TOWNSHIP OF KING

Regional Municipality of York

DESIGN CRITERIA
AND
STANDARD DETAIL DRAWINGS

January 2019

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.

Reference Table

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

The Township of King	King Township or the Township
The Regional Municipality of York	York Region, the Region
Toronto and Region Conservation Authority	TRCA
Lake Simcoe Region Conservation Authority	LSRCA
Ministry of the Environment Conservation and Parks	Ministry of Environment, MOE, MOECP
Ministry of Natural Resources	MNR
Township of King Clerk	Township Clerk, Clerk
Township of King Director of Engineering, Public Works and Building	Director of Engineering, Director, Engineer
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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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 Township of King. 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 of King 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 of King 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's Engineering and Planning staff to discuss areas of preliminary concern and other issues prior to commencement of the engineering design (see Section 1.04).

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 King 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 of King 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 (May2013)* 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
- construction considerations

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

A preliminary engineering report (**Functional Servicing Report**) must be submitted by the Developer's Consulting Engineer to the Director of Engineering, Public Works and Building in accordance with the current standards. This report must be presented in a readable,

comprehensive and professional manner. The report must be signed and sealed by a Professional Engineer.

This Preliminary Report shall contain the following and be submitted in hard copy and digital formats:

1. The Draft Plan

   The Draft Plan must be in a form acceptable to the Planning Departments of the Regional Municipality of York and the Township of King.

2. Contour Plan

   This plan must be at a scale of no larger than 1:1000, giving contour lines at sufficient intervals to permit assessment of existing surface drainage patterns. Contour intervals shall not be greater than 1.0 m. This plan is to extend to the limits of the drainage area to be serviced proposed sanitary and storm sewer systems, including lands beyond the boundaries of the subdivision. For large external drainage areas, separate Contour Plans at a larger scale may be provided. All elevations are to refer to Geodetic Datum.

3. General Plan of Services

   This will be a plan based on the Draft Plan and must schematically show the proposed storm sewer systems and their connection to existing systems. Direction of flow must be indicated on all sewers. This plan is to be accompanied by preliminary engineering calculations indication the quantity of storm water flow at the connection to existing systems and/or at proposed outfalls. Consideration must be given to the whole catchment area to ultimately be developed. Blocks for storm and sanitary sewers and watermain systems shall also be shown.

   Preliminary road profiles and area grading requirements must also be identified in the Preliminary Report. Blocks of land for community mail centres must be identified on the Draft Plan and the General Plan of Subdivision.

4. Drainage Plan

   When a natural drainage channel passes through and is affected by the construction of the subdivision, drawings must be submitted to indicate the location and typical cross-sections of the existing channel and of any proposed changes. In general, creek diversions will not be permitted, unless these are in the nature of improvements to the existing watercourse. An erosion-sediment control plan will be required. A preliminary stormwater management plan and report will be required by the Township of King in accordance with Section C2.05 of this document. The Consulting Engineer must submit an outline of the erosion-sediment control plan.

Any proposed modifications to an existing channel and/or floodplain will require Conservation Authority review and approval. The Consulting Engineer must meet with Conservation Authority staff and confirm their requirements, prior to proceeding with the preliminary engineering report.

5. Soils Report

A preliminary soils investigation and report from an independent soils consultant will be required by the Director of Engineering, Public Works and Building with particular attention to sub-surface ground conditions and the ability of the soils to structurally support underground services, roads and foundations for residential, commercial, or industrial type structures. Said soils report is also to address all normal and customary matters related to the construction of roads and services, including soil parameters as relate to possible groundwater infiltration, corrosivity, etc.

6. Hydrogeologic Report

Where private services are proposed, a hydrogeologic report will be required by the Director of Engineering, Public Works and Building, to establish the suitability of the development area and its component sub-areas, to safely accommodate private water supply and waste disposal systems with acceptable impacts on existing adjacent developments, in conformance with Ontario Ministry of the Environment policies and regulations. The specific soil and groundwater testing will be dependent on the local hydrogeologic setting and existing development, and must be reviewed with the Director of Engineering, Public Works and Building prior to commencement of the field verification studies.

7. Watermains and Sanitary Sewers

Where watermains and sanitary sewers are proposed, comprehensive servicing reports shall be prepared and submitted to the Director of Engineering, Public Works and Building.

A1.06 Functional Design Report

A functional report and plan is required prior to commencement of the final design. Prior to the commencement of the final design, the Developer's Consulting Engineer shall meet with the Director to discuss the Township's requirements, and with the Region's Transportation Services Department to discuss the Region's requirements. It is suggested that when possible, this be a joint meeting. The functional report shall provide all details, calculations, costs, alternatives and recommendations necessary to evaluate the proposed development.

The functional report and plan shall include, but will not necessarily be limited to the following considerations:

- major roadway alignments, cross-sections and intersections
- roadway structures
- watercourse improvements and channelizations
- railway crossings
- parkland development
- major trunk sewers
- storm drainage systems
- sanitary drainage systems
- water distribution systems
- lot grading design
- pumping station locations
- noise attenuation measures
- servicing capacities

In cases where the subdivision development under consideration forms part of a larger area set aside for future development, the functional report shall confirm that the servicing design does not limit the future development. The functional report shall be a definite requirement, when a subdivision is being phased and the engineering design is being undertaken for each phase separately.

The FSR shall also review and include descriptions of works that are required in conjunction with the servicing of the development site as may be referenced as a Community Improvement item and/or items that are referenced in the current Development Charges by-law for the Township.

The functional report shall be signed and sealed by a Professional Engineer.

A2.00 Submissions

Engineering drawings shall be submitted simultaneously to York Region and to the Township of King. The Consulting Engineer is advised to review York Region's design criteria to determine the requirements for submission of engineering drawings to the Region.

A2.01 First Submission to the Township of King

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

1. One copy of the approved Draft Plan.

2. Two copies of the proposed plan for registration showing all lot and block numbering and dimensioning.

3. Two copies of all "R" Plans showing 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. Two copies of the complete set of engineering drawings, including:
   a) General Plan of Services
   b) Lot Grading Plan
   c) Area Rough Grading Plan
   d) Storm Drainage Plan(s)
   e) Sanitary Drainage Plan(s)
   f) all Plan and Profile drawings
   g) all detail drawings other than the Township of King Standard Detail Drawings
   h) all drawings pertinent to the design
   i) Utility Co-ordination Plans
   j) two copies the sewer design sheets (including Excel copies)

6. Two copies of all other calculations necessary to check the design.

7. Two copies of a soils report for confirmation of the pavement design, prepared by a qualified Soils Consulting Engineer.

8. Street Lighting designs and photometric calculations.

9. Noise Attenuation and Vibration reports.

10. Two sets of streetscape/landscape/tree planting plans for boulevards.

In addition to all the above, a submission checklist (as found in the appendix) is to be reviewed by the submitting engineer and signed as to the completeness of the submission. The Township may reject any submission which is deemed to be incomplete or not meeting 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 format) on DVD (two copies). All plans are to be geo-referenced to UTM coordinates as defined by the Region of York and/or the Township of King.

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 of King Engineer. The design of the underground electrical distribution system shall be completed by Ontario Hydro. This design shall be submitted to the Director of Engineering, Public Works and Building and shall be approved prior to the final approval of the engineering drawings. The design of the telephone system, cable TV 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 Ministry of the Environment Applications

The Township approvals for storm and sanitary sewers are provided by the Region of York under the MOE Transfer of Review Program. The Transfer of Review Program allows the technical review of Environmental Compliance Approvals (ECAs), which has replaced the Certificate of Approval process for certain types of municipal sewage/storm works. The Transfer of Review Program covers a number of works that are of a noncomplex or less environmentally sensitive nature. The Township approvals for storm water management facilities are to be submitted directly to the MOE.

As part of the second engineering submission the Developer is to submit three copies of the completed Application for Environmental Compliance Approval and all required documents, to the Township for review. Applications shall be completed electronically online, with all of the required sections completed fully and the Application Status shown on Page 5 reads "Form Complete" and to be submitted in colour. Incomplete applications will be returned to the Developers Engineer. If the Township has comments related to the approval process, they will be sent to the Developers Engineer, the Township will not recommend approval until all

comments are addressed. Once the Township is satisfied with the application, the application will be signed by the Director and returned to the Consultant for further processing.

The Municipal Drinking Water Licensing Program has now replaced the Certificate of Approval program for municipal residential drinking water systems. The Developer is no longer required to submit an application to the Ministry of the Environment for approval. The Developer is now required to submit Form 1 – Record of Watermains Authorized as a Future Alteration and all required documents, to approval. See Appendix 2 for further information and background related to water system infrastructure.

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 of King, the original drawings shall be submitted to the Director of Engineering, Public Works and Building for signing. These drawings will be signed and dated by the Director of Engineering, Public Works and Building and returned to the Consulting Engineer for further printing and distribution. Changes or revisions to the drawings, after the signature of the Director of Engineering, Public Works and Building has been affixed, must be formally submitted to the Director of Engineering, Public Works and Building for approval, and shall be detailed in an appropriate revision items.

If, after one year from the date of the signing of the engineering drawings by the Director of Engineering, Public Works and Building, the Developer fails to commence construction, the Director of Engineering, Public Works and Building reserves the right to revoke any/or all approvals related to the engineering drawings.

A2.05 Infrastructure Attribute Data

As part of the submission of design drawings, 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 coordinates for the development site and all asset items contained therein. The data will 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 8 for this purpose.)

(Note – this information is to be provided in conjunction with the drawings submissions but, in any event, no later than prior to execution of a Subdivision Agreement and/or Re-Servicing Agreement.)

A2.06 Preparation of Subdivision Agreement

The draft of the Subdivision Agreement will be prepared by the Director of Engineering, Public Works and Building 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) prior to the preparation of the draft Subdivision Agreement Schedules.

Note: Prior to commencement of preparation of the Subdivision Agreement, the Developer's Consulting Engineer shall provide the Director of Engineering, Public Works and Building with the following:

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

2. 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.

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

4. A breakdown of the number of units proposed within the subdivision:
   - Single family units
   - Semi-detached units
   - Townhouse units
   - Apartment units

5. Two copies of the Reference Plan for the subdivision.

6. Two copies of the legal description of the subdivision, based on the Reference Plan.

7. Two copies of 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.

8. Two copies of the Reference Plans (65R-) for any easements to be granted to the Township.

9. Two copies of the engineering drawings and landscaping plans acceptable to the Director of Engineering, Public Works and Building (including digital files).

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

11. 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.

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

13. 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:

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.

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

    - Ontario Hydro
    - Bell Canada
    - Consumer's Gas (Enbridge)
    - appropriate cable company
    - any other authority where required

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

15. Proposed timetable for construction of services.

16. Proposed staging plans.

A2.07 Requirements Prior to Commencement of Construction

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 Director for approval (allow at least two weeks for approval):

1. Three sets of all construction specifications.

2. The names of proposed contractor and subcontractors.

3. The contractor's list of suppliers.

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

5. All other information specified in the Subdivision Agreement as a requirement prior to commencement of construction or other information required by the Director of Engineering, Public Works and Building.

6. Conservation Authority permits 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). The EPW Department reviews Construction Management Plans to ensure safe and efficient traffic operations during construction activity. This document provides a general outline of the traffic management and construction scheduling details that should be included in your CMP's.

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 Representative
   - General Contractor
   - Sub-Contractors
   - 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
    - 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 emergency on-site.

Detailed Information

The following components with detailed explanations should be identified and included in the Plan:

- Work Days/Hours
- Delivery and Truck Routes
- Location of Site Office – Worker Access and Parking
- Health and Safety Initiatives
- Truck Unloading/Staging Areas
- Construction Site Signs, Route Notices, etc.
- On-Street Parking Occupancy
- Pedestrian Access, Sidewalk Obstructions
- Siltation and Erosion Controls, stormwater control
- Air, Noise, Dust Controls
- 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 Regional 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 standard drawings, shall be used on all engineering drawings. A title sheet is required for the 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 referenced 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 Director of Engineering, Public Works and Building, in accordance with the requirements of Section A2.05.

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

A4.00 General Plan of Services

1. A “General Plan of Services” drawing shall be prepared for all developments at a maximum scale of 1:1000.

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 manholes 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 exiting 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 manholes shall be shown on the plan and on the profile portion of the drawing. The manholes 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 manholes which have safety platforms are to be noted.

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

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

12. Manhole 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.

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 the 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 TV 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 (see Section C2.01).

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; and
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:

> 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.
>
> The Township will apply a replacement "ratio" approach rather than adopting a more complicated "tree valuation" approach to determine the requirement for compensation for trees that are removed to facilitate the development of a site. Both the Toronto and

Region Conservation Authority and Lake Simcoe Region Conservation Authority utilize this approach.

Trees are to be compensated at a 3:1 ratio of trees planted versus trees removed. The ratio would be applied to existing trees with a 100 mm diameter (DBH) or greater that are proposed to be removed. 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).

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

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.

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 established by the Township at an average cost, to be set from time to time, being no less than $400.00 per tree.

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 Director of Engineering, Public Works and Building. 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 to check 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 manhole or sewer detail shall be 1:25.

A7.00 Certificate of Acceptance and Assumption

The term “Acceptance” is used to describe when all of 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 of King.

When the services are completed and cleaned to the satisfaction of the Consulting Engineer, he shall advise the Director of Engineering, Public Works and Building (in writing) that the work is completed and shall request an inspection by the Township of King. The Township of King 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 Director of Engineering, Public Works and Building, a letter shall be issued setting out the date for the commencement of the Maintenance Period.

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 so advise the Township and shall request a final inspection by the Township of King. When all work is completed to the satisfaction of the Director of Engineering, Public Works and Building, a report shall be forwarded to the Council recommending Assumption of the works.

A8.00 "As-Constructed" Drawings

A8.01 General

The "As-Constructed" drawings constitute the original engineering drawings, which have been amended to incorporate the construction changes and variance in order to provide accurate information on the work as installed in the development.

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 x-refs within the files. These files are to be accompanied by Adobe PDF (Vector image) files which are appropriately named.

The Registered Plan number and Certificate of Approval (MOECC) number for the subdivision must be clearly shown on all As-Constructed "General Plan of Services".

A8.02 "As-Constructed" Field Survey

The "As-Constructed" revisions shall be based upon a final survey of all the subdivision services and the Consulting Engineer's construction records. The final survey of the subdivision services shall include a field check of the following items:

- location and invert elevations of all sewer manholes
- distances between all sewer manholes
- location of all roadway catchbasins
- location, rim and invert elevations for all rear yard and lot catchbasins
- 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 centreline elevations
- site benchmarks
- location of all service connections to all lots and blocks and location of connection from nearest downstream manhole (i.e., +023)
- sewer pipe sizes
- location of all fencing constructed as part of the subdivision services
- "As-Constructed" tree planting

A8.03 Drawing Revisions

The original drawings shall be revised to incorporate all changes and variances found during the field survey and to provide the ties and additional information to readily locate all underground services. One set of prints of the approved engineering drawings shall be submitted, which show the approved figures with the changed figures in coloured highlights.

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 pencil notations on the drawings shall be removed and shall be replaced in ink.

All street names, lot numbering and block identification shall be checked against the Registered Plan and corrected if required.

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 "As-Constructed" revision note shall be placed on all drawings in the revision block. The title sheet of the Engineering Drawings shall be clearly marked with "As-Constructed", (48 pt. Grotesque 216).

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 "As-Constructed" drawings may be checked by the Township of King 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 will 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 8 for this purpose.)

A8.06 Submissions

Upon completion of all construction work and the "As-constructed" revisions, the original drawings and asset inventory data sheets shall be submitted to the Township of King for their permanent records.

The submission of the "As-Constructed" drawings to the Township of King must be completed for all underground works as soon as possible after the installation of said services (i.e. prior to preliminary acceptance). Subsequently, the as-constructed drawings shall be completed to the full extent of all works and submitted for review before "Final Acceptance" of the subdivision will be given.

The Consulting Engineer shall provide a written declaration to the Township of King 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

Township of King
Design Criteria and Standard Detail Drawings

SECTION B ROADWAYS

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B1.00 Classifications

All roadways in new developments shall be classified in accordance with the Township's current Official Plan which includes the following:

- Arterial Roads (generally all Region of York roads)
- Collector Roads
- 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 urban design standards.

The road classifications and resulting designs shall be in conformity with the policies and guidelines contained within the ***Transportation Master Plan (2015)***. 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 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 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 and arterial road widenings to match development. The traffic study must conform to the Transportation Master Plan (2015) and to the Region of York Traffic Impact Study Guidelines (if any of the boundary roads are Regional roads).

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 Appendix 7.)

B2.00 Geometric Design Elements

Table B-1: Geometric Design Elements

Geometric Detail	Rural	Local	Collector
Operating Speed (km/hr)	50-80	50	50
Road Allowance Width	20.0	20.0	26.0
Pavement Width (m) (face to face)	6.7	8.5	12.5
Maximum Grade (%)	6	6	6
Pavement Cross-fall (%)	2	2	2
Minimum Horizontal Radius (m)	80	80	110
Minimum Visibility Curves in Sag (K Values)	8	8	12
Minimum Visibility Curves on Crests (K Values)	8	8	12
Minimum Tangent Length between Reverse Curves (m)	30	30	50
Intersection Angle (degrees)	85-95	85-95	85-95
Minimum Tangent Length required at stop-controlled intersections (m) from intersecting road center line	30	30	50

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

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

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).

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 (Standard Drawing KS-224) must not have a deflection angle greater than 110 degrees.

B3.03 Vertical Curves

All points of grade change in excess of 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. A 1% or 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:

	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:

	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 down gradient 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. 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:

Local Road	Collector Road
40 mm HL3	40 mm HL3
50 mm HL8	80 mm HL8
150 mm Granular “A”	150 mm Granular “A”
300 mm Granular “B”	450 mm Granular “B”

All depths noted are compacted depths.

All materials shall be compacted as follows:

Item	Compaction Required (% of Standard Proctor Density)
HL3 Asphalt	Minimum 96%
HL8 Asphalt	Minimum 96%
Granular “A”	Minimum 100%
Granular “B”	Minimum 100%
Backfill and Subgrade	Minimum 98%

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 with regard to eliminate 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 stripped shall remain on site to be used within the limits of the subdivision. Topsoil shall not be sold and removed from the site.

In order 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 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 of 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. All deficiencies and settlements have been repaired.

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

7. The approval of the Director 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 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 conditions 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.

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. These costs will be borne by the developer.

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).

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, unless specifically approved by the Township.

All curb and gutter is to be protected from damage from heavy equipment and vehicles

Driveway depressions shall be formed in the curb according to the details and locations as shown on the Standard Detail Drawings. If the driveway depression should be improperly located, then that section of depressed curb which is 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. The new driveway depression at this location can be formed by cutting the back of the curb with a curb cutting machine, provided the existing section is free from cracks and other defects, and that the entrance is to a single-family residence. 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 in accordance with the detail on the Standard Drawing.

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.

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.

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.

Sidewalks shall be installed at the locations as shown on the Typical Road Cross-Sections. The standard width of sidewalks for all local streets shall be 1.5 m, with sidewalks on collector roads and areas of higher traffic being 1.8 m. Sidewalks are generally not required on cul-de-sacs, unless they serve 25 units or more; or they provide access as part of a continuous pedestrian system (i.e. connect to a walkway).

Construction shall comply with Standard Drawing KS-231 and the depth of concrete shall be a minimum thickness of 130 mm and increased to 180 mm at all driveway locations. Full depth expansion joints shall be installed between every third sidewalk bay. Sidewalks must not be “dipped” at driveways. Concrete used in sidewalks is to be specified as 32 MPa, C2 (per CSA A23.1).

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.

B8.01 Minimum Driveway Design

The minimum consolidated depth requirements for the granular base and asphalt in driveways shall be as follows:

a) Single Family Residential

- Asphalt 50 mm of HL3 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”
  225 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”

Alternate types of driveways (i.e., paving stones, concrete pads, etc.) will be subject to approval by the Director.

B8.02 Driveway Grades

The maximum permissible design grade for any driveway on private lands shall be 6% (desirable), or 8% (maximum). The minimum grade for all driveways shall be 1%. The use of negative grade driveways is not permitted in urban areas. Negative sloping driveways will only be considered in estate residential developments under special circumstances. Where negative sloping driveways are used, a positive slope of at least 2.5% must be maintained from the garage over a minimum distance of 10.0 m. Any variations from these limits must be approved.

B8.03 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 TV junction boxes, water service valve boxes, side lot lines and other driveways, 1.5 m 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.).

6. In no case shall a driveway be located less than 6.0 m from an intersection, or within a daylight triangle.

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

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C1.00 Drainage Policies

The Township of King 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) 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:

a) Prevent loss of life and minimize property damage and health hazards.

b) Minimize inconvenience from surface ponding and flooding.

c) Minimize adverse impacts on the local groundwater systems and base flows in receiving watercourses.

d) Minimize downstream flooding and erosion.

e) Minimize pollution discharges to watercourses.

f) Minimize soil losses and sediments to sewer systems and water bodies from construction activity.

g) Minimize impairment of aquatic life and habitat.

h) Promote orderly development in a cost-effective manner.

The following sections dealing with the design of SWM facilities are provided here for convenience. In any case where the SWM 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 instance.

C2.00 Attainment of Drainage Objectives

C2.01 Stormwater Management (SWM) Planning, Policies and Design Criteria

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

- Stormwater Management Planning and Design Manual (2003) MOEE

- Stormwater Management Criteria (2012) TRCA
- Approaches to Manage Regulatory Event Flow Increases Resulting From Urban Development (2016) TRCA
- Erosion and Sediment Control Guidelines (2006) TRCA
- Technical Guidelines for Stormwater Management Submissions (2016) LSRCA
- Low Impact Development Stormwater Management, Planning and Design Guide (2010) TRCA/CVC

or, the most recent version of the above or any new documents issued by these agencies.

Proponents are also required to confirm design criteria and obtain approvals from any other relevant ministries or agencies (i.e., Ministry of Transportation, Ministry of Natural Resources and Forestry, Department of Fisheries and Oceans, etc.).

The planning and design of stormwater management (SWM) facilities shall be discussed with the Township, the TRCA and LSRCA early in the planning process and shall focus on minimizing the number of pond facilities and focusing on source level controls.

Independent on-site SWM facilities are discouraged for individual lot/block development. Water quality and quantity controls in new development areas are to be provided in Township-owned municipal blocks. Proponents in these areas may consider providing on-site control (meeting Building Code requirements), however, credit for these facilities toward reducing downstream municipal SWM facilities will not be given. In the case of infilling proposals, on-site SWM concepts may be considered in conjunction with any potential off-site storm drainage improvements.

The planning and design of each pond shall also focus on opportunities to integrate the pond with the surrounding topography and land uses. Ponds are to be created as public amenity features and are to be safe, significantly visible and accessible to the general public. Opportunities for linkages through the use of trails to larger open space, floodplain areas or other SWM facilities are to be maximized.

C2.02 Low Impact Development Techniques

Development proponents shall consult with the Township with respect to the suitability of applying Low Impact Development (LID) principles to the proposed development application. It is generally maintained that it is preferred that such facilities are installed within the public realm, however, certain of the LID techniques are not considered suitable within road allowances. There is concern that implementing infiltration LID's along roadways may lead to contamination of groundwater resources (due to the risk of sodium and chloride contamination as a result of winter maintenance practices). Many of these features can be located in parks, open spaces, buffer blocks, etc. 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.

While it is recognized that LID's are customarily employed to assist with issues of groundwater balancing (to satisfy the requirements of the conservation authorities), any such LID that requires maintenance by the Township will be subject to review and satisfactory acceptance of the Township.

C2.03 Levels of Service

The level of service to be provided by the storm drainage 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.

Table C-1: 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
Major System	1:100 year storm	• drainage areas may require classification as a floodplain using Regulatory storm criteria (TRCA and LSRCA) • overland flow cannot exceed width or flow capacity of right-of-way
Culverts	per MTO Directive B-100	• see following Table C-2

Item	Level of Service	Comments
Stormwater Management	Control of 1:100 year storm and safely pass Regional storm	• maximum level of control

Table C-2: Level of Service for Bridges and Culverts (per 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	1:10 year	1:25 year
Driveways	1:5 year	1:10 year

C2.04 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 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.

a) Site Location Plan.

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

c) Engineering plans for stormwater facility 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 location and existing 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

d) Landscaping/restoration plans and details.

e) Erosion and sediment control plans and details.

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

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

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

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

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

k) 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.

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

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

n) Sample or supporting calculations for the following:

- extended detention drain downtime (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)

o) Hard and digital copies of input/output files from hydrologic modeling (digital files may be provided on a disk).

p) 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

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 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
- sediment testing, removal and disposal

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.

C2.05 Hydrology and Hydrologic Modelling

The most current rainfall data from the Toronto-Pearson meteorological station is to be used for design of storm drainage and SWM facilities. The equations to calculate rainfall intensity are provided below.

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
- 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.

The following are the A, B, C values for the Chicago distribution design storms to be used in the equation: Intensity = A / (t+B) ^C, as indicated in Table C-3.

Table C-3: Chicago Distribution Design Storm Parameters

Return Period	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
A	789.070	980.848	1118.790	1284.892	1405.794	1443.947
B	6.205	6.013	6.018	6.008	6.012	5.273
C	0.823	0.806	0.800	0.793	0.788	0.776

C3.00 Stormwater Management Pond Design and Features

C3.01 General Requirements

Stormwater ponds are required to meet provincial SWM prerequisites as set out by MNR/MOE, the TRCA and the LSRCA with regard to water quality, quantity and erosion control. SWM pond locations, functions and design criteria shall be confirmed through consultation with the relevant Conservation Authority and the Township of King. Where stormwater FS-DAS studies have been completed, the design criteria shall follow the approved report. End-of-pipe facilities are acceptable to the Township when the designs are safe, maintainable, integrated with the surrounding landscape, and aesthetically pleasing.

The Township concedes the overall design requirements to the most recent provincial direction, as is acceptable to the TRCA and the LSRCA. Exceptions to this are in circumstances that involve:

- matters of public safety and aesthetics
- 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
- conflicts with land use

In these cases, the Township may invoke additional release rate stipulations and design requirements over and above those required by other agencies.

In the detailed design of storage structures, it is recommended that operation be checked for spring flood due to combined snow-melt 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 in order 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, an increasing density of appropriate plantings and vegetation on steeper slopes, handrails/guardrails at headwalls and placing signs which inform of the function and potential hazards of SWM ponds.

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

Table C-4: 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 MOE design guidelines in order 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 Regulatory event) with 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.	
	Signage shall be placed to educate and advise the public of the purpose, characteristics and dangers associated with the facility, with one sign located on each side of the pond.	

	Bollards or gates to discourage vehicular access to the maintenance road.
	Pond inlet and outlet pipes are to be equipped with grates per the OPSDs.
	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.

C3.02 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 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, 1.5 m high black vinyl-coated fencing, posts and hardware shall be used.

Should gates in fences be requested by private homeowners, the Township requires that a clause, prepared by the Township, be registered on title of the private property absolving the Township of all liability associated with having a gate installed in a fence bordering a Township-owned SWM facility. The Township will not be responsible for legal costs incurred for registering the clause on title of the property or for the cost of the gate installation. The Township may also require construction of the fence on the private property side of the property line.

C3.03 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 in order to discuss maintenance operations and features, specifically clean-out procedures and sediment management and removal. These features include:

- Provide a primary maintenance access to the facility (minimum 8 m in width between adjacent properties) suitable for municipal equipment but supports vegetation growth on the surface of the roadway.

- 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%.
- All maintenance vehicle access roads construction shall be structurally designed to support municipal equipment and allow for vegetation growth on the surface of the roadway.
- Provision of a drain-down pipe leading from the permanent pool to a manhole with de-watering sump, if a gravity outlet is not available.
- In order 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).
- 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.
- 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.
- Use of a reverse-sloped control pipe, which reduces thermal impacts (wet pond application).
- Provision of flow control devices in manhole structures located in a berm for easy access, maintenance and cleaning as opposed to a vertical pipe structure located in the pond.
- 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.
- A gate valve to enable the normal pond outlet to be closed in case of chemical spills.

C3.04 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 registered 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.

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

C3.05 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:

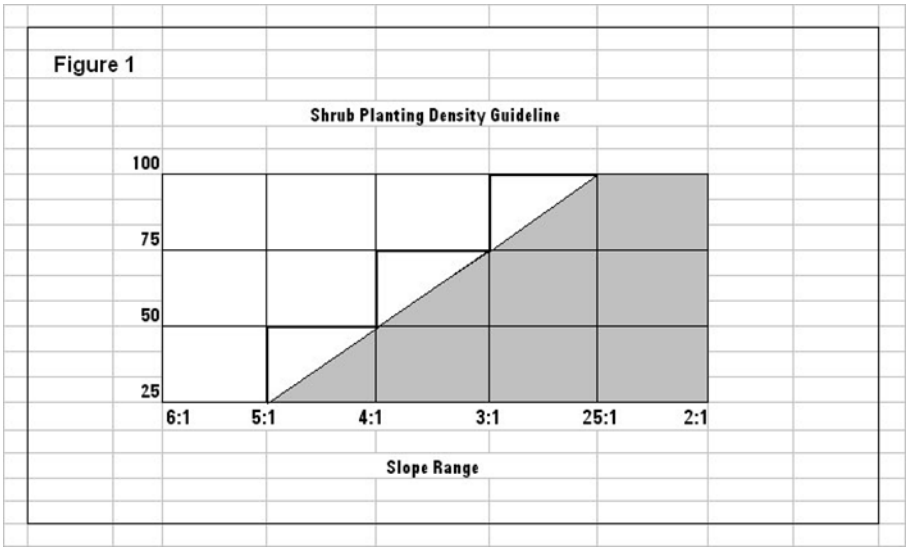
- provide shade to areas of the permanent pool (minimize thermal impacts)
- proposes vegetation which has high nutrient up-take capability and is planted in shallow ponding areas in the extended detention zones
- provide outlooks or viewing features with space suitable for installation of benches and 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



C4.00 Major Drainage System

C4.01 General

Urban stormwater conveyance systems may include open channels and swales, storm sewers, manholes and catchbasins, foundation drainage collectors (FDC), 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.

C4.02 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.

C4.03 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 of King requires that and 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.

C4.04 Major System Design Criteria

The design of the major system shall be such that runoff is conveyed within the boundaries of municipal road allowances, blocks or easements.

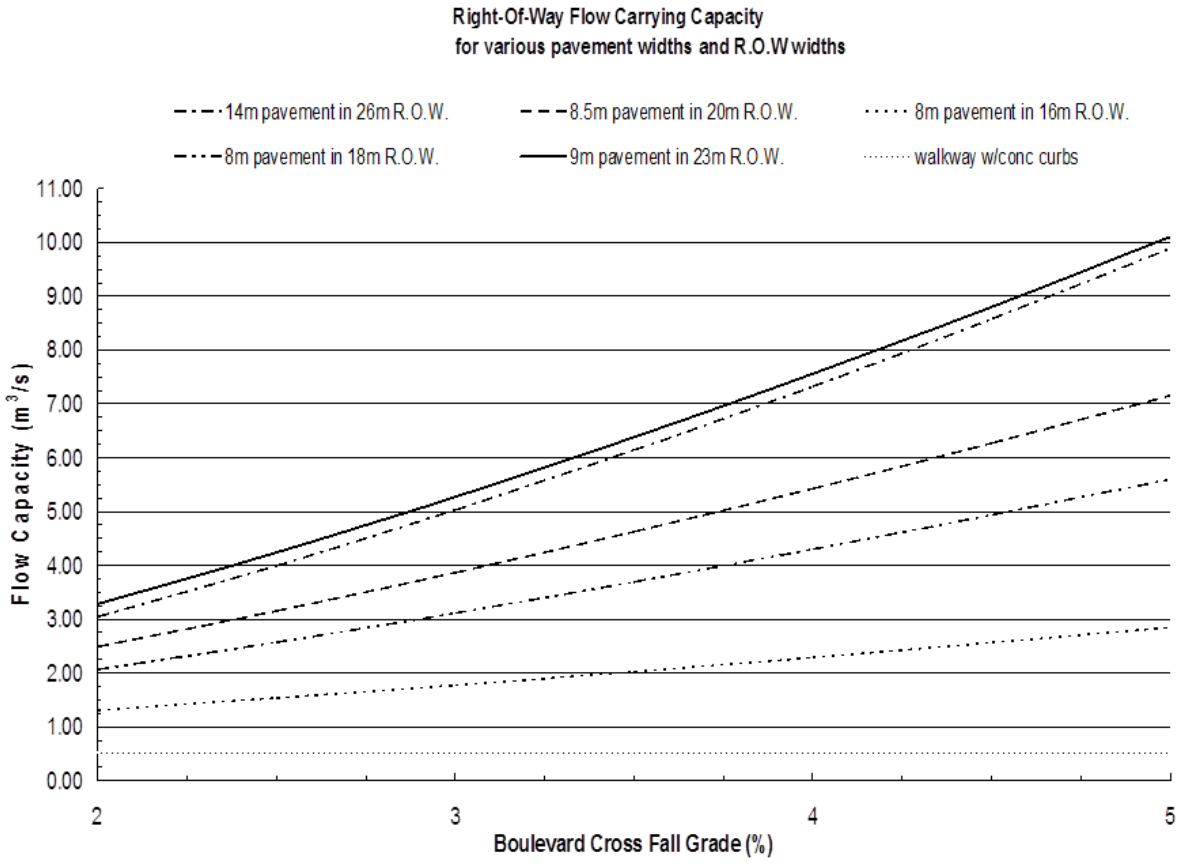
Fences, garden sheds and other flow impediments significantly reduce the flow carrying capacity of swales on private property. Overland flow from public property onto swales on private property must be limited to no more than 0.1 m^3/s, or a drainage area of 1 ha, whichever is smaller. Otherwise, overland flow must be limited to road rights-of-way, walkways and easements, free of fences and other impediments to flow.

A continuous overland flow drainage route is to be identified on the engineering drawings and grading plans. The extent of any overland ponding at low points is also to be shown on the grading plans. The maximum allowable depth of flow where vehicle or pedestrian traffic takes

place or may be expected is 0.45 m. Any inlet grating associated with the major drainage system is to include a 50% blockage factor in its design.

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



C5.00 Minor Drainage System

C5.01 General

Urban stormwater conveyance systems may include open channels and swales, storm sewers, manholes and catchbasins, foundation drainage collectors (FDC), 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.

C5.02 Design Criteria

The design of the minor drainage system shall provide un-surcharged conditions up to the 1:5 year storm.

Consideration may be given to using a 1:10 year storm for high value commercial development, and for downtown business areas. In such cases, the Township of King may require some internal control in the form of temporary ponding on parking areas furthest away from the building or underground storage. The Township may require the Developer to provide a manhole located at the streetline to control discharges into the storm sewer system. Goss traps shall be placed in parking lot catchbasins where there are nearby fuelling areas.

The minor system design 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. A hydraulic gradeline (HGL) analysis shall be completed and submitted to the Township for review and approval. The analysis shall determine the number and location of storm sewer inlet control devices required to ensure protection against basement flooding by maintaining the HGL for the 100 year storm event below basement elevations. 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.

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 use of sump pumps is discouraged, however, will be considered by the Township if they are deemed to be the only viable option available

C5.03 Runoff Quantity

The design of the storm sewers shall be computed on the Town's standard Storm Sewer Design Sheet. All storm sewer minor system designs shall be based on a 5 year frequency unless otherwise directed by the Town.

a) All storm sewers shall be designed according to the rational 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.

b) The value for rainfall intensity shall be calculated in accordance with the values as provided in Section C2.01. The equation for the 5 year storm is indicated as:

$$i = 980.848/ (T+6.013)^{0.806}$$

C5.04 Run-off or Imperviousness Coefficients

Runoff coefficients to be used in storm sewer design with the Rational Method shall be as follows:

Parks over 4 ha	0.20
Parks 4 ha and under	0.25
Single-family residential (urban)	0.45
Single-family residential (estate residential)	0.40
Semi-detached residential	0.60
Townhouses, row houses, etc.	0.75
Apartments	0.75
Schools and churches	0.75
Industrial	0.75
Commercial	0.90
Heavily developed areas	0.90
Paved areas	0.85

A 10 minute inlet entry time at the head of the system must be utilized unless large external drainage areas exist.

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.

The design for minor water courses, associated culverts and structures will be designed to a 25 year storm frequency unless otherwise directed by the Township or Conservation Authority.

C5.05 Storm Sewer Design

Table C-5 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-5 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-5: 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

Diameter (mm)	Q max (m^3/s)	Slope min* (%)	Slope critical (%)	Slope max (%)
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
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.				

C5.06 Minimum Sizes

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

C5.07 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 FDCs 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. Manholes are to be common wherever possible with drop structures.

C5.08 Location

The storm sewers shall be located as shown on the standard Township of King 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 MOE regulations.

C5.09 Sewer Alignment

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

Radial pipe is permitted for all storm sewers 1,050 mm in diameter and larger, provided that a manhole 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.

C5.10 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 manholes 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.

C5.11 Pipe Crossings

A minimum clearance of 0.2 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 MOE 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.

C5.12 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.

C6.00 Sewer Pipe

C6.01 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 450 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. 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. Externally ribbed pipe will not be permitted. 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.

C6.02 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 of King 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.

C6.03 Video Record

All newly constructed storm sewers shall be CCTV inspected upon satisfactory completion of all other testing, prior to the issuance of “Certificate of Completion”.

At the discretion of the Director of Engineering, Public Works and Building, additional video inspections and records may be required prior to “Final Acceptance.”

All sewers, including manholes and laterals, 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.

In most cases the CCTV inspections will be carried out by a contractor as selected by, and under the supervision of, the Township. The Township will provide a copy of the reports to the Developer in cases where deficiencies have been detected and will require further actions.

In developments that pre-date the requirement for completion of CCTV by the Township, they will be afforded the option to complete the CCTV inspections with their own contractor (matching the required specifications) or may elect to have the Township complete the inspections for them. Such a request should be made in writing to the Township well in advance of the required schedule for same. (The developer will be responsible for costs associated with the sewer inspections.)

CCTV inspections should be coordinated with the anticipated schedule for the benchmark dates (i.e. date for Acceptance or Assumption). The CCTV video inspection records and copies of the reports shall be submitted in CD or DVD formats only (not cassettes). CCTV reports that are deemed to be outdated may be insufficient to justify final acceptance of the underground services and may need to be repeated, at the sole discretion of the Director.

C7.00 Manholes

C7.01 Location

Manholes 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 (example: PVC to concrete)
- at either the beginning or end of radial pipe sections

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

C7.02 Maximum Spacing

The maximum spacing between manholes shall be as follows:

Pipe Size	Maximum Manhole 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

C7.03 Manhole Types

Manholes shall be constructed of precast concrete. Although the Standard Drawings provide details for manholes 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 manholes shall be individually designed and detailed.

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

Precast manholes shall conform to ASTM specifications C478 M latest revision.

Manhole covers shall be as per OPSD 401.010 Type “B”

C7.04 Manhole Design

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

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

3. Safety gratings shall be provided in all manholes when the depth of the manhole 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 manholes shall not be lower than the obvert of the outlet pipe.

5. The maximum change in direction of flow in manholes, 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 manholes 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 manholes shall be 230 mm.

9. Manholes 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 manhole stack shall be 685 mm square.

11. The manhole shall be centered on the sewer main.

C7.05 Grades for Manhole Frames and Covers

All manholes, 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 manholes in new subdivisions. No concrete shall extend over the edge of the manhole.

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

C7.06 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 are not permitted. Precast drop structures are permitted. All drop structures shall be constructed in accordance with KS-171.

C7.07 Head Losses

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

In order to reduce the amount of drop required, the 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 manholes on sewers where the outlet pipe is 1,050 mm or greater. In addition, hydraulic calculations may be required for manholes 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 manhole.

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

The minimum drops across manholes shall be as follows:

Change of Direction	Minimum Drop (mm)
0	20
1° to 45°	50
46° to 90°	80

C8.00 Catchbasins

C8.01 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.

The maximum allowable drainage path to a catchbasin is as follows:

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. The hydraulic capture capacity of the catchbasins is given in the Township of King Standard Detail Drawings. To ensure that the capture or inlet capacity matches that of the storm sewer, the spacing of catchbasins on streets may be varied.

If detailed analysis of the major-minor system and SWM analysis of the pipe system indicate the need for inlet controls, additional constrictions should be implemented. 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.

C8.02 Catchbasin Types

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

Special catchbasins and inlet structures shall be fully designed and detailed by the Consulting Engineer.

C8.03 Catchbasin Connections

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.

In general, catchbasins located in close proximity to a manhole shall have their leads connected to the manhole. Long catchbasin connections (in excess of 20 m) shall be connected to a manhole or, alternatively, the lead can be connected to the sewer and a 1200 mm manhole catchbasin used in lieu of the normal 600 mm square catchbasin.

C8.04 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 Director. These must be bicycle safe and able to withstand traffic loads.

C8.05 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.

C8.06 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 601.01 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.

C9.00 Inlets, Outfalls and Special Structures

C9.01 General

Inlet and outlet structures, including headwalls, 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.

C9.02 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. Gabions, rip-rap or concrete shall be provided at all inlets to protect against erosion and to channel the flow to the inlet structure.

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.

C9.03 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 grating over the outlet as per OPSD 804.050.

Safety railings shall be provided along the top of all headwalls 0.6 m in height or greater. Railings 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.

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.

Gabions, rip-rap, concrete blocks, concrete or other erosion protection shall be provided at all outlets to prevent erosion of the watercourse, and to the area adjacent to the headwall. The extent of the erosion protection shall be indicated on the Engineering Drawings and shall be dependent upon the velocity of the flow in the storm sewer outlet, the soil conditions, the flow in the existing watercourse and site conditions.

C9.04 Open Channels

The proposed criteria for an open channel design shall be submitted to the Director of Engineering, Public Works and Building for his approval by the Consulting Engineer, prior to the actual design being undertaken. The Consulting Engineer shall also be responsible for obtaining the approval of the design from the Ministry of Environment, and the local Conservation Authority, if the open channel concept is favourably considered.

The minimum side slopes of channels shall be three 3:1 (H:V). The designer shall provide for dry weather flow in the design of open channels. The maximum velocity for sod-lined channels shall be 1.25 m/s, and for concrete-lined channels shall be 2.5 m/s, for the 100 year or Regional Storm flow.

Dry weather flow inverts of open channels are to be designed with gabion mats or terra-fix blocks, subject to the Director of Operation’s approval. The Township of King prefers the use of terra-fix blocks for dry weather flow inverts.

C10.00 Gabion Baskets and Filter Fabric

C10.01 Gabion Baskets

Gabions are to be installed in accordance with the manufacturer's specifications and OPS specifications. Gabions may be filled by hand or by mechanical means, however the front face is to be placed by hand to provide a neat and uniform outer face. Every effort shall be made to keep voids and bulges in the gabions to a minimum.

The engineering drawings shall include special detailed drawings of all gabion basket structures used for the construction of retaining walls, erosion control structures, siltation traps, inlets, outfalls, and other special structures.

C10.02 Filter Fabric

Where specified, "Terrafix-Type 27OR" or "Textual 7612" or approved equal filter material shall be placed on the back side of the gabions strictly in conformance with the lines and dimensions shown on the engineering drawings.

The fabric shall be laid against the gabion baskets, fully extended but without tension, and shall be held against the gabion baskets so that no displacement will occur during backfilling. Care must be taken during installation to prevent puncture or tearing of the fabric. The successive filter fabric mats shall have an overlap of 200 mm minimum.

The filter fabric must meet the requirements of Class II, OPSS 1860.07.02.

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 generally be permitted. Semi-detached units will require separate sewer laterals for each side. Townhouse units may be permitted to have combined sewer laterals depending on the specific installation layout and details.

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

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. The riser shall be constructed with a “controlled settlement joint” as shown on the Standard Drawings.

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 an 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 Director, “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

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

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 0.9 m above grade. The top of this marker shall be painted black.

Storm drain connections shall be installed to the end of the connection and shall be fitted with a manufactured watertight plug.

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.

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 Director.

SECTION D

Watermains and Appurtenances

Township of King
Design Criteria and Standard Detail Drawings

SECTION D WATERMAINS AND APPURTENANCES

Table of Contents

D1.00 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 Township of King.

The Township of King 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.

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 such software as determined by the Township from time to time. Boundary conditions for modeling purposes shall be obtained from the Township and by carrying out on-site hydrant flow tests in consultation with the Township.

D2.02 Fire Flows

The requirements for fire flows shall be discussed and agreed upon with the Director of Engineering, Public Works and Building 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.

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 "C" values shall be used in the Hazen-Williams equation, for the design of water distribution systems regardless of pipe materials:

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:

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

Watermains shall be located as shown on the Standard Township of King Roadway Cross-Section. This location shall generally be on the north or east side of the street.

The minimum depth of cover shall be 1.8 m.

D3.02 Bedding and Backfill

Watermain bedding shall be Granular “A” or approved equivalent. Watermain cover material shall be clear sand or approved equivalent.

D3.03 Horizontal Separation between Watermains and Sewers

MOE 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 1984, 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 of surface water and/or the leakage from sewers in the trench.

D3.04 Watermain Crossing Sewers

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

MOE Design Guidelines for Sewage Works 2008 (Chapter 5. Design of Sewers):

- 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; and
- 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:

a) Where watermain is located on a cul-de-sac the configuration of the dead end shall be as illustrated on Standard Drawing KS-877.

b) 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.

c) 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 devise 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.

D3.07 Minimum Sizes

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

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 fill material and at all tees, horizontal bends, vertical bends, hydrants, end of mains and valves. 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 Drawings 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.

D5.00 Fire Protection

D5.01 General

All fire protection design requirements shall be reviewed with the Director or Engineering, Public Works and Building 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 2.0 m minimum distance from the edge of any driveway or house service connection. Other above ground utilities such as light standards, transformers, street signs or boulevard trees shall be located no closer than 3.0 m from a hydrant.

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.

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), 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)

(* NOTE – The EPWB Department 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 Drinking Water Quality Management Standards of the Township (see Appendix 2).

D6.00 Service Connections

D6.01 General

Individual service connections shall be installed to each lot, semi-detached unit or townhouse unit within the development.

D6.02 Material

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). Copper pipe is not permitted in new construction.

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 1100 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.

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

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

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 shall be sized based on the applicable calculations.

D6.04 Location

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 Director. (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.

The minimum cover over water services shall be 1.8 m.

D6.05 Connections to Supply Main

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 0.30 m from the outer edge of a driveway, as shown on the Standard Drawing.

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 *(to be moved to Section K6.0)*

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. Generally, it will be necessary to have meter chambers installed at the street line with a backflow prevention device (i.e. double check valve assembly) in close proximity thereto. 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. Check valves may be installed in the building (i.e. mechanical room) for some instances at the discretion of the Director of Engineering. No branching of water lines between the street and the meter will be permitted.

, all sites are to be metered and the specific requirements are to be discussed with Operations staff during the site plan review. (The manufacturer and type of meter are subject to the discretion of the Operations department.)

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 Insertion Meters

A method of metering all new developments is required. The system must include an Electromagnetic Insertion Probe Flowmeter (being a make/model as directed by the Township) to be installed in a chamber at the entrance to the site. The meter is to be installed in accordance with the supplier specifications.

The configuration must ensure that all consumption/flows within the development are measured form the onset of the system operation. The actual location requires approval of the Director.

D9.00 Testing Requirements

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

D10.00 Watermain Material

D10.01 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.

D10.02 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

Table of Contents

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 Township of King 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 Hydraulic Design

E2.01 Sanitary Drainage Plan

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 manhole length of sewer, shall be computed on the standard sanitary sewer design sheets, as so stipulated by the Township. For each area entered on the design sheet, the manhole 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.

E2.02 Residential Sewage Flows

The following 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/c/d shall be used.

The unit of peak extraneous flow shall be 0.21 L/s/ha.

For Residential Development the peaking factor shall be calculated based on the Harmon formula,

$$M = 1 + \frac{14}{4 + (P)^{1/2}}$$

where,

P = population, in thousands

Maximum M – 4.0

Minimum M – 2.0

For Industrial Development the peaking factor peaking factor shall be calculated as follows:

$$Mi = 6.6604 \times Area^{-0.1992}$$

where,

Mi = industrial peaking factor

A = gross lot area (ha)

The design population shall be derived from the drainage area and expected maximum population over a design period of 20 years.

For areas where the lands are zoned for specific residential use but detailed planning information is not available, the following population densities shall apply:

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:

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.

E2.03 Commercial Sewage Flows

A design flow of 65 m^3/ha/day including allowances for infiltration and peaking effort shall be used for the design of all local sewers.

The area shall be based on the gross lot area.

E2.04 Industrial Sewage Flows

A design flow of 35 m^3/ha/day for light industry and 55 m^3/ha/day for heavy industry shall be used.

The area shall be calculated using the gross area included in the industrial block or development.

The Township of King, through its planning policies encourages the establishment of only those industries which have low sewage requirements (dry industries).

E2.05 Institutional and Schools Sewage Flows

A design of 65 m^3/ha/day including allowances for infiltration and peaking effect 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.

E2.06 Extraneous Flows

Measures are to be implemented to mitigate all extraneous flows into the sanitary sewer system. Reference should be made to the “Sanitary Sewer System Inspection, Testing and Acceptance Guideline” (Oct. 2011) as prepared by the Region of York.

The following items are to be considered in the design and implementation of any extension of the sanitary sewer system:

a) All sanitary sewers shall have watertight joints and heavy wall (SDR 26) gasketted fittings.

b) Sanitary sewer manholes shall be in accordance with OPS specifications, except that all manhole joints are to be wrapped in Denso or equal water-proofing membrane.

c) Frames and covers shall be OPSD 401.030 watertight covers.

d) Controlled settlement joints are required on all risers greater than 4.5 m depth.

e) Manholes to be gasketed as per OPSS 1351 and CSA 257.3 and shall be watertight.

f) Manhole joints to be further waterproofed from the outside using denso-wrap, or equal.

g) All manhole joints shall be sealed. Joints and pipe connections shall be wrapped and waterproofed with denso-tape in accordance with manufacture's recommendations and as directed by the engineer (a minimum 0.3 m above and below).

h) All manhole adjustment rings shall be mortared between all rings and from the outside of the structure prior backfilling.

i) Flow monitoring may be required at the discretion of the Director of Engineering, Public Works and Building if deemed necessary to verify infiltration and inflow (I/I) are within acceptable levels.

E3.00 Sanitary Sewer Design

E3.01 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 MOE Regulations.

E3.02 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-1: Allowable Sanitary Sewer Capacities and Gradients

Diameter (mm)	Q Max (m^3/s)	Slope Min (%)	Slope Critical (%)	Slope Max (%)
200	0.042	0.33	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

E3.03 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).

E3.04 Minimum Size

The minimum allowable size for a sanitary sewer shall be 200 mm in diameter.

E3.05 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.

E3.06 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.

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). 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. Manholes are to be common wherever possible with drop structures.

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 Engineer.

E3.07 Curved Sewers

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

E3.08 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 manholes to allow for future extension of the sewer.

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

E3.09 Sewer and Watermain Crossings

Al crossings are to be completed in accordance with MOE guidelines. (See Section D3.04 above.)

E3.10 Service Connections to Deep Sewers

No service connections shall be permitted to sanitary sewers exceeding 6.0 m in depth unless otherwise approved by the Township. Depth is measured from the final centreline finished road elevation to the top of the sanitary sewer.

E3.11 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.

E3.12 Pipe Bedding

The class of pipe and the type of bedding shall be selected to suit loading and proposed construction conditions. Details and types of bedding and backfill are illustrated in OPSD 802.010 and 802.030. 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 recommendations of a Geotechnical Engineer will be required in determining strength of pipe required and construction methods to be used. The Geotechnical Engineer shall also provide recommendations regarding the placement of Clay Seals (per OPSS 410) based on the prevailing soil and groundwater conditions.

E4.00 Manholes

E4.01 Location

Manholes 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 maintenance to the sewer.

E4.02 Maximum Spacing

The maximum allowable spacing between manholes shall be as follows:

Pipe Size (mm)	Maximum Manhole Spacing (m)
200 to 750	110
825 to 1,200	125
1,200 and over	150

E4.03 Manhole Types

Manholes shall be constructed of precast concrete. The Ontario Provincial Standard (OPS) manhole details shall be used for manhole design, where applicable. In all cases where the standard drawings are not applicable, the manholes shall be individually designed and detailed.

A reference shall be made on all profile drawings to indicate the type and size of all sanitary manholes.

Pre-cast manholes shall conform to ASTM Specification C478 M latest revision.

E4.04 Head Losses

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

When pipe size does not change through a manhole and the upstream flow velocity does not exceed 1.5 m/s, the following minimum invert drops across the manhole shall be made to compensate for hydraulic losses:

Alignment Change	Drop Required
Straight run	0.02 m
15 to 45 degrees	0.05 m
46 to 90 degrees	0.08 m

In order 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.

Hydraulic calculations shall be submitted for all junction and transition manholes on sewers where there is a change in velocity of greater than 0.6 m/s is proposed. In addition, hydraulic calculations may be required for manholes where in the opinion of the Township, there is insufficient invert drop provided across any manhole.

E4.05 Manhole Design

1. All manhole openings shall be located on the side of the manhole parallel to the flow for straight run manholes, or on the upstream side of the manhole at all junctions.

2. The manhole shall be centred on the sanitary sewer main.

3. The maximum change in the direction of flow in any sanitary sewer manhole shall be 90°. A change of flow direction at acute interior angles shall not be permitted.

4. A maximum drop of 0.5 m will be allowed only if the design of the sewer cannot be modified to reduce the drop or modified to accommodate a drop structure. If the design of the sewer system is such that the difference in elevation between the manhole inlet and outlet will exceed 0.25 m, then a drop structure, as detailed on the Standard Drawings, will be required.

5. Whenever feasible, sewer systems shall be designed to avoid the use of drop structures.

6. For all junction and transition manholes, the drop required shall be calculated using the standard calculation sheet, “Hydraulic Calculations for Manholes” found in the MOE Design guidelines.

7. The obvert(s) on the upstream side of a manhole shall in no case be lower than the obvert(s) on the downstream side of the manhole.

8. All manholes shall be benched as detailed on the applicable OPSD. When any dimension of a manhole exceeds those on the Standard Drawings, the manhole must be individually designed and detailed.

9. Safety gratings shall be required in all manholes 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.

10. A rubber-gasketted fitting (Kor-n-Seal or equivalent) is to be used to connect the sewer to the manhole.

11. All manholes are to be made watertight. The entire external surface area of the maintenance hole including all walls, joints and roof slab shall be wrapped in approved

waterproofing membrane. This is to be accomplished by the use of Denso sealants or approved equivalent (Blueskin, etc).

E4.06 Manhole Frame and Covers

All manhole covers shall be per OPSD 401.010, Type A (Closed), except where specified otherwise. All covers for manholes located in low areas or those areas susceptible to surface inflows, both on and off the roadway, shall be watertight lids with external lifting apertures (per OPSD 401.030 or equivalent). All frames and covers shall comply with OPSS1850. Long sections of pipe having watertight lids should be avoided to allow for proper venting.

Maintenance holes shall be located outside the Regional flood plain. If maintenance holes cannot be located outside the Regional flood plain, then it shall be elevated to minimum 100-Year elevation and the top of maintenance holes shall be sealed and anchored properly so that it cannot be easily displaced or shifted due to high flows.

Watertight bolted down covers shall be provided on sanitary maintenance holes located in areas susceptible to flooding and/or vandalism. Where significant sections of sanitary sewers are provided with watertight covers, extended vents shall be required.

All manholes 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 manholes in new subdivisions. No concrete shall extend over the edge of the manhole. Prior to the placement of the final course asphalt, the manhole frame shall be adjusted to suit the final surface asphalt elevation.

E5.00 Sanitary Service Connection

E5.01 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. All connections are to have a watertight PVC test fitting installed at the property line. A clean-out tee is to be installed at the property line as directed by the Township. The sewer connection shall extend 1.5 m inside of the property line and terminate with a plug (glued in place). The pipe is to be green in colour and marked with a 50 mm x 100 mm x 2.4 m stake painted green.

E5.02 Location

The proposed locations for the sanitary sewer service connections shall be shown on the plan and profile drawings and shall be in accordance with the locations specified on the Standard Drawings KS-175 and KS-176.

E5.03 Connection to Main

The connection to the main sewer shall be made with an approved manufactured tee. Approved saddles shall only be used for connection to pre-existing sewer mains. Connections to manholes will not be allowed.

A manhole shall be installed on the main sewer at the intersection of a service connection which has a size greater than one half the diameter of the main sewer, except as provided below.

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 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).

E5.04 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.

E5.05 Depth

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, shall be:

- Minimum: 2.5 m
- Maximum: 3.0 m

Risers shall be used when the depth to obvert of the sewer main exceeds 4.5 m. The riser connection shall incorporate the use of a “controlled settlement joint”.

E5.06 Grade

The minimum and maximum grades for sanitary sewer service connections shall be as follows:

Size of Connection (mm)	Minimum Grade (%)	Maximum Grade (%)
125	2	8
150	2	6
200	1	6

E5.07 Test Fittings and Clean-Outs

All domestic service connections shall have a 125 mm x 125 mm cast iron test fitting (Crowle Industries or equivalent) installed at the property line. In certain circumstances, where directed, a vertical riser clean-out shall be installed (per KS-193).

E5.08 Connection to Multiple Family and Other Blocks

An inspection manhole shall be required on private property (1.5 m from property line to centre of rim) on all connections to multiple family, ICI and other blocks.

E5.09 Materials

For single family and semi-detached areas, the service connections shall be PVC (SDR28) pipe conforming to CSA Specification B182.1 for extra strength pipe, or latest revision thereof.

Any bends on sanitary service connections shall be long radius, sweep bends.

E5.10 Inspection

Sanitary sewer connections are to be inspected by CCTV camera from the main line to the property line. Services are to be installed and plugged prior to the pressure testing completed on the mainline system.

Sanitary services are to be inspected by CCTV camera from the sewer main to the stub. No connections from a dwelling to the lateral are permitted prior to this inspection being completed.

E6.00 Pipe Materials

E6.01 Sanitary Sewers

Sanitary sewers shall be constructed of Polyvinyl Chloride (PVC) SDR 35 pipe. PVC pipe shall conform to CSA Specification B137.0 and B137.3 or latest revisions thereof.

Pipes greater than 375 mm diameter shall be reinforced concrete pipe. Reinforced Concrete Pipe shall conform to CSA Specification A275-2-M1982 or latest revision thereof, Class 50-D, 65-D, 100-D or 140-D, as required.

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

E6.02 Sanitary Service Connections

All sanitary service connections for residential uses shall be constructed with Polyvinyl Chloride (PVC) bell and spigot pipe. The pipe materials shall be Polyvinyl Chloride (PVC) SDR 28 pipe conforming to CSA Specification B137.0 and B137.3 or latest revisions thereof.

E7.00 Inspection and Testing

All pipe testing should be per York Region "Sanitary Sewer System Inspection, Testing and Acceptance Guidelines" (Oct. 2011 or latest amendment thereto). (See Appendix 5.)

All sewers, including manholes and laterals, 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.

Manholes are to be inspected for wrapping (water proofing) of all joints and sealing of manhole adjustment (Moduloc) rings prior to backfilling. Manholes are to be inspected internally using CCTV methods.

In most cases the CCTV inspections will be carried out by a contractor as selected by, and under the supervision of, the Township. The Township will provide a copy of the reports to the Developer in cases where deficiencies have been detected and will require further actions.

In developments that pre-date the requirement for completion of CCTV by the Township, they will be afforded the option to complete the CCTV inspections with their own contractor (matching the required specifications) or may elect to have the Township complete the inspections for them. Such a request should be made in writing to the Township well in advance of the required schedule for same. (The developer will be responsible for costs associated with the sewer inspections.)

CCTV inspections should be coordinated with the anticipated schedule for the benchmark dates (i.e. date for Acceptance or Assumption). The CCTV video inspection records and copies of the reports shall be submitted in CD or DVD formats only (not cassettes). CCTV reports that are deemed to be outdated may be insufficient to justify final acceptance of the underground services and may need to be repeated, at the sole discretion of the Director.

SECTION F

Lot Grading

Township of King
Design Criteria and Standard Detail Drawings

SECTION F LOT GRADING

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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 Township of King.

It is imperative that the overall initial Draft Plan of Subdivision be laid out with regard to the lot grading criteria outlined in this section. In particular 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.

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. Grading shall be performed in such a way as to preserve existing trees wherever possible.

3. 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.

4. Storm drainage is to be directed to approved outlets on public lands and shall not adversely affect adjacent lands.

5. 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

F2.00 General Grading Plan

F2.01 Drawing Requirements

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 an house types.

5. The specified lot grade shall be shown at a location 7.6 m from the streetline. 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. 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.)

9. All terracing required shall be shown with the intermediate grades specified.

10. 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).

11. Existing elevations are to be shown on 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.

12. 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.

13. 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 of these slopes to prevent disturbance to the existing vegetation.

14. 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 slit fencing shall be shown along the boundary of 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.

15. Lot drainage is to be self-contained within the subdivision limits, unless expressly approved otherwise.

16. The lot grading plan shall show proposed locations for building envelopes, and envelopes for private sewage disposal systems (where applicable).

17. The lot grading plan shall show all proposed easements for registration. Easements are required for all rear lot catchbasins and sewer connections.

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 where difficulties in providing side yard swales are encountered.

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.

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 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 to have the same SHG based on the higher SHG calculated on the basis of 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:
   - on road grades of under 2% – no more than four units
   - on road grades of 2% to 4% – no more than two units
   - 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%) 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 brick line and the final ground elevation of all houses.

F3.04 Swales

1. Swales shall have a minimum grade of 2% 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. All swales shall be located on one side (typically the higher side) of a common lot line, and not on the lot line.

6. The maximum area contributing flow to a side yard swale shall be that from three backyards or 750 m^2, whichever is less.

F3.05 Rear Lot Catchbasins

1. The use of rear lot catchbains is to be avoided at all times.

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 “hour glass” easements will be permitted in instances where 3.0 m widths are not achievable between houses.

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 Plot Plan Information

Prior to application for a building permit, individual plot plans (individual house siting plans) for each lot shall be prepared and shall be submitted to the Developer’s Consulting Engineer for approval. These lot grading plans shall include the following:

- lot description and house number, including Registered Plan Number
- dimensioned property limits and house location
- house type; normal, side split, back split, etc.
- finished first floor elevation
- finished garage floor elevation
- finished and original grades over septic tile beds
- finished basement floor elevation (all locations)
- elevation of underside and top of footings
- top of foundation wall (all locations)
- existing and proposed lot grades for each of the corners of the lot and intermediate points of grade change
- existing trees to be maintained
- driveway locations, widths and proposed grades
- finished road grades adjacent to the lot

- location of house entrances
- location of rainwater downspouts
- location of walkways
- arrows 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, luminaire poles, bell and cable TV 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 all road features along frontage and flankage of lots (curb lines, catchbasins, sidewalks, etc.)
- lot grading certificate by Developer's Engineer in accordance with the Subdivision Agreement requirements
- site benchmark information from approved engineering drawings

After approval and certification by the Developer's consulting engineer, 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 retaining walls are required they shall be constructed of concrete. No wood retaining walls will be permitted. 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.)

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

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 1.5 m high, black vinyl-coated fencing, with posts and hardware to match. Under specific circumstances, where warranted by an acoustic study, fencing shall be solid board fence.

All fences shall be installed in consideration of the following:

1. 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
2. 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.
3. 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.)

F3.10 Construction Requirements

As rough grading proceeds, the Developer must immediately enforce an erosion control program by applying a seed and mulch mixture to the area of concern, to the satisfaction of the Director. 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 of King 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 of King. 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.

"As-Built" lot grading plans for each lot shall be submitted to the Director of Engineering, Public Works and Building by the Developer's Consulting Engineer, prior to the issuance of a "Final Occupancy Certificate". "As-Built" lot grading plans shall include all requirements identified under Section F4.01.

Prior to 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 location 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 location 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.

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 50 km/hr 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 centres, 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 in accordance with OPS specifications. Durable (thermoplastic) markings shall be used on any road which intersects an arterial road, at the intersection and back to a distance of 100 m from the arterial road. Approved markings are to be placed in accordance with applicable OPS specifications.

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; and
- 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; and
- 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. A street trees and other plant materials are subject to approval of the Director of Parks, Recreation and Culture.

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 King Township 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 #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 #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

A 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 Director of Engineering, Public Works and Building 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 to prepare 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 Director of Parks, Recreation and Culture. 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 Director of Public Works.

The Developer is to consult with the Director of Parks, Recreation and Culture 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 Director of Engineering, Public Works and Building. All topsoil stripped from parklands shall remain on-site and not removed or sold. The seed mixture proposed shall be approved by the Director of Engineering, Public Works and Building 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 Director of Parks, Recreation and Culture. If constructed by 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 Parks Recreation and Culture Department. 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 Parks Department. Metering requirements for water service connections shall be confirmed with the EPW (Operations) staff.

Where required by the Township of King, 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 Township in order 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.

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 Director of Engineering, Public Works and Building 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 TV 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 TV 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		
Township of King		

Standard Notes on Utility Drawings are as follows:

1. 1.0 m separation is to be maintained between edge of driveway and all street furniture.

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 suitable located in the plan of subdivision on 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 of King 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
- 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 Director of Engineering, Public Works and Building. 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 Director of Engineering, Public Works and Building. 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 Director of Engineering, Public Works and Building.

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 Director of Engineering, Public Works and Building.

J3.00 Street Lighting Design

The street lighting system shall be designed by a qualified Professional Engineer in accordance with the ANSI/IESNA RP-8-00 – Illuminating Engineering Society of North America's American National Standard Practice for Roadway Lighting (latest version). All street lighting systems for roadways shall meet the requirements of the Township and Hydro One.

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. Roadway lighting shall be designed using the values found in the IESNA Reference Guide Figure 22-8 and abbreviated in the following table:

Road Classification (IESNA R2 & R3)	**Luminance Values**	
	Average Maintained Illuminance Values (Lux)	**Illuminance Uniformity Ratio (Average to Minimum)**
Local Residential	4.0	6:1
Rural	4.0	6:1
Collector	6.0	4:1
Major Collector/Arterial [a]	9.0	3:1

Notes:

a) Regional roads are subject to requirements/approvals of York Region.

b) All other Road Classifications not identified above will be considered on an individual basis in accordance with Township requirements.

c) Intersections shall have an illumination equal to the sum of the current design levels of the intersecting roadways.

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-tenth (1/10) of the spacing between luminaires, or 5.0 m, whichever is smaller. At intersections the grid spacing is 2.0 m throughout the calculation area.

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.

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. 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
- “dark sky” friendly fixtures with no up light characteristics

Light fixtures are to be Eaton Cooper Lighting’s “**Springdale**” 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.

On existing residential streets and in industrial areas, the standard street lighting luminaires are to be Leotek’s **Green Cobra** fixtures, 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 by the use of 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 pedestal to be energized at 240 volts split neutral. Main breaker 60 amp, full size neutral, up to four individual circuits, 120 volt, 40 amp single pole breakers. Each 120 volt, 40 amp breaker typically feeds a circuit in each direction to six street lights. (Maximum of six lights on one circuit.)

Where it is deemed practical, the street light system shall incorporate a loop design. The end of each circuit is to be capped off in the street light hand hole to provide an alternate feed from another circuit. The alternate feed shall be taped and insulated (capped) so as not to pose a hazard.

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 King Township.

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.

    a) Lot/Road accessible: Yes / No

    b) Is a Central Metering service required: Yes / No

    c) Construction Type: Street Lights/Traffic Lights

    d) ESA Permit (when constructed): Yes / No

    e) Is Foundation In: Yes / No

    f) Hydro at Lot Line: Yes / No

    g) Service Type: OH/UG (Over Head / Under Ground)

    h) Service size required: 60, 70, 100, 125, 200, 400

    i) Is temporary service required: Yes / No

    j) Detailed description of service required: _____

    k) Address/Specific location for installation: (GPS/Intersection/City/etc.)

    l) Existing Hydro One Account Number: Name: XXXX; Account # XXXXXXXX

m) Contact Person: Name/Company/Phone number (Contact EPW 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'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

Engineering and Public Works staff will provide locate services under their jurisdiction as part of the “One Call” utility locate system. EPW’s normal utility locate requirements shall generally apply where applicable and appropriate. The costs of this service within new subdivisions (prior to final assumption) will be charged to the developer, owner, contractor, or consultant as appropriate.

EPW staff will, upon provision of adequate notice, locate services based on the as-constructed details provided by the Developer’s consultant. 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 Township of King 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.

As part of the servicing submission, it is necessary to supply GIS attribute data to the Township in a format as may be described from time to time. 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 format that will allow importation to their GIS system. (Sample spreadsheets and datasets are included in Appendix 8 for this purpose.)

The Township of King is also responsible for the collection of revenue for water consumption and therefore, the "metering" arrangement for the subject property shall also be approved by the Township of King.

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. These drawings shall be titled as follows:

- Site Grading Plan
- Site Services Plan
- Landscaping Plan
- Electrical Services Plan
- Drainage Area Plan

Additional engineering drawings shall be prepared where required, or when requested by the Director of Engineering, Public Works and Building. Prior to receiving a Building Permit, all plans must be approved 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:

1. A key plan at a scale of 1:10,000 showing the site location.

2. A north arrow.

3. The street names, lot and Registered Plan numbers, and property dimensions.

4. The outline of all buildings with the building numbers and unit numbers indicated, and garage locations within the unit.

5. The roadway and all driveways.

6. Adjacent lands.

7. Existing land features (i.e., trees, watermains, etc.).

8. The reference bench mark (geodetic) used to establish vertical control, and the site bench marks to be used for construction.

K2.02 Site Grading Plan

The Site Grading 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.

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.

K2.03 Site Services Plan

The Site Services Plan 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 and size of all watermain connections to the property.

4. The basement floor elevations of all buildings to be constructed.

5. The location, size, length, grade, material and bedding requirements for all sanitary services to be constructed within the development.

6. The location, size, length, grade, material and bedding requirements for all storm sewers to be constructed within the development.

7. The location, size and material specifications for all watermains to be constructed within the development.

8. The location, invert elevation, and rim elevations for all sanitary and storm manholes to be constructed.

9. The location of all hydrants, valves, and water meters within the development.

10. The location and size of all sanitary, storm and water service connections to the individual units.

11. The location of all roof water leader downspouts.

12. All construction notes required to describe the construction detail or requirements.

13. The locations of prime and reserve tile-bed areas, including mantles where required.

14. The locations of water supply to be constructed within the development.

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 Director of Public Works.

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 Director of Engineering, Public Works and Building to assess light trespass.

The Electrical Services Plan shall be submitted to Ontario Hydro for approval.

K2.06 Drainage Area Plan

A plan shall be prepared to a scale of 1:1,000 or 1: 2000, 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 techniques shall be employed over all sites in accordance with requirements identified under Section C, subject to the Director’s approval.

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.

4. The grade of grassed or other landscaped areas shall have a maximum slope of 10% and a minimum slope of 1%.

5. Swales on grassed areas shall have a minimum slope of 1.5% 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 300 mm.

8. The maximum depth for any drainage swale shall be 750 mm.

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 Roadway Design

1. All roadways shall be designed in accordance with the most recent engineering requirements of the Township of King.

2. The minimum pavement design for all multiple-family roadways shall be:

    a) Subgrade compacted to 95% proctor density.

    b) 300 mm compacted depth of Granular “B”.

    c) 150 mm compacted depth of Granular “A” or crushed limestone.

    d) 50 mm compacted depth of HL8 asphalt base course.

    e) 35 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:

a) Subgrade compacted to 95% proctor density.

b) 150 mm compacted depth of Granular “A” or crushed limestone.

c) 50 mm compacted depth of HL3 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. The minimum grade for any roadway shall be 1.0%, and the maximum grade shall be 6%.

7. The minimum grade for any driveway in a multiple-family project shall be 1% and the maximum grade shall be 7.0%. (This maximum grade creates an undesirable condition and should be used only when necessary to site conditions.)

8. 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:

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

a) 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 Type “2” bedding as shown on the Township of King Standard Drawings.

K5.00 Construction

All storm drain connections 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 Director of Engineering, Public Works and Building.

K6.00 Water Connections under Site Plan Control

K6.01 General

All sites are to include a water connection from the main to the street line in accordance with the standards of the Township. Such connections are to include for backflow preventer check valves and for metering of flows as further detailed below. The principal types of mechanical backflow preventer to be utilized are to testable devices such as the reduced-pressure principle assembly, pressure vacuum breaker assembly, and double check valve assembly.

K6.02 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.

K6.03 Metering

All flows 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.

K6.04 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.

K6.05 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.

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

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), 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).

K7.00 Private Servicing of Residential Lots

K7.01 General

All private wells and/or waste-disposal systems shall be constructed in accordance with the appropriate legislation and regulation administered by the Ontario Ministry of the Environment Conservation and Parks and such requirements specified by the York Regional Health Unit.

Where a development is privately serviced, all wells shall be constructed in conformance with the Building Code and Ontario Water Resources Act, R.S.O., 1990, and current Ontario Regulation, and all private waste disposal systems shall be constructed in accordance with the Environmental Protection Act, R.S.O., 1990, and current Ontario Regulation, and with the requirements of the York Region Health Unit.

K7.02 Water Supply Systems

1. Each water supply well must be drilled to the depth of the aquifer proposed for development in the supporting hydrogeological report, prior to applying for a Building Permit.

2. The well shall comprise new steel casing, having an inside diameter at least 125 mm, and a wall thickness at least 4.7 mm, and a commercial, wire wound, stainless steel screen at least 0.3 m in length if completed in the overburden. The annular space shall be grouted from a depth of 3 m to surface in accordance with the Ontario Well Regulation.

3. Each well shall be capable of delivering at least 9 L/minute of essentially sand-free water for a continuous six-hour period or two four-hour periods during any given 24-hour period, as determined by a controlled-discharge pumping test.

4. The distribution system shall be capable of delivering at least 825 L within one hour during the peak-demand morning and evening periods from combined storage and direct-well withdrawals.

5. The system shall be equipped with suitable water treatment equipment to provide water supplies, meeting the Ontario Ministry of the Environment Drinking Water Objectives for nitrate, iron, manganese, methane, hydrogen sulphide, and the Ontario Ministry of Health standards for bacteriological quality.

6. Prior to the issuance of each individual Building Permit, a Letter Report shall be prepared by the Hydrogeologist certifying the well yield, the domestic supply adequacy, the ground water treatment and system storage requirements, and the well construction conformance with the current Ontario Regulation, for distribution to the Developer, the Township and the York Region Health Unit, and subsequently to the lot purchaser.

K7.03 Waste Disposal Systems

1. Each system shall be constructed with materials meeting the standards specified in the current Ontario Regulation.

2. The tile-bed area of a private waste disposal system shall be sized on the basis of Class 4 system requirements, whether in-ground or raised, as determined by the specific soil and water table conditions on the individual lot.

3. A reserve tile bed area shall be provided, equal in size to the prime tile bed area, on which no building or structure may be constructed.

K7.04 Certification of Services

The Developer shall retain a qualified Consultant approved by the Director of Engineering, Public Works and Building who specializes in the design of private well and sewage systems. This Consultant will be responsible to both the Developer's Consulting Engineer and the Developer to complete the design, supervise and provide on-site inspection for the installation of private systems on the lots, and 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.

K7.05 Landscaping Design

The landscaping requirements shall be detailed in the Site Plan Agreement.

K7.06 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.

K8.00 Final Submissions and Approvals

K8.01 "As-Constructed" Drawings

After all construction is complete, the design drawings shall be amended to incorporate the changes and alterations made during construction in order that the drawings as amended represent the services and conditions as construction. Two sets of "As-Constructed" drawings must be submitted to the Township of King.

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 underground services in a format as may be described from time to time. 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 format that will allow importation to their GIS system. (Sample spreadsheets and datasets are included in Appendix 8 for this purpose.)

K8.03 Site Plan Certification

Upon completion of construction, the Consulting Engineer shall provide written certification to the Township of King that all works have been constructed in accordance with the approved plans and specifications, and in accordance with good engineering practices.

K8.04 Final Inspection

Upon completion of all construction, 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.

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 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 width as determined by the Director in the following circumstances.

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 drainage swales where drainage from more than one lot or 0.5 ha, whichever is greater, is provided.
- 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, and in the opinion of the Director of Engineering, Public Works and Building.

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, water quality control facilities and infiltration facilities.
- 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:

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:

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