as per OPSD 400.100 (Perforated). Rear lot catchbasin frame and covers shall be “Birdcage” style (not pyramidal).

The use of rivetted bar grates in roadways will only be considered in special circumstances at the discretion of the Township. These must be bicycle safe and able to withstand traffic loads.

C9.05 Catchbasin Pre-Treatment Devices

All catchbasins upstream of a municipal underground stormwater storage or treatment facilities are to be installed with a pre-treatment “EnviroBasin” product for the removal of trash and debris. Additional site-specific areas or locations as determined by the Township may require approved pre-treatment products to be installed for stormwater quality control.

C9.06 Catchbasins at Intersections

All catchbasins at street intersections shall be located on the tangent of the curb at a minimum of 0.6 m distance from the beginning or the end of the radial portion of the curb. Where practical, a catchbasin shall be added upstream of any sidewalk ramps.

C9.07 Grades for Catchbasin Frames and Grates

All catchbasins located within the travelled portion of a roadway shall have the frame elevation set flush with the surface of the base course asphalt. The adjusting and setting of the frames and grates shall be completed in accordance with the details provided in the Standard Drawing, upon placement of surface course asphalt.

Temporary asphalt curbing shall be placed behind all catchbasins within the travelled portion of the roadway at the stage of base course asphalt. Asphalt curbing shall be placed in accordance with OPSD 601.010 between the two adjacent expansion joints, as shown on the Standard Drawing.

Prior to placing surface course asphalt, temporary asphalt curbs shall be removed and replaced by concrete curb.

C10.00 Inlets, Outfalls and Special Structures

C10.01 General

Inlet and outlet structures, including headwalls, that are not OPSD standards shall be designed and detailed by a Structural Engineer. The details provided shall include the existing topography, proposed grading and the work necessary to protect against erosion. Grates will be provided on all inlet and outlet structures and shall be designed and detailed when standard drawings are not appropriate. All metal parts shall be galvanized to adequately protect against rusting.

C10.02 Inlets

For other than minor swales, where catchbasins with pyramidal tops are used, inlet structures shall be fully designed by the Consulting Engineer. Inlet grates shall generally consist of inclined parallel bars or rods set in a plane at approximately 18° with the top away from the direction of flow. Suitable erosion protection shall be provided at all inlets to protect against erosion and to channel the flow to the inlet structure. Gabion baskets are not permitted. Rip rap protection requires specific approval of the Township.

Fall protection, as noted in the following section regarding “Outlets” is to be incorporated into the design of inlet structures.

Hydraulic design calculations for inlet structures must be performed in accordance with guidelines established by the Ministry of Transportation, Ontario, Drainage Manual.

The design of any culvert on a new or reconstructed watercourse where an inlet grating is required must provide a measure of safety and minimize the risk of entanglement or entrapment of a person.

C10.03 Outlets

The OPSD 804.030 standard headwall shall be used for all storm sewers less than 900 mm in diameter. For sewers 900 mm in diameter and larger the headwall shall be in accordance with OPSD 804.040 or individually designed. All headwalls shall be equipped with a lockable grating over the outlet as per OPSD 804.050.

Fall protection shall be provided along the top of all headwalls 0.6 m in height or greater. Fall protection may also be required along shorter headwalls where a risk to pedestrian safety has been identified. The site-specific conditions must be reviewed in determining the requirement for safety railings and must have due regard to public health and safety. The fall protection design shall satisfy OBC’s “non-climbable” and loading requirements.

All outlets shall blend in the direction of flow of the watercourse with the directional change being taken up in the sewer rather than the channel.

Storm sewer outfalls shall not be connected to existing or proposed road crossing culverts. Storm sewer outfalls must be terminated at separate headwall structures, adjacent to the outlet side of road crossing culverts.

Rip rap, concrete blocks, concrete, erosion mats or other erosion protection approved by the Township shall be provided at all outlets to prevent erosion of the watercourse, and to the area adjacent to the headwall. Gabion baskets are not permitted. The extent of the erosion protection shall be indicated on the Engineering Drawings and shall be dependent upon the velocity of the flow in the storm sewer outlet, the soil conditions, the flow in the existing watercourse and site conditions. Supporting calculations for the proposed erosion protection specifications, extent of coverage and details are to be submitted.

C11.00 Storm Sewer Connections

C11.01 General

The installation of a sewer service connection to serve more than one residential building (i.e., double service) will not be permitted. Semi-detached units will require separate sewer laterals for each side. Townhouse units are required to have individual storm service connections.

Refer to Standard Drawing KS-177 for storm sewer service connection details.

Connections to storm sewers are restricted to the use and purposes noted in the Township's current Sewer Use By-law.

C11.02 Connection Size and Grade

The minimum size for storm drain connections shall be 150 mm, installed at a minimum grade of 2% from the storm sewer to the building envelope.

C11.03 Depth of Connection

For low rise residential dwellings, the storm drain connection shall be installed to a sufficient depth to provide for the drainage of weeping tiles around the foundation of the house in accordance with the Standard Detail Drawings.

Concrete or PVC risers shall be used on all drain connections when the depth to invert of the storm sewer exceeds 4.5 m. Concrete pipe risers shall be concrete encased as shown on the Standard Drawings. PVC pipe risers shall be constructed in HL8 blend clear stone bedding with a "controlled settlement joint" as shown on the Standard Drawings (reference Standard Drawings KS-178 and KS-191).

C11.04 Connection to the Storm Sewer

The connection of the storm drain to the storm sewer shall be made by means of a manufactured tee on the storm sewer line for storm sewer sizes up to and including 450 mm, and by means of a saddle for storm sewer sizes in excess of 450 mm. As an alternate, with explicit approval of the Township, "Kor-N-Tee" connectors may be used for 150 mm and 200 m diameter storm drain connections.

C11.05 Storm Drain Materials

Storm drain connections shall be constructed of polyvinyl chloride (SDR 28) pipe. PVC pipe to be white in colour.

C11.06 Location and End Fitting

Storm drain connections shall be installed to the location as shown on the Township of King Standard Drawings.

Storm sewer service connections shall be installed with a 150 mm diameter PVC wye branch fitting and watertight cap at the street line for testing purposes. The service shall be extended 1.5 m into private property, and the end of the service shall be fitted with a manufactured watertight plug. Refer to Standard Drawing KS-177.

After construction, the end of the connection shall be marked by a suitable length of 50 mm x 100 mm lumber, extending from the obvert of the connection to a point 1.2 m above grade. The top of this marker shall be painted black.

C11.07 Connections for ICI Blocks

Since the ultimate development of a block within a new subdivision may be unknown at the time of the construction of the underground services, it may be desirable to delay the installation of the storm drain connections to the blocks in the Plan of Subdivision until further information is available (i.e., Site Plan approval).

If the block is developed prior to the placement of the surface course asphalt, then the service connection can be installed to the location required to suit the development. If no development proposals are received for the block at the time of the placement of the surface course asphalt, then the storm drain connections shall be installed to the locations shown on the approved Engineering Drawings prior to the placing of the surface course asphalt.

In either case, all trenches crossing the travelled portion of the roadway shall be backfilled with granular material thoroughly compacted, and the road base shall be restored.

C11.08 Decommissioning Existing Services

Existing storm service connections that are to be abandoned or replaced by services in a new location shall be excavated at the sewer main and capped. The cap shall be a permanent fitting of the same material and class as the service pipe and shall be watertight. Where applicable, the roadway excavation is to be backfilled with granular material and compacted to 100% standard proctor density. The road pavement material is to be restored to equal to or better than existing conditions and at least meeting the Township's minimum requirements for road pavement composition based on the road classification. The boulevard area around the excavation is to be backfilled to match the surrounding grades, provide for surface drainage and restored with topsoil and sod to the satisfaction of the Township.

C12.00 Construction

Construction of all storm sewers and appurtenances shall be in accordance with the Specifications and Standard Detail Drawings of the Township of King (or in their absence any OPS drawings and specifications) as exists at the time of approval of the design drawings by the Township.

SECTION D

Watermains and Appurtenances

Township of King
Design Criteria and Standard Detail Drawings

SECTION D Watermains and Appurtenances

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D1.00 General

D1.01 Jurisdiction

The Regional Municipality of York is responsible for the supply, treatment and storage of water for municipal water systems within the boundaries of the Corporation of the Township of King ("the Township").

The Township is responsible for the distribution of the treated water to the individual users.

The Township of King is licenced under the Safe Drinking Water Act, 2002, to operate drinking water systems within the Township. Proposed alterations or additions to the current drinking water system must be applied for through the Township. Further details can be found in Appendix 2.

All watermain design shall conform to the Ministry of Environment document "Watermain Design Criteria for Future Alterations Authorized Under a Drinking Water Works Permit", or latest amendment.

Any connection to a water system and the use of said water is also governed by By-law No. 2014-73, being "A by-law to regulate and control connections to and the use of water provided by the Township of King Drinking Water Systems", known as the Water Use By-law.

D1.02 Policy Requirements

It is a policy requirement of the Township to consider programs related to water demand and conservation in the Township and to work with York Region, Conservation Authorities and other public agencies to advance programs and educational initiatives that promote water conservation and water use efficiency. Also, to consider potential impacts from climate change when planning sewer and water services. Further, to work closely with York Region to plan sewer and water services to support growth within the horizon of this plan and to consider needs beyond the horizon of this Plan.

D2.00 Hydraulic Design

D2.01 General

All watermains shall be sized to meet the greater of the 'maximum day plus fire' flow or the 'maximum hour' demand.

Watermains in subdivisions shall have a minimum of two connections to the existing water network. The Township will require a computer analysis for all or any phased portion of the proposed watermain systems. The analysis shall be completed using **Infowater** software. The existing boundary conditions are to be verified by the Consultant by arranging for on-site hydrant flow tests with the approval of and in consultation with the Township.

D2.02 Fire Flows

The requirements for fire flows shall be discussed and agreed upon with the Township prior to proceeding with the detailed design.

In general, the fire flows for a particular area of the municipality shall be determined as outlined in "Water Supply for Fire Protection, A Guide to Recommend Practice", prepared by the Fire Underwriters Survey of the Insurance Bureau of Canada. In general, the minimum fire flow required shall be 7,000 L/min for low rise residential developments.

D2.03 System Pressures

The maximum sustained operating pressure shall not exceed 700 kPa (100 psi). If pressure in a localized area is above this level, a pressure-reducing valve shall be installed on each service connection within that area.

The normal operating pressure should be approximately 350 to 480 kPa (50 to 70 psi). Under normal conditions of maximum day demand, the pressure shall not drop below 275 kPa (40 psi) at any point in the water system.

Under conditions of simultaneous maximum day and fire flow demands, the pressure shall not drop below 140 kPa (20 psi) at any point in the water system.

D2.04 Friction Factors

The following Friction Factors or “C-factors” shall be used in the Hazen-Williams equation, for the design of water distribution systems regardless of pipe materials:

Table D-1: Watermain Friction Factors

Pipe Diameter (mm)	C-Factor
150	100
200 to 300	110
350 to 600	120
Over 600	130

The above C-factors represent long-term values. A C-factor of 140 shall be used to calculate maximum velocities for transient pressure estimations, or for checking pump motor sizes for runout conditions.

In evaluating existing systems for expansion, the C-factors shall be determined by actual field tests, wherever possible.

D2.05 Domestic Demand

Domestic water demand shall be calculated on the basis of an average day consumption rate of 370 L per capita per day.

Maximum day and peak hour factors shall be 2.0 and 2.75, respectively.

The following densities should be used for determining expected populations in residential developments:

- Single Detached Dwellings = 3.5 ppu
- Semi-Detached Dwellings = 3.5 ppu
- Townhouses = 2.9 ppu
- Apartments = 2.0 ppu

D2.06 Commercial, Industrial and Institutional Water Demands

A population equivalent of 86 persons per hectare shall be used for design purposes to estimate the water consumption for large commercial areas unless more specific data is available. Water consumption for commercial, industrial and institutional uses shall be calculated from the following table:

Table D-2: Water Consumption by Land Use

Use	Water Consumption
Commercial	28 m^3/ha/d
Industrial	28 m^3/ha/d
Institutional	18 m^3/ha/d

D3.00 Watermain Design

D3.01 Locations and Alignment

Watermains shall be located within the road allowances as shown on the Standard Drawing of the Township's roadway cross-sections. This location shall generally be on the north or east side of the street.

The minimum depth of cover shall be 1.8 m.

Changes in horizontal or vertical alignments shall be made with fittings not exceeding 45 degrees change in direction.

D3.02 Bedding and Backfill

Watermain bedding and cover material shall be per Standard Detail KS-801 consisting of crusher run limestone bedding and sand cover.

D3.03 Horizontal Separation Between Watermains and Sewers

MECP Guidelines state as follows:

Sewers/sewage works and watermains located parallel to each other shall be constructed in separate trenches maintaining a minimum clear horizontal separation distance of 2.5 m in accordance with the Procedure F-6-1: "Procedures to Govern the Separation of Sewers and Watermains", dated July 2021, as amended.

In cases where it is not practical to maintain separate trenches or the recommended horizontal separation distance cannot be achieved, the Ministry, in accordance with the above-noted procedure, may allow deviation from the separation requirements.

When it is not practical to maintain a separate trench and a minimum horizontal separation distance, the crown of the sewer should be at least 0.5 m (1.6 ft) below the invert of the watermain and separated by in-situ material or compacted backfill. Joints should be offset as much as possible between sewers and watermains.

Where this vertical separation cannot be obtained, the sewers should be constructed of watermain quality pipe, pressure tested in place at a pressure of 350 kPa (50 psi) without leakage in accordance with the OPSS 701. In rock trenches, drainage should be provided to minimize the effects of impounding surface water and/or the leakage from sewers in the trench.

D3.04 Watermain Crossing Sewers

MECP Guidelines state as follows:

Watermains should cross above sewers wherever possible. Whether the watermain is above or below the sewer, a minimum vertical distance of 0.5 m (1.6 ft) between the outside of the watermain and the outside of the sewer should be provided to allow for proper bedding and structural support of the watermain and sewer pipes. Sufficient structural support for the sewer pipes should be provided to prevent excessive deflection of the joints and settling. The length of water pipe should be centered at the point of crossing so that joints in the watermain will be equidistant and as far as possible from the sewer. The crossing should be perpendicular if possible. Design of watermain crossing sewers is governed by the following:

- MECP Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Future Alterations Authorized Under an Environmental Compliance Approval (May 2023).
- MECP F-6-1 Procedures to Govern Separation of Sewers and Watermains (July 2021).
- Section 15 of the MECP's Watermain Design Criteria for Future Alterations Authorized Under a Drinking Water Works Permit (June 2021).

When it is impossible to obtain proper horizontal and vertical separation as stipulated above, one of the following methods should be specified:

- The sewer should be designed and constructed equal to the water pipe and should be pressure tested at 350 kPa (50 psi) to assure water tightness.
- Either the watermain or the sewer line should be encased in a watertight carrier pipe which extends 3 m (10 ft) on both sides of the crossing, measured perpendicular to the watermain.

D3.05 Utility Crossings

Watermains crossing over or under other utilities shall be designed with a 200 mm minimum clear separation between the outside edges of the watermain and the utility.

D3.06 Dead-Ends

Wherever possible, the water distribution system shall be designed in grid patterns or looped to avoid dead-end sections.

Where dead-ends cannot be avoided, the following criteria will apply:

- Where watermain is located on a cul-de-sac the configuration of the dead end shall be as illustrated on Standard Drawing KS-877.
- Where watermain is located at the termination of a phase within an approved plan of subdivision, and the schedule for construction of subsequent phases are known to be

imminent, the watermain is to terminate with a temporary hydrant, preceded by a valve to facilitate the future extension of the watermain without disruption to the existing users.

- Where watermain is located at the termination of an approved Plan of Subdivision, and the schedule for construction of future adjacent developments are not known to be imminent, the watermain is to terminate with a metered automatic flushing devise, preceded by a valve. The flushing device is to be equipped with a positive outlet to either the storm or sanitary sewer when available, or to a surface outlet with adequate erosion protection, graded such that the discharge will not adversely affect adjacent lands or private property. Details of this system will be at the direction of the Township. The cost of all flushed water is to be borne by the Developer.
- Demonstration of water turnover rate not exceeding 24 hours.

D3.07 Minimum Sizes

For all watermains designed to carry fire flows, the following minimum sizing for watermains shall apply:

Table D-3: Minimum Watermain Size

Residential Areas	150 mm diameter
Commercial Areas	250 mm diameter
Industrial Areas	250 mm diameter*

*To be sized according to the anticipated water demand.

D3.08 Tracer Wires

A tracer wire shall be provided along the top of all Polyvinyl Chloride (PVC) and Concrete Pressure Pipe (CPP) watermains to permit future field tracing. These tracer wires shall be attached to the top of the watermain. Tracer wires shall be No. 12 gauge stranded copper (TWH), complete with plastic coating.

Tracer wire shall be connected to valves in chambers and the tracer wire is to be carefully extended along the bottom of the chamber, up the backside of the steps along the chamber wall and securely fastened to the top rung with fiberglass tape. The tracer wire is also to be connected to the bottom flange of all hydrants.

Tracer wire is to be continuous with no joints. Where joints are needed (between rolls) they are to be soldered together plus wrapped in dielectric tape over wrapped with vinyl tape.

Confirmation of the continuity of the tracer wire installation is to be provided in writing by the Owner’s Consulting Engineer as part of the commissioning of the watermain system.

D3.09 Thrust Restraint

Mechanical joint restraints are to be installed on bell and spigot joints for all watermains constructed in engineered fill material. All tees, horizontal bends, vertical bends, hydrants, end of mains and valves regardless of whether they are or are not located in engineered fill material. The use of concrete thrust blocks is generally discouraged, and they will only be permitted where deemed absolutely necessary by the Township.

Restrained joints and granular thrust blocks shall be used for all PVC watermains. The details and length of joint restraint shall be as specified on Standard Drawing KS-830.

Where conditions warrant, additional watermain restraints may be required. The Engineer may be required to provide calculations in support of the proposed restraint design and configuration.

Mechanical restraints are to be identified on all Plan and Profile Drawings.

All mechanical restraint systems shall be installed with cathodic protection as outlined in Section D7.00.

D4.00 Valving Requirements

D4.01 Type

Gate valves shall be used on all watermains 300 mm in diameter and smaller. All valves shall have mechanical joint ends and shall be wrapped in Denso tape. All valves shall have a non-rising stem and a 50 mm square operating nut opening counter-clockwise. Any valves deeper than 2.4 m require the operating nut to have a valve stem extension.

D4.02 Size

All valves shall be the same size as the connected watermain.

D4.03 Number, Location and Spacing

Two valves are required at a tee intersection and three valves are required at a cross intersection with the valves being located at a point where the streetline projected, intersects the watermain. All valve boxes shall be located in boulevards and out of pavement areas wherever possible. In no case shall a valve be located in a driveway.

Valve spacing along a watermain shall not exceed 300 m, and to permit the isolation of no more than 20 lots.

D4.04 Valve Boxes and Chambers

All valves shall be located within three-piece, sliding-type, size “D” valve boxes as per Standard Drawing KS-840.

Valves shall be placed in a chamber for any pipes being 300 mm diameter, or larger, as specified on Standard Drawing KS-841. The frame and cover shall be set flush to finished grade. The top of the roof slab of the chamber shall be at least 0.60 m below the profile of the finished pavement.

Wherever possible, chambers shall be provided with a connection to a storm sewer system (sewer, manhole or catchbasin). (Said connection shall be a 100 mm (min.) PVC or HDPE pipe.) Where a connection is not possible, the chamber is to be fully water-proofed, including all joints and adjustment rings.

All chambers are to have the tracer wire extend from the valve along the bottom of the chamber up the backside of the steps along the chamber wall and securely fastened to the top rung with fiberglass tape.

D4.05 Air Relief Valves

Air relief valves shall be installed at all significant high points of the water distribution system. Air relief valves shall be double-acting type, combination air release valve. Chambers are to be provided with drainage connections wherever possible.

Air relief valves shall be housed within a chamber as specified on Standard Drawing KS-843 and drained to storm sewers where possible. The chambers are to be equipped with “P” traps to prevent movement of gases.

D4.06 Drain Valves

Drain valves shall be located at the low points of all watermains 300 mm in diameter and greater. These valves shall be constructed in a separate chamber as illustrated in the Standard Detail Drawings. Chambers are to be provided with drainage connections or water-proofed as noted above.

D4.07 Water Meters, Back-Flow Prevention Valves and Chambers

Where specified, water meters and back-flow prevention valves shall be installed in chambers either separately or in combination in one chamber based on the watermain size, as noted in Standard Drawings KS-845, KS-846 and KS-847. Where noted, the installation shall include external by-pass piping with control valves and valve boxes. The valve chamber sizes noted on the Standard Drawings are guidelines only and are to be determined by the Design Engineer based on product dimensions, material specifications and manufacturers recommendations. Shop drawings signed and stamped by a Professional Engineer may be requested by the Township.

D5.00 Fire Protection

D5.01 General

All fire protection design requirements shall be reviewed with the Township at the preliminary design stage.

D5.02 Hydrant Spacing

Hydrants shall be installed on all watermains 150 mm in diameter and larger, and to provide full coverage (meaning coverage to the full extent of the lots or blocks within the plan) of the area based on the following maximum diameters:

- 150 m in residential areas (or to provide for a maximum hose length of 75 m).
- 75 m in industrial and commercial areas.

D5.03 Branch Valves and Boxes

All hydrants installed on watermains up to and including 300 mm in diameter shall be installed with a 150 mm diameter branch valve attached to the watermain with an anchor tee.

D5.04 Locations of Hydrants

Hydrants shall be located on the projection of a lot line and offset from the streetline in accordance with the standard cross-section.

Hydrants shall be located 3.0 m minimum distance from the edge of any driveway or house service connection and all above ground utilities such as light standards, transformers, street signs and boulevard trees.

D5.05 Type

All fire hydrants shall be equipped with 100 mm (4”) diameter “Storz” nozzle with the fitting facing the street. The side ports shall be 65 mm diameter (CSA thread) with caps. Hydrants are to be supplied with a hose nozzle cap chain and S-hook. All hydrants shall be equipped with a non-rising stem and shall open in a counter-clockwise direction.

The Township-approved fire hydrant is Mueller – Century.

All hydrants shall be installed in accordance with OPS specifications, have open drainage holes and be installed with mechanically restrained joints (without thrust blocks). The hydrant base is to be installed in open-graded granular material enclosed with a geotextile fabric to ensure free draining of the boot.

In areas of known high water, the hydrant drain holes shall be plugged and the Township shall be advised. This is to be reflected on the Record Drawings.

The hydrant is to be set at such a height that the distance from the finished ground around the hydrant to the bottom of the flange is between 75 mm and 150 mm.

All hydrants shall be fitted with anti-tampering devices of a type required by the Township (until so advised).

D5.06 Colour of Hydrants

The hydrant body shall be painted yellow using rust proof paint. The Storz cap (only) shall be painted black. The hydrant shall be demarked using pre-manufactured hydrant marker rings* to be installed on the side ports. These rings are to be colour coded in accordance with the NFPA 291 coding based on measured fire flows (as field tested). In addition, port caps and the hydrant bonnet are to be painted with the same NFPA colour code as the marker rings, which are as follows:

- Light Blue for Class AA (= / > 5,680 L/min or 1,500 gpm);
- Green for Class A (3,785 to 5,675 L/min or 1,000 to 1,499 gpm);
- Orange for Class B (1,900 to 3,789 L/min or 500 to 999 gpm); and,
- Red for Class C (< 1,900 L/min or 500 gpm).

*The Township is to be contacted for the purchase of the appropriate hydrant marker rings.

D5.07 Hydrant Flow Testing

All testing and commissioning procedures are to be as outlined in the Township's Water Commissioning Standards (see Appendix 2).

D6.00 Water Service Connections

D6.01 General

Individual service connections shall be installed to each lot, semi-detached unit or townhouse unit within the development. For service connection information for industrial, commercial and institutional properties also refer to Section K. For service connection information for infill residential development also refer to Section M.

D6.02 Material

Refer to Appendix 3 – Approved Materials List for approved products.

All water service connections 50 mm in diameter and smaller shall be constructed of cross-linked polyethylene (PEX) material manufactured to Copper Tube Size (CTS) or Type K soft copper water service pipe.

A continuous tracer wire shall be provided along all PEX services to permit field tracing of the services. In order to facilitate secure connections for the tracer wire, the main stops and curb stops shall be equipped with set screws. The tracer wire shall be connected to the set screw on the main stop and curb stop and shall extend up the curb stop to be accessible from the ground surface. The wire is to be taped to each service at intervals not to exceed 1.0 m. All tracing wires shall be 12 gauge, stranded copper wire complete with outer plastic coating.

PEX material shall be pressure rated to a minimum of 1,100 kPa (160 psi). Pipe shall be manufactured using the high pressure peroxide (Engel) method of cross linking in accordance with AWWA C 904, ASTM D3350 and a minimum degree of cross-linking of 80% in accordance with ASTM D 2765, Method B. Pipe to have a co-extruded UV Shield made from UV resistant high-density polyethylene, being blue in colour.

Pipe is to be certified to standards: ASTM F876, F877, F2023, CSA B137.5, NSF/ANSI 14 & 61.

Pipe connecting to AWWA C800 compression joint valves and fittings shall be installed using stainless steel support liners inside pipe at each connection according to manufacturer's specifications. No joints or connections are permitted under the roadway. The PEX pipe is to be installed in the trench with a slight sweep in the line to provide some flexibility for future movement.

Type K soft copper water services shall be manufactured to ASTM B88.

All water service connections 100 mm in diameter and larger shall be constructed of PVC piping, conforming to the requirements of Section D10.01.

Curb stops shall be installed with stainless steel cotter pins.

D6.03 Minimum Sizing

The following factors shall be used to determine the minimum size of service connections:

- The peak water consumption of the building to be serviced;
- The total length of service that will be required to reach the building;
- The elevation of the building with respect to the elevation of the watermain;
- The available head in the watermain;
- The loss of head in the service connection;
- The required head at the point of water usage; and,
- Fixture counts per OBC.

Regardless of the above, the minimum size of service connection to be provided for a single-family residence is as follows:

- Units located less than 30 m from the supply main shall be 25 mm in diameter.
- Units located 30 m or more from the supply main or larger homes shall be sized based on the applicable calculations.

D6.04 Location and Alignment

Water service connections shall be installed to the mid-point of the frontage of all single-family lots as shown on the Standard Drawings. In no case shall the service be located so that the curb stop is located within the driveway. In any case, where the final house siting and driveway results in impacts to the curb stop, the entire water service shall be re-located to the satisfaction of the Township. (Frost collars are not permitted.)

The location of water service connections for semi-detached lots shall be as shown on the Standard Drawings to avoid locating the service under driveways.

The location shall be shown on all Plan and Profile Drawings and Composite Utility Plans.

Water services shall be placed perpendicular from the watermain to the curb stop or control valve location.

The minimum cover on water services shall be 1.8 m.

D6.05 Connections to Supply Main

Main stops shall be installed on watermains while the main has been charged and is at operating pressure. Water service connections 50 mm in diameter and smaller may be tapped into the supply main, with the following restrictions:

- For ductile iron watermains, a stainless-steel saddle shall be used for all 38 mm to 50 mm connections.
- For PVC watermains, a stainless-steel saddle shall be used for all connections.

D6.06 Location of Curb Stop or Control Valve

The curb stop on all water service connections 50 mm in diameter and less shall be located on Township property at the street limit, a minimum of 0.60 m from the outer edge of a driveway, as shown on the Standard Drawing. Curb stops are to be located clear of any permanent landscaping features or trees.

The control valve on water service connections 100 mm in diameter and larger shall be located at the supply main, with the valve secured to the supply main by means of anchor tees, flanged fittings or approved restraining tie-rods, as illustrated on Standard Drawing KS-840.

D6.07 Commercial and Industrial Connections

Refer to Design Criteria Section K6.0.

D6.08 Decommissioning Existing Services

Existing water service connections that are to be abandoned or replaced by services in a new location shall be decommissioned by cutting and capping at the main. The localized excavations in the roadway shall be backfilled with unshrinkable fill and the roadway pavement shall be restored to the Township standards. Any curb sections that were removed or damaged sections of curb are to be replaced.

D7.00 Corrosion Protection

D7.01 General

All ferrous watermains, ferrous fittings and tracer wires water service connections shall have corrosion protection provided by means of sacrificial anodes.

D7.02 Tracer Wires

Cathodic protection shall be provided for all tracer wires on PVC and CPP watermains. One 2.3 kg zinc anode is to be installed for every 500 m of tracer wire, as per the Standard Drawings. The location for the anodes shall be shown on the Construction Drawings.

D7.03 Service Connections

One 2.3 kg zinc anode is to be installed on each copper service connection. If the service is connected to a ferrous watermain, an insulated main stop must be used. Also, an insulated fitting shall be installed between the curb and the street line if the building being serviced is located 7.6 m or more from the property line.

D7.04 Valves, Hydrants and Fittings on Non-Ferrous Watermains

One 2.3 kg zinc anode is to be installed on every valve, hydrant and fitting connected to a non-ferrous watermain.

Fittings shall include bends, tees, crosses, sleeves, reducers, plugs, caps, joint restrainers and couplings, etc.

All thermite weld connections shall be coated with Roybond 747 Primer and Royston “Handy Cap”, or approved equal.

Alternatively, mechanical joint fittings may be cathodically protected by installing 175 g “Protector Caps”, or approved equal, on each mechanical joint bolt.

D7.05 Valves, Hydrants and Fittings on Ferrous Watermains

All valves and fittings installed on ferrous watermains shall be cathodically protected by a 14.5 kg magnesium anode.

Bonding cables shall be provided on each side of the fitting to the existing watermain.

Bonding cables shall be No. 6, seven-strand, coated copper wire, connected to the fittings and watermain by a thermite weld (Cad weld).

All thermite weld connections shall be coated with Roybond 747 Primer and Royston “Handy Cap” or approved equal.

D7.06 Connecting Non-Ferrous Watermains to Ferrous Watermains

When connecting a non-ferrous watermain to a ferrous watermain, the ferrous watermain shall be cathodically protected by a 14.5 kg magnesium anode.

D8.00 Testing Requirements

All testing and commissioning procedures are to be as outlined in the Water Commissioning requirements of the Township (see Appendix 2), which may be amended from time to time.

D9.00 Watermain Material

D9.01 Watermain Pipes

Watermain pipe up to and including 300 mm diameter shall be Polyvinyl Chloride (PVC) pipe, manufactured in accordance with the latest edition of AWWA C900. A minimum Class 150 pipe shall be used. This corresponds to the maximum allowable working pressure (operating pressure) to which the pipe can be subjected.

Fittings shall be of cast iron or ductile iron, cement-lined and shall be manufactured to AWWA C110. All fittings shall be supplied with mechanical joint ends.

Refer to Appendix 3 – Approved Materials List for approved products.

D9.02 Sampling Stations

Water sampling stations will be required where directed by the Township and be constructed as per the approved Standard Drawing and/or Specification.

SECTION E

Sanitary Sewers and Appurtenances

Township of King
Design Criteria and Standard Detail Drawings

SECTION E Sanitary Sewers and Appurtenances

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E1.00 Jurisdiction

The responsibility for the treatment of sanitary wastes in municipally-operated sewage treatment plants rests with the Regional Municipality of York.

The Corporation of the Township of King (“the Township”) is responsible for the local sewage collection works.

Prior to the commencement of any design for any sanitary sewage works within the Township, the Applicant shall obtain confirmation from York Region that adequate treatment plant capacity is available for the development proposed.

E2.00 Township of King Sanitary Sewer System CLI-ECA

The Township regulates its sanitary sewer collection infrastructure through the Consolidated Linear Infrastructure Environmental Compliance Certificate (CLI-ECA) issued to the municipality by the MECP. New, altered or re-constructed services are to be designed, constructed, certified and documented in accordance with the requirements of the CLI-ECA. Proponents are to review the CLI-ECA to ensure the “additional approved works” being applied for approval from the Township are in compliance with the CLI-ECA regulation. Township may from time to time amend these Design Criteria to ensure compatibility of designs with the CLI-ECA.

E3.00 Hydraulic Design

E3.01 Sanitary Sewer Network and Drainage Plan

The grading of the development application and layout of the sanitary sewer system is to avoid sewers in excess of 6.0 m deep. The plan is also to avoid the need for local sanitary pumping stations and forcemains. The Township will only accept the addition of sanitary pumping stations when technical or physical conditions prevent conveyance to an existing outlet by gravity.

The sanitary drainage plan shall be prepared to a scale suitable to show all the tributary areas that are being used to determine the design flows. For each sub-catchment, the plan shall indicate the land use, area and population. Where lotting is not known, population density shall be shown.

The design flow, in each maintenance hole length of sewer, shall be computed on the standard sanitary sewer design sheets (refer to Appendix 6), as so stipulated by the Township. For each area entered on the design sheet, the maintenance hole numbers, size and grade of the sewers, and the number of the detailed plan and profile for each section of the sanitary sewer shall also be shown.

E3.02 Residential Sewage Flows

The following Harmon formula shall be used to calculate the sewage flow for residential areas:

$$Q(d) = \frac{PqM}{86.4} + IA$$

where,

$Q\,(d)$	=	Peak domestic flow plus extraneous flows, in L/s
P	=	Design population, in thousands
q	=	Average daily per capita flow, in L/cap/d
M	=	Peaking factor
I	=	Unit of peak extraneous flow, in L/s/ha
A	=	Gross tributary area, in hectares

An average daily per capita flow of 370 L/cap/d shall be used.

See Section E3.06 for peak extraneous flow rates. For Residential Development the peaking factor shall be calculated based on the Harmon formula,

$$M = 1 + \frac{14}{4 + \sqrt{P}}$$

where,

P = population, in thousands
Maximum $M - 4.0$
Minimum $M - 2.0$

The design population shall be derived from the drainage area and expected maximum population over a design period of 20 years or as directed by the Township. Future land use and population shall be based on the approved Official Plan and Secondary Plans of the area. For areas where the lands are zoned for specific residential use but detailed planning information is not available, the following population densities shall apply:

Table E-1: Population Densities per Hectare if Planning Information is not Available

Type of Housing		Persons/Hectare
Single-family Dwelling		60
Semi-detached and Duplex		100
Townhouse		125
Apartment	Low Density (62 u/ha)	150
	Medium-Low Density (86 u/ha)	210
	Medium Density (124 u/ha)	300
	High Density (274 u/ha)	600

These population density figures are to be utilized for sewer design purposes and not for population density calculations.

When the number and type of housing units within a proposed development are known, the calculation of population for the proposed development shall be based on the following:

Table E-2: Population Densities per Residential Unit

Type of Housing	Persons/Unit
Single and Semi-Detached	3.5
Townhouse	2.9
Apartment	2.0

Future land use and population shall be based on the approved Official Plan and Secondary Plans of the area.

E3.03 Commercial Sewage Flows

A minimum allowance for average commercial flows to be used for the design of all local sewers shall be 65 m^3/ha/day inclusive of peaking effort. Actual dry weather and wet weather flow monitoring data for a minimum period of two years at the subject site or a similar site observed locally (including with a locally installed rain gauge) may be compiled, analyzed and submitted

to the Township by the applicant. The Township in its sole discretion, will determine if the data may represent alternative design criteria for a particular site or service area.

The area shall be based on the gross development area included in the commercial block.

E3.04 Industrial Sewage Flows

The Township of King, through its planning policies encourages the establishment of only those industries which have low sewage requirements (dry industries). The area shall be based on the gross development area included in the industrial block.

Where historical data is not available from a comparable site which has been monitored for at least two years, a design flow of 35 m^3/ha/day for light industry and 55 m^3/ha/day for heavy industry shall be used.

For industrial development, the peaking factor to be applied to average flow rates shall be calculated as follows:

$$M_i = 6.6604 \times A^{-0.1992}$$

where,

M_i = industrial peaking factor

A = gross lot area (ha)

E3.05 Institutional and Schools Sewage Flows

An average design flow of 65 m^3/ha/day inclusive of peaking effort shall be used for the design of all local sewers.

The area shall be calculated using the gross area included in the school or institutional site.

E3.06 Extraneous Flows

The peak extraneous flow shall be 0.26 L/s/ha. Also, higher extraneous flow design values may be directed by the Township or the Region of York based on flow monitoring and/or I&I studies.

Measures are to be implemented to mitigate all extraneous flows into the sanitary sewer system as outlined in the Township's sanitary sewer design and construction requirements. Reference should also be made to the document "Inflow and Infiltration Reduction Standard for Sewers Servicing New Development (February 2022)", as amended, prepared by the Region of York. Flow monitoring may be required at the discretion of the Township if deemed necessary to verify infiltration and inflow (I/I) are within acceptable levels.

E4.00 Sanitary Sewer Design

E4.01 Location

All sanitary sewers shall be located as shown on the typical Township of King roadway cross-sections. In general this location is 1.5 m north or east of the centerline of the road allowance.

All sanitary sewers are to have a minimum horizontal separation of 2.5 m and a vertical clearance of 0.5 m from watermains in accordance with MECP Regulations.

E4.02 Pipe Capacities

Manning's formula shall be used in determining the capacity of sewers.

$$Q = \frac{1000AR^{2/3}S^{1/2}}{n} \qquad V = \frac{R^{2/3}S^{1/2}}{n}$$

where "Q" is in litres/second, "V" is in metres/second, "R" is in metres, "S" is in metres/metre, and "A" is in square metres.

The roughness coefficient "n" shall be 0.013 for all types of sewers.

Table E-1 provides the allowable sanitary sewer capacities and gradients. This table shall be used to determine the maximum and minimum slopes for sanitary sewers. Although the Manning's formula is to be used as a basis for sewer design, the values listed in Table E-1 will supersede the results of Manning's calculations, where applicable. In the case of partial pipe flow, the actual velocity is to be checked against the minimum allowable velocity at the design flow rate.

Table E-3: Allowable Sanitary Sewer Capacities and Gradients

Diameter (mm)	Q Max (m^3/s)	Slope Min (%)	Slope Critical (%)	Slope Max (%)
200	0.042	0.50	1.54	8.2
250	0.074	0.50	1.43	6.1
300	0.12	0.50	1.34	4.8
375	0.20	0.50	1.25	3.5
450	0.32	0.50	1.17	2.8

E4.03 Flow Velocities

Minimum acceptable velocity = 0.6 m/s

Maximum acceptable velocity = 3.0 m/s

The above velocities are to be based on the “actual” design values (not full pipe values).

In certain circumstances, such as rehabilitation/replacement of an existing sewer where deepening of individual sewer section will not be possible, design flow velocities of less than 0.6 m/s may be considered provided that appropriate measures are taken to facilitate maintenance requirements.

E4.04 Minimum Size

The minimum allowable size for a sanitary sewer shall be 200 mm in diameter. The minimum velocity criteria noted above at the actual flow rate should be met.

E4.05 Minimum and Maximum Grades

The absolute minimum and maximum grades for sanitary sewers shall be in accordance with Table E-1 subject to achieving minimum acceptable velocity at the actual flow. The minimum grade for the first upstream leg shall not be less than 1.0%. The maximum grade for the first upstream leg shall not be greater than 2.0% unless the sewer is to be extended in the future. Notwithstanding the absolute minimum grades acceptable, a typical minimum grade of 1.0% should be provided unless the site grading and velocity warrants otherwise.

E4.06 Minimum and Maximum Depths

The depth of the sewer shall be measured from the final centreline finished road elevation to the top of the sanitary sewer. The minimum depths of sewers for residential, commercial and institutional areas shall be 2.75 m. For industrial areas, the minimum depth shall be 2.15 m. In all instances, the proposed sanitary sewer shall be installed at a depth sufficient to also service lands external to the site as determined by the Township.

The maximum depth of sewers with direct lateral connections shall be 6.0 m (measured from finished centerline of road elevation to invert of sewer) unless otherwise approved by the Township. In cases where deeper sewers are required these shall be considered trunk sewers and no direct lateral connections will be permitted. Separate local sewers constructed above and adjacent to the trunk sewers will be required for connection of service laterals. Maintenance holes are to be provided as common connection points for local and trunk sewers constructed with external drop structures. Details regarding drop structure requirements are provided in the Sanitary Maintenance Hole standards.

E4.07 Curved Sewers

The use of radius pipe or deflected pipe is not permitted.

E4.08 Termination Points

All sewers shall be terminated at the subdivision limits when external service areas are being considered in the design with suitable provision in the design of the terminal maintenance holes to allow for future extension of the sewer.

Where external areas are not included in the sewer design, the sewer shall extend at least halfway across the frontage and or flankage of the last lot or block in the subdivision.

E4.09 Sewer and Watermain Crossings

All crossings are to be completed in accordance with MECP guidelines.

E4.10 Changes in Pipe Size

No decrease of pipe size from a larger size upstream to a smaller size downstream will be allowed regardless of the increase in grade.

E4.11 Pipe and Pipe Fitting Materials

Sanitary sewers up to and including 375 mm diameter shall be constructed of Polyvinyl Chloride (PVC) SDR 35 pipe.

Externally ribbed pipe products will not be permitted.

PVC pipe shall conform with ASTM D3034/F679 and certified to CSA specification CSA B182.2 or latest revisions thereof. PVC sanitary sewer shall be green in colour.

PVC fittings shall be heavy wall SDR 26 gasketted fittings and comply with ASTM D3034/F1336 and certified to CSA B182.2. Moulded fittings shall be injection moulded and meet ASTM D1784. Moulded fitting gaskets shall comply with ASTM F913 or F477.

Pipes greater than 375 mm diameter shall be reinforced concrete pipe conforming to OPSS.MUNI 820 and CSA Specification A275-2-M1982 or latest revision thereof, Class 50-D, 65-D, 100-D or 140-D, as required.

All sanitary sewers and fittings shall have watertight joints.

The type and classification of all sanitary sewer pipe and the sewer bedding type shall be clearly indicated on all Profile Drawings for each sewer length.

E4.12 Pipe Bedding and Sewer Trench Plugs

The class of pipe and the type of bedding shall be selected to suit loading and proposed construction conditions. The recommendations of a Geotechnical Engineer will be required in determining the strength of pipe and class of bedding required and the recommended construction methods.

Details and types of bedding and backfill are illustrated in KS-181 for flexible pipe and 802.030 for rigid pipe. For flexible pipe, sand cover shall be placed to a minimum depth of 300 mm above the top of pipe before the placement of backfill material. The following bedding materials may be considered as a minimum for specification by the Geotechnical Engineer and shall be placed from a minimum 150 mm below the bottom of the pipe to the top of the pipe.

- Granular 'A' conforming to OPSS.MUNI 1010.
- 19 mm Crusher Run Limestone conforming to OPSS.MUNI 1010 Granular 'A' Specification Table 2.
- 19 mm Type 2 Clear Limestone conforming to OPSS.MUNI 1004 100% crushed and fully wrapped in filter cloth per Terrafix 270R or approved equal (placed under Granular 'A' or 19 mm Crusher Run Limestone for water bearing sand and silt).
- HL6 Limestone conforming to CSA S6 latest edition Table 7.9.

The width of the trench at the top of the pipe must be carefully controlled to ensure that the maximum trench width is not exceeded unless a higher class of bedding or higher strength pipe is used.

The Geotechnical Engineer shall also provide recommendations regarding the placement of Sewer Trench Plugs based on the prevailing soil and groundwater conditions. Trench plugs may consist of a bentonite mixture or suitable native clay material. Where static groundwater levels are greater than 1.0 m above the average sanitary sewer obvert elevation, trench plugs shall be placed no greater than 80 m apart. Trench plugs shall be constructed in accordance with the Region's Standard Drawing I&I-105.

E5.00 Maintenance Holes

E5.01 Location

Maintenance holes shall be located at each change in alignment, grade or pipe material, at all pipe junctions, and at intervals along the pipe to permit entry for inspection and maintenance of the sewer.

Maintenance holes located at road low points or within 1 m of the curb face require measures to reduce stormwater inflow from the surface.

Maintenance holes shall be located outside of floodplains. If it is not possible, the finishing elevation (i.e., top of frame and cover) shall be raised above York Region's 25 year design storm flood elevation. Maintenance holes located within the flood plain shall be fully sealed and waterproofed, have a waterproof bolt down cover installed. Each precast concrete structure riser section shall be fastened to one another using steel straps in accordance with York Region Standard Drawing I&I-111. The number of steel straps and their locations and orientation within each maintenance hole shall be determined by a structural Professional Engineer.

E5.02 Maximum Spacing

Maximum maintenance hole spacing identified in the following table may be increased for a sanitary sewer segment to extend the location of a maintenance hole outside of a floodplain.

Table E-4: Maximum Maintenance Hole Spacing

Pipe Size (mm)	Maximum Spacing (m)
Up to and including 450	110
525 to 750	125
750 to 1,650	150

E5.03 Maintenance Hole Design and Construction

The most current revision of the Ontario Provincial Standard (OPS) Maintenance Hole Specifications and Drawings shall be used for maintenance hole design, where applicable. In all cases where the Standard Drawings are not applicable, the maintenance holes shall be individually designed and detailed on the drawings signed and stamped by a structural Professional Engineer. A reference shall be made on all Profile Drawings to indicate the type and size of all sanitary maintenance holes.

a) Maintenance holes shall be constructed of precast concrete with a monolithic base conforming to CSA A257.4-M1982. Maintenance holes are to be gasketed as per OPSS 1351 and CSA 257.3.

b) Maintenance holes are to be watertight per the Region of York specifications and details contained in the document “Inflow and Infiltration Reduction Standard for Sewers Servicing New Development (February 2022)” or as amended. The following design and construction requirements apply:

c) Waterproof the exterior structure sections from 0.5 m above to 0.5 m below the joint in each section where groundwater pressure on the structure is less than 85 kPa (12.3 psi) or the seasonally high groundwater table is less than 0.6 m above the top of the deepest connecting sewer.

d) Waterproof the entire exterior of the structure where groundwater pressure on the structure is greater than 85 kPa (12.3 psi) or the seasonally high groundwater table is greater than 0.6 m above the top of the deepest connecting sewer, per Region of York Standard I&I-104.

e) The waterproofing requirements including surface preparation, priming if required, waterproofing membrane and protection board materials and installation and backfilling shall be as specified in the Region of York documentation noted above for the reduction in sewer inflow and infiltration.

f) All lifting hooks in precast concrete sections are to be filled with non-shrink mortar mix.

g) Flexible sewer pipe connections to maintenance holes shall be made with watertight factory installed resilient connectors as noted in Standard Drawing I&I-106A. Rigid sewer pipe connection to maintenance holes shall be made with a resilient connector where pipe sizes permit, or use of a core and seal boot with mortared annular spaces and a waterproof membrane as noted in Standard Drawing I&I 106-B.

h) All maintenance hole access openings shall be located on the side of the structure parallel to the flow for straight runs or on the upstream side of the structure at all junctions.

i) The structure shall be centred on the sanitary sewer main.

j) The maximum change in the direction of flow in any structure shall be 90 degrees. A change of flow direction at acute interior angles shall not be permitted.

k) Whenever feasible, sewer systems shall be designed to avoid the use of drop structures.

l) If the design of the sewer system is such that the difference in elevation between the inlet and outlet sewers exceeds 0.61 m, then an external drop structure in accordance with York Region Standard Drawings I&I-107A and I&I-107B will be required. A maximum difference in elevation of 0.61 m will be allowed only if the design of the sewer cannot be modified to reduce the drop.

m) External drop structures are also to be provided where every new local sewer connects to maintenance hole above a new trunk sewer installed at depths greater than 6.0 m. The external drop pipe is to connect with a manufactured tee to the trunk sewer outside of the maintenance hole and not outlet directly into the structure at a lower elevation.

n) Internal drop connections in accordance with York Region Standard Drawing I&I-109 may be used for connecting local sewers to existing trunk sewer maintenance holes where internal dimensions permit unobstructed access for inspection, maintenance and monitoring. Sufficient space must be available for access with confined space equipment. Only one internal drop connection will be permitted to a maintenance hole.

o) The obvert(s) on the upstream side of a maintenance hole shall in no case be lower than the obvert(s) on the downstream side of the maintenance hole.

p) All maintenance holes shall be benched as detailed on the applicable OPSD. When any dimension of a maintenance hole exceeds those on the Standard Drawings, the maintenance hole must be individually designed and detailed.

q) Safety gratings shall be required in all maintenance holes greater than 5.0 m in depth. Safety gratings shall not be more than 4.5 m apart and shall be constructed in accordance with the Standard Drawings. Whenever practical, a safety grating shall be located 0.5 m above the drop structure inlet pipe.

E5.04 Head Losses

Suitable drops shall be provided across all maintenance holes to compensate for the loss in energy due to the change in flow velocity and for the difference in the depth of flow in the sewers. When pipe size does not change through a maintenance hole and the upstream flow velocity does not exceed 1.5 m/s, the following minimum invert drops across the maintenance hole shall be made to compensate for hydraulic losses:

Table E-5: Minimum Drop Across Sanitary Maintenance Holes

Alignment Change	Drop Required
Straight run	0.03 m
15 to 45 degrees	0.05 m
46 to 90 degrees	0.08 m

For all junction and transition maintenance holes, the drop required shall be calculated using the standard calculation sheet, “Hydraulic Calculations for Maintenance Holes” found in the MECP Design guidelines. To reduce the amount of drop required, the Designer shall restrict the change in velocity between the inlet and outlet pipes to 0.6 m/s. Where there is a proposed change in velocity greater than 0.6 m/s, hydraulic calculations are to be submitted.

E5.05 Maintenance Hole Frame and Covers

All maintenance hole covers shall be per OPSD 401.010, Type A (Closed) modified with a single lift hole in lieu of two lift holes, except where specified otherwise. All covers for maintenance holes located floodplains shall be watertight lids with external lifting apertures (per OPSD 401.030 or equivalent). All frames and covers shall comply with OPSS1850 and CSA-B70.1-03. Long sections of pipe having watertight lids should be avoided to allow for proper venting or extended venting shall be provided in these cases.

All maintenance hole adjustment rings shall be mortared between all rings and from the outside of the structure and waterproofed with a membrane from the underside of the frame to the top precast section and protected with a geo-composite protection board prior backfilling.

All maintenance holes located within the travelled portion of the roadway shall have the rim elevation initially set flush with the base course asphalt. A maximum of 300 mm height of modular rings shall be permitted on all maintenance holes in new subdivisions. No concrete shall extend over the edge of the maintenance hole. Prior to the placement of the final course asphalt, the maintenance hole frame shall be adjusted to suit the final surface asphalt elevation.

E6.00 Sanitary Service Connection

E6.01 General

All sanitary sewer connections for single, semi-detached and townhouse lots shall be made with single service pipes and shall conform to Ontario Provincial Specifications. Any changes in vertical or horizontal alignment of the service are to be made with long radius sweep bends. The sewer connection shall extend 1.5 m inside of the property line and terminate with a watertight cap. The pipe is to be green in colour and marked with a 50 mm x 100 mm wood stake extending from the pipe invert to 1.2 m above the ground surface and painted green.

E6.02 Location

The locations of sanitary service connections to single family and semi-detached residential lots shall be in accordance with those specified on Standard Drawings KS-175 and KS-176, respectively. The locations of service connections to townhouse blocks shall be in accordance with Standard Drawing KS-179.

In cases where lot frontage widths allow, or as directed by the Township, service connections shall be located outside of driveways and include the installation of surface clean-outs as noted in Section E6.07. Sanitary services would take precedence over storm services to be located outside of driveways at the street line.

The location of service connections for condominium residential, apartments, industrial, commercial and institutional blocks shall be site specific and assessed during the design process. The service locations to all lots and blocks within the development shall be shown on the Plan and Profile Drawings.

E6.03 Size

Service connections for single, semi-detached and townhouse units shall be 125 mm in diameter.

Service connections for multiple family and other blocks, commercial, institutional and industrial areas shall be sized individually, according to the intended use.

E6.04 Connecting Services to the Sanitary Sewer

As noted above regarding the maximum depth of sewer mains, direct service connections are not to be made to sewer mains which are in excess of 6.0 m below the centerline of road. Where sewers are in excess of 6.0 m in depth to service other areas, a local sanitary sewer at a shallower depth is to be provided.

The connection to new PVC sewer mains shall be made with an approved manufactured tee. Connections to new concrete mains are to be made with factory installed resilient adaptors. The invert elevation of the service shall not be lower than the springline of the sewer main.

Where a service connection is to be made to an existing PVC sewer main, a manufactured tee is required. Connections to existing concrete sewer mains are to have field installed resilient adaptors or “Kor-N-Tee” connectors. Connections to an existing ABS pipe are to be made with a solvent welded saddle. Any alternative saddle connections to existing sewers require specific approval from the Township.

No service connection of a size greater than one-half the diameter of the main sewer shall be cut into the main sewer; however, a 125 mm or 150 mm service connection will be permitted to connect to a 200 mm or 250 mm main sewer (provided an approved manufactured tee is installed and provided the invert of the service connection is above the spring line of the main sewer).

Otherwise, connections to maintenance holes will only be permitted under the following conditions:

- At the intersection of a service connection which has a size greater than half the diameter of the main sewer.
- At termination points including subdivision entrances and cul-de-sacs.

A maximum of two connections per maintenance hole will be permitted. Any connection directly to a maintenance hole must be pre-cored and shall be made with a manufacturer installed watertight, resilient connector.

E6.05 Service Depth at the Property Line

The depth of the service connections for single family units and semi-detached units at the property line, measured from the final centreline road elevation to the service invert shall be a minimum of 2.5 m and a maximum of 3.0 m.

A near-vertical riser section is required where the crown of the sewer is greater than 3.5 m up to and including 4.5 m below the centerline of road. Where the crown of the sewer is greater than 4.5 m up to and including 6.0 m below the centerline of road, the riser portion is to include a “controlled settlement joint” conforming to CSA B182.2 and ASTM D3034 to compensate for settlement and reduce vertical loads on the mainline sewer tee. The riser configurations are to be in accordance with Standard Drawing KS-191.

Bend fittings shall consist of sweep bends where shown on the Standard Drawings from the mainline tee to the property line to meet the maximum and minimum slope requirements shown on the Standard Drawings.

E6.06 Grade

The minimum and maximum grades for sanitary sewer service connections shall be in accordance to Standard Drawing KS-190 and as follows:

Table E-6: Grades for Sanitary Sewer Connections

Size of Connection (mm)	Minimum Grade (%)	Maximum Grade (%)
125	2	8
150	2	6
200	1	6

E6.07 End Fittings and Surface Cleanouts

All domestic sanitary service connections shall be installed with a 125 mm x 100 mm diameter PVC wye branch fitting at the street line for testing purposes. A watertight 100 mm diameter cap shall be installed on the branch line. The service shall be extended 1.5 m into private property, and the end of the service shall be fitted with a manufactured watertight plug. Refer to Standard Drawing KS-190.

Only where required by the Township and where sanitary services may be located outside of driveways or roadways, a 100 mm diameter PVC vertical pipe shall be installed on the wye branch fitting within the road allowance at the street line to provide a surface cleanout. The top of the cleanout shall be flush with the finished grade and fitted with a cast iron square cap rated for heavy duty external use. Refer to Standard Drawings KS-193 and KS-194.

The end of the service plug shall be marked by a suitable length of 50 mm x 100 mm lumber, extending from the obvert of the connection to a point 1.2 m above grade. The top of this marker shall be painted green.

E6.08 Connections to Development Blocks

The configuration of services to condominium residential, apartments, industrial, commercial and institutional blocks shall be determined on a site specific and assessed during the design process. An inspection maintenance hole shall be constructed on private property (1.5 m from property line to centre of rim) on all connections to these land uses.

E6.09 Decommissioning Existing Services

Existing sanitary service connections that are to be abandoned or replaced by services in a new location shall be decommissioned by cutting and capping the service at the sewer main. The cap shall be a permanent fitting of the same material and class as the service pipe shall be watertight. Excavations in the roadway shall be backfilled with unshrinkable fill and the roadway pavement shall be restored to the Township standards. Any disturbed areas in the boulevard

are to be backfilled to match the surrounding grades, provide for surface drainage and restored with topsoil and sod to the satisfaction of the Township.

E6.10 Service Connection Materials and Pipe Bedding

For single-family, semi-detached and townhouse lots, the service connections including sweep bend fittings shall be PVC (SDR 28) bell and spigotted pipe conforming to CSA Specification B182.2 for extra strength pipe with gasketed joints, or latest revision thereof and green in colour.

Service connection bedding shall consist of 19 mm crusher run limestone or Granular A bedding to the top of the pipe and 300 mm depth of sand cover above the pipe in accordance with Standard Drawing KS-180.

E7.00 Sanitary Sewer System Inspection and Testing

The inspection, testing, reporting and certification of a new sanitary sewer system is to be carried out as required in the Region of York "I&I Reduction Standard for Sewers Servicing New Development" (February 2022), as amended. The most current version of this standards report is to be obtained by the Consulting Engineer at the following location:

https://www.york.ca/environment/water-and-wastewater/inflow-and-infiltration

Appendix D of the most current version of this Region of York standards document contains inspection forms which are to be used to record the inspections and testing in the Township. The forms are to be completed by the Consulting Engineer and submitted to the Township. These include:

- Maintenance hole inspection report;
- Service connection inspection report; and,
- Maintenance hole, mainline sewer and service connection leakage testing report.

In new developments, the Developer is responsible to arrange for sewer preparation, inspection, all testing, reporting and evaluation of the results of the inspection. Digital files including CCTV videos and supporting reports are to be submitted electronically to the Township.

The sewer system is not to be put in service without completion of the required testing, repair of any defects or deficiencies and certification of the works. The Developer's Engineering Consultant and the Town's representative are to witness the performed tests. The Developer's Consultant is to review and approve final testing reports and certify that all deficiencies have been corrected prior to requesting the release of Building Permits and prior to requesting assumption by the Township. The following summarizes the typical tests involved; however, the Developer's Consultant is responsible to meet all obligations outlined in the most current Region of York sewer testing documentation.

a) Mandrell testing (deflection testing).

b) Maintenance hole visual inspections and where directed, further tested by a water exfiltration test, water infiltration test, negative air vacuum test and/or chimney seal leakage test.

c) Mainline Sewer

Testing and inspection of the mainline sewer (standard gravity PVC pipe and PVC pressure pipe) shall be completed and certified by the Professional Engineer as follows:

- **1st Inspection – Prior to Building Permit Issuance:**

  - Low pressure air exfiltration testing.
  - Closed circuit television (CCTV) inspection.
- **2nd Inspection – Prior to Occupancy (Prior to Top Asphalt):**
  - No additional testing required unless deficiencies are identified during earlier inspections.
- **3rd Inspection – Prior to Final Acceptance (Assumption):**
  - Sewer flushing and CCTV inspection of mainline sewers.

d) Service Connections

Testing and inspection of service connections (from sewer main to street line and from street line to building face) shall be completed and certified by the Professional Engineer as follows:

- **1st Inspection – Prior to Building Permit Issuance:**
  - No testing required.
- **2nd Inspection – Prior to Occupancy (Prior to Top Asphalt):**
  - Closed circuit television (CCTV) inspection
  - Low pressure air exfiltration testing.
  - Testing to cover **100% of laterals**.
  - Inspection direction: **House to Main**.
- **3rd Inspection – Prior to Final Acceptance (Assumption):**
  - Closed circuit television (CCTV) inspection of **100% of laterals**.
  - Inspection direction: **Main to Cleanout / Backwater Valve**.

e) Flow Monitoring

- Flow monitoring may be required at the discretion of the Township to confirm that infiltration and inflow (I/I) quantities are within acceptable limits.

E8.00 Sewage Pumping Stations

Sewage pumping stations shall be planned and designed in accordance with the requirements included in Appendix 5, where the Township approves the use of a local sanitary pumping station to service a development area.

The property and site plan requirements for a sewage pumping station are to be determined prior to Draft Plan approval. The type of pumping station is to be assessed and submitted to the Township for approval. A functional design is to be prepared, including identifying the site layout and configuration requirements. Detailed design is to meet the requirements of Part B of Appendix 5.

E9.00 Servicing Implementation Guide (SIG)

In different parts of the Township, York Region might require additional inflow and infiltration measures into the wastewater system and refers to a Servicing Implementation Guide (SIG) document that was prepared by the Township together with the Region. The SIG document would contain more stringent design requirement than those in the current guideline. When requested by the Region, the proponent should ensure the design is in compliance with the SIG document in additional to the current guideline.

SECTION F

Lot Grading

Township of King
Design Criteria and Standard Detail Drawings

SECTION F Lot Grading

Table of Contents

F1.00 General

The grading of all lots and blocks in new developments must be carefully monitored by the Consulting Engineer in order to provide sites that are suitable for the erection of buildings and to provide satisfactory drainage from all lands within the development. In this regard, the design of the grading for all developments will be of primary concern to the municipality and the following criteria shall be used in the preparation of all lot grading plans for new developments in the Corporation of the Township of King ("the Township").

It is imperative that the overall initial Draft Plan of Subdivision be laid out consistent with the lot grading criteria outlined in this section. Lots requiring rear yard drainage swales may require extra depth than the adjacent lots to the rear to allow adequate space to create a rear yard amenity area as outlined in this section.

The criteria in this section is primarily intended for subdivision design; however, relevant requirements would also be applicable for re-development applications, site plans, and infill residential developments.

F1.01 Objectives

1. All areas shall be graded in such a way as to provide proper positive drainage, maximum use of land and ease of maintenance.

2. The MECP SWM Planning & Drainage Manual requires basement floor elevations above high groundwater levels. Furthermore, the National Research Council Canada recommends foundation drainage systems not to be relied upon to prevent groundwater flooding associated with continually or periodically high groundwater levels. As such, basement elevations should be designed to be minimum 0.6 m above the seasonal high groundwater table.

3. Grading shall be performed in such a way as to preserve existing trees wherever possible.

4. Drainage flows must be directed away from houses. The front yards of all lots shall be graded to drain towards the street. Driveways shall not be utilized as drainage outlets.

5. Storm drainage is to be directed to approved outlets on public lands and shall not adversely affect adjacent lands.

6. The use of rear lot catchbasins and retaining walls should be minimized. Overland flow outlets must be provided for all rear lot catchbasins with no impact on building envelopes. The maximum allowable flow depth or ponding depth in any swale before overflowing to a downstream outlet is 0.30 m.

7. The subdivision area grading and detailed lot grading shall be designed to minimize the use of retaining walls in all applications. Where site constraints require the use of a retaining wall, it shall be subject to Township approval.

8. Where in the opinion of the Township, the area of a lot is occupied by a substantial 3:1 (h:v) graded slope, which would otherwise be useable space graded to a maximum of 5%, the Township may require the Applicant to include a notification clause to this effect in the Purchase and Sale Agreement of the lot.

9. The area draining across a sidewalk shall be minimized by designing the development such that if a sidewalk is placed in front of lots that have back-to-front drainage patterns, the lots behind the lots with the sidewalk must also have back-to-front drainage.

10. A 0.60 m wide undisturbed strip shall be maintained within the subject property abutting all existing lands.

11. No alterations to existing boundary elevations or adjacent lands shall be undertaken unless written agreement with the adjacent property owner is obtained and submitted in a format acceptable to the Township.

F2.00 General Grading Plan

F2.01 Drawing Requirements

For Draft Plan and Subdivision Engineering Submissions, the drawing scale shall be 1:500 for single-family or semi-detached areas, and 1:200 for multi-family areas.

F2.02 General

All general lot grading drawings are to include the information outlined below:

1. All lots and blocks within the subdivision are to be shown and are to be numbered in accordance with the plan proposed for registration.

2. Existing contours are to be shown at maximum 0.5 m intervals within the subdivision limits and 15 m beyond the subdivision limits.

3. Proposed centreline road elevations are to be shown at 20 m stations along all roads within and abutting the subdivision. (Elevations are to be shown for the 20 m stations in accordance with the Profile Drawings.)

4. Proposed elevations are to be shown for all lot corners and intermediate points of grade change. On large blocks, a proposed elevation is to be shown at 15 m intervals along the frontage of the block and at reasonable intervals along the side and rear of the block to clearly illustrate the grading of the block in relation to the surrounding lands and house types.

5. The specified lot grade shall be shown for all lots. For “split” type drainage patterns, the specified rear of house grade shall also be shown. The specified minimum basement floor elevation for each lot shall also be shown where it may be impacted by hydraulic grade line issues.

6. The direction of the surface water runoff from the rear of all the lots shall be indicated by means of an arrow pointing in the direction of the runoff.

7. All swales, other than the normal side yard swales, are to be shown along with the invert elevations of the swale at regular intervals (i.e., centreline of each lot for rear yard swales).

8. Side yard swales are to be constructed on the common property line. Rear yard swales shall direct drainage to rear lot catchbasins or to side yard swales.

9. All rear yard catchbasins shall be shown along with the rim elevation of the catchbasin and the invert elevation of the outlet pipe. (The use of RLCB's is to be avoided wherever possible.)

10. A "useable area" (typically rear yard areas) is to consist of a minimum of 3 m from the back of the house graded at 2% and a further 2 m wide area graded at 2% to 5%. Terracing may start at a minimum distance of 5 m from the back of the house.

11. All terracing required shall be shown with the intermediate grades specified.

12. All lot surfaces shall be constructed to a maximum lot grade of 12% (calculated from the difference in lot elevations between the rear wall of the house and property line – embankments included).

13. Existing elevations are to be shown on existing property lines at key locations including swale inverts, top and bottom of banks, changes in slopes, etc. Existing elevations are also to be shown extending onto adjacent lands approximately 15 m, or greater if required, from the subdivision limit to enable assessment of the grading between the subdivision and the adjacent areas. (The interval of those elevations shall be dependent upon the degree of development of the adjoining lands with the developed areas requiring the most information.) The lot grading plan must accommodate drainage patterns on adjacent property.

14. The lot grading plan shall make note of the Township of King Standard Drawings that are applicable to the grading of the development. The Township reserves the right to refuse any house type which is incompatible with the lot grading design specified for a lot.

15. The lot grading plan shall note all existing slopes that are to be left in an undisturbed state. Temporary fencing shall be required along the top and/or bottom of these slopes to prevent disturbance to the existing vegetation.

16. An undisturbed flat area having a width of 0.6 m shall be provided at the boundary limits adjacent to other properties, in order that the existing boundary elevations shall be maintained. Such grading must be stipulated on the approved lot grading plan. Approved silt fencing shall be shown along the approved limit of disturbance associated with the subdivision. No filling up to or upon private lands shall be tolerated unless written permission is obtained from the adjacent Owner. Where two developments are concurrently underway, the common boundary elevations are to be established to mutually beneficial elevations, agreed to by each party.

17. Lot drainage is to be self-contained within the subdivision limits, unless expressly approved otherwise.

18. The lot grading plan shall show proposed locations for building envelopes, and envelopes for private sewage disposal systems (where applicable).

19. The lot grading plan shall show and dimension all proposed easements for registration. Easements are required for all rear lot catchbasins and sewer connections.

20. Servicing of any lots or blocks with foundation drain sewers or roof leader collectors or clean water systems is to be indicated.

21. Where storm sewer servicing is available, foundation drainage using sump pumps is not permissible.

F3.00 Lot Grading Design

F3.01 Type of Drainage Pattern

1. Back-to-front drainage is desirable in instances where drainage contributing to each side yard swale is restricted to the lots directly adjacent to the swale and no external flows or flow from the rear yards of neighboring lots is captured by the side yard swale.

2. Rear yards which drain through abutting lower back-to-front type lots are permitted where:

    a) Sufficient fall is available between the adjacent streets to achieve desired grades for swales and yards as per the criteria outlined in this section.

    b) The drainage from the upstream lot is limited such that a minimum of 50% of the roof area of the upstream lot drains to the front yard.

3. Split lot drainage with rear yard catchbasins is required in the following cases where difficulties in providing side yard swales are encountered. Refer to Section L regarding easement and block requirements.

    a) The maximum flow allowable to any side yard swale shall be the lesser of either flow from five rear yards or the flow from an area of 750 m^2 (measured from where the swale crosses the front property line).

    b) The maximum length of a rear yard swale to an outlet point (road allowance or catchbasin) shall be a total of 50 m, with no individual path longer than 35 m.

    c) Rear yard swales that discharge across a public domain sidewalk or walkway shall be the lesser of 25 m in length or convey flow from a maximum area of 750 m^2 (measured from where the swale crosses the road allowance property line).

4. Walkout, back-split and front-split lots will be permitted where required due to topography constraints. In all cases the grade differential between the front and rear yard specified house grade shall be governed by the required sloping required along the side of the building envelope. Grades shall vary from a minimum 2% to a maximum 4:1 slope and shall be confined to the building side yard area.

5. In determining maximum permissible grade differential between front and rear property line elevations compatibility with existing, adjacent homes will be considered by the Township. While these standards do not set out maximum allowable grade differentials the Township will limit the grade differential on a site-specific basis based on the particular circumstances unique to each subdivision. Lots with a front to rear grade differential greater than 2.4 m are considered extraordinary and will require specific

approval from the Town. These circumstances or similar cases where large, sloped areas exist in the lot grading design may require advisory clauses and sign-off clauses to be inserted into Purchase and Sale Agreement of all prospective Purchasers.

F3.02 Specified House Grade (SHG)

The specified house grade, or building envelope grade, represents the highest lot elevation adjacent to the proposed building. This elevation shall be a minimum of 0.15 m above invert of the highest swale adjacent to the building. Top of foundation for any building will be a minimum of 0.15 m above the specified house grade. The basement floor elevation shall be a minimum of 0.60 m above the seasonally high groundwater elevation.

The following criteria shall apply to detached and semi-detached units:

1. Rear to Front Lot Drainage

   The SHG for this type of lot grading will be based on the highest apron swale invert (swale breakpoint) at the rear of the building. (Refer to KS-401 for additional details.)

2. Split Drainage

   The SHG for this type of lot grading will be based on the highest sideyard swale invert (swale breakpoint) adjacent to the building. (Refer to KS-402 for additional details.)

3. Backsplit, Walkout and Front Walkout Drainage

   The SHG for this type of lot grading will be noted for the front and rear of the building. The SHG will be based on the highest sideyard swale invert (swale breakpoint) adjacent to the building. (Refer to KS-403 and KS-404 for additional details.)

The following criteria shall apply to on-street townhouses:

1. End Units – The SHG will be based on the criteria noted above for detached and semi-detached units.

2. Interior Houses – SHG will be the highest exterior elevation adjacent to the unit and will be a minimum of 0.15 m above an adjacent swale, or a minimum of 2.0% above the streetline or lot line elevation.

3. Units with common driveways are to have the same SHG based on the higher SHG calculated based on the above criteria.

4. Grade separation between SHG’s to be taken up externally with 3:1 minimum embankment or approved retaining wall construction.

5. Split or walk-out house types, front and back SHG's to be established using applicable criteria above.

6. Number of units at same SHG shall be as per the following:

   a) On road grades of under 2% – no more than four units.

   b) On road grades of 2% to 4% – no more than two units.

   c) On road grades of over 4% – each unit is considered individually.

7. Where difference in SHG elevations exceeds 0.5 m, retaining walls should be used.

F3.03 Slopes

1. Yard surfaces shall have a minimum slope of 2% and a maximum slope of 5%. Where additional elevation difference is required beyond the maximum of 5%, terracing is permitted. In this instance yard surfaces shall have a maximum slope of 3:1 to a maximum vertical grade differential of 1.0 m and 4:1 if the vertical grade differential exceeds 1.0 m. An intermediate level area (2% to 5%) of at least 1.5 m is required between successive terraces.

2. Rear yards shall be graded such that minimum of 5.0 m or 75% of the rear lot depth, whichever is greater, is to be sufficiently level (2% to 5% slope) or as may be dictated by the Township's Zoning By-law. This shall be considered to be the rear lot "useable area". Downgradients to the rear lot line beyond the "useable area" greater than 10% will not be permitted.

3. The maximum permissible grade along rear lot line between lot corners shall not exceed 6%.

4. All lots shall have a 0.6 m wide apron at a 2% slope away from the house along at least one side of the house in order to permit the construction of a walkway to the rear of the house.

5. A minimum separation of 0.15 m shall be provided between top of foundation wall (i.e., brick line or the bottom of siding) and the final ground elevation of all houses.

6. Finished lot grades in sodded areas within 0.6 m of a property line are to be no greater than 5% slope to allow for grass cutting adjacent to property line fencing.

7. Where a noise fence and earth berm in combination is proposed for noise mitigation purposes, the berm and fence shall be constructed entirely on the lots. Should the fence prevent access to a portion of the lot area, advisory clauses and sign-off clauses are to

be inserted into Purchase and Sale Agreement of all prospective Purchasers and the clauses are to be registered on the land title of the lot.

8. A flat area (i.e., 2% to 5% slope) with a minimum width of 1.0 m shall be provided along the perimeter of the property limit. Steep slopes abutting the property limit are to be avoided.

F3.04 Swales

1. Swales shall have a minimum and maximum longitudinal grade of 2% and 5%, respectively, and maximum side slopes of 3:1.

2. Swales shall range in depth from a minimum of 0.15 m to a maximum of 0.45 m.

3. Swales parallel to the rear lot lines shall be located at a distance based on the depth of swale but under no circumstances will the invert of the swale be permitted to be located more than 1.0 m from the rear lot line.

4. Drainage flows which are carried around houses are to be confined in defined swales located as far from the house as possible. The depth of these swales should be kept as close as possible to the minimum of 0.15 m.

5. For new constructions, all side yard swales shall be located on common lot lines. Rear yard swales are to be offset from the lot line.

6. The maximum area contributing flow to a side yard swale shall be per Section F3.01 above.

7. Basement windows located on the side of a dwelling adjacent to an overland flow route swales hall be a minimum of 300 mm above the 100 year flow event.

F3.05 Rear Lot Catchbasins

1. The use of rear lot catchbasins is to be avoided in all cases. Notwithstanding this objective, the Township may direct the design and installation of rear lot catchbasin(s). These would serve as provisional future drainage inlets where site, soils and groundwater conditions between lots may cause concern for resident’s use of the lot areas.

2. All rear lot catchbasin grates are to be “beehive” type (not pyramidal). The centerline of the catchbasin top is to be 1.2 m from the rear lot line. The catchbasin frame to be set at the elevation of the invert of the lowest swale.

3. Rear yard catchbasin leads shall be a minimum diameter of 250 mm and a minimum slope of 1.0%. The leads shall be encased in concrete from the catchbasin to the street line.

4. All catchbasin leads are to be located a minimum of 0.6 m from lot line; catchbasin leads to be constructed on one lot. All catchbasin leads are to be on easements having a minimum width of 3.0 m. The use of “hourglass” easements will be permitted in instances where 3.0 m widths are not achievable between houses at Township’s discretion.

5. Rear lot catchbasin leads shall be connected directly to manholes whenever possible. The layout of the storm sewer shall have consideration to this requirement to maximize the number of RLCB leads which can connect directly to manholes.

6. When rear lot catchbasins are required, the Designer must consider the impacts that a plugged catchbasin will have with respect to flooding depth and area which will be impacted. The grading design must incorporate allowance for drainage outlets in the event that plugging does occur, such that ponding will not exceed 0.3 m.

F3.06 Required Individual Lot Grading Plan/House Siting Plan/Plot Plan Information

Lot grading plans shall include the following minimum information:

- For unassumed subdivisions include the Registered Plan Number and Lot Number;
- Municipal address;
- Scale and north arrow;
- Dimensioned property limits and house location;
- Finished first floor elevation;
- Finished garage floor elevation;
- Finished and original elevations over septic tile beds;
- Finished basement floor elevation (all locations);
- Elevation of underside of footings;
- Top of foundation wall (all locations);
- Existing and proposed lot elevations for each of the corners of the lot and intermediate points of grade change;
- Existing trees to be maintained or removed, including tree preservation fencing;
- Driveway locations, widths and proposed grades;
- Finished road elevations and grades adjacent to the lot;

- Location of house entrances, including number of risers;
- Location of rainwater downspouts;
- Location of sump pump discharge;
- Location of walkways;
- Arrows with percentage slope indicating the direction of all surface drainage and swales;
- Location and elevation of swales;
- Location of patios, decks and/or porches;
- Location of terraces, retaining walls and tree wells;
- Location and dimensions of all easements;
- All yard catchbasins with rim elevations;
- Curb cut locations and dimensions;
- Hydrants, utility poles, community mailbox, bell and cable T.V. pedestals, hydro transformers and point of supply for hydro service;
- Location and type of any private sewage disposal system and reserve areas and private wells;
- Location of any stormwater management facilities, such as dry well, infiltration trenches, rain barrels, etc. All infiltration facilities shall be a minimum of 5.0 m away from face of building;
- Location of all road features along frontage and flankage of lots (curb lines, catchbasins, sidewalks, etc.);
- For unassumed subdivision, lot grading certificate by Developer's Engineer in accordance with the Subdivision Agreement requirements; and,
- Site benchmark information from approved Engineering Drawings or topographic survey.

Lot grading plot plans shall be stamped and signed by the builder's Architect and the Applicant's Consulting Engineer responsible for the design of the subdivision. After approval and certification by the Applicant's Consultant, the lot grading plans shall be forwarded to the Township for review and approval.

F3.07 Retaining Walls

The lot grading design should minimize, and ideally eliminate, the need for retaining walls to be constructed. Specific permission from the Township will be required for any retaining walls being proposed. All reasonable alternatives must be investigated prior to the Township being in a position to consider allowing the use of retaining walls.

Where required by O.B.C., fall protection guards in compliance with O.B.C. are to be provided at the top of retaining walls. All retaining walls considered as “Designated Structures” as per the Ontario Building Code (O.B.C.) Section 1.3.1.1 shall require a building permit. The O.B.C. describes a Designated Structure as a retaining wall exceeding 1,000 mm in exposed height adjacent to:

- Public property.
- Access to a building.

On private property to which the public is admitted, where retaining walls are necessary and agreed to by the Township, the structures shall be free standing gravity walls constructed of reinforced poured concrete, large size heavy precast concrete blocks (135 kg sections) or armor stone. No wood or gabion basket retaining walls will be permitted. Tie back systems are to be avoided in all applications. If in the sole opinion of the Township that tiebacks cannot be avoided, the tiebacks are to be located entirely on the same property as the retaining wall. In addition, a restrictive covenant will be required over the installed tiebacks to protect its structural integrity, resulting from the potential alteration of grading, planting of trees and vegetation, proposed swimming pool installation, etc.

All retaining walls, regardless of height, must be designed and stamped by a Professional Engineer. Certification from a Professional Engineer will be required for each wall constructed clearly stating that the wall has been designed to suit the site conditions, that construction of the wall has been inspected by the Engineer and that it has been constructed in accordance with the design.

Detailed drawings for retaining walls shall include the following notes and illustrate:

a) That “the walls have been designed in accordance with accepted engineering principles”.

b) That “the wall is suitable for the geotechnical condition of the site and for the loading type”.

c) A weeping tile with outlet locations and elevations are shown.

d) A filter cloth envelope surrounding the compacted free draining granular material.

e) Sufficient top of wall and bottom of wall elevations.

f) Type and material of wall.

g) A cross-section for the length, type, and location of any tiebacks.

h) The location, type, and fastening of the 1.2 m black vinyl chain link fence.

i) Surcharge load used and appropriate design calculation.

j) A swale at top of wall conveying runoff away from the back of the wall, if surface drainage is directed towards the wall.

F3.08 Sodding and Ground Cover Requirements

1. Lots (including drainage ditches or swales) are to be completely topsoiled and sodded with 150 mm of topsoil and No. 1 Nursery Sod.

2. Clear stone (19 mm gradation) at a minimum depth of 100 mm shall be placed in side yard areas between houses with a distance less than 2.6 m instead of sod. A transition run-out area to drain the sub-grade shall be provided at the clear stone/sod interface. This shall be detailed on the grading plans.

F3.09 Fencing and Gates

The Township requires fencing along the perimeter of lots adjacent to stormwater facilities, open space areas, and other Township-owned facilities. Typically, such fences will be 1.8 m high, chain link black vinyl-coated fencing, with posts and hardware to match in accordance with the Township Parks Department Standard Drawing SD 501, as revised from time to time.

Under specific circumstances, where warranted and as specified by an acoustic study, fencing shall be solid board fence.

All fences shall be installed in consideration of the following:

- Fence between private and public lands – the posts are to be entirely on the private side, including the footings, and the mesh is to be on the public side of the posts.
- Privacy fencing along the ROW and between two private lots – fence is to be entirely on the private side, with the fence posts shall be centered on the lot line.
- Acoustic fencing between commercial and residential – to be entirely on the private residential side so the homeowner maintains full control. (This fencing is in favour of the homeowner.)

Galvanized steel swing gates are to be installed to control access to municipal lands. The gates are to typically be installed on stormwater pond and other municipal facilities maintenance access roads and at the access points to trails. The gates are to be lockable and include reflective panels or markings which are subject to approval of the Township. Refer to Appendix 3.

F3.10 Earthmoving Estimates and Construction Requirements

When required by the Township, the Applicant is to state the estimated volume of earth expected to be imported or exported from a site. The estimate is to be provided in writing or

noted on an Engineering Drawing which makes up the approved drawing set. The estimate may be in terms of cubic meters of earth or the number of tandem dump truck loads. The estimate provided will be used to assess the potential impacts of the volume of vehicle traffic on the condition of roads, assess potential disturbance to surrounding area land uses and to evaluate potential haul routes alternatives.

In addition, should the project involve importation of earth fill over 10,000 m^3, the Applicant is required to meet the MECP requirement to register with the Resource Productivity and Recovery Authority (RPRA).

As rough grading proceeds, the Developer must immediately enforce an erosion and sedimentation control program by applying a seed and mulch mixture to the area of concern, to the satisfaction of the Township. Under certain circumstances, the Developer may need to apply for a separate Site Alteration Permit under the By-laws of the Township.

The Developer and his Engineer shall control the placement of imported fill material on lots where private sewage disposal systems are required. The Engineer is required to certify the grading and compaction of said soil placement. Imported fill material placed on registered lots must meet or exceed the original ground's capability to support a private sewage disposal system as required by the Building Department.

Where the proposed grading plan identifies fill over registered lots, "engineered fill" shall be placed and supervised by the Consulting Geotechnical Engineer.

F4.00 Certification

F4.01 Approvals

Prior to the release of any lot from the conditions of the Subdivision Agreement, the Developer's Consulting Engineer shall provide certification to the Township that the grading and drainage of the lot is in accordance with the approved lot grading and drainage plans. The Developer's Consulting Engineer shall also submit lot grading certificates to the Township. If retaining walls have been constructed on any lot an additional Certificate will be required for each lot with retaining walls.

If the grading differs from the approved lot grading plan, the Consulting Engineer shall provide details of the variance from the approved plans and shall include his recommendations for rectification of the area if required.

Prior to requesting Acceptance, the Developer's Engineering Consultant will be required to submit a Lot Grading Certificate for every lot being placed on maintenance.

SECTION G

Traffic Signs and Pavement Markings

Township of King
Design Criteria and Standard Detail Drawings

SECTION G Traffic Signs and Pavement Markings

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G1.00 Traffic Controls

The proposed location and type of all street name signs, traffic control signs, signalization and pavement markings shall be shown on the Traffic Control Plan. The plan shall be prepared by a Professional Engineer skilled in municipal traffic design.

All traffic control devices, including warning and regulatory signs, street signs, parking restrictions, etc., shall conform to the Ontario Traffic Manual.

G2.00 Signage

All regulatory signs must be installed at the completion of the base course asphalt and maintained by the Developer until “Final Acceptance” by the Township. All signs indicating parking restrictions are to be installed prior to the occupancy of any initial dwelling or building being issued in a development.

The Developer will be responsible for installing all street signs and maintaining all signs in the subdivision until assumption of the subdivision by the Township with the exception of street name signs. Temporary street name signs are to be installed by the Developer at the completion of the base course asphalt and prior to the issuance of building permits in the subdivision. Prior to final assumption, upon completion of surface paving and boulevard grading, the Developer will install all permanent street name signs.

G2.01 Street Name Signs

Location

Street name signs shall be placed at each intersection and shall identify each street at the intersection. The locations of the street name signs are to be shown on the Traffic Control Plan and shall be installed on common posts with the stop signs or other signs wherever possible. The locations of the street name signs are shown in the Township of King Standard Drawing KS-331.

Type

The street name signs shall display the same message on each side of the sign. Sign messages shall be white lettering on a green background; both lettering and background to be fabricated from Scotchlite reflective sheeting, High Intensity Grade (as manufactured by 3M Canada Limited). Lettering shall be fabricated from 2270 Silver Sheeting; PA Series C. Lettering for names of streets shall be upper case, 100 mm in height. Lettering for “street”, “boulevard”, “crescent”, “trail”, “avenue”, “land”, etc., shall be upper case, 50 mm in height. The street name sign blades shall be extruded aluminum manufactured from 50S T6C aluminum alloy. The blades shall have a width of 2.3 mm and a length of 610 to 915 mm. Correct spacing must be adhered to in order that the message will appear aesthetically correct.

All assigned street names require prior approval from the Clerk in accordance with Policy COR-POL-131 (2019 or latest amendment thereto). Streets assigned the name of a veteran of the armed forces shall include a poppy symbol on the sign blade.

Installation

Street name signs shall be fitted on top of a 75 mm diameter, galvanized steel post, 10 gauge minimum, and 3.65 m in length.

Street name signs must be erected by the Developer at the completion of the base course asphalt road construction, and prior to the issuance of Building Permits. (Temporary signs may be utilized until the placement of top course asphalt.) Signs are to be maintained by the Developer until Final Assumption by the Township of King.

G2.02 Traffic Control and Advisory Signs

Location

Traffic control and advisory signs shall be located in accordance with the Ontario Traffic Manual. All “No Parking” and “No Stopping” zones should be clearly identified with signs in accordance with the Manual.

In school zones “no parking” is to be implemented on the side of the road where the school is located and “no stopping” is to be implemented on the opposite side of the street.

All roads under the jurisdiction of the Township of King shall be posted with a 40 km/h maximum speed limit (or less based on-site specific conditions).

All signs shall be mounted approximately at right angles to the direction of and facing the traffic that they are intended to serve. On curbed alignments, the angle of placement is to be determined by the course of the approaching traffic rather than by the roadway edge at the point where the sign is located. Signs for different purposes should not be placed closer together than 30 m.

Type

All signs are to be in accordance with the Ontario Traffic Manual and constructed of engineering grade, reflective materials.

Erection

All traffic control signs shall be mounted on hot-dipped, galvanized steel, cold rolled “U” channel (80,000 psi) posts 3.65 m in length. Channel posts shall have a minimum thickness of 5 mm and a minimum width of 62 mm. The posts shall be pre-punched with a minimum of 24 holes at 50 mm centers, compatible with standard bolt hole arrangements for traffic control signs.

Traffic control signs must be erected by the Developer at the completion of the base course asphalt road construction and prior to the issuance of Building Permits. Signs must be maintained by the Developer until Final Assumption by the Township of King.

G3.00 Pavement Markings

Pavement Markings for traffic control shall be provided and conform to the current standards of the Ontario Traffic Manual (OTM) – Book 11. All markings are to be completed with approved traffic paint and placed as approved in accordance with OPS specifications.

All markings on any road which intersects an arterial road, shall be durable (thermoplastic) material at the intersection and back to a distance of 100 m from the arterial road. In addition, stop bars on any class of roadway shall be made of durable (thermoplastic) material. Other painted markings shall be applied using organic solvent-based traffic paint.

Pavement markings shall be indicated on the plans for all stop bars, pedestrian crossings, centre and lane lines, as required or directed by the Township for all subdivision streets. Stop bars are required at all stop-controlled intersections of any road with another road.

The following materials are excerpts from the OTM and should be used for guidance purposes in Township applications:

G3.01 Directional Dividing Lines

Directional dividing lines are used to designate the portion of a two-way roadway available for traffic traveling in each direction. Directional dividing lines are generally placed to coincide with the geometric centre of the pavement but may be placed off-centre in order to make the most efficient use of the roadway. Criteria for use includes:

- Directional dividing lines are required throughout the entire length of all multi-lane roadways.
- Directional dividing lines must be extended on both sides of a painted or flush-type median.
- Directional dividing lines are discontinued through major roadway intersections.
- Directional dividing lines are generally required throughout the length of all two-lane, two-way roadways.

Roadways in Urban Areas

Two-lane, urban roadways which do not fulfil an arterial function may not require a continuous directional dividing line. Requirements for short sections of directional dividing line at specific roadway features are outlined below.

Rural Roads

Low-volume, rural roadways must be marked according to the following:

- Along their entire length, if 6 m wide or more, and carrying a two-way, peak-hour volume of 200 vehicles or more.

- Continuously, along any section where the collision experience indicates a need to define the division between opposing traffic streams.
- Continuously, in any area with heavy night traffic or tourist traffic.
- Continuously, in any area where the roadway is likely to be obscured frequently by fog or other atmospheric conditions.

Dividing Lines at Specific Roadway Features

Where a continuous directional dividing line is determined to be impracticable or unnecessary, short segments of directional dividing line are required at specific roadway features. These include:

- Vertical curves, horizontal curves, intersections, crosswalks, crossovers, railway crossings, bridges, subways, and obstructions within the roadway.

G3.02 Lane Lines

Lane lines are used to separate traffic lanes that move in the same direction. Lane lines organize traffic in its proper channels, and promote the efficient use of the roadway at congested locations. Lane lines should be used where the following conditions exist:

- On rural and arterial urban highways having two or more adjacent lanes for traffic moving in the same direction.
- At the approaches to intersections with other roads.
- At crosswalks and at crossovers.
- In hazardous locations on rural highways and city streets.
- At congested locations, particularly on streets, where the roadway has to accommodate more lanes of traffic than would be possible without lane lines.

Normally, lane lines break at intersections unless the situation warrants extra guidance information to the driver.

SECTION H

Street Tree Planting

Township of King
Design Criteria and Standard Detail Drawings

SECTION H Street Tree Planting

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H1.00 Responsibility

The Developer is responsible to plant trees along all road allowances in and abutting the development in accordance with the specifications established pursuant to the Subdivision Agreement. Street trees and other plant materials are subject to approval of the Corporation of the Township of King ("the Township").

Tree locations on Regional Roads must be confirmed with the Regional Municipality of York.

H2.00 Locations

Trees shall be planted within the road allowance in locations identified on the Township's typical road sections.

At least one tree shall be planted in front of each semi-detached and single-family dwelling unit, and at 12 m maximum intervals adjacent to all multiple-family lots, blocks and parklands.

Where the lot frontage exceeds 25 m, a second tree per lot shall be planted.

Trees shall be placed along the flankage of all lots at the same spacing interval required for the frontages. A minimum of two trees shall be placed along the flankage side of each corner lot. For all industrial roads, trees must be planted at a maximum interval of 25.0 m.

Trees shall be so located that development of a natural mature tree form in any species or variety used will not conflict with other essential street functions and services. Trees shall be planted at a minimum of 3.0 m from driveways, street lights, hydrants, service connections, etc.

H3.00 Timing of Construction

All trees are to be placed during either the Spring or Fall dormant season in unfrozen soil.

H4.00 Types

The species of trees to be planted shall be selected from trees hardy to the Township of King area and commonly used in municipal tree planting programs. Consideration is to be given to those species as identified in the tree inventory report for the subject lands. The species of trees, locations, and the percentages of each species to be used in each development shall be shown on the Engineering Drawings.

The following list includes, but is not limited to, those trees acceptable for this purpose:

- Red Oak
- English Oak
- Pin Oak
- Bur Oak
- Common Hackberry
- Crimson King Maple
- Little Leaf Linden
- Crimson King Maple
- Norway Maple
- Sugar Maple
- Silver Maple
- Red Maple
- Schwedler Maple

Trees shall be planted in tree pits, large enough to accommodate the root system of the tree when properly spread out for planting. Minimum size for tree pits shall be 1,000 mm in diameter and 1,000 mm deep. Trees shall be planted in a mixture of 1/3 peat moss and 2/3 genuine topsoil, property filled in around the tree roots to eliminate air pockets.

Trees shall be protected by steel “T” rail posts, placed on both sides of the tree and in a line parallel with the street line. A No. 9 gauge wire protected by vinyl tubing shall be used to support the tree to the steel posts.

H5.00 Quality and Source

All trees that die or fail to grow prior to “Final Acceptance” of the subdivision shall be replaced by the Developer. In any event, the minimum maintenance period for any tree should be at least two years (or two winter seasons).

All trees shall be No. 1 quality nursery grown stock, 2.25 m to 4.0 m in height, with a minimum trunk diameter of 50 mm measured at a minimum of 0.3 m above ground level. All trees shall be free from physical damage, insects, pests and diseases, and must have at least three quarters of the root system intact. All trees must meet with the standards of the Canadian Nursery Landscape Association and the International Society of Arboroculture.

H6.00 Screening

Screening acceptable to the Township, suitable for the purpose, shall be placed adjacent to the rear or side property lines of all lands abutting collector or arterial roads where 0.30 m reserves are provided. The screening shall be placed on the road allowance or the 0.30 m reserve. The species and spacing of proposed tree screening shall be submitted to and approved in writing by the Township prior to the commencement of the planting programs. All tree screening shall be installed during the Spring or Fall dormant season.

All forms of screening shall be identified on the Engineering Drawings.

SECTION I

Parklands

Township of King
Design Criteria and Standard Detail Drawings

SECTION I Parklands

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I1.00 Plan

The Developer shall be responsible for preparing a conceptual facility fit plan and a detailed grading plan for all lands to be dedicated for park purposes. This plan must be submitted to and approved by the Corporation of the Township of King ("the Township"). This plan shall show all existing trees and features that are in conformity with the end use of the park and that are to remain. All dead trees and other features not in conformity to the end use of the park shall be removed by the Developer.

The said plan shall form part of the approved Engineering Drawings and ensure that the park lands are graded and stabilized to the satisfaction of the Township.

The Developer is to consult with the Township for all intended future facilities and services to be installed within the park blocks. Specific reference is to be made to the Parks Development Standards for any works to be ultimately installed thereon.

I2.00 Grading

The park shall be fine graded in accordance with the approved grading plan with particular care being taken to avoid damage to those trees or features that are to remain. All graded areas shall be covered with a minimum of 200 mm of approved topsoil and shall be seeded and fertilized in accordance with the specifications of the Township. All topsoil stripped from parklands shall remain on-site and not removed or sold. The seed mixture proposed shall be approved by the Township prior to placement. All stones and debris shall be removed and disposed of by the Developer prior to the seeding or sodding of any park.

The Developer shall provide fencing along park boundaries or walkways as required by the Township of King. Building materials or equipment cannot be stored on said parkland and parkland shall not be used as a dump site.

I3.00 Timing of Construction

All park blocks must be scheduled to be graded and seeded (or sodded) within one year of the completion of the base course of asphalt or at 50% occupancy of the dwellings. Seeding must be carried out during the desirable months for seeding of May, August or September.

Boulevard grading and sodding on road allowances adjacent to parklands shall be completed at the same time as the park seeding.

Completion of parkland development is to be to the satisfaction of the Township. If constructed by the Owner, the park is to be completed prior to 50% occupancy, or if phased, 50% occupancy of any first phase. If it is constructed by the Township, all required grading is required prior to 25% occupancy, or if phased, 25% occupancy of any first phase.

I4.00 Maintenance

The Developer shall be responsible for the maintenance, fertilizing and mowing of the parklands until “Final Acceptance”, or until control may be assumed by the Township. In any event, the minimum maintenance period for parks should be at least two years (or two winter seasons).

I5.00 Services

The Developer shall provide a water service connection and sanitary sewer and storm sewer lateral connections to the street line for the park, unless otherwise directed by the Township. Metering requirements for water service connections shall be confirmed with the Township.

Where required by the Township, underground primary or secondary electrical cables shall be placed from the road allowance to designated locations within parkland.

SECTION J

Street Lighting and Utilities

Township of King
Design Criteria and Standard Detail Drawings

SECTION J Street Lighting and Utilities

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J1.00 General

A Composite Utility Plan (CUP) is to be submitted to the Corporation of the Township of King ("the Township") to ensure that conflicts between utilities, municipal services and driveways are avoided. The plan will indicate the location of all underground and all above ground services and utilities. The Developer's Consulting Engineer is expected to execute the coordination of all utilities and municipal services.

The hierarchy of municipal servicing and utilities shall generally apply when determining installation locations. These are, in descending order, municipal sewers and watermains including appurtenances, hydro, gas, telephone, cable, and other.

All utility surface features are to be installed, wherever possible, at projections of lot property lines. The Township requires that the use of aboveground utility furniture be minimized in all new developments.

Development shall accommodate the implementation of leading-edge communication technologies, including those required to deliver broadband services. Conduit for broadband shall generally be provided as part of all development proposals, with priority given to the provision of broadband conduit on collector and arterial roads, as determined by the Township.

Composite utility plans shall be submitted with each engineering package. The engineering package will be reviewed only as a complete submission.

J1.01 Location of Utilities

The location of utilities within the road allowance shall be as detailed on the Township of King Standard Drawings. Utility drawings shall be submitted to the Township for approval of utility locations.

All utility wiring is to be used underground or direct buried. Hydro transformers are to be housed in suitable enclosures and mounted on transformer pads installed at the final surface of ground. Hydro transformer pads must be placed in locations detailed on the Township of King Standard Drawings. Bell telephone and Cable T.V. junction boxes are to be mounted at the surface in approved standard enclosures, provided by the appropriate utilities. Hydro transformer pads and Bell telephone and Cable T.V. junction boxes are, in general, to be located adjacent to common lot lines.

If overhead wires are located adjacent to the existing development, along the frontage of the site on existing roads, these services are to be buried as part of the program to service the internal roads.

J2.00 Composite Utility Drawings

All utilities are to be shown on the Composite Utility Plan and to be submitted for the review and approval of the Township showing utilities including street lighting poles, lighting power centers, transformers, switching cubicles. This drawing shall be prepared at a scale of 1:500, unless otherwise approved and also show locations of all municipal services including sewers, watermains, laterals, manholes, catchbasins, sidewalks and driveways in addition to utilities including street lighting poles, Canada Post mailbox locations, and locations of all street trees. It is the Consulting Engineer's responsibility to ensure there are no conflicts resulting from the design of the various utilities and the municipal roads and services.

All details of any entranceway features and structures within the proposed right-of-way are to be indicated on the Composite Utility Drawing, as circulated to the various utilities. The drawings shall also indicate the presence of any pumping stations or other such facilities that may necessitate particular service requirements.

The Composite Utility Plan is to be approved by all individual utility agencies identified on the drawing and Canada Post, prior to approval of all drawings and prior to construction. Any revisions to the approved Composite Utility Plans will require approval of each agency. This shall be done by noting the revision in the title block of the drawing and having the title block of the drawing initialed by a representative of each agency.

J2.01 Utility Drawing Preparation

1. The Composite Utility Plan is to show municipal addresses, as well as lot numbers.

2. Drawings shall specify type of pole, conduit, fixture, lamp wattage, size of conductor being used.

3. Provide details of pole and fixture(s) wiring.

4. Specify locations of transformers, means of disconnects, power and control centers.

5. Lighting pole installation are to clearly show locations with respect to property line and offset.

6. The typical cross-section shall be shown or referenced on the Utility Drawing.

7. A maximum of two items of street furniture will be permitted on any lot.

8. Utility clearances are shown in Table J-1 which represents the minimum clear separation distance for public utilities.

In addition to the aforementioned information, each CUP shall have a signature block provided for approval of each of the utilities as shown below:

ACCEPTED BY	NAME	DATE
Hydro One		
Enbridge Gas		
Bell Canada		
Rogers		
Canada Post		

Standard Notes on Utility Drawings are as follows:

1. The separation to be maintained between edge of driveways and all street furniture is as noted in Section B8.04 of the Township's Design Criteria.

2. All gas services to be installed at the opposite side of the lot from hydro service.

3. Underground hydro to have 1.0 m horizontal clearance at hydrant locations. Underground hydro shall clear manholes and catchbasins by minimum of 1.0 m; otherwise, concrete encasement is required.

4. Hydro primary and cables to be concrete encased over split duct at watermain and hydrant connection crossings. All road crossing by Hydro primary and secondary cables shall be concrete encased and reinforced as per standard detail drawing(s).

5. Gas mains shall clear underground structures by 300 mm minimum.

6. The offices of Bell, Hydro, Gas, Cable T.V. and the Township must be contacted for precise locates before any digging can commence in the boulevard areas.

Table J-1: Public Utility Clearance Requirements

	Condition/Utility	Gas Line	Hydro	Bell, CATV	Water/ Sewer Lines
1	Minimum Vertical Distance	0.3 m	0.3 m	0.3 m	1.2 m
2	Minimum Horizontal Distance	0.9 m	0.9 m	0.3 m	1.2 m
3	Minimum Distance Below Ditch Inverts	0.6 m	0.9 m	0.3 m	1.7 m
4	Minimum Distance from Structure/Chambers	0.3 m	0.3 m	0.3 m	0.6 m
5	Minimum Distance from Hydrants	0.3 m	1.0 m	0.3 m	0.6 m

J2.02 Community Mailbox Requirements

In general, community mail centres and/or site individual super mail boxes shall be placed in locations approved by the Township of King. Community mail centres shall be constructed in mini-parks, centrally and suitably located in the plan of subdivision in consultation with Canada Post Corporation. The design of the community mail centre must incorporate such criteria as pedestrian safety, traffic flow and aesthetics. The Township may require the Developer to furnish the following amenities within the community mail centre:

- Park benches;
- Fencing;
- Garbage containers;
- Landscaping;
- Pedestrian lighting;
- Concrete pad or interlocking stone finished surface;
- Architectural controlled kiosks;
- Architectural controlled canopies over clusters of super mail boxes; and,
- Adjacent car bays parallel to the travelled portion of the roadway.

All details associated with community mail centres shall be identified on the Engineering Drawings and will be subject to the approval of the Township. The Developer shall be responsible for constructing community mail centres within residential subdivisions and ensuring accessible mail delivery during construction.

In areas where site individual super mail boxes are proposed within a residential subdivision, the locations will be subject to the approval of the Township. In general, individual super mail boxes shall be located near the rear lot line of flankage lots on concrete pads. The location of super mail boxes shall in no way restrict site lines at intersecting roads. When establishing the spacing of street lighting within a residential subdivision, consideration must be given for the placement of a street light adjacent to the location of super mail boxes. Parallel car bays shall also be located adjacent to super mail boxes to ensure a continuous traffic flow. The length of bays will be governed in general by the number of super mail boxes.

All amenities associated with site individual super mail boxes shall be constructed at the Developer's expense. All associated details must be shown on the Engineering Drawings and will be subject to the approval of the Township.

The approval of Canada Post Corporation with respect to location of community mail centres and/or site individual super mail boxes will be required prior to the approval of the Engineering Drawings by the Township.

J3.00 Street Lighting Design

The street lighting system shall be designed by a qualified Professional Engineer in accordance with the ANSI/IES RP-8-22 – American National Standard/Illuminating Engineering Society Recommended Practice for Lighting Roadway and Parking Facilities (latest version). All street lighting systems for roadways shall meet the requirements of the Township and Hydro One.

That illumination of street rights-of-way will be in a manner that minimizes light pollution and energy consumption, while providing a safe level of illumination onto the roadway and sidewalks. Illumination is to be designed based on a “dark sky” policy across the Township.

Further, human-scaled lighting is to be provided in strategic areas with high levels of pedestrian activity such as sidewalks within the Village Cores, transit stops and stations, schools and other public buildings, and parks.

The objective in designing street lighting is to provide a uniform distribution of lighting at a level that is adequate for the intended use of the roadway. The illuminance method of roadway lighting calculations determines the amount or quality of light incident on the roadway surface and the luminance method of roadway lighting calculations determines how ‘bright’ the road is by determining the amount of light reflected from the pavement in the direction of the driver. The recommended illuminance and luminance values, uniformity ratios and the disability veiling ratios are given in the following two tables:

Table J-2: Roadway and Sidewalk Lighting Requirements

Illuminance & Luminance Design Criteria					Illumination for Sidewalks	
Road and Pedestrian Conflict Area Classification	**AVG. ILLUMINANCE (Lux)**	**AVG./MIN. Illuminance Uniformity Ratio**	**AVG. LUMINANCE (cd/m^2)**	**MAX. VEILING LUMINANCE RATIO**	**AVG. (Lux)**	**AVG./MIN. UNIFORMITY RATIO**
Local (Low)	4.0	6.0	0.3	0.4	3.0	6.0
Local (Medium)	7.0	6.0	0.5	0.4	5.0	4.0
Collector (Medium)	9.0	4.0	0.6	0.4	5.0	4.0
Major/Arterial (Medium)	12.0	3.0	0.9	0.3	5.0	4.0

Notes:

a. Regional roads are subject to requirements/approvals of York Region.

b. Luminance Method should be considered for the straight roadways. All others should be calculated in the Illuminance Method.

c. Intersections shall have illumination per the following table:

Table J-3: Intersection Lighting Requirements

Illumination for Roadway Intersections		
Roadway Functional Classification	**AVG. (Lux)**	**AVG./MIN.**
Major/Major	26.0	3.0
Major/Collector	22.0	3.0
Major/Local	20.0	3.0
Collector/Collector	18.0	4.0
Collector/Local	10.0	4.0
Local/Local	8.0	6.0

A photometric layout will be required and must include the following information:

1. A summary table of the illumination and uniformity values resulting from the design in accordance with parameters indicated in the above table (i.e., average, average to minimum, etc.). In addition to the above noted requirements, the table must show the Light Loss Factor (LLF) used when calculating the proposed lighting levels. Lighting drawings and photometric including statistical data shall be designed/reviewed/approved by a Professional Engineer.

2. In the longitudinal direction, the distance between grid lines should be one-third (1/3) of the pole height, or 3.0 m, whichever is smaller.

3. When establishing the spacing of street lighting within a residential subdivision, consideration must be given for the placement of a street light adjacent to the location of community mail boxes.

4. In determining the position of a light standard, the Designer shall take into consideration the location of driveways, living room windows and other aspects of a particular site. The objective is to provide a sense of security and to minimize spill and other disturbances to residential properties. Luminaires Isoline may be required to evaluate the light spill.

5. The street lighting design submission package is to be submitted to the Town and shall include a cost estimate for the proposed street lighting installation works (including wiring, poles, pedestals, etc.).

6. The Developer’s Consulting Engineer shall be responsible for the review/approval of any required Shop Drawings submitted by the Contractor/supplier for verification or compliance to the lighting design and Town specifications.

7. Design shall specify type of pole, conduit, luminaire, lamp wattage, size of conductor being used. Provide details of pole installation and luminaire(s) wiring.

8. The Designer shall specify on drawings location of transformers, means of disconnects, power and control centers and other related infrastructure.

9. Pole spacing shall be supported by detailed photometric calculations. Maximum spacing shall not exceed 50 m.

10. The Engineer shall include specification sheets on luminaires, arms, and poles to be installed as part of submission.

J3.01 Street Light Poles

Poles in residential areas are to be 9.1 m (30 ft), Class A, spun reinforced concrete, octagonal, direct bury, black polished finish, complete with cast zinc hand hole and cover (per Stress/Crete E-300-BPO-G-S11 S/F 120, or equivalent). Poles are to be supplied with 1.5 m (60”) black aluminum, decorative scroll arm bracket (per Aluminous).

Standard poles for industrial areas are to be 9.1 m (30 ft), Class B, spun reinforced concrete (round) direct bury, complete with cast zinc hand hole and cover (per Stress/Crete E-300-BPR-G-M00 S/F 180, or equivalent). Poles are to be supplied with 1.8 m polished aluminum elliptical arm bracket (per Powerlite RE6MA).

In areas where expressly approved by the Township, utility (i.e., “Trafalgar”) poles may be utilized which incorporate the facilities for various utilities within the street light pole, subject to prior approval by Township.

The street light riser conductors between the in pole handhole and the luminaire shall be 2-#12AWG NMWU copper conductor, plus ground. In addition, the luminaire shall be protected by a 10 amp in-line fuse in the street light pole handhole.

All concrete poles to have a minimum of two coats of transparent sealer (i.e., “cap seal”) applied from the base of the pole to approximately 2 m above the top of the hand hole box.

J3.02 Street Lighting Luminaires

Standard street lighting luminaires are to be Light Emitting Diode (LED) “coach style” luminaires. The following are the criteria are required:

- Low glare from luminaires;
- Readily available product for ease of replacement;
- Products which will allow the Township to maintain a consistent aesthetic look and feel throughout the Township; and,
- “Dark sky” friendly fixtures with no up light characteristics.

Light fixtures are to be Cooper Lighting Solutions' model "**Springdale**" or approved equivalent as supplied in accordance with the Township's specifications. The mounting height of the fixtures is to generally be 7.6 m above the finished grade complete with individual photocell sensors. The arm is to be 1.5 m (5') Scroll Arm. Pole, Arm, and Luminaire color should be black.

On existing residential streets and in industrial areas, the standard street lighting luminaires are to be Leotek's **Green Cobra Head** fixtures or approved equivalent, neutral white (4000k), complete with individual NEMA photocell sensors. The mounting height of the luminaire is to be 7.6 m (25 ft) above the finished grade, or as required to obtain appropriate lighting levels.

J3.03 Street Light Pedestals

Pedestals are not permitted. Street Light circuits are to be isolated using in-pole circuit breakers, to the satisfaction of Hydro One.

J3.04 Site Plans

Exterior lighting systems for all site plan developments shall be designed in accordance with all applicable codes and regulations by a Professional Engineer having qualifications in this field. The lighting system shall be designed by a qualified Professional Engineer in accordance with the Illuminating Engineering Society of North America's American (IESNA) National Standard Practice for Lighting (latest version). No light shall be permitted to extend beyond the limits of the site boundary. Selected fixtures shall be such as to mitigate any uplight (i.e., "dark sky").

Site plan photometric layout should indicate the lighting level at property line and adjacent property.

J3.05 Installation Details – Wiring

All wiring must conform to the Ontario Electrical Code. Each Streetlight Circuit to be energized at 120 Volt, 40 Amp breaker feeding to a maximum of six street lights.

J4.00 Submissions

Design and layout drawings are to be submitted by an Electrical Consultant, signed and stamped by a Professional Engineer, and are to be included with the submission of Engineering Drawings. Include manufacturer's shop drawings for all materials to be supplied.

Please note that the street lights must be numbered on the drawings, in accordance with the Township's asset identification numbers.

Prior to the installation of the lighting system (and preferably prior to the purchase of the street light components), the Electrical Consultant shall submit shop drawings of the light fixtures, poles and related materials for review and approval of the Township. As part of this submission, a letter is to be provided from the manufacturer(s) which guarantees a minimum 10-year warranty on the materials and workmanship, in favour of the Township of King.

J5.00 Street Light Energization Procedure

The Township requires the following procedure with regard to the commissioning of street lights:

1. The Electrical Consulting Engineer (ECE) is required to inspect all equipment and works associated with street light construction including but not limited to underground wiring, street light pole and installation, light fixture and installation, fuses and connections.

2. Once the street light construction is complete, the ECE is required to provide a Letter of Certification stating that the Consultant has reviewed and inspected the street light equipment and installation and certifies that same has been supplied and constructed in general accordance with the design and drawings.

3. The ESA Certificate of Inspection (ESA) shall be attached to the above noted Certification. The "As-Built" Drawings shall also be attached to the above noted Certification.

4. The ECE is required to coordinate all requirements for connection and energization of the street lighting circuits within the plan in accordance with the procedures of Hydro One. This procedure includes the requirement to obtain a Service Notification, and to provide the following information so Hydro One can issue a service notification to the field office:

    - Lot/Road accessible: Yes/No
    - Is a Central Metering service required: Yes/No
    - Construction Type: Street Lights/Traffic Lights
    - ESA Permit (when constructed): Yes/No
    - Is Foundation In: Yes/No
    - Hydro at Lot Line: Yes/No
    - Service Type: OH/UG (Over Head/Under Ground)
    - Service size required: 60, 70, 100, 125, 200, 400
    - Is temporary service required: Yes/No
    - Detailed description of service required: _____
    - Address/Specific location for installation: (GPS/Intersection/City/etc.)
    - Existing Hydro One Account Number: Name: XXXX; Account # XXXXXXXX
    - Contact Person: Name/Company/Phone number (Contact Township staff for the name of the person and the billing account number)

Hydro One requires the person/customer who will be taking the ownership on the monthly bills to call into the Customer Communications Centre (888-664-9376) to have a service layout set up. Hydro One's general rule is one service layout per transformer. They also require load information for the lights. From this order a technician will go to site to complete the service layout. This is then mailed/emailed to the customer who will need to pay any costs and sign the contract. ESA is also required for any service prior to us being able to connect.

Once a service notification has been issued, the "contact person" will receive a call from Field Staff. The callback will confirm the information and service requirements. Technical information will be provided if needed.

J6.00 Utility Locate Services

The Township staff or their contracted Locate Service Provider (LSP) will provide locate services under their jurisdiction as part of the “Ontario One Call” utility locate system. The Township’s normal utility locate requirements shall generally apply where applicable and appropriate. The Township only provides locate services within municipal road allowances or Township-owned blocks. Locating services for infrastructure on private property are not provided. The costs of this service on roadways within new subdivisions (prior to final assumption) will be charged to the Developer, Owner, Contractor, or Consultant as appropriate.

Township staff will locate services based on the as-constructed details provided by the Developer’s Consultant and within the time period applicable to the type of request received. Township staff will not dig or otherwise expose services to confirm their location and will not take responsibility for the as-constructed information as provided by others.

SECTION K

Lands Developed Under Site Plan Control

Township of King
Design Criteria and Standard Detail Drawings

SECTION K Lands Developed Under Site Plan Control

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K1.00 Site Plan Control

K1.01 Site Plan Agreement

The developer of lands under Site Plan Control, as specified in both the Township's Official Plan and Site Plan Control By-law, shall be required to enter into a "Site Plan Agreement" with the Corporation of the Township of King ("the Township") prior to the commencement of construction of any building or service within the parcel of land.

K1.02 Regional Municipality of York Responsibility

The Region of York is responsible for all trunk sanitary sewers and trunk watermains that are constructed or proposed for construction on all road allowances, blocks and registered easements within the Township of King. Generally, no local service connections are allowed on any regional mains.

K1.03 Township of King Requirements

Drawings showing the location, size, grade invert elevations, material and bedding requirements for all storm, sanitary and watermain service connections, shall be prepared and submitted to the Township of King for approval. Engineering Drawings shall also be prepared for all sanitary and storm sewers and watermains that are required to be constructed within road allowances or registered easements to service the subject property. The drawings are to be prepared to Township of King requirements.

A Stormwater Management (SWM) Brief is to be submitted where on-site stormwater quantity, quality, erosion control or volume controls are required in accordance with the policies and requirements included in Section C of the Township's Design Criteria. The Site Plan Drawings are to reflect the recommendations of the SWM Brief, as accepted by the Township.

Infrastructure attribute data is to be provided to the Township and unique infrastructure identification (ID) numbers are to be requested by the Professional Engineer as noted in Section K9.02 for any Township-owned infrastructure.

The Township is also responsible for the collection of revenue for water consumption from municipal water supplies, and therefore, the "metering" arrangement for the subject property, where applicable, shall also be approved by the Township.

All works within the lands subject to Site Plan Control are to be designed in compliance with the Building/Plumbing Code (in addition to the specifications contained in this manual) to the full satisfaction of the CBO or CBCO of the Township.

K1.04 Professional Engineer

The Developer shall retain a qualified Professional Engineer to prepare all Engineering Drawings and to supervise the construction of all engineering services. The Consulting Engineer shall act as the Developer's representative in all matters pertaining to the design and construction of the services in the development.

K2.00 Engineering Drawings

K2.01 Requirements

Engineering Drawings are required for each development. The following should be provided at a minimum:

- Site Grading Plan, including erosion and sedimentation controls and details;
- Site Services Plan and General Notes;
- Landscaping Plan;
- Electrical Services Plan;
- Drainage Area Plans and Stormwater Management;
- Details Plan;
- Composite Utility Plan (CUP); and,
- A copy of original topographic survey.

Additional Engineering Drawings such as separate Erosion and Sedimentation Control Plans and Details shall be prepared where required, or when requested by the Township. Prior to receiving a Building Permit, all plans must be approved by the Township.

All site storm drainage facilities proposed must be constructed before receiving a Building Permit.

All Engineering Drawings shall be prepared from one base plan prepared at a minimum scale of 1:200, and shall contain the following information:

- A Key Plan at a scale of 1:10,000 showing the site location;
- A north arrow;
- The street names, lot and Registered Plan numbers, and property dimensions;
- The outline of all buildings with the building numbers and unit numbers indicated, and garage locations within the unit;
- The roadway and all driveways;
- Adjacent lands;
- Existing land features (i.e., trees, watermains, etc.); and,
- The reference benchmark (geodetic) used to establish vertical control, and the site benchmarks to be used for construction.

K2.02 Site Grading and Erosion and Sedimentation Control (ESC) Plan

The Site Grading and ESC Plan shall show the following information:

1. Centreline grades at 15 m intervals along all existing streets bounding the property and existing grades.

2. A legend indicating which are existing and proposed elevations.

3. Contours at maximum 0.5 m intervals to indicate the existing elevations of the site. These contours are to extend to a minimum distance of 15 m beyond the property limits to indicate the grading and drainage patterns of the adjacent lands. As an alternate to contours, spot elevations may be noted on the drawings to illustrate existing grade conditions, provided that these elevations were obtained from field survey on a regular grid pattern with the interval not to exceed 15 m.

4. Cross-sections as required to clarify the proposed grading, particularly in relation to adjacent lands.

5. Proposed elevations on paved areas, around proposed buildings, along swales, along roadways, parking areas, driveways, catchbasin rim elevations, and any other elevations necessary to establish the grading and drainage patterns for the development. Arrows to be used to indicate direction of the surface drainage.

6. Show limits of ponding areas (as may result from on-site stormwater controls).

7. All manholes, catchbasins, hydrants, and valves to be shown by a symbol with a legend provided.

8. All sidewalks and walkways.

9. All building elevations to be established and referenced to a “Finished First Floor” (or a “Finished Entrance Floor” elevation) and a “Finished Basement Floor” elevation and a “Top of Foundation Elevation”.

10. A typical roadway cross-section to indicate the pavement and granular base design.

11. Roadway dimensions and curb radii.

12. The location and detail of all curbs including the location and width of all curb depressions.

13. The location of embankments, retaining walls, stairs, play areas, swimming pools, etc.

14. The location of wells, waste disposal tile bed areas, etc.

15. Erosion and sedimentation control (ESC) measures consistent with Sections A6.06 and C2.01 of the Township Design Criteria. The ESC designs are to address changes in site conditions as the development proceeds until all exposed soils are stabilized.

K2.03 Site Services Plan and General Notes

The Site Services Plan and General Notes shall show the following information:

1. All existing underground services on the streets and easements adjacent to the property.

2. The location, size, grade, invert elevations of all storm and sanitary service connections to the property.

3. The location, size, construction details and specifications of stormwater management measures including an oil-grit separator sized for 80% TSS removal and LID storage and treatment facilities including key elevations, dimensions and flow control devices.

4. The location and size of all watermain connections to the property.

5. The basement floor elevations of all buildings to be constructed.

6. The location, size, length, grade, material and bedding requirements for all sanitary services to be constructed within the development.

7. The location, size, length, grade, material and bedding requirements for all storm sewers to be constructed within the development.

8. The location, size and material specifications for all watermains to be constructed within the development.

9. The location, invert elevation, and rim elevations for all sanitary and storm manholes to be constructed.

10. The location of all hydrants, valves, and water meters within the development.

11. The location and size of all sanitary, storm and water service connections to the individual units.

12. The location of all roof water leader downspouts.

13. All construction notes required to describe the construction detail or requirements.

14. The locations of prime and reserve tile-bed areas, including mantles where required.

15. The locations of water supply to be constructed within the development.

16. The necessary General Notes to describe material specifications and construction requirements of the project which are to be based on the Township's General Notes Drawing included in Appendix 1.

K2.04 Landscaping Plan

The Landscaping Plan shall be prepared by a qualified Landscape Architect, if required by the Township. The Landscaping Plan shall show all landscaping details as required by the Site Plan Agreement.

All manholes, catchbasins, hydrants, valves, street lights and other servicing features that appear above grade shall also be shown on the Landscaping Plan.

K2.05 Electrical Services Plan

The Electrical Services Plan shall be prepared by a qualified Electrical Consultant. The Electrical Services Plan shall show all details of the electrical distribution system and the street and parking lot lighting systems. All hydro lines are to be located underground, unless expressly approved by the Township.

The design of parking lot illumination must be in accordance with the guidelines of the Illuminating Engineering Society of Canada.

To confirm the average maintained lighting level and the absolute minimum lighting level, a computer printout of the lighting levels throughout the parking lots may be required. The computer printout must identify lighting levels 10 m beyond the property line in all directions, in order for the Township to assess light trespass.

The Electrical Services Plan shall be submitted to Ontario Hydro for approval.

K2.06 Drainage Area Plan and Stormwater Management

A plan shall be prepared to a scale of 1:1,000 or 1:2,000, dependent upon the size of the watershed area, to show the nature of the drainage of the lands surrounding the development site, and to show all external drainage areas that are contributory to the drainage system for the development. The external drainage areas shall be divided into smaller tributary areas, and the area and location to which the tributary area is considered in the design shall be clearly shown. The plan shall clearly show all existing contours used to justify the limits of the external drainage areas.

In lieu of precise information on development on the whole or any part of a watershed area, the latest Zoning By-law and Official Plan issued by the Township of King shall be used to determine the correct values of the runoff parameters to be used for all external areas in the design and to determine the specific areas to which these values apply.

An internal storm drainage plan shall be prepared to a scale of 1:200 and shall include all roads, laneways, lots, blocks and other lands within the development. The proposed storm sewer system shall be shown on this plan with all manholes numbered consecutively from the outlet. These manholes shall be the tributary points in the design, and the area contributing to each manhole shall be clearly outlined on this plan. The area, in hectares, of each contributing area (to the nearest hundredth) and the runoff parameter used, shall be shown in a circle located within the contributing area. In cases where areas of different runoff parameters may be tributary to the same manhole, the areas and the parameters shall be separately indicated on the plan.

Stormwater management measures which provide quantity control, the “Enhanced” level of runoff quality control (i.e., 80% TSS removal), erosion control and runoff volume control shall be employed over all sites in accordance with requirements identified under Section C, subject to the Township’s approval.

K2.07 Details Plan

A Details Plan showing specific features included in the design through enlarged views, cross-sections, drawings of special devices, manufacturer’s product information, data tables, copies of Standard Drawings, etc. where necessary, are to be prepared by the Professional Engineer. Plans views, cross-sections and details are to be drawn to scale.

K2.08 Composite Utility Plan (CUP)

A Composite Utility Plan will be required for all condominium developments and other developments as requested. The Plan should show the above ground and below ground services for natural gas, hydro, telecommunications and any other utilities in combination with the civil servicing shall be prepared by the Professional Engineer. The CUP is to confirm there is sufficient space for trunk line and house service utility corridors including the required clearances between utilities and civil servicing for the Site Plan. Sufficient cross-sections or details shall be included on the plan or supplemental drawings as required. The Professional Engineer shall coordinate the utility designs and circulate the CUP to the utility representatives. A utility sign-off chart is to be included on the CUP, to be completed by all representatives prior to acceptance by the Township.

K3.00 Design Requirements

K3.01 Site Grading Design

1. The drainage of the site is to be self-contained.

2. The grading of the site is to be compatible with the elevation of the surrounding lands.

3. All grassed embankments shall have a maximum slope of 3:1. In residential settings, embankments shall have a maximum slope of 3:1 to a maximum vertical grade differential of 1.0 m and 4:1 if the vertical grade differential exceeds 1.0 m. An intermediate level area (2%) of at least 1.5 m is required between successive terraces.

4. The “flat” grade of grassed or other landscaped areas shall have a maximum slope of 5% and a minimum slope of 2%.

5. Swales on grassed areas shall have a minimum slope of 2.0% and a maximum slope such that the velocity for the flow contained does not exceed 1.25 m per second.

6. The maximum length for any drainage swale shall be 75 m.

7. The minimum depth for any drainage swale shall be 150 mm.

8. The maximum depth for any drainage swale shall be 750 mm, or 450 mm in residential settings.

9. The maximum side slope on any drainage swale shall be 3:1.

10. All driveways shall have positive drainage towards the roadway.

K3.02 Site Earthmoving Requirements

When required by the Township, the Applicant is to state the estimated volume of earth expected to be imported or exported from a site. The estimate is to be provided in writing or noted on an Engineering Drawing which makes up the approved drawing set. The estimate may be in terms of cubic meters of earth or the number of tandem dump truck loads. The estimate provided will be used to assess the potential impacts of the volume of vehicle traffic on the condition of roads, assess potential disturbance to surrounding area land uses and to evaluate potential haul routes alternatives.

In addition, should the project involve importation of earth fill over 10,000 m^3, the Applicant is required to meet the MECP requirement to register with the Resource Productivity and Recovery Authority (RPRA).

K3.03 Roadway Design

1. All roadways shall be designed in accordance with the most recent engineering requirements of the Township of King.

2. The following minimum pavement design for all multiple-family roadways shall be reviewed by the Geotechnical Engineer and a recommendation provided to the Township. The more stringent of the Engineer's recommendation or the minimum criteria shall be specified:

   - Subgrade compacted to 95% proctor density.
   - 300 mm compacted depth of Granular "B".
   - 150 mm compacted depth of Granular "A" or crushed limestone.
   - 50 mm compacted depth of HL8 asphalt base course.
   - 40 mm compacted depth of HL3 asphalt surface course.

3. All driveways in multi-unit plans shall be paved with asphalt or an approved alternate from the edge of the roadway to the garage. The minimum asphalt pavement design for all driveways shall be:

   - Subgrade compacted to 95% proctor density.
   - 150 mm compacted depth of Granular "A" or crushed limestone.
   - 80 mm of HL3A asphalt, placed in 2 lifts; (Alternative: initial 50 mm HL8 with 30 mm HL3A top asphalt).

4. The minimum width of a roadway for two-way traffic with no street parking shall be 7.50 m.

5. All roadways serving projects shall be designed to facilitate passage of emergency and service vehicles. Curb returns in entrances shall have a minimum 8.0 m radius, while bends within the site shall have at least a 12 m turning radius. Provision shall be made for vehicle turning on dead end streets and/or laneways.

6. For multiple-family, commercial, industrial, apartment and other entrances, the existing curb and gutter shall be completely removed and replaced with a steel reinforced depressed curb section.

7. The minimum grade for any roadway shall be 1.0%, and the maximum grade shall be 6.0%. The minimum gutter grade shall be 0.7%.

8. The minimum grade for any driveway in a multiple-family project shall be 2% and the maximum grade shall be 8.0%. (This maximum grade creates an undesirable condition and should be used only when necessary to site conditions.)

9. The location of driveway entrances on Township roads must be such that the minimum sight distance is maintained on the Township's road in both directions. Refer to criteria listed in Section B for minimum sight distance at driveway entrances.

10. All private roadways and parking lots in commercial, institutional and industrial sites shall be paved in accordance with Township of King Standard Drawings.

K4.00 Storm Connections under Site Plan Control

K4.01 General

All blocks of land within the Plan of Subdivision shall have a storm drain installed from the storm sewer to the street limit.

K4.02 Connection Size

The storm drain connection to all multi-family and other blocks shall be sized individually according to the intended use of the lands, and in accordance with the requirements of Section C.

K4.03 Depth of Connection

The depth of the storm drain connection shall be governed by the grading of lands and the extent of the area to be served. The depth of the connection shall be sufficient to provide for drainage of all lands within the block, but in no case shall the depth to the top of the pipe be less than 1.5 m.

K4.04 Connection to Main Sewer

The connection of the storm drain to the storm sewer may be made at a manhole or directly to the storm sewer if the size of the connection is less than one-half of the size of the storm sewer. If the connection size is greater than one-half the size of the main sewer, the connection must be made to a manhole on the storm sewer. A service manhole must be installed on the private lands within 1.5 m of the street limit.

K4.05 Storm Drain Materials

Concrete pipe shall be used for a storm drain connection to all blocks in the class as required by design. Class of pipe is to conform to OPSS Section 1820.07.01.

K4.06 Bedding for Storm Drain Connections

All storm drain connections shall be installed using bedding as shown on the Township of King Standard Drawings for sewer mains and service connections.

K4.07 Stormwater Management Measures

The on-site internal stormwater management control measures (i.e., quality and quantity control, volume control and water balance) proposed in the SWM Brief report shall be compatible with

the storm drainage connection and/or overland flow route available to the Site Plan block as outlined in an approved governing SWM design study. Any proposal to alter the outlet conditions, storm service connection or the required controlled flow rates is subject to approval by the Township.

The requirements of Section C in the Township's Design Criteria regarding the level of stormwater management quality, quantity, volume and erosion control apply where the Site Plan area is not included in a previously approved SWM design study.

K4.08 Construction

All storm drain connections, site servicing and stormwater management measures shall be constructed in accordance with the specifications and Standard Detail Drawings of the Township of King, current at the time of approval of the Engineering Drawings by the Township.

K5.00 Water Connections under Site Plan Control

K5.01 General

All sites are to include a water connection from the main to the street line in accordance with the standards of the Township. The specific requirements related to connections for ICI blocks are to be developed in conjunction with the Consulting Engineer based on the expected use and scale of the site, buildings, etc. Such connections are to include for backflow preventer check valves and for metering of flows as further detailed below and applicable Township Standard Detail Drawings. The principal types of mechanical backflow preventer to be utilized are testable devices such as the reduced-pressure principle assembly, pressure vacuum breaker assembly, and double check valve assembly.

K5.02 Pipe Specifications

All pipes are to be of materials approved by the Township, being PEX or PVC depending on the size of the connection. (Any servicing pipes within the site may be of materials as otherwise approved under the OBC.)

The provision of the pipe, the size and the need are to be established by an Architect or Engineer as necessary for the applicable use of the site. Said considerations will include the fixture demands of the proposed use, requirements for fire suppression, Building Code requirements, etc.

Generally, only one service connection pipe is permitted to any site and should be such as to provide for fire suppression systems and domestic needs. All water flows into the site are to be metered.

K5.03 Metering

All flows from municipal supplies are to be metered and the meter product material is to be as stipulated by the Township, all at the cost of the proponent.

Meters are to be installed in a chamber at the street line and shall include a remote reader as supplied by the manufacturer and to be installed in a location at the Township's choosing. Adequate separation may be required between the meter assembly and the check valve. Therefore, it may be necessary to install the check valve in a separate chamber. Meter and check valves may be installed after immediately entering the building (i.e., mechanical room) before any branching occurs, subject to the approval of the Township.

K5.04 Connections to Main

All pipes are to be connected to the mains as approved by the Township. Said connections may be completed in different manners depending on the size and the materials involved (both for proposed and existing pipes.) The proponent should pre-consult with Township staff to determine the approach to be used for the specific application.

K5.05 Fire Hydrants

All fire hydrants shall be equipped with 100 mm (4") diameter "Storz" nozzle with the fitting facing the roadway. The side ports shall be 65 mm diameter (CSA thread) with caps. All hydrants are to be supplied per Section D5.

Hydrants are to be located clear of all obstructions. A minimum clearance of 3.0 m is to be provided to roadways, driveways, parking spaces, aboveground utilities and trees.

All hydrants shall be fitted with anti-tampering devices of a type required by the Township (until so advised).

For hydrants located on private property, the hydrant body shall be painted red using rust proof paint. The Storz cap (only) shall be painted black. The hydrant shall be demarked using pre-manufactured "hydrant rings" to be installed on the side ports. These are to be colour coded in accordance with the NFPA 291 coding based on measured fire flows (as field tested). In addition, port caps and the hydrant bonnet are to be painted with the same NFPA colour code as the marker rings, which are as follows:

- Light Blue for Class AA (=/> 5,680 L/min or 1,500 gpm).
- Green for Class A (3,785 to 5,675 L/min or 1,000 to 1,499 gpm).
- Orange for Class B (1,900 to 3,789 L/min or 500 to 999 gpm).
- Red for Class C (< 1,900 L/min or 500 gpm).

All testing and commissioning procedures are to be as outlined in the Drinking Water Quality Management Standards of the Township (see Appendix 2).

K6.00 Private Servicing Under Site Plan Control

K6.01 General

The following requirements are applicable to non-residential development proposed under Site Plan Control. Refer to Section M – Residential Infill Development for requirements for individual residential lots.

K6.02 Private Water Supply Systems

The Developer is responsible to secure a private source of potable water with a capacity sufficient to meet the peak demands including fire flow requirements if required by the Township. Groundwater supply sources shall be secured through retaining a licensed well driller and meeting all requirements of O.Reg. 903 with respect to well construction documentation and reporting to the MECP. The Developer is responsible for all water quality and quantity aspects of the private water supply system.

At its discretion, the Township may include a condition in the Site Plan Agreement for the Developer to demonstrate that a newly constructed well or an existing well servicing the development does not result in off-site impacts including well interference.

K6.03 Private Wastewater Disposal Systems

The Developer is to retain a qualified septic system designer (i.e., a licensed Professional Engineer or Architect or person who has obtained a Building Code Identification Number (BCIN) and is familiar with septic system designs and regulations).

Septic systems with a design load equal to or less than 10,000 L/day will be reviewed by the Building Department of the Township of King. The Designer shall prepare calculations, drawings and specifications based on site soil and groundwater conditions meeting the requirements of the Ontario Building Code. The design is also to be compatible with the grading, drainage and servicing designs for the development. Submissions are to be provided to the Township. Construction inspection, documentation and certification requirements of the septic system as outlined in the permit issued by the Building Department are to be met.

Septic systems with a design load greater than 10,000 L/day will be reviewed and approved by the MECP. Submission materials are to be provided directly to the MECP. All the requirements of a permit issued by the MECP are to be met by the Developer.

At its discretion, the Township may include conditions in the Site Plan Agreement for the Developer to provide copies of the MECP design approval and permit prior to the start of construction and a copy of the final inspection and approval completed by the qualified Septic System Designer after construction.

K6.04 Landscaping Design

The landscaping requirements shall be detailed in the Site Plan Agreement.

K6.05 Electrical Design Requirements

The requirements for the design of the electrical distribution system and the street lighting shall be agreed upon with Ontario Hydro and the Township of King.

K7.00 Certifications

The following correspondence and certifications are to be provided to the Township:

1. Prior to disturbance of the site (i.e., grubbing, topsoil stripping, earthmoving or demolition of existing structures), a signed and stamped letter by the Professional Engineer certifying that the necessary erosion and sedimentation controls and tree protection measures shown on the approved plans have been installed.

2. Prior to the issuance of Building Permits, a letter is to be provided by the Professional Engineer to the Township confirming that the on-site storm drainage and stormwater management systems these works are complete and operating as per the design.

3. The Designer of private on-site water and wastewater servicing systems is to certify that the private systems have been installed in accordance with all approved drawings and to the satisfaction of the Township, York Region Health Unit, and the Ministry of the Environment, Conservation and Parks.

4. As noted in Section K9.04 below, a Final Certification is to be provided to the Township once all works have been constructed, inspected and Final Inspection completed by the Township or its agent.

K8.00 Final Submissions and Approvals

K8.01 Final Inspection

Upon the Professional Engineer's inspection of the completed works and ensuring all deficiencies have been corrected, the Developer shall request the Township of King to carry out a final inspection of the works. All deficiencies found during this final inspection shall be immediately corrected by the Developer. This final inspection is carried out for the benefit of the Township of King and shall in no way relieve the Developer of his obligations under the Condominium Act and the Site Plan Agreement.

K8.02 Infrastructure Attribute Data

As part of the submission of "as-built" data, it is necessary to supply GIS attribute data to the Township for infrastructure assets owned by the Township in a format as may be described from time to time. A request for unique infrastructure database identification (ID) numbers is to be made by the Professional Engineer to the Township. Sample request form spreadsheets and datasets are included in Appendix 9 for this purpose. The unique ID numbers supplied by the Township are to be assigned to the infrastructure items by the Professional Engineer in a spreadsheet format. The data must also include geo-referenced coordinates for the development site and all items contained therein. The data will be provided to the Township in a spreadsheet that will allow importation to their GIS system.

K8.03 "As-Built" Drawings

After all construction is complete and all deficiencies have been corrected, the Design Drawings shall be amended to incorporate the changes and alterations made during construction in order that the drawings as amended represent the constructed services and conditions. The drawings shall also be amended to show the Township's unique identification (ID) numbers assigned to infrastructure that will be owned by the Township, as noted in Section K8.02 above. The digital "As-built" Drawing files in AutoCAD and PDF formats, along with two sets of printed drawings if requested, must be submitted to the Township.

K8.04 Site Plan Certification

Upon completion of construction and the Final Inspection and correction of all deficiencies, the Professional Engineer shall provide a signed and stamped letter to the Township of King certifying that all works have been constructed in accordance with the approved plans and specifications, and in accordance with good engineering practice.

SECTION L

Conveyance of Easements and Blocks

Township of King
Design Criteria and Standard Detail Drawings

SECTION L Conveyance of Easements and Blocks

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L1.00 Easements and Blocks

The Corporation of the Township of King ("the Township") shall require blocks of land or easements to be conveyed without consideration, free and clear of all liens and encumbrances, to the minimum width requirements, or to a greater acceptable width as determined by the Township in the following circumstances. The Design Consultant shall demonstrate the acceptable width of easements or blocks through providing sufficient cross-sections which account for overall depth to the service invert and size of the buried service. The cross-sections are to include the location and elevation of adjacent existing and proposed properties and structures.

In general, all municipal sewers and watermains are intended to be located within municipal lands or along right-of-ways and not located on private lands.

L1.01 Easements are Required

The Township shall require an easement to be conveyed without consideration, and all prior liens and encumbrances shall postpone their interest in favour of such an easement, to at least the minimum requirements to the Township of King Design Criteria:

- Rear and side yard piped storm drainage systems, including catchbasins, French drains, manholes and other appurtenances.
- Easements for road drainage shall be employed only where a block of land is impractical, in the opinion of the Township.

L1.02 Conveyance of Blocks of Land are Required

Conveyance of blocks of land are required for:

- All overland flow routes, open channels and defined drainage systems accommodating a major storm.
- Walkways, bicycle paths and community mail centres.
- Valleys, streams, open channels, watercourses (whether flowing or intermittent), seepage areas, wetlands, natural bodies of water and floodplain lands identified by the Township as being environmentally significant requiring protection or designated as hazard or open space lands.
- Stormwater Management facilities, including detention and retention ponds or structures, water quality control facilities and LIDs.
- Storm sewers, watermains and sanitary sewers (other than private connections).
- Where underground services are required beyond the limits of a subdivision or site plan.

L2.00 Easement Requirements

L2.01 General

Easements should be located on one side of the common lot line between adjacent lots. Pipes shall be centred on the easement. The easements will not be permitted to straddle common lot lines. Buildings or building extensions will not be permitted to encroach over the limits of the Township easements.

Where two pipes are to be located on one easement, the minimum width of easement shall be the width of easement required for the larger of the two pipes plus half the width of easement for the smaller pipe, rounded to the next 1.0 m increment. Additional easement width may be required to ensure adequate separation between the two pipes and a minimum separation of 3.0 m between the easement limit and the nearest pipe.

L2.02 Storm Connections for Rear Yard Catchbasins

The minimum width of permanent easements for leads to rear yard catchbasins shall be 3.0 m for pipe sizes ranging from 250 mm to 450 mm in diameter. For pipe sizes greater than 450 mm, criteria under Section L3.02 shall apply. The lead shall be centred on the easement.

L2.03 Drainage Swales

The minimum width of permanent easements for lot drainage swales shall be 3.0 m. Additional easement widths may be required depending on the critical depth of swales proposed. Drainage swales are to be centred over easements.

L3.00 Blocks of Land Requirements

L3.01 General

Blocks of land shall be of sufficient dimension to accommodate the proposed facility, access from a public right-of-way, and maintenance requirements.

The minimum width of blocks of land for open drainage channels shall be the width of top of open channel plus 3.0 m along one side of the channel for maintenance requirements.

Valley lands (crest of slope to crest of slope) may be contained within blocks of land to be conveyed to the Township of King, or the appropriate authority, as a condition of development (subject to provisions of Section C). Blocks of land shall include 3.0 m platform widths on both sides. Blocks of land will not be considered as part of parkland dedication requirements.

L3.02 Storm and Sanitary Sewer Mains

The minimum width of blocks for storm and sanitary sewers shall be in accordance with the following:

Table L-1: Minimum Block Widths for Storm and Sanitary Sewers

Size of Pipe	Depth of Invert	Minimum Width of Block
Up to 600 mm	3.5 m maximum	3.0 m
750 mm to 1,500 mm	3.5 m maximum	6.0 m
1,650 mm and up	4.0 m maximum	4.0 m plus 3 times I.D. of pipe, rounded to next 0.5 m increment

L3.03 Watermains

The minimum width of blocks for watermains shall be in accordance with the following:

Table L-2: Minimum Block Widths for Watermains

Size of Pipe	Depth of Invert	Minimum Width of Block
Up to 450 mm	3.7 m maximum	3.0 m
600 mm and up	3.7 m maximum	6.0 m

SECTION M

Residential Infill Development

Township of King
Design Criteria and Standard Detail Drawings

SECTION M Residential Infill Development

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M1.00 Infill Development Applications and Process

Residential infill development relates to the proposed modification of existing or construction of new homes where Site Plan Control does not apply. The following applications may involve construction on vacant lots, demolition and replacement of an existing residence on a single lot, increasing hard surfaces on an existing lot or the creation of additional residential lots than previously existed:

1. Zoning Certificate Application (i.e., single lot redevelopment application).

2. Hard Landscaping Exemption Permit Application (with respect to By-law 2021-039, as amended) which applies only within the boundaries of the three Urban Villages in the Township as delineated in the Official Plan and where the hard landscaping ratio (includes all impervious areas) exceeds 60% for single family, semi-detached and 80% for townhouse lots. Applicants are to prepare a lot coverage breakdown of the proposed hard landscaping.

3. Lot creation through a Consent Application and Zoning By-law Amendment and potentially an Official Plan Amendment application.

4. "Major Development" within the following areas:

    a) Oak Ridges Moraine Conservation Plan (ORMCP) (2017).

    b) Lake Simcoe Protection Plan (LSPP).

    c) South Georgian Bay Lake Simcoe Source Protection Plan (SGBLSSPP).

    d) Well Head Protection Area – WHPA-Q2 (quantity concern for reduced infiltration).

    e) Significant Groundwater Recharge Area (SGRA).

    Definitions of "Major Development" within these areas vary and include:

    - The creation of four or more lots.
    - The total construction or reconstruction of all pavement and buildings ground floor area combined being greater than 500 m^2.
    - The construction of a building or buildings with a ground floor area of 500 m^2 or more.
    - The establishment of a major recreational use, defined in Section 38 of the ORMCP.

Refer to Appendix 12 for a list of drawing content requirements related to Residential Infill Developments.

Township staff will review and provide any comments necessary to meet the infill development technical requirements prior to the issuance of permits for construction. Re-submissions of drawings and documents after the first submission shall include a response to the previous comments describing how the comments and red-lined drawing comments have been addressed. The response letter should provide sufficient detail to assist with understanding all design revisions to minimize further reviews.

M2.00 Oak Ridges Moraine Conservation Plan Area

A substantial portion of the Township is located within the ORMCP area. Applications for site alteration, infill or re-developed residential development in the ORMCP are subject to applicable legislation, as may be amended, including but not limited to:

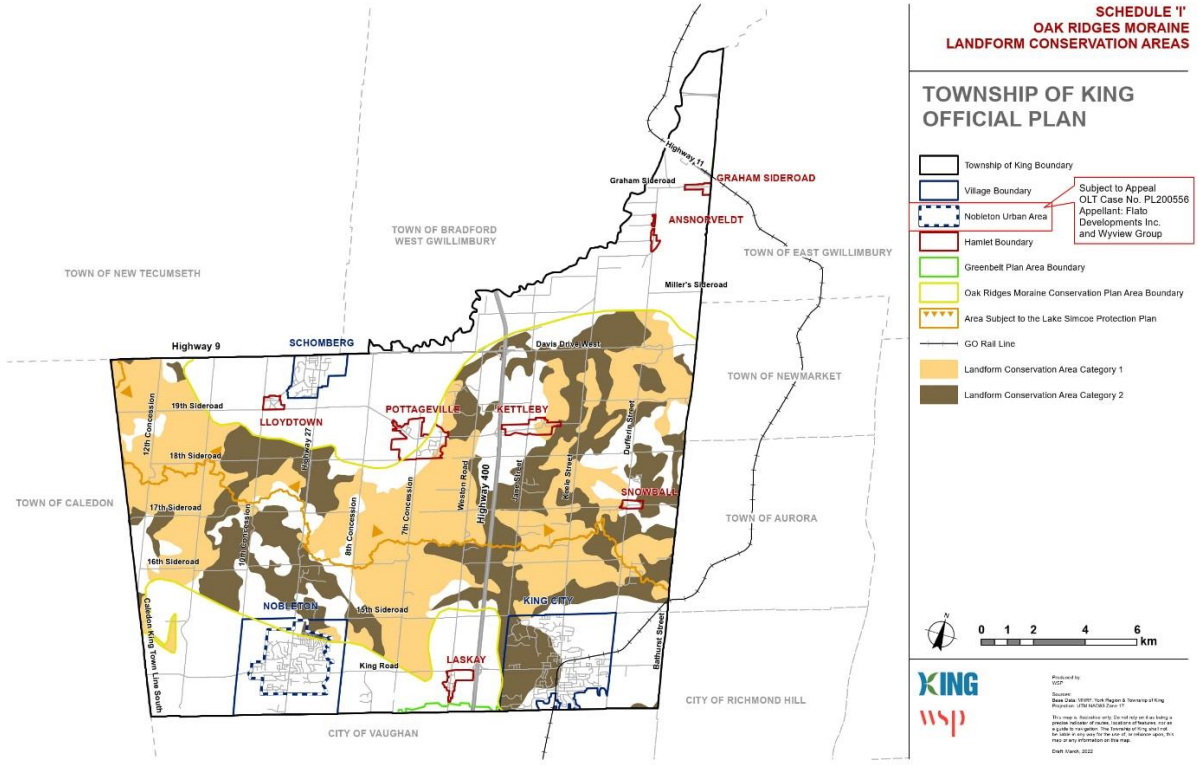
1. Outside of settlement area lands, the maximum total impervious surface coverage shall be 10% of the sub-watershed area or any lower percentage which may be specified in an applicable watershed or sub-watershed plan.

2. For lands within a settlement area, the application shall account for the objective of ensuring that at least 30% of the area of the sub-watershed has self-sustaining vegetation.

3. For lands within a settlement area, the municipality shall consider the importance of maintaining, and where possible improving or restoring natural vegetation.

4. Meeting the requirements of Landform Conservation in areas identified as Category 1 and Category 2 which may require the preparation of a landform conservation plan. Figure M-1 shows Schedule I of the Township's Official Plan regarding ORMCP Landform Conservation Areas.

Figure M-1: Official Plan Schedule 'I' – Landform Conservation Areas



M3.00 Qualifications of Designers

The submitted plans and related calculations are to be prepared, sealed and signed by a qualified Professional which may be an Ontario Land Surveyor (OLS), a licensed Ontario Architect Association (OAA) Architect, a licensed Engineering Technologist (LET) or a licensed Professional Engineer (P.Eng.).

Stormwater Management Reports or Briefs are to be prepared by a licensed Engineering Technologist (LET) or a licensed Professional Engineer (P.Eng.) with related experience with storm drainage calculations, stormwater conveyance, detention and retention systems and low impact development facilities design.

M4.00 Sedimentation and Erosion Controls (ESC)

Infill development projects are to include measures to prevent erosion from the site and sedimentation onto adjacent properties and the municipal road allowance during construction until the site is fully restored. The measures may include siltation control fencing, interceptor swales, rock check dams or Siltsox products, sediment basins or ponds (based on the drainage area and sensitivity of adjacent lands), mud-mats at construction entrances and temporary stabilization of exposed soils with topsoil and hydroseed. Temporary stabilization should be utilized when soils remain exposed for longer than 30 days.

The ESC measures and standard details are to be included in the drawing set. Notes are to be included on the drawings which describe the installation, inspection, maintenance, replacement and removal procedures related to the ESC measures. The design should be based on ESC Notes and Detail Drawings included in Appendix 1 from the TRCA standard ESC documentation.

As described below in Section M9.00: Inspections and Certifications, the qualified Professional is to prepare and submit to the Township prior to disturbance of the site, a letter certifying that all ESC measures and tree protection and security fencing has been installed on the site in accordance with the approved drawings.

M5.00 Grading Design

M5.01 General

The grading design should be generally consistent with the design requirements described in Sections F3.01 to F3.05, F3.07 and F3.08, inclusive for Plans of Subdivision. However, these sections are also to be read in conjunction with the following, which apply to infill applications. The general content of a typical infill or re-development lot grading plan is shown on Standard Drawing KS-405.

M5.02 Sites in Unassumed Developments

In developments which have not been assumed by the Township, the Grading Plan is to be reviewed and accepted by the Consulting Engineer who designed the subdivision. The Applicant is to provide correspondence from the Consulting Engineer stating that the grading design is in conformance with the approved subdivision grading design.

M5.03 Site Earthmoving Estimates

When required by the Township, the Applicant is to state the estimated volume of earth expected to be imported or exported from a site. The estimate is to be provided in writing or noted on an Engineering Drawing which makes up the approved drawing set. The estimate may be in terms of cubic meters of earth or the number of tandem dump truck loads. The estimate provided will be used to assess the potential impacts of the volume of vehicle traffic on the condition of roads, assess potential disturbance to surrounding area land uses and to evaluate potential haul routes alternatives.

In addition, should the project involve importation of earth fill over 10,000 m^3, the Applicant is required to meet the MECP requirement to register with the Resource Productivity and Recovery Authority (RPRA).

M5.04 Slopes and Swales

1. Existing grades are to be maintained within 0.6 m from all property lines.

2. Slopes in yard areas and adjacent to buildings shall be between a minimum of 2% and a maximum of 5% and provide positive drainage away from foundations. Where the maximum slope is exceeded, a 3:1 (h:v) terrace is required unless the top and bottom of slope elevation difference exceeds 1.0 m where a 4:1 (h:v) slope is to be provided.

3. Rear yards shall be graded such that minimum of 5.0 m or 75% of the rear lot depth, whichever is greater, is to be sufficiently level (2% to 5% slope) or as may be dictated by the Township's Zoning By-law. This shall be considered as the rear lot "useable area".

4. Provide a 0.6 m wide apron at a 2% slope away from the house along at least one side of the house in order to permit the construction of a walkway to the rear of the house.

5. Finished lot grades in sodded areas within 0.6 m of a property line are to be no greater than 5% slope to allow for grass cutting adjacent to property line fencing.

6. Sodded swales are to be maintained or constructed to convey stormwater runoff around and between buildings to a positive outlet. Swales are not to be filled in or replaced with shallow buried pipes or weeping tiles.

7. Swales shall have a minimum and maximum longitudinal grade of 2% and 5% respectively and maximum side slopes of 3:1.

8. Swales shall range in depth from a minimum of 0.15 m to a maximum of 0.45 m.

9. Swales parallel to the rear lot lines shall be located at a distance based on the depth of swale but under no circumstances will the invert of the swale be permitted to be located more than 1.0 m from the rear lot line.

10. Drainage flows which are carried around houses are to be confined in defined swales located as far from the house as possible. The depth of these swales should be kept as close as possible to the minimum of 0.15 m.

11. Where multiple lots are being re-developed, side yard swales on these lots shall be located on common lot lines. Where re-development occurs adjacent to existing development, side yard and rear yard swales are to be located such that the 0.6 m undisturbed strip inside the re-developed lot is maintained.

12. Basement windows located on the side of a dwelling adjacent to a major system overland flow route swale shall be a minimum of 300 mm above the 100-year flow elevation.

M5.05 Building/Structure Design

A minimum separation of 0.15 m shall be provided between the top of foundation wall (i.e., the bottom of the lowest brick course) and the final ground elevation.

M5.06 Retaining Walls

The Ontario Building Code (O.B.C.) describes a “designated structure” as a retaining wall exceeding 1,000 mm in exposed height adjacent to:

1. Public property.

2. Access to a building.

3. Private property to which the public is admitted.

All retaining walls considered as “designated structures” as per the O.B.C. Section 1.3.1.1 shall require a Building Permit. Where required by O.B.C., fall protection guards in compliance with O.B.C. are to be provided at the top of retaining walls.

Where retaining walls are necessary and agreed to by the Township, the structures shall be free standing gravity walls constructed of reinforced poured concrete, large size heavy pre-cast concrete blocks (135 kg sections) or armor stone. No wood or gabion basket retaining walls will

be permitted. Tie back systems are to be avoided in all applications. If in the sole opinion of the Township tiebacks cannot be avoided, the tiebacks are to be located entirely on the same property as the retaining wall.

The submitted design drawing for all retaining walls greater than 1 m in height and within a distance from adjacent private property equal to the height of the wall is to be signed and sealed by a licensed Professional Engineer.

The retaining wall design drawing is to include the following:

1. A statement that “The walls have been designed in accordance with accepted engineering principles” is to be included on the drawing.

2. A statement that “The wall is suitable for the geotechnical condition of the site and for the loading type” is to be included on the drawing.

M6.00 Storm Drainage and Stormwater Management (SWM) Design

The Township requires stormwater management mitigation measures based on the development's site location and characteristics including:

1. Hard Landscaping Exemption Permit Application, to mitigate where hard surfaces exceed 60% of the lot area.

2. Infill developments within the three urban Village Boundary where the imperviousness of post-development areas exceeds pre-development imperviousness.

3. Should the application meet the definition of "Major Development" as noted in Section M1.00 above.

4. The site is located within the Oak Ridges Moraine Conservation Plan (2017), or as amended, areas.

5. As required by the Lake Simcoe Protection Plan (LSPP) where the site is in a significant groundwater recharge area (SGRA) or the South Georgian Bay Lake Simcoe Source Protection Plan (SGBLSSPP) where the site is in a Wellhead Protection Area – Quantity concern for reduced infiltration (WHPA-Q2).

In these cases, municipal storm drainage systems were designed for lower development density. Increased runoff volume and peak flows reduce the available capacity in the municipal storm sewers (i.e., minor drainage system) during frequent storm events (i.e., up to and including the 1:5 year storm). The capacity of roadways, channels, stormwater management ponds and watercourses (i.e., major drainage systems) to convey and control runoff from larger events such as the 1:100 year storm are also impacted.

Groundwater recharge which supports drinking water supplies and natural wetlands, creeks and streams are affected by increased imperviousness. Streambank erosion conditions are also impacted by increased runoff volume. The LSRCA and TRCA have prepared guidelines for Source Water Protection which are supported by the Township. It is noted that with the exception of the most westerly portions of the Township, almost all of the municipality is identified as being in a future significant groundwater quantity threat area.

The Applicant is to prepare an assessment of proposed versus existing stormwater-related conditions aimed to preserve existing Township infrastructure capacity and to protect and preserve groundwater quality and quantity.

Any proposed stormwater management system or facility shall not negatively impact neighbouring properties.

The accepted SWM measures along with the related lot grading and servicing designs are to be implemented as part of infill developments.

M6.01 Peak Flow Control

An assessment of changes in peak flows is to be completed in the following cases:

1. Where there is an increase in site imperviousness within any of the sub-drainage areas to be identified on the site, as demonstrated in the breakdown provided by the Applicant's qualified Professional.

2. Within the Urban Villages boundaries, where hard surfaces exceed 60% of the lot area.

3. Where impacts on other landowners may occur or where directed by the Township.

The effectiveness of permeable paving stones to reduce runoff is limited due to the many alternative products and base materials specifications, variable construction practices and the need to supervise, inspect and certify the installations. Permeable paving stones are therefore considered the equivalent to asphaltic or concrete paving, which is also consistent with the following legislation:

- Site Alteration By-law 2021-039 as amended, includes paving stones as hard landscaping;
- The ORMCP (2017) includes parking lot and driveways where paving stones are implemented as "impervious surfaces".

Existing and proposed drainage areas and their runoff characteristics are to be determined and documented and used as a basis for SWM calculations. Runoff coefficients noted in Table M-1 for hard surfaces and vegetated surfaces are to be used to calculate "C" values for site-specific conditions. Higher runoff coefficients above standard values apply to design storms greater than 1:5 years.

Table M-1: Runoff Coefficients (C Values)

Surface Type	Runoff Coefficients (C Values)		
	Return Period Design Storms		
	1:5 year	1:25 year	1:100 year
Vegetated Surface	0.20	0.30	0.40
Hard Surface	0.90	0.95	1.00

The time of concentration for small sites can be less than a typical 10-minute value used for the first pipe of a municipal sewer systems. Calculation of the time of concentration for small sites is to be prepared based on appropriate methods such as the Bransby-Williams Method for catchments with a composite C value equal to or greater than 0.40 and the Airport Method for catchments with a composite C value less than 0.40 (per LSRCA Technical Guidelines for SWM Submissions).

Allowable release rates from each drainage outlet from the site are to be based on the smaller of the pre-development drainage area peak flow or release rates determined in watershed studies approved by the Conservation Authority. The full range of design storms (i.e., 1:2 year to the 1:100 year) provided in Table C-3, Section C2.10 are to be controlled through on-site detention or retention of runoff.

If a positive outlet is not available from a tank or gallery, the site may be limited to retaining the total increased runoff volume on-site and discharging through infiltration and/or reuse of water on the site (i.e., a cistern design).

The maximum required storage volume may be determined using hydrologic software models (Visual OTTHYMO, PCSWMM, MIDUSS, etc.) or the Modified Rational Method.

Digital input and output model files are to be submitted as well as hard copies. If the Modified Rational Method is chosen, the following is to be submitted:

1. Rainfall intensities are to be based on the equation and parameters in Section C2.10.

2. Runoff rates/release rates/storage volume calculations are to be submitted in a working Excel spreadsheet file using the following from the ASCE Hydrology Handbook (1996). One-minute storm duration increments are required to clearly show when the required peak storage volume occurs.

   $V_p = Q_p \times D - Q_o ((D+t_c) / 2)$

   Where,

   V_p = peak volume at the storm duration D.

   Q_p = peak runoff rate at the storm duration D.

   Q_o = maximum allowable discharge rate

   D = storm duration

   t_c = Time of Concentration

3. Design calculations for the selected flow control device (orifice plate, orifice tube, weir, etc.) are to be provided.

4. Note that the storage and discharge calculations are to demonstrate how the proposed SWM system controls the full range of design storms from the 2-year to 100-year events. If necessary, where only one flow control device is proposed, the 100-year

post-development flow may be required to be released at the 2-year pre-development peak flow which results in control of all design storms.

5. Calculations showing that the selected storage tank, LID gallery, etc. provides the required storage volume.

M6.02 Water Quality Control

Water quality control is to be provided to the greatest extent possible on residential infill development. Runoff from driveways and vehicle parking areas which is directed to infiltration galleries is of primary concern for impacts to groundwater quality and mitigation measures are required.

MECP recognizes the benefits that LIDs such as vegetated swales, bioswales and buffer strips provide in improving stormwater runoff quality. These measures are commonly used or can be accommodated in residential development as part of the grading and stormwater drainage design.

A preliminary phosphorous budget may be required by the Township and the LSRCA as part of a functional servicing report or other study for major development, including development greater than 500 m^2 in impervious surface area. The analysis is to demonstrate that the phosphorous load from the development will not exceed pre-development phosphorous loading, or such criteria as required by the Conservation Authority. Where a development cannot meet the pre-development phosphorous loading target, the Township and Authority may require phosphorous offsetting through a development agreement, conditions of approval or other mechanisms. Refer to the current version of the LSRCA Phosphorous Offsetting Policy.

M6.03 Stream Erosion Control

Where existing stream erosion is noted to be occurring on or downstream of a development application, the Township will require an erosion analysis of the drainage system as described in Section C5.03.

Otherwise, the most current Conservation Authority requirements regarding stream erosion control criteria are to be consulted which may also result in a stream erosion analysis. If a greater volume of runoff is to be retained or detained on site for other purposes (peak flow control, water balance, etc.) the maximum design volume will apply:

1. In the TRCA jurisdiction, a minimum on-site volume retention (cistern, soakaway pit, infiltration trench, etc.) of 5 mm over the total impervious area is the minimum requirement for erosion control.

2. In the LSRCA jurisdiction for a site under 2.0 ha, an erosion control study may not be necessary. However, detention of the runoff from a 25 mm, 4-hour Chicago distribution

for a minimum 24 hours is required. The Township should be consulted to confirm the applicable LSRCA criteria on a site-specific basis.

M6.04 Water Balance and Runoff Volume Control

Stormwater volume control requires retaining a portion of the runoff on the site, typically in depressed areas, ponds, galleries or tanks which have no outlet. The stormwater may be re-used on the site (i.e., irrigation or in a grey-water system subject to Building Department approval), and/or held for evaporation or infiltration into the groundwater system.

The proponent is to pre-consult with the Township and the relevant Conservation Authority to confirm if a water balance study and/or a hydrogeological assessment for the site is required to verify the volume control criteria. Submission requirements are based on the type of planning application (subdivision, site plan, infill development, etc.), the site location and proposed impervious area including the ground floor area of buildings.

M.6.04.1 Major Development

The following Schedules G4 and C4 of the Official Plan show approximate boundaries of the ORMCP, Wellhead Protection Areas (WHPA) and Significant Groundwater Recharge Areas (SGRA) where requirements apply to applications identified as major development. Where a site is covered by more than one legislation, the most stringent of the “major development” definitions applies. Township staff will confirm the site location relative to these areas during the application screening process.

Figure M-2: Official Plan Schedule 'G-4' – Well Head Protection Areas

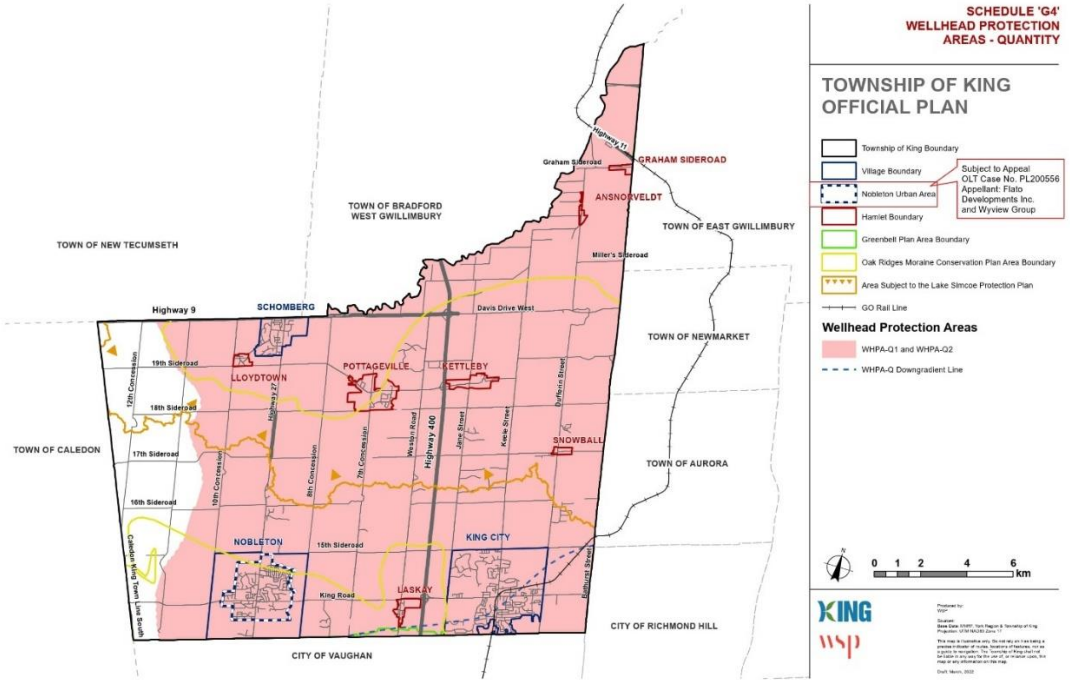
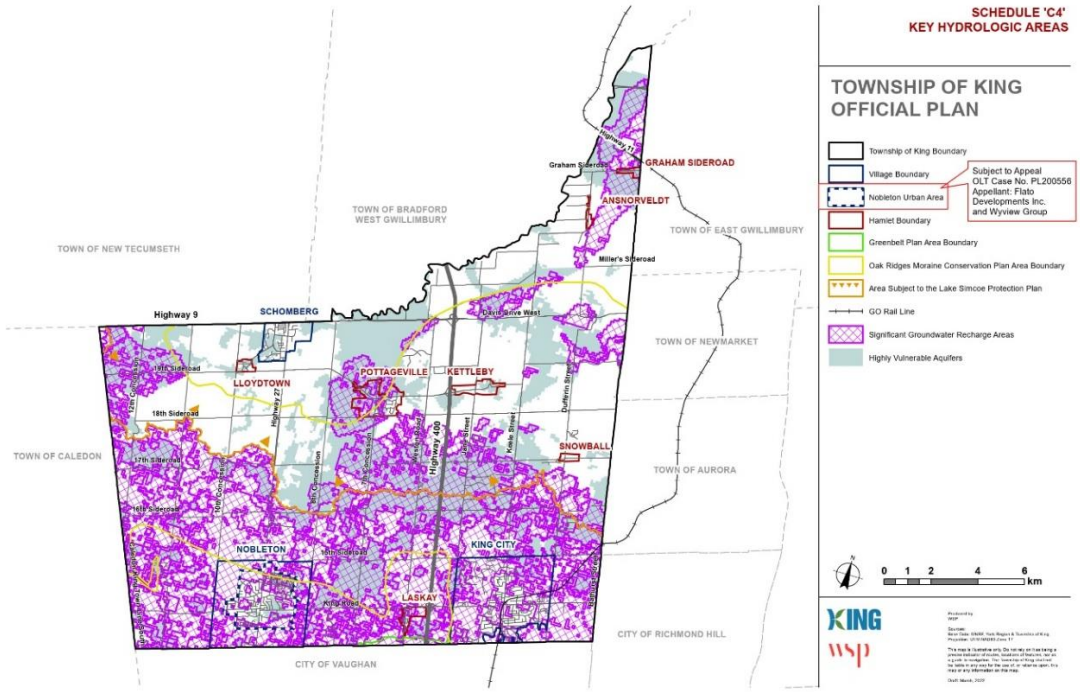


Figure M-3: Official Plan Schedule 'C-4' – Significant Groundwater Recharge Areas



The following definitions of "Major Development" in environmental areas (i.e., Oak Ridges Moraine and Source Water Protection areas) determine volume control requirements and should be confirmed early in the application process.

Table M-2: Major Development Definitions

Conservation Authority	"Major Development" Definition			
	ORMCP	**WHPA-Q2**	**SGRA**	**All Remaining Watershed Areas**
TRCA	Creation of four or more lots (i.e., Subdivision, Site Plan) OR Construction of building(s) with total ground floor area equal to or greater than 500 m^2.	Creation of four or more lots (i.e., Subdivision, Site Plan) OR Construction of more than one single family dwelling.[1]	Creation of four or more lots (i.e., Subdivision, Site Plan) OR Construction of building(s) with total ground floor area equal to or greater than 500 m^2.[2]	N/A
LSRCA	Creation of four or more lots (i.e., Subdivision, Site Plan) OR Construction of pavement and building(s) ground floor area combined is equal to or greater than 500 m^2.[3]	Creation of four or more lots (i.e., Subdivision, Site Plan) OR Construction of pavement and building(s) ground floor area combined is equal to or greater than 500 m^2.[3]	Creation of four or more lots (i.e., Subdivision, Site Plan) OR Construction of building(s) with total ground floor area equal to or greater than 500 m^2.[4]	Creation of four or more lots (i.e., Subdivision, Site Plan) OR Construction of building(s) with total ground floor area equal to or greater than 500 m^2.[5]

Notes: ORMCP – Oak Ridges Moraine Conservation Plan (2017).
WHPA-Q2 – Well Head Protection Area (quantity concern due to increased imperviousness).
SGRA – Significant Groundwater Recharge Area.
[1] CTC Source Protection Plan Policy REC-1 document "Guidance: Water Balance Assessments, April 19, 2018".
[2] Region of York Official Plan 2022, Office Consolidation June 2024.
[3] South Georgian Bay Lake Simcoe Source Protection Policy (SGBLSSPP), Land Use Policy 12 (LUP-12).
[4] Lake Simcoe Protection Plan (LSPP) Recharge Policy 6.4-DP.
[5] Lake Simcoe Protection Plan (LSPP) SWM Policy 4.8-DP.

Where applications do not meet the definition of "Major Development," typically a "best efforts" approach (e.g., lot level LIDs that retain runoff from roof downspouts, vegetated areas and pre-treated runoff from residential driveways or parking areas) is to be applied. The proposed measures are also to be consistent with the balance of the Township's Design Criteria (e.g., lot grading, lot servicing, etc.).

"Major Development" shall provide sufficient on-site retention volume to ensure there is no infiltration deficit in the post-development condition. The LSRCA also requires a minimum retention volume of the runoff volume from a 25 mm rainfall over the impervious area of the site.

For "Major Development" where the site has restrictions of high groundwater or low soil permeability, reduced retention volumes, off-site compensation measures or monetary contributions to the Township or Conservation Authority programs to maintain groundwater quantity may be required. Requirements for sites with restrictions are to be discussed with the approval authority (i.e., Township and/or Conservation Authority).

M.6.04.2 Submission Requirements and Design Criteria

Volume control submission requirements and design criteria are provided in the following table:

Table M-3: Volume Control Submission Requirements and Design Criteria based on Site Location

Conservation Authority Jurisdiction	Type of Development	Within ORMCP				Within WHPA-Q2				Within SGRA				Other Areas	
		Supporting Studies Required	Design Measures to Maintain Pre-Development Recharge [1]	Best Efforts to Maintain Water Balance [2]	Minimum Volume Control Criteria Apply [3,4]	Supporting Studies Required	Design Measures to Maintain Pre-Development Recharge [1]	Best Efforts to Maintain Water [2]	Minimum Volume Control Criteria Apply [3,4]	Supporting Studies Required	Design Measures to Maintain Pre-Development Recharge [1]	Best Efforts to Maintain Water Balance [2]	Minimum Volume Control Criteria Apply [3,4]	Supporting Studies Required	Best Efforts to Maintain Water Balance [2,5]
TRCA	Non-Major	X	X	✓	X	X	X	✓	X	X	X	✓	X	X	✓
	Major	WBS & HA	✓	X	✓	WBS & HA	✓	X	✓	WBS & HA	✓	X	✓	X	✓
LSRCA	Non-Major	X	X	✓	X	X	X	✓	X	X	X	✓	X	X	✓
	Major	WBS & HA	✓	X	✓	WBS & HA	✓	X	✓	WBS & HA	✓	X	✓	WBS & HA	✓

Notes: WBS – Water Balance Study required.
HA – scoped Hydrogeological Assessment (i.e., depth to seasonally high groundwater and soil infiltration rate determinations) for LIDs design (i.e., see Schedule C of the LID Design Guide).
X – not required.
ü – required.
[1] Maintain pre-development recharge based on the water balance study or to the greatest extent possible due to site restrictions.
[2] Where a water balance study has not been completed, "best efforts" includes lot level LIDs that retain runoff from roof downspouts and vegetated areas to address water quality.
[3] For all applications within the TRCA, a minimum volume for water balance is not required; however, as noted in Section C2.06, a 5 mm volume over all impervious surfaces is to be retained on-site for stream erosion control purposes.
[4] For Major Development within the LSRCA, the minimum volume to be retained for sites without restrictions is the runoff volume from a 25 mm rainfall over all new and/or reconstructed impervious surfaces. For sites that may have restrictions as defined by the LSRCA, refer to the latest LSRCA Technical Guidelines for reduced requirements.
[5] Where a Water Balance Study per LSPP Policy 4.8-DP has been completed, "best efforts" are to maintain pre-development recharge or to the greatest extent possible due to site restrictions.

M.6.04.3 Water Balance

Where required for "Major Development" applications, proponents are to prepare and submit a water balance study using a methodology acceptable to the Township and the relevant Conservation Authority. The analysis is to determine the infiltration deficit resulting from increased impervious area on the site.

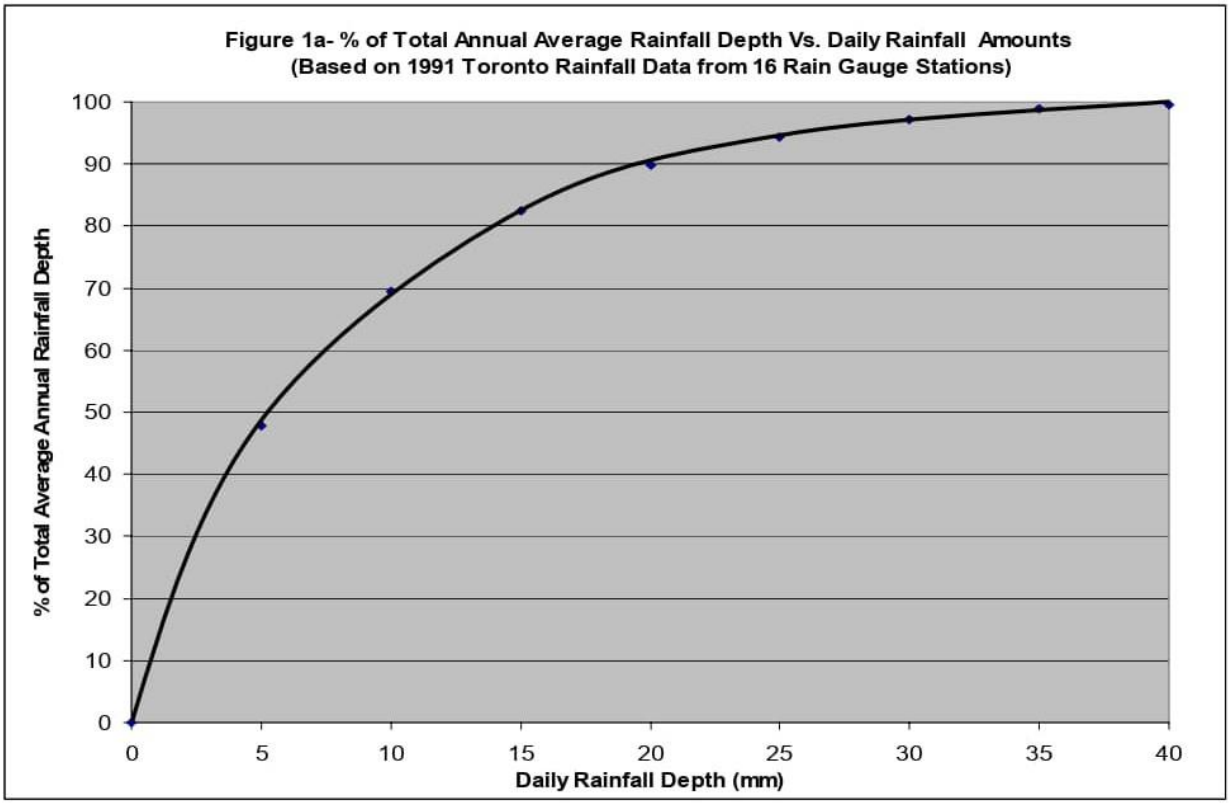
For "Major Development" sites within the TRCA watershed, the TRSPA Water Balance Tool available on the below website provides annual precipitation and evapotranspiration values under existing conditions for site specific locations:

https://trca.ca/conservation/drinking-water-source-protection/trspa-water-balance-tool/

The total TRSPA Water Balance Tool values may not balance for small site areas (i.e., generally infill developments). However, the precipitation and evapotranspiration values are considered reasonable and may be used as part of a water budget analysis for small sites. An acceptable methodology (i.e., Table 3.1 MECP infiltration factors) may then to be chosen by the Designer to estimate the annual infiltration portion of the existing conditions water budget for small sites.

Figure M-3 (and Appendix 11 of the Township's Design Criteria) includes a figure which relates a percentage of annual rainfall to a daily rainfall amount (i.e., Figure 1a from the City of Toronto Wet Weather Flow Management Guidelines, November 2006). This figure may be used to relate the annual infiltration deficit, as a percentage of annual rainfall depth to a daily rainfall amount. The daily rainfall depth at the calculated percentage is the design value for volume control LIDs that will meet the water balance requirements for the site.

Figure M-4: Total Annual Average Rainfall Depth vs. Daily Rainfall Amounts



Source: Wet Weather Flow Management Guidelines, City of Toronto (November 2006)

In the LSRCA watershed, the volume control criteria for "Major Development" of 22.5 mm over the site impervious area (i.e., runoff from a 25 mm rainfall) correlates to an infiltration ratio of 92% of the average annual rainfall. Unless the infiltration deficit exceeds 92% of the average annual rainfall amount, this volume control criteria applies to sites which do not have restrictions as outlined in the LSRCA design criteria.

M.6.04.4 Scoped Hydrogeological Assessment

A "Major Development" is to undertake a scoped hydrogeological assessment to confirm if native or imported soil permeability and the depth to seasonally high groundwater at the infiltration LIDs site is restrictive in meeting water balance requirements. Refer to Section C3.01a) and b) which describe the requirements of establishing these site conditions.

Section C5.04 further outlines design requirements for LIDs to meet pre-development groundwater recharge volumes. For sites with restrictions, refer to Section C5.03.02 above.

M6.05 SWM Design Requirements

LID designs shall be based on criteria included in the MECP SWM Design Manual (2003) and the LID Design Guide (2010) including but not limited to:

1. Establishing the seasonal groundwater level monitoring using monitoring wells or test pits at the proposed LID location to determine the seasonally high groundwater elevation. The preferred separation distance between the bottom of infiltration LIDs and seasonally high groundwater is 1 m.

2. Determine the existing and design soil infiltration rates of soils at the LID site through soil sampling and grain size analysis (e.g., septic system soil testing), on-site percolation tests (per Appendix C of the LID Design Guide) or from soil type descriptions (Table 4.4, MECP SWM Guidelines, 2003) including:

   a) Table C-1 to relate percolation time (min/cm) to infiltration rate (mm/hr).

   b) Table 4.4 to estimate percolation rate (mm/hr) based on on-site soils investigations.

   c) Table C-2 to determine the Safety Correction Factor to establish the design infiltration rate.

   The on-site soils test results or soils classification and the design infiltration rate determinations are to be signed and stamped by a Professional Engineer.

3. Maximum soakaway pit depth based on Equation 4.2 (MECP SWM Guidelines, 2003).

4. Required soil cover for trenches, per Figure 4.4 (MECP SWM Guidelines, 2003).

5. Infiltration trench bottom area based on Equation 4.3 (MECP SWM Guidelines, 2003).

6. Upstream collection system sizing calculations (sewers, rainwater leaders, swales, channels, etc.).

7. LID sizing calculations including required volume versus capacity provided, detention time. discharge rate, etc.

8. LID construction details.

9. Outfall system capacities and details.

10. Designed overflows or by-pass systems to surface grading or pipe systems with adequate capacity for overflows once the design LID volume is full.

11. Supplier information for any proposed manufactured conveyance, storage, flow control or treatment products.

M6.06 SWM Design Features

The following LIDs are the most effective methods of retaining relatively clean runoff from roof areas on infill developments. All systems are to have overflow outlets to the ground surface with positive drainage. Pipe capacity calculations based on the peak flow rates expected from the contributing areas are to be prepared. Designers are to review the MECP SWM Guidelines (2003) and the Low Impact Development (LID) SWM Design Manual (2010) and select and design the measures appropriate to the site:

1. Area drain inlets in the invert of grass swales near the swale outlet from the site, connected to infiltration trenches or galleries. Surface inlets from vegetated swales capture runoff from areas other than rooftops during infrequent storms to reduce downstream flood potential.

2. Roof leaders to individual soakaway pits.

3. Roof leaders connected to an underground collection system piping and outletting to clear stone-filled infiltration trenches or galleries.

4. Roof leaders connected to an underground collection system piping and outletting to buried tanks or chambers.

5. Roof leaders connected to an underground collection system piping and outletting to a cistern for pumped reuse on the site (i.e., irrigation).

6. Soakaway pits, infiltration trenches or galleries are to be a minimum 5 m from a building foundation, per the Ontario Building Code.

M6.07 SWM Report and Drawing Requirements

A Stormwater Management Report or Design Brief is to be prepared, signed and stamped by the Professional Engineer or licensed Engineering Technologist. The documents are to include the necessary figures, calculations, specifications and drawings to support the design and describe the works to be constructed. A summary of the report and drawing content requirements is provided in Appendix 12.

M7.00 Servicing Design

M7.01 General

The servicing design should be generally consistent with subdivision design requirements for subdivisions with specific conditions noted in the following sections. The Owner should be aware that all service lateral construction, decommissioning of existing services as applicable and restoration work within the municipal right-of-way must be performed by Township designated contractors, at the Owner's cost.

M7.02 Sites in Unassumed Developments

In developments which have not been assumed by the Township, the Servicing Plan is to be reviewed and accepted by the Consulting Engineer who designed the subdivision. The Applicant is to provide correspondence from the Consulting Engineer stating that the servicing design is in conformance with the approved subdivision design.

M7.03 Driveways and Site Access Design

Driveway designs are to primarily align with the Township's current Zoning By-law. Secondly, the design is to be based on criteria noted in Section B8.00 and as noted below:

1. The Applicant shall apply to the Township of King for an Entrance Permit and the Applicant is responsible for ensuring the requirements of the permit are met during and following the construction period. In addition, the applicant shall apply for a Road Occupancy Permit in order to carry out work on the Township's road allowance.

2. Either year-round or seasonal half-load restrictions may apply to the roadway fronting the site location or on adjacent Township streets or Regional roads. The extent of load restriction is to be confirmed; however, a common restriction is for vehicles in excess of 5,000 kg (5 tonnes) per axle. Applicants and consultants are to review the current restrictions on the Township's website. Applicable restrictions are to be noted on the Servicing Plan and Grading Plan.

   https://www.king.ca/half-load-restrictions

3. The Applicant is to confirm if any municipal trees on Town-owned lands are being removed and the tree locations are to be shown on the Grading Plan. If trees are to be removed, information on the number, species, trunk diameter, etc. are to be provided by the Applicant. The Community Services Department will require compensation for any tree removals within the road allowance.

4. Driveway entrance designs in the road allowance are to be in accordance with Standard Drawing KS-341 and shall consist of the following:

    a) In urban areas, asphalt surfaces only. Interlock stone, concrete driveways are not acceptable.

    b) A maximum 0.3 m wide flare in the width of the driveway immediately behind the curb may be constructed. Driveway widening in excess of a total of 0.5 m is not acceptable.

    c) Driveway curbs, borders or edging is not to placed in the road allowance.

    d) Driveway aprons are to be constructed perpendicular to the centerline of the existing road pavement.

5. The design minimum and maximum grades within the lot shall be 2% and 6%, respectively, which allows for construction tolerances and ensures that the constructed driveway requirements will be met. The constructed driveway minimum and maximum grades within the lot shall be 1% and 8%, respectively.

6. Driveways in the Urban Village areas are to provide continuous positive slope from the front of the building or garage to the edge of roadway pavement. Reverse slope driveways or ramps in Urban Village areas will not be permitted unless receiving written permission from the Township. Where a reversed-slope driveway or ramp may be considered for approval by the Township, a site investigation is to be completed. A report prepared by a Professional Engineer is to be submitted to the Township for review and approval prior to the issuance of a Building Permit. The site investigation and report are to be in accordance with the requirements of “Appendix F – Reverse Slope Driveway Guidelines, Design Criteria for Sewers and Watermains, 2nd Edition, Chapter 6,” City of Toronto (Sept. 2022) or as directed by the Township. In addition, the Township may require a warning clause to be registered on title of the property regarding any sump pumps associated with the reverse slope driveway or ramp stormwater infrastructure.

7. Reverse slope driveways in rural areas are discouraged; but where they are approved in writing by the Township, the design must meet O.B.C. requirements.

8. Heat tracing of private driveways shall not extend beyond the street line into the driveway apron in the road allowance.

9. A drainage solution is to be designed to intercept snowmelt from heat-traced pavement on private property to prevent snowmelt from reaching the driveway apron and road pavement in the boulevard. A trench drain at the street line with a pipe outletting to either a roadside ditch or a private property LID constructed below the frost level may be considered by the Designer. Other solutions that may be proposed are subject to acceptance by the Township.

10. Driveways are to have a minimum 150 mm depth of compacted Granular A and 80 mm depth of HL3A asphalt (in two lifts) from the roadway edge of pavement or curb to the front of the house or garage. An alternative asphalt driveway pavement of 50 mm depth of HL8 and 30 mm depth of HL3A may be used.

11. Driveway culvert design is to be in accordance with Standard Drawing KS-340. The condition of existing driveway culverts will be assessed by the Township. For new driveway construction, the minimum culvert size is 400 mm diameter or equivalent diameter to the next downstream culvert, whichever is larger. The Applicant may be required to confirm drainage areas, prepare flow calculations and culvert capacity calculations to confirm the size of a new or replacement culvert.

M7.04 Sanitary Servicing Design

Sanitary servicing shall be consistent with the requirements noted in Sections E5.00 and E6.00 and the following noted below:

1. Private septic systems:

    a) The Applicant is to retain a qualified septic system designer (i.e., licensed Professional Engineer or Architect or person who has obtained a building code identification number (BCIN) and is familiar with septic system designs and regulations).

    b) Design Drawings and calculations based on site conditions, soil types and groundwater levels confirmed through field testing are to be prepared by the qualified Designer and submitted to the Township of King Building Department for review and approval.

    c) The septic system design is to be coordinated and consistent with the house siting, the lot grading and the balance of the servicing design and is to be shown on the Servicing and Grading Plans.

    d) Construction inspection, documentation and certification requirements of the septic system as outlined in the permit issued by the Building Department are to be met.

2. Connections to municipal sanitary sewer systems:

    a) Each residential lot is to be serviced by a single sanitary service pipe. The service shall be a 125 mm diameter SDR 28 pipe within the road allowance.

    b) Applicants are encouraged to reuse existing service connections, which may be enforced by the Township. Applicants are advised that if a new service connection is accepted, sewer construction and road and boulevard restoration will be completed by the Township's municipal contractor at the expense of the Applicant.

Service connection details are shown on Standard Drawings KS-175, KS-176, KS-179 and KS-191.

c) Existing service connections which are approved to be decommissioned are to be cut and capped at the sewer main and not at the property line.

d) The existing or proposed service lateral invert elevation at the street line is to be shown on the drawing. The depth of the service connection at the street line is to be sufficient to extend to the building envelope below the footings and service the furthest and lowest point of the building at a minimum slope of 2%.

e) The Applicant is to retain a licensed sewer inspection firm to inspect and confirm that the existing sanitary service proposed for reuse within the road allowance is acceptable by flushing and inspecting the service by CCTV. A report with the CCTV inspection prepared by the licensed firm is to be submitted to the Township for acceptance prior to the issuance of a Building Permit.

f) All domestic service connections shall have a 125 mm diameter capped PVC surface cleanout pipe installed in the road allowance at the street line, inside a slide-type valve box and cover with the top set to finish grade as per Standard Drawings KS-193 and KS-194.

g) Upon completion of either a new sanitary service from the mainline sewer to the building face or installation of the surface clean out at the street line on an existing service, the Applicant is to retain a licensed sewer inspection firm to complete the following testing of all new piping up to the building face or existing piping from the clean out to the building face. A report is to be prepared by the inspection firm and is to be certified by the qualified person who prepared the servicing design and is to be submitted to the Township prior to the issuance of an Occupancy Permit:

- Low pressure air exfiltration testing; and,
- CCTV inspection.

h) Sanitary service connections shall be solely gravity-fed. Use of grinder or ejector pumps will be considered only where achieving minimum grade is not possible. The pump and the pump discharge to a gravity sanitary sewer are both to be entirely located on the private property being serviced by the pump and shall be subject to specific approval of the Township.

M7.05 Storm Servicing Design

Storm services shall be consistent with the requirements noted in Section C11.00 and the following noted below:

1. The use of a sump pump will not be permitted if the lot has an existing storm connection available. Applicants are encouraged to reuse existing service connections, which may be enforced by the Township. Applicants are advised that if a new service connection is accepted, sewer construction and road and boulevard restoration will be completed by the Township's municipal contractor at the expense of the Applicant. Service connection details are shown on Standard Drawings KS-175, KS-176, KS-177 and KS-178.

2. Existing services which are approved to be decommissioned are to be capped at the street line.

3. Sump pumps are discouraged. Where the property is currently serviced by a storm lateral or other lots along the same street are serviced by storm laterals, a sump pump will not be permitted. The proposed foundation drain must discharge via a gravity storm connection.

4. Where the depth of the existing storm sewer connection does not allow for gravity flow from the footing elevation, the Township may provide specific approval for a sump pump outlet to connect directly to a gravity storm service pipe. In this case, an above ground air brake/air gap shall be provided to prevent a suction or vacuum condition in the storm service connection.

5. Where the Township finds that a sump pump service outletting to finished grade is acceptable, the outlet is to be directed generally towards the street and away from adjacent properties.

6. The existing or proposed service invert elevation at the street line is to be shown on the drawing. The depth of the service connection at the street line is to be sufficient to extend to a minimum 0.6 m below the footing at the building envelope at a minimum slope of 2%.

7. Storm service connections to a municipal sewer are to be 150 mm diameter SDR 28, installed at a minimum slope of 2%.

8. Foundation drainage from a building is not to be connected to any stormwater soakaway pits or infiltration galleries.

9. An overflow branch pipe to a splash pad is to be provided on roof leaders that are connected to buried soakaway pits or infiltration galleries.

10. Overflow pipes or structures from soakaway pits or infiltration galleries shall not be connected to the storm sewer service.

11. Runoff calculations and swale capacity calculations may be required by the Township where drainage from external areas outlets through the infill development property. The Applicant is responsible to convey all external flows overland without obstructions or relying on shallow buried pipes or weeping tiles.

12. If a buried roof leader pipe collection system is proposed, the pipe sizes are to be calculated based on the design peak flow from the contributing areas conveyed to a LIDs. The Township's storm sewer design sheet is to be used for these calculations.

M7.06 Potable Water Servicing

Water services shall be consistent with the requirements noted in Section D6.00 and the following noted below:

1. For properties serviced by a private drinking water well:

    a) The Owner is responsible to retain the services of a licensed well driller to install a new potable water well or modify an existing well to service the development, in accordance with O.Reg. 903, including providing documentation to the MECP as required.

    b) The Owner is responsible to ensure there are no off-site impacts including well interference due to the construction of a new well or reuse of an existing well to service the development and that sufficient water volume is available.

    c) The Owner is responsible to ensure the water quality of an existing well proposed for continued use on the site or a newly constructed well proposed to service the development meets the current drinking water guidelines for potable water in Ontario.

2. Properties serviced by a municipal water distribution system:

    a) Confirmation is to be provided that the size of the existing water service to the lot is adequate to meet the peak demand with acceptable residual water pressure based on the proposed dwelling's fixture count. The analysis should have regard for the Township's current standard minimum water service size of 25 mm diameter.

    b) Applicants are encouraged to reuse existing services or replace an existing service in the same location. A proposal to install a new water service at a different location than an existing service is subject to approval by the Township. Applicants are responsible for the full cost of new water service construction, connection to the watermain, capping the existing service at the main and road and boulevard

restoration. These works will be completed by the Township's municipal contractor and not the contractor completing the private servicing to the building.

c) A new curb stop is to be installed on the water service at the street line.

d) The Fire Department will review and provide any comment on fire protection matters. If a fire hydrant is located within the boulevard it should be shown on the drawings.

M8.00 Drawing Requirements

Refer to Appendix 12 for descriptions of the content required in various drawings to be submitted.

The Applicant may submit a combined Grading and Servicing Plan for applications where the presentation of all existing conditions and proposed design information can be shown clearly. However, at the discretion of the Township, a separate Grading Plan and Servicing Plan as well as other drawings such as an Erosion and Sedimentation Control Drawing or a Details Drawing may be required where the amount of information to be provided cannot be shown clearly. Cross-sections, retaining wall drawings and other details at smaller scales may be required which cannot be presented in plan view alone.

M9.00 Inspections and Certifications

The Applicant is to retain the qualified Professional who designed, signed and stamped the drawings approved for construction by the Township to complete inspections and provide certifications to the Township. Certifications are to state that the individual has attended the site and witnessed the construction of services including storm drainage and storage measures and overall lot grading. The following certifications are to be provided to the Township:

1. Prior to disturbance of the site (i.e., grubbing, topsoil stripping, earthmoving or demolition of existing structures), a signed and stamped letter prepared by the qualified Professional certifying that the necessary erosion and sedimentation controls and tree protection measures shown on the approved plans have been installed.

2. Prior to final grading and restoration of sites that include LIDs or SWM-related infrastructure, the qualified Professional is to sign and stamp a certification letter to the Township that these specific works have been constructed in accordance with the drawings approved by the Township and in accordance with good engineering practice.

3. Following the completion of construction and stabilization of the site, the qualified Professional is to sign and stamp a certification letter to the Township that the works including all aboveground and underground facilities/infrastructure and the overall site grading and drainage features have been constructed in accordance with the drawings approved by the Township and in accordance with good engineering practice.