DESIGN GUIDELINES

for

THE CORPORATION

of the

TOWN OF COBOURG

Cobourg
Ontario, Canada

Prepared By: **Engineering & Environmental Services**
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SECTION A – GENERAL INFORMATION

A 1.00 THE CORPORATION OF THE TOWN OF COBOURG

The Town of Cobourg is the authority for all appurtenances that are installed on all road allowances and registered easements within the Town of Cobourg.

A 1.01 Definitions

(a) LUSI refers to Lakefront Utilities Services Incorporated.

(b) 'Consulting Engineer' means a professional engineer or firm of engineers that is skilled and experienced in municipal work, 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 and approved by the Town.

(c) Developer

(d) Operating Authority

A 1.02 Familiazation

Prior to commencement of the engineering design, the Consultant shall obtain up to date copies of the Town of Cobourg Design Guidelines and a copy of the Ontario Provincial Standards to familiarize themselves with the requirements of a subdivision design in the Town of Cobourg. Meetings shall be held with Town staff and their Designates to confirm allocation, cost sharing, external drainage areas and other data prior to commencement of Engineering Design.

A 1.03 Functional Report

A functional report is required in accordance with the Official Plan for Draft Plan approval. Prior to the commencement of the Engineering Design and the Functional Report, the Developer's Engineer shall meet with the Engineering staff to discuss the Town's requirements. The functional report shall provide all details, calculations, costs, alternatives and recommendations necessary in order that the decisions can be logically made.

The functional report shall include, all relevant background information with respect to Site Constraints and Existing Conditions such as, but not limited to:
(a) Topography and drainage
(b) All pipelines (Trans Canada, Enbridge, Union Gas, etc.)
(c) Hydro easements/corridors
(d) Trunk sewers and watermains
(e) Utilities

The functional report shall address but will not necessarily be limited to the following considerations:

(a) The Draft Approved Plan of Subdivision,
(b) Topography and drainage,
(c) Stormwater Management Report, external drainage areas, overland flow

routes and watershed drainage area, watercourse improvement and channelization,
(d) Storm drainage systems, including Hydraulic Grade Line (HGL) constraints
(e) Soils Report/Geotechnical investigations,
(f) Major roadway alignments, cross-sections and intersections,
(g) Roadway structures,
(h) Railway crossings,
(i) Parkland development,
(j) Major trunk sewers,
(k) Sanitary drainage systems,
(l) Water distribution systems,
(m) Lot grading design,
(n) Pumping station locations,
(o) Phasing,
(p) Adjacent developments,
(q) Other utilities,
(r) Existing natural and built features on or adjacent to the developing lands.

The Functional Report shall contain the following:

The Draft Plan

The Draft Plan must be in a form acceptable to the Planning Department of the Town of Cobourg.

Contour Plan

This plan shall be a plan at the scale of no larger than 1:1000 giving contour lines at sufficient intervals to permit assessment of existing surface patterns. This plan is to extend to the limits of the drainage area to be served by proposed sanitary and storm sewer systems, including lands beyond the boundaries of the subdivision. All elevations shall refer to Geodetic Datum.

General Plan of Services

This will be a plan based on the Draft plan and shall show all existing and proposed underground services and their connection to existing systems. Direction of the flow must be indicated on all sewers. This plan is to be accompanied by engineering calculations indicating 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 and easements for storm drainage systems shall also be shown.

Soil Report/Geotechnical Investigation

A preliminary soils investigation and report from an independent Soils Consultant will be required by the Town of Cobourg. The soils report should include sufficient information so as to assess the constructability of sewer systems, engineered fill requirements, water table information, founding levels for building and recommended pavement structure.

Stormwater Management Report

The Stormwater Management Report must address the quality and quantity criteria for the watershed or sub-watershed within the proposed development. This report must also address any concerns from the Ganaraska Conservation Authority and MOE design criteria for stormwater management (Stormwater

Management Planning and Design Manual, 2003). Minor and major flow systems must be identified in the report.

Drainage Plan

When a natural drainage channel passes through and is affected by the construction of the development, plans must be submitted to indicate the location of the any proposed changes. In general, creek diversions will not be permitted unless these are approved by the Ministry of Natural Resources and the Ganaraska Region Conservation Authority. A Sediment and Erosion Control Plan and a preliminary stormwater management plan will be required by the Town of Cobourg.

Soils Report

A preliminary soils investigation and report from an approved Soils Consultant will be submitted to the Director of Public Works unless otherwise indicated. The soils report should include sufficient information so as to assess the constructability of sewer systems, engineered fill requirements, water table information, founding levels for building and recommended pavement structure.

Traffic Impact Report

Unless waived in writing by the Director of Public Works, all developments bordering collector and arterial roads are to provide a traffic impact analysis report based on projected traffic flows and the ultimate build out of the development.

The Director of Public Works may require traffic impact reports for subdivisions not bordering collector and arterial roads if deemed appropriate. In these situations, the need for study will be identified during the Draft Plan Approval process.

Noise Report

All developments adjacent to, or within close proximity to, major noise sources, such as, but not limited to; those generated by future rail and road facility expansions, shall be required to conduct a noise and vibration analysis to demonstrate compliance with MOE guidelines. These reports are required to be submitted with the Plan of Subdivision application.

Additional Reports

The Town of Cobourg may require a study and report which evaluates the geographical and hydrogeological characteristics of a rural area where private services are proposed. This study shall identify the suitability of the development area and its component sub-area to safely accommodate private water supply and sewage disposal systems.

A 2.00 SUBMISSIONS

Engineering drawings shall be submitted to the Town of Cobourg. Refer to Appendix A, Checklist for Subdivision Design.

A 2.01 First Submission to the Town of Cobourg

After approval of a planning application, the initial submission of engineering drawings to the Town of Cobourg shall contain a minimum of:

(a) 10 copies of the approved draft plan,
(b) 5 copies of the proposed plan for registration showing all lot and block numbering and dimensioning,
(c) a declaration from the Consulting Engineer indicating 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,
(d) 5 copies of a soils report prepared by a qualified Soils Consulting Engineer,
(e) 10 copies of all General Plan of Services,
(f) 10 copies of all Lot Grading Plans,
(g) 10 copies of all Area Rough Grading Plans,
(h) 10 copies of all Storm Drainage Plans,
(i) 10 copies of all Sanitary Drainage Plans,
(j) 5 copies of all Sanitary Sewer Design Sheets,
(k) 5 copies of all Storm Sewer Design Sheets,
(l) 10 copies of all Plan and Profile Drawings,
(m) 10 copies of the Park/Block Grading Plans
(n) 10 copies of all detail drawings other than the Town of Cobourg Standard Detail Drawings,
(o) 10 copies of all drawings pertinent to the design,
(p) 5 copies of all other calculations necessary to check the design,
(q) 10 copies of the Sediment and Erosion Control Plan along with the Storm Water Management Reports and Plans,
(r) 10 copies of Street planting, Utility Coordination plans, Acoustical Design Reports and Plans, and Tree Preservation Plans,
(s) 10 copies of 11 x 17 reduced sets of all drawings submitted,
(t) 5 copies of the Traffic Impact Report (if applicable), and
(u) 5 copies of the Noise Report (if applicable).

All drawing sets must be stamped, signed and dated, and must have the submission number and submission date.

A submission that is deemed incomplete will be returned to the consultant without any review or other comments.

The above information will be reviewed by the Town of Cobourg and one set of marked up drawings and calculations will be returned to the Developer's Consultant with any required revisions noted.

A 2.02 Subsequent Submissions

Subsequent submissions of Items (d) through (r) inclusive shall be made until the engineering drawings and design are acceptable to the Director of Public Works.

The design of the electrical distribution system and the street lighting shall be completed by the Consultant in consultation with the operating authority. This design shall be submitted to the Planning Department, complete with a Letter of Approval from the operating authority.

The streetlight poles, standards and lamps shall be to the Town of Cobourg standards. The location of the streetlight poles and transformers shall be shown on the Street Furniture Plan and/or Utility Coordination Plan.

The consultant must also coordinate the planning and construction of other utilities involved with the subdivision.

A 2.03 Ministry of the Environment Applications

After the engineering design and drawings are approved by the Town of Cobourg, the Developer's Consultant shall make all required applications to the Ministry of the Environment.

A 2.04 Other Approvals

The Consultant 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, Fire Marshall, Medical Officer of Health, etc,). The Town of Cobourg shall be kept informed of the progress of these submissions by copies of all correspondence and approvals.

A 2.05 Approved for Construction Plans

All 'Approved for Construction Plans' shall be stamped, signed and dated by the Consulting Engineer. After all approvals have been received from all necessary agencies, 6 full size sets of 'Approved for Construction Plans', signed by all authorities, and one electronic copy of the 'Approved for Construction Plans' in AutoCad format, acceptable to the Town of Cobourg, shall be submitted to the Town of Cobourg.

An additional 3 copies of the 'Approved for Construction' drawings shall be submitted in an 11 x 17 scalable format for inclusion in the Subdivision Agreement.

If, after one year from the date of the original approval of the engineering drawings by the Director of Public Works, the Developer fails to enter into a Subdivision Agreement with the Town of Cobourg, the Director of Public Works reserves the right to revoke all approvals related to the engineering drawings.

A 3.00 ENGINEERING REQUIREMENTS

(a) All engineering drawings shall be prepared in a neat and legible fashion. The design information presented on these drawings shall be completed in AutoCad format, acceptable to the Town of Cobourg.
(b) All engineering drawings shall be prepared on 3 mil drafting film (mylar) with a matte surface on the working side.
(c) All drawings shall be referred to Vertical Control Datum, based on Universal Transverse Mercator (UTM), Zone 17, NAD 83 coordinates. The reference Geodetic Bench Mark and Site Bench Marks and the reference Horizontal Control coordinates and site Horizontal Control coordinates to be used for construction shall be identified on all drawings.
(d) The reference Geodetic Bench Mark and Site Bench Marks to be used for construction shall be identified on all drawings.
(e) A Key Plan at a scale of 1:10000 shall be shown on the top right hand corner of all drawings, and the area covered by the drawing shall be clearly identified.
(f) The standard Town of Cobourg title block as shown in detail drawings shall be used on all engineering drawings.
(g) All General Plans, Lot Grading Plans, Area Rough Grading Plans, Storm Sewer Drainage Area Plans, Sanitary Sewer Drainage Area Plans, Street Furniture Plan, Sediment and Erosion Control Plan and Profile Drawings and Detail Drawings shall be prepared on standard A1 sheets.

(h) Stamps, tapes and stick on labels shall not be used except for the Professional Engineer's stamp. Self-adhesive films may be used as screening to accentuate construction details however; this screening shall be removed during the 'As Constructed - Services' revisions to the drawings.
(i) The lot numbering and block identification on all engineering drawings shall be the same as shown on the Registered Plan for the area. All road allowances, lots, blocks, easements and reserves shall be shown and identified on **all** engineering drawings in the same manner as corresponding Registered Plans.
(j) When the information presented exceeds the limits of the page and requires more than one drawing, match lines and corresponding reference drawing number shall be used with no overlapping of information.
(k) A north arrow shall be referenced on all drawings.
(l) All engineering drawings shall be stamped and signed in ink by a professional engineer.

A 3.01 Inspection During Construction

It is the duty of the owner's Engineer to demonstrate adequate inspection of major and minor works through the submission of an inspection plan.

Monitoring of inspection shall be performed by the Public Works Division.

The owner's Engineer shall submit an inspection plan, for approval by the Director of Public Works, outlining inspection methods for major and minor works.

Plans shall include, but not be limited to:
- qualified on site inspector complete with contact information
- individuals certifying satisfactory installation of works, complete with contact information.
- time allocation of staff performing inspections or certifications.
- all testing to be performed and testing frequency.
- third party sub-contractor performing inspection, certifying or testing of works, including, but not limited to: materials, installation, compaction, compactions testing and site grading.
- any other relevant inspection or certifying activity.

The owner's Engineer shall prepare weekly reports indicating:
- number of site visits and time spent on site
- works completed
- works in progress
- compaction reports
- change orders and/or directions to the contractor involving issues of non-compliance
- adherence to construction scheduling
- any other reports pertaining to the project.

A 4.00 GENERAL PLAN OF SERVICES DRAWING

(a) A General Plan of Services Drawing shall be prepared for all developments at a scale of 1:1000.
(b) 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 Plan as closely as possible.
(c) An index of all drawings associated with the development shall be shown on all General Plan of Services.
(d) All road allowances, lots, blocks, easements and reserves shall be shown and identified in the same manner as the Registered Plan.
(e) All existing services, utilities and abutting properties shall be shown in dotted lines.

(f) All services to be constructed shall be shown on the General Plan of Services Drawings in solid lines.
(g) All storm and sanitary sewers shall be shown, identifying length, size, sewer material and grade on the General Plan of Services Drawings.
(h) All Maintenance Structures will be shown and shall be numbered in accordance with the design drawings.
(i) All catchbasins shall be shown and shall be numbered in accordance with the design drawings.
(j) All watermains, valves, hydrants, bends, couplings, restraints and blow-offs shall be shown. Watermains to be identified by size and materials.
(k) All curbs and sidewalks shall be shown.
(l) All street light poles and transformers are to be shown.
(m) All fencing to be indicated by the height and type of fence.
(n) Dimensioning of utilities and roadways is not required in the General Plan of Services Drawings.
(o) Registered Plan number must be shown on the As-Constructed General Plan of Services Drawings.
(p) All sites for parks, schools, churches, commercial and industrial development must be shown.
(q) If a subdivision encroaches on an existing floodplain path, the approved fill line restrictions must be shown, as specified by the local conservation authority.
(r) The reference Geodetic Bench Marks and the Site Bench Marks to be used for construction shall be identified.

A 5.00 PLAN AND PROFILE DRAWINGS

(a) All Plan and Profile Drawings shall be prepared at a scale of 1:500 horizontally and 1:50 vertically.
(b) Plan and Profile Drawings are required for all roadways, blocks and easements 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 grade.
(c) All Plan and Profile Drawings shall be prepared so that each street can be filed separately. The street names shall be identified on the plan portion of the drawings.
(d) The reference drawing numbers for all intersecting streets and match lines shall be shown on all Plan and Profile Drawings.
(e) All existing or future services, utilities and abutting properties shall be shown in dotted or dashed lines.
(f) All services to be constructed shall be shown in solid lines.
(h) The profile portion of the drawing shall be a vertical projection of the centerline whenever possible.
(i) All road allowances, lots, blocks, easements, and reserves shall be shown and identified in the same manner as the Registered Plan. Lot and block frontages shall be shown.
(j) All curb, gutter and sidewalks shall be shown and dimensioned on the plan portion of the drawing.
(k) All storm sewers shall be shown and dimensioned on the plan and shall also be plotted on the profile drawings. The sewers shall have a complete description on the plan and 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.
(l) All storm sewer Maintenance Structures shall be shown on the plan and on the profile portion of the drawing. The Maintenance Structures shall be identified by chainage, number on the plan and on the profile and shall also be referred to the applicable Town of Cobourg / Ontario

Provincial Standards or to a special detail on the profile portion of the drawing. All invert elevations shall be shown on the profile with each having reference to the north arrow.

(m) All catchbasins and catchbasin connections shall be shown. Catchbasins shall be numbered for easy reference, and the pipe diameter for the lead identified on the plan portion of the drawing.

(n) Safety platforms and corresponding proposed elevations to be noted in the profile portion of the drawings for all storm sewer Maintenance Structures requiring them.

(o) All drop connections shall be noted and referenced to the Town of Cobourg / Ontario Provincial Standards with regard to sizing and inverts.

(p) All rim and invert elevations for rear lot catchbasins and catchbasin/Maintenance Structures shall be shown plus details of the Rear Yard Catchbasin.

(q) Storm sewer Maintenance Structure benching details shall be shown at a scale of 1:50 whenever the Town of Cobourg/Ontario Provincial Standards are not applicable.

(r) All sanitary sewers and watermains, including any/all appurtenances, to be shown, described and dimensioned on the portion of the drawing as per the design Guidelines requirements of the Town of Cobourg/LUSI. In addition, the watermains shall be plotted to true scale size on the profile portion of the drawing and described.

(s) The above notwithstanding, the location of all storm, water and sanitary service connections shall be shown on the plan portion of the drawing using different symbols for each service. These services need only to be dimensioned when the location differs from the standard location as shown on the Town of Cobourg/Ontario Provincial Standards. 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.).

(t) The centreline of construction with the 25m stations noted by a small cross shall be shown on the plan portion of the drawing.

(u) 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.) In addition, intermediate stations and elevations shall be labelled on the profile at 5 metre intervals through all vertical curves.

(v) Chainages for the centre line of construction shall be shown on the plan portion and profile portion of the drawing. The horizontal curve B.H.C., E.H.C., chainages shall be noted. The curve data (angular deflection, radius, tangent, length and chord) shall be noted also.

(w) The proposed pavement design shall be noted on the plan portion of each road drawing.

(x) Special notes necessary to detail construction procedures or requirements shall be shown.

(y) Basement elevations for all existing dwellings to be shown and noted on the profile portion of the drawings. Proposed minimum basement elevations to be determined for any/all lots created through the development and noted in the plan portion of the Plan Profile Drawings and Lot Grading Plans.

(z) All existing services, utilities and features shall 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.

(aa) The curb radii at all intersections shall be shown on the plan portion of the drawing.

(bb) Profiles of roadways shall be produced sufficiently beyond the limits of the proposed road, to confirm the feasibility of possible future extensions.

(cc) The location of all major utility structures including luminaire poles and transformers and pedestals shall be clearly shown on the Utility Coordination Plan.

(dd) The location of all underground traffic signal and utility duct work shall be shown on the plan section of the road drawing. In chart form, the utility ducts shall be shown as follows: reference letter, chainage, number of ducts required for Hydro, Bell, Cable, Streetlights and spare, and the length of the ducts.

A 6.00 OTHER DRAWINGS

A 6.01 Lot Grading Plans and Area Rough Grading Plans

All lot grading and area rough grading shall be prepared in accordance with the guidelines given in Section G of this manual.

A 6.02 Storm Drainage Plans

All drainage plans for storm sewer design shall be prepared in accordance with the Guidelines given in Section E of this manual.

A 6.03 Landscaping Plans

All landscaping plans shall be prepared in accordance with Sections G and H of this manual utilising Graphic Media as described in Sub-sections A 3.00 (a) and (b). All landscape plans are to be prepared and sealed by a Landscape Architect registered with the Ontario Association of Landscape Architects (OALA).

A 6.04 Detail Drawings

The Town of Cobourg Standard Detail Drawings shall be utilized whenever applicable. The use of the latest revision of the Ontario Provincial Standard Drawings may be utilized when approved by the Director of Public Works. These drawings need not be reproduced as part of the engineering drawings for the development, but must be referred to by number as part of the engineering drawings for the development, and must be referred to by number on the affected Plan and Profile Drawings. The Consultant shall be responsible for checking the suitability of the details provided on the Town of Cobourg Standard Drawings Details for the application proposed. Individual details shall be provided by the Consultant for all special features not covered by the OPSS/OPSD.

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 Maintenance Structure or sewer detail shall be 1:50.

A 6.05 Sediment and Erosion Control Plan

All Sediment and Erosion Control Plans shall be prepared in accordance with the Guidelines provided in Section N of this manual.

A 6.06 Street Furniture/Utility Coordination Plan

All Utility Coordination Plans shall be prepared in accordance with the Guidelines provided in Section O of this manual.

A 7.00 AS CONSTRUCTED - SERVICES DRAWINGS

A 7.01 General

The 'As Constructed - Services' Drawings constitute the original engineering drawings, accompanied by the electronic file, in AutoCad format, which has been revised to incorporate the construction changes and variances in order to provide accurate information on the works as installed in the development. The Registered 39R Plan Number must be clearly shown on all 'As Constructed - Services' General Plan of Services Drawings.

A 7.02 Drawing Revisions

'As Constructed - Services' Revisions shall be based upon a final survey of **all** the subdivision services and the Consultant's construction records. The final survey of the subdivision services shall include a field check of the following items:

(a) Location and invert elevations of all sewer Maintenance Structures.
(b) Distances and grades of pipes between all sewer Maintenance Structures.
(c) Location of all roadway catchbasins.
(d) Location, rim and invert elevations for all rear yard and lot catchbasins.
(e) Location of all sidewalks and curbs.
(f) Location of all valve boxes and valve chamber,

(g) Location of all hydrants,
(h) Location of all other special watermain appurtenances,
(i) Road centreline elevations as shown on drawings,
(j) Site bench marks,
(k) Changes in sewer pipe sizes and material or class plus revised sewer design sheet if required,
(m) Location of all fencing constructed as part of the subdivision services,
(n) Location of all driveways, boulevard tree plantings, streetlight poles and transformers shall be shown on the Utility Coordination Plan,
(o) Location of all service connections and clean outs to all lots and blocks, and location of connection from the nearest downstream Maintenance Structure,
(p) All electronic copies shall be submitted in the Town of Cobourg's current version of AutoCad, on a cd. The cd shall be labelled with the contract number, subdivision name, Registered 39R Plan Number and the drawing numbers. All files are to be named by the drawing number. For plotting purposes, provide a list of pen colours with coordinating pen sizes.
(q) Original design information (inverts, grades, etc.) is to remain on the drawings with a double horizontal line through it and the as built information boxed in, adjacent to the original information,
i.e. E. INV. ~~97.5~~ (original design invert) 97.35 (As Constructed - Services invert)

The original 'Approved for Construction' 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.

All sewer and road grades shall be recalculated to two decimal places.

All street line invert elevations of storm and sanitary service connections to each block shall be noted on the drawing.

All screening shall be removed.

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

The Contractor, 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 - Services' Revision note shall be placed on all drawings in the revision block.

A 7.03 Tolerances

As Constructed - Services information shall be accurately shown on all drawings.

All sewer lengths shall be shown to the nearest 0.10 m.

The information shown on the 'As Constructed - Services' Drawings may be checked by the Town of Cobourg 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 revisions.

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

A 7.04 Submissions

Upon completion of all construction work and the 'As Constructed - Services - revisions, one full size paper copy, an electronic file, in AutoCad format, acceptable to the Town of Cobourg, shall be submitted to the Town of Cobourg for their permanent records.

The submission of the 'As Constructed - Services' Drawings to the Town of Cobourg must be completed before Preliminary Acceptance of the above ground works will be given. The Mylar prints have to be submitted before Final Year Maintenance is issued.

An 'As Constructed - Services' General Plan will be submitted on Disc in AutoCad format as part of the Preliminary Acceptance. The revised signed original General Plan drawing will be submitted with the remaining Myalrs.

SECTION B – ROADWAYS

B 1.00 CLASSIFICATIONS

All roadways in new developments shall be classified according to the Town of Cobourg Official Plan, expected traffic volume and intended use of the roadway. For predominantly residential areas, four classifications shall be noted, as follows: Arterial, Collector, Local, Laneways. These classifications are defined in the Town of Cobourg Official Plan. For industrial areas, the streets shall be classified Local or Collector dependent upon the length of the street, traffic volume expected and volume of truck traffic expected. Arterial roadways shall be sub-classified as divided or undivided. The proposed classification of all streets in the development shall be confirmed with the Town of Cobourg prior to the commencement of the design.

The following table is presented as a guide to the determination of the street classification.

GUIDELINES	LOCAL	COLLECTOR	ARTERIAL
Source Provided	Land Access	Land Access Traffic Movement Transit Routes	Traffic Movement Transit Routes
Length of Trip	Short	Medium	Long
Flow	Interrupted	Interrupted	Through Collector
Interconnections	Local collector	Local Collector Arterial	Arterial Freeway
Estimated A.A.D.T.	0-1,000	1,000-3,000	Over 3,000

B 1.01 Roadway Cross-Sections

For a summary of the general roadway cross sections and their intended uses, refer to the Town of Cobourg Official Plan.

The following table summarizes the roadway cross-sections available and their intended uses.

TYPE	USES
8.5M local road in a 15m road allowance	To be used only as a service road in Urban Residential Areas
8.5m local road in an 18.5m road allowance. (Curb and Gutter)	To be used in all Urban Residential Areas
8.5m local road in a 20.0m road allowance. (Curb and Gutter)	To be used in all Urban Residential Areas

B 2.00 GEOMETRIC DESIGN ELEMENTS

B 2.01 Residential Streets – Urban

Geometric Detail	Local	Collector	Arterial
Minimum Right-of-Way Width (metres)	17 – 20	20 – 30	26-36
Minimum Design Speed (km per hour)	50	50	
Minimum Safe Stopping Sight Distance (metres)	65	65	
Minimum Sag Curve K value	12	12	
Minimum Crest Curve K value	8	8	
*Minimum Sag Curve Parameter in Illuminated K value	5	5	

Geometric Detail	Local	Collector	Arterial
Minimum Curve Radius (metres)	N/A	N/A	
Pavement Width (Face to Face of Curbs in metres)	8.5	10	
Pavement Crossfall (per cent)	2.0	2.0	
Minimum Grade (per cent)	0.5	0.5	
Maximum Grade (per cent)	6.0	6.0	
Intersection Angle (degrees)	70 – 90	80 – 90	
Minimum Tangent Length at intersections (m)	30	50	
Minimum Tangent Length	30	50	

between Reverse Curbs (m)

*Based on comfort Guidelines. Use in illuminated areas only when stopping sight distance requirements are met.

B 2.02 Industrial Streets

Geometric Detail	Local	Collector	Arterial
Minimum Right-of-Way Width (metres)	17-20	20-30	26-36
Design Speed (km per hour)	50	60	
Minimum Safe Stopping Sight Distance (metres)	65	85	
Minimum Sag Curve K value	8	18	

Geometric Detail	Local	Collector	Arterial
Minimum Crest Curve K value	8	15	
Minimum Curve Radius (m)	90	130	
Pavement Width (Face to Face Of Curbs in metres)	10.0	10.0	
Pavement Crossfall (per cent)	2.0	2.0	
Minimum Grade (per cent)	0.5	0.5	
Maximum Grade (per cent)	6.0	6.0	
Intersection Angle (degrees)	70 – 90	80 – 90	
Minimum Tangent Length at Intersections (metres)	30	60	
Minimum Tangent Length Between Reverse Curves (metres)	30	60	

B 2.03 Arterial Streets

Arterial streets will be designed to the Town of Cobourg Design Standards.

B 3.00 DESIGN ELEMENTS

B 3.01 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 Geodetic Design Standards for Ontario Highways. The minimum visibility curves to be used are outlined in the geometric details for each roadway classification.

B 3.02 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 one to two percent 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.

B 3.03 Curb Return Radii at Intersections

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

Pavement Width Street A	**Pavement Width Street B**	**Curb Return Radii**
8.5m	8.5m	8.0m
8.5m	10.0m	10.0m
8.5m	11.0m	10.0m
10.0m	10.0m	12.0m
10.0m	11.0m	12.0m
11.0m	11.0m	12.0m

Industrial designated streets will be required to have a minimum 15m radius.

B 3.04 Cul-De-Sacs and Bulbs

Permanent cul-de-sacs shall be constructed in accordance with the details provided in the standard drawings. Minimum gutter grades of 0.5% shall be maintained along the flow line of all gutters around the cul-de-sacs. All cul-de-sacs, bulbs and intersections shall be detailed at a scale larger that the road plan. The details shall show gutter, crown and other grades sufficient to determine that the road will properly drain and shall be used as a basis for layout.

Maximum length of a cul-de-sac shall be 100 metres.
Minimum cul-de-sac radius shall be 13.0 metres.

B 3.05 Temporary Turning Circles

Temporary turning areas are to be built to the geometric standards of permanent cul-de-sac standards.

B 3.06 Location of Utilities

All non-municipal utilities shall be in a joint utility trench, unless otherwise approved. The location of utilities within the road allowance shall be as per the Town of Cobourg Standard Drawings. Utility Coordination Plans shall be submitted to the Director of Public Works for approval as per Section O of the Design Criteria.

All utility wiring is to be constructed underground. Hydro transformers are to be housed in suitable enclosures and mounted on transformer pads installed at the final surface of ground. Bell Telephone junction and Cable TV boxes may be mounted at the surface in approved standard enclosures.

Consideration shall be given for locating transformers and switch boxes in the least visible location so as to the limit the impact on the street scape.

B 3.07 Emergency Access

Emergency access entrances are to be avoided wherever possible. Where an emergency access is required to meet the requirements of local emergency services, its design must meet the requirements of the Town of Cobourg and shall be approved by the Director of Public Works.

B 4.00 PAVEMENT DESIGN

The minimum pavement design for all streets in new subdivisions shall be detailed on the Town of Cobourg Standard Drawings. A qualified Soils Consultant shall be engaged by the Developer to sample, test and design a suitable pavement section. Soil sampling shall be carried out in the presence of the Soils Consultant at intervals not exceeding 60 m along the center line of the subdivision road. The composition and design thickness of the pavement section shall be determined from:

(a) Mechanical Sieve Analysis of the Sub-grade Soil
(b) Frost Susceptibility
(c) Drainage, and
(d) Traffic Volumes.

Three copies of all test results and proposed road designs shall be submitted with the engineering drawings. In no case will a pavement design less than the minimum current and corresponding OPSS/OPSD for the particular road classification be considered acceptable.

The Consulting Engineer shall be responsible for approving the source of supply and quality of all materials supplied by the Developer and his Contractors. Testing and approval of all granular materials at the designated pits and subsequent in-situ verification tests shall be performed by the Consulting Engineer and shall be presented to the Town.

Prior to the placement of concrete and the asphalt pavement, the Consulting Engineer must submit to the Director of Public Works for approval, the concrete and asphalt pavement mix designs for all mixes.

Asphalt and concrete designs and materials are to conform to OPSS Guidelines.

B 5.00 CONCRETE CURB AND GUTTER

Concrete curb and gutter conforming to the current OPSS/OPSD shall be used on all new roadways.

Adjustment and final setting of catchbasin frames shall be completed by pouring concrete, or using adjustable concrete riser units, immediately prior to the placement of the top lift of asphalt. Riser units shall be parged on the outside of the catchbasins only. Catchbasins shall be initially set to base asphalt elevation. Temporary asphalt curb shall be placed at catchbasins until they are raised to final grade just prior to top asphalt.

Driveway depressions shall be formed in the curb according to the details and locations as shown on the current OPSD. If the driveway depression should be 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 providing the existing section is free from cracks and other defects, otherwise the curb is to be replaced.

Accessible curb ramps shall conform to the County of Northumberland Facility Accessibility Design Standards. See Appendix B for design detail.

B 6.00 SIDEWALKS

The location requirements for sidewalks in new subdivisions shall be confirmed with the Director of Public Works prior to commencing the detailed design. In general, sidewalks are required on both sides of all arterial and collector roadways and on one side of local streets unless warranted on both sides. For local roadways, the locations of schools, parks, churches, commercial establishments, the length of street and traffic volume expected and the number of dwelling units serviced will be some of the Guidelines used in determining whether sidewalks are required on both sides of the street.
The sidewalk shall conform in details and dimensions to the current OPSD and shall be installed at locations as shown on the typical road cross-sections. The standard width of sidewalk for streets is 1.50 m.

The sidewalks shall be increased in thickness at all driveway locations as shown in the current OPSD. In cases where the sidewalk has been constructed prior to the establishment of an entrance the existing sidewalk shall be removed and shall be replaced with a thickened sidewalk section.

At street intersections the curb and the sidewalk shall be depressed to meet the roadway elevations as shown in the current OPSD.

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. An expansion joint shall be provided to separate the back of the curb from the face of the sidewalk.

Accessible curb ramps shall conform to the County of Northumberland Facility Accessibility Design Standards. See Appendix B for design detail.

B 7.00 DRIVEWAYS

The developer, or his assign, is responsible for the grading and provision of hard surface of the entire length of all driveways from garage to curb, to Town of Cobourg standards. For egress to arterial roads, a turn-around must be provided within the property.

B 7.01 Minimum Driveway Design

The minimum consolidated depth requirements for the granular base and asphalt in driveways shall conform to the current OPSD.
Driveways are to be located on the low (downhill) side of the lot.

B 7.02 Driveway Grades

The maximum permissible design grade for any driveway shall be 8%. This maximum grade is not recommended and should be employed only in exceptional cases where physical conditions prohibit the use of lesser grades.

Driveway widths and locations shall conform to the latest revised Town of Cobourg Zoning By-law and Official Plan.

Minimum design grade for any driveway shall be 2.0%. The specified grades for all driveways shall be directed away from the houses. The use of reverse driveways is not permitted.

For industrial and commercial sites requiring site plan approval, a break in grade for driveways shall occur at the street line, providing positive drainage from property line to the roadway while keeping all flows from these properties contained within the property itself.

B 7.03 Driveway Depressions

The width and location of the depressions in the curb and gutter for single family residential driveways shall be as detailed in the current OPSS/OPSD.

The width and location of the driveway depressions for apartment, commercial and industrial driveways shall be detailed on the engineering drawings. These driveways shall be designed to accommodate the anticipated vehicular traffic without causing undue interference with the traffic flow on the street. The minimum width of any driveway depression for commercial, apartment or industrial driveways shall be a minimum 15.7 metre. All apartment, commercial and industrial driveways shall be provided with barrier curbs constructed to blend into the roadway curb and gutter.

B 8.00 BOULEVARDS

All boulevard areas are to be graded between 2% and 5%. The minimum boulevard width shall be 2.0 metres, unless otherwise approved. All boulevard areas to be graded according to the details shown on the current OPSD and to the satisfaction of the Director of Public Works. In order to minimize construction problems for the other utility companies, the grade of the boulevard shall be constant from the back of the curb to the municipal right-of-way. Terracing or embankments within the road allowance on new subdivision streets shall not be permitted.

All debris and construction materials shall be removed from the boulevard area upon completion of the initial stage of road construction and the boulevards shall be maintained in a clear state until the roadway section is completed.

Clean, weed free, topsoil as defined by the latest OPSS, shall be placed on all boulevard areas prior to sodding. The minimum depth of topsoil required shall be such that the combined thickness of the topsoil and sod is a minimum of 200mm. Number 1 nursery sod shall be used for all boulevard areas.

B 9.00 STAGING OF CONSTRUCTION

The construction of all roads in new subdivisions shall be staged in order that the completion of the roadway coincides with the completion of the development of the surrounding lands. The initial stage of construction shall include all underground services, the road base and a "wear course as approved by the Director of Public Works" of asphalt, for building construction, traffic movement and land access.

The second stage of roadway construction shall include pulverizing, re-grading, and compaction of the "wear course as approved by the Director of Public Works" asphalt, the installation of full, single stage curb and gutter, installation of base and final courses of asphalt and all other works necessary to complete the roadway to the final design cross section.

This work shall not commence in any area until ALL the following conditions are met:

(a) A minimum period of one year has expired from the completion of Stage 1 construction.
(b) 85% of the dwellings with frontage or flankage on the street are completed to the fine grading and topsoil stage.
(c) All undeveloped blocks and lots are graded in accordance with the approved Lot Grading Plan.
(d) All service connections for multiple family, commercial, institutional or other blocks are installed.
(e) The approval of the Town is obtained in writing.

B 9.01 Residential and Local Collector Roadways

For residential and local collector roadways, the initial stage of construction shall consist of:

- The grading to the full cross sectional width of the right of way.
- The complete granular base
- The wear course as approved by the Director of Public Works

The second stage of road construction shall comprise the following:

- The installation of full, single stage curb and gutter
- The installation of concrete sidewalk
- Pulverizing, re-grading and compacting of the wear course as approved by the Director of Public Works
- The completion of the base and surface courses of asphalt
- The grading, top soiling and sodding of all boulevards
- The grading, gravelling, curbing and paving of all driveways
- The final adjustment, to grade, of all utilities
- All other work necessary to complete the roadway to the final design cross section, including boulevard tree plantings

B 9.02 Major Collector, Industrial Collector and Arterial Roadways

For these roadways, the initial stage of construction shall consist of:

- All work necessary to complete the roadway to the final design cross section, with the exception of the surface asphalt
- The boulevard sodding
- The driveway approach paving
- The full curb and gutter and sidewalk

The second stage of construction shall comprise the following:

- The surface asphalt
- The final adjustment to grade of all utilities in the surface asphalt
- All other work necessary to complete the roadway to the final design cross section including boulevard tree plantings.

B 10.00 CONSTRUCTION REQUIREMENTS

B 10.01 Clearing and Grubbing and Area Rough Grading

The timing of this work shall be as per the subdivision agreement. The road allowance shall be cleared of all trees and shrubs not to be included in 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 traveled portion of the road to the necessary grade and in conformity with the cross section shown on the drawings. Rough grading of all lots and easements must be performed prior to the placement of granular materials in the roadways. The sub-grade for all roads shall be properly shaped and compacted to 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 stock piled at locations approved by the Director of Public Works.

All sediment and erosion control as outlined on the Sediment and Erosion Control Plan must be in place and functioning before any clearing, grubbing or earth work operations start.

For any excess fill removed to a disposal site classified as “swamp, ravine, floodplain or lake”, the Developer must receive prior written permission from the local Conservation Authority.

B 10.02 Road Sub-Drains

100mm 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, and connected to the storm sewer system, at a grade matching the proposed road grade.

B 10.03 Sub-Grade

The sub-grade for all roads shall be properly shaped and compacted to 95% Standard Proctor Maximum Dry Density (SPMDD) prior to any application of granular base course materials. The finished sub-grade shall be proof rolled in the presence of the soils consultant and certified as being acceptable. The soils consultant shall provide a certificate indicating that the sub-grade has been inspected and is suitable for the placement of the granular materials.

B 10.04 Granular Base

The sub-grade for all roads shall be properly shaped and compacted to 100% Standard Proctor Maximum Dry Density (SPMDD) prior to any application of hot mix asphalt. The finished granular base shall be proof rolled in the presence of the soils consultant and certified as being acceptable. The soils consultant shall provide a certificate indicating that the granular base has been inspected and is suitable for the placement of the hot mix asphalt.

B 10.05 Asphalt Compaction Requirements

Shall conform to the specification outlined in OPSS 310.

B 10.06 Snow Clearing and Summer Maintenance

Snow clearing and summer maintenance shall be carried out by the Town of Cobourg so that the roads and adjacent roadways are kept in a condition acceptable to the Director of Public Works.

B 10.07 Other Requirements

Whenever it is necessary to cut through an existing Town road, the Developer's contractor will be responsible for obtaining a Road Occupancy Permit and 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 Director of Public Works. Where the road is not part of the Town road system, approval from the appropriate road authority will also be necessary. In all cases, the Fire and Police Departments, School Boards, Ambulance Service, Town of Cobourg Public Works Department and Transit Authorities must be notified by the Developer or his contractor.

All work will be done in accordance with ordinances and by-laws of the Town of Cobourg.

SECTION C – ENTRANCEWAYS

C 1.00 GEOMETRIC DESIGN

Design speed shall be 20 km/h over posted speed or 85% tile of actual operating speed, whichever is the highest.

Stopping sight distance shall be based on design speed as per the Ministry of Transportation Geometric Design Standards for Ontario Highways, and the Town of Cobourg Official Plan.

Vertical curvature shall be based on TAC – Geometric Design section 2.1.3.3.

Horizontal curvature shall be based on TAC – Geometric Design section 2.1.2.2.

	Arterial Type "A"	**Arterial Type "B"**
Minimum Grade:		
✓ road profile	0.50%	0.50%
✓ curb & gutter (along road)	0.50%	0.50%
✓ curb & gutter (in intersections)	0.60%	0.60%
Maximum Grade:		
✓ road profiles	8.00%	8.00%
✓ through an intersection	2.50%	3.00%
✓ intersection grade difference	2.00%	2.00%
Maximum Grade for 15 m beyond the limit of the backfall grade:		
✓ local roads	1.5%	2.0%
✓ collector roads	1.5%	1.5%
✓ arterial roads	1.0%	1.0%
Right-of-way width	36>50 m	30>36 m
Minimum Radius at Intersection	15 m	15 m
Minimum Intersection Angle	70º	70º
Pavement Crossfall	2%	2%
Super Elevation Max. (urban/rural)	4/6%	4/6

C 2.00 ROAD PAVEMENT DESIGN

The pavement design for arterial roads will be considered on an individual basis. The composition and construction thickness of the road pavement shall be designed based upon the following factors:

- mechanical analysis of the Subgrade soil
- drainage
- frost susceptibility
- the future volume and class of traffic expected to use the pavement

C 3.00 ALIGNMENT

C 3.01 Maximum Grades

The maximum grades for arterial roads shall be 8.0%.

C 3.02 Vertical Curves

All road profile grade changes in excess of 1.5% shall be designed with vertical "K" curves as outlined by Ministry of Transportation Geodetic Design Standards for Ontario Highways. Side road crossfall grade changes approaching crown line of main road shall not exceed an algebraic difference greater than 2.0% if the intersection is to be signalized.

C 3.03 Horizontal Alignment

The radius of curvature shall be shown to the centerline of the proposed road on the plan and the radius of the proposed curb shall be indicated on the plan adjacent to the curb.

C 3.04 Road Allowance Cross-Section

The typical road allowance cross-section shall be as specified by the Town of Cobourg. Details shall be provided for any approved special provisions required due to unique physical conditions on the site or for existing or future design conditions such as retaining walls, slope protection, culverts, bridges or special crossfall conditions.

C 3.05 Intersections

At the intersection of two roads any transition of the minor classification road shall not interfere with the normal crossfall of the major road.

A 2% backfall shall be provided on all road profiles where local streets intersect with arterial roads. The backfall grade shall be from the crown of the major road to the end of curve or first catch basin on the local road.

Ontario Provincial standard drawings (latest revision) should be used as guidelines for intersection designs. Where two major arterial roadways intersect, the intersection may have to be splined.

C 4.00 ENTRANCE STRUCTURE DESIGN

Entranceway refers to any private road, laneway, driveway, gate or other structure or facility constructed as a means of access to a Town of Cobourg road.

C 4.01 High Volume Entranceway

Refers to an entranceway providing access to and/or egress from:

- an office, retail or institutional building
- an apartment building containing more than five dwelling units

- an employee or other parking lot
- an industrial facility, warehouse or trucking terminal
- a community or regional shopping center
- a recreational complex or other public facility

C 4.02 Low Volume Entranceway

Refers to an entranceway providing access to and/or egress from:

- a single family residence
- an apartment building containing not more than five dwelling units
- a farm consisting of not more than four plowable hectares or a field forming part of a farm and used exclusively for the passage of animals and crops

Other entranceways serving land uses not covered above are subject to interpretation by the Town of Cobourg as to whether the 'high volume' or 'low volume' entranceway requirements will be applied.

C 4.03 Basic Entranceway Dimensions

Basic widths, curb spacing, radii and angles of entrances for various land uses shall be as per the Town of Cobourg Official Plan and Comprehensive Zoning By-law.

ENTRANCE WAY GEOMETRICS	DIMENSION REFERENCE (SEE FIG. 1)	URBAN			RURAL		
		Res.	Com.	Ind.	Res.	Com.	Ind.
Width (m)	W						
Minimum		3.5	4.5	6.0	4.9	5.5	6.0
Maximum		7.5	9.0	12.0	9.0	9.0	12.0
Right Turn Radius (m)	R						
Minimum		1.5	3.0	4.5	3.0	4.5	7.5
Maximum		4.5	16.0	16.0	7.5	24.0	24.0
Minimum Spacing (m)							
From property line	P	R	R	R	R	R	R
From point of tangency	C	1.5	3.0	3.0	12.0	17.0	17.0
Between driveways	S	7.5	7.5	7.5	1.5	1.5	1.5
Angle	A	70	70	70	70	70	70

The minimum width of commercial and industrial driveways is intended to apply to a one-way operation. The driveway width is to be measured at the edge of pavement between the inner limit of the curb return radius or between the curb return radius and the near edge of a curbed island, which has a surface area of at least $4.6m^2$.

In high pedestrian activity urban areas, the following will apply:

- maximum driveway width will be 9.0m

- the side of a driveway exposed to entry or exit by right turning vehicles, the radius should be half of the values shown in Table 1
- the minimum spacing between driveways in urban areas should be 7.5m

Minimum acute angle measured from the center line of roadway and generally based on one-way operation.

Ontario Provincial Standard Drawing Numbers OPSD-301.010, OPSD-301.020 and OPSD-301.030 (latest revision) should be used as guides for rural entrance design.

C 4.04 Driveway Entrance

The following are the minimum depth requirements:

- **Residential**
  - Asphalt Entrance
    - 300 mm granular "B"
    - 150 mm granular "A"
    - 50 mm HL4 base course

  - Granular Entrance (Rural Only)
    - 300 mm of Granular 'A'

- **Light Industrial, Commercial and Apartments**

  - Asphalt
    - 300 mm granular "B"
    - 150 mm granular "A"
    - 50 mm HL4 base course

The width of curb cutout for residential driveways shall be as specified by the Town of Cobourg. The width of curb cutout for apartment, commercial and industrial driveways shall take into account the basic width of the driveway and the radius of curvature as further outlined below. Where mutual driveways are constructed between two adjoining properties, the curb cutout shall be continuous.

The maximum grade permissible for an access driveway, from the sidewalk to the garage shall be 8%. This maximum grade is not recommended and should be employed only in exceptional cases where physical conditions prohibit the use of lesser grades. There shall be a minimum grade of 2% from the property line to the curb line.

The radius of curvature from the road into apartment, commercial and industrial driveways shall be designed to accommodate the anticipated vehicular traffic without causing undue interference with the traffic flow on the street.

Where high volume entranceway will enter onto a Town of Cobourg road, the Town of Cobourg may require, as a condition of access, the construction of a median barrier to block left turn access to and/or egress from the subject property.

SECTION D - SANITARY SEWERS

D 1.00 DESIGN FLOW

Sewage flows shall be calculated on the basis of:

D 1.01 New Residential

Average Flow
364L/person/day

Infiltration
- 22.5 m^3 / gross/ha/day – when foundation drains are not connected to the sanitary sewer.

Calculated on the number of gross hectares of residential lands tributary to the sanitary sewer systems.

Design flows shall be calculated on the Town of Cobourg's Standard Design Sheet (see Appendix)

Peaking Factor

$K_H = 1 + \frac{14}{4+P^{1/2}}$

K_H - Harmon peaking factor
P - Population in thousands

K_H - Maximum 3.8
- Minimum 1.5

Population Density

Population density may change from time to time, please verify with the Town of Cobourg's Planning Department to ensure accuracy.

When lands are zoned for a specific residential use and detailed information is not available, the following population densities shall apply: (u/ha = units per hectare)

TYPE OF HOUSING	UNITS/HECTARE
Single family dwelling	20
Semi-detached & duplex	20
Townhouse	50
Apartment	
- low density	50
- med density	100
- high density	100

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	PERSON/UNIT
Single family dwelling & semi-detached	3.23
Townhouse	2.68
Apartments	1.62

Undeveloped Land

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

D 1.02 Commercial

Design Flow: site specific or to Ministry of the Environment standards, based on usage, and approved by the Town of Cobourg.

Floor Space Index: 0.50 of gross lot area unless designated otherwise in the secondary plan.

D 1.03 Industrial, Schools/Institutions

Design Flow Industrial

- 180 m^3/gross ha/day including infiltration and peaking effect for local sewers.
- 90 m^3/gross ha/day including infiltration and peaking effect.

Design Flow Schools and Institutions

- 112 m^3/gross ha/day including infiltration and peaking effect.

The area is calculated using the number of gross hectares included in the industrial, school or institutional site. This flow figure will apply unless evidence exists which will require additional treatment or provide additional volume.

D 1.04 Sanitary Drainage Area Plan

The tributary areas used in the evaluation of the design flows shall be shown on a plan to a scale that will fit a standard 'D' size sheet. This plan shall indicate the land use, area, population density or number of units, and the design flow in L/s. For each area entered on the design sheet, the maintenance hole numbers, the size and grade of the sewers, and the plan number of the detailed plan and profile for each section of the sanitary sewer shall also be indicated.

D 2.00 SANITARY SEWER DESIGN

D 2.01 Location

Sanitary sewers shall be located at the centreline of the road and a minimum of 3.0m from the storm sewer.

D 2.02 Pipe Capacities “Q”

Sewer capacities shall be computed by using Manning’s Formula on the basis of sewer pipe flowing full. (See Appendix)

D 2.03 Roughness Coefficient "n"

For all types of pipe, a roughness coefficient to match the Ministry of the Environment Roughness Coefficient Guidelines shall be used.

D 2.04 Velocity and Grade

The following Manning formula shall be used for calculating sewer capacity:

$$Q = \frac{7.855 \times 10\text{-}6}{n} D2.R0.67\ S\ 1/2$$

Where Q = Flow capacity of sewer (L/s)
D = Inside diameter of pipe (mm)
R = Hydraulic radius of pipe (mm)
S = Sewer slope
n = Kutter or Manning roughness coefficient

For small diameter sewers (i.e., less than 900 mm), Kutter's formula gives a more conservative estimate of sewer capacity. For this reason, Kutter's formula is usually used to calculate minimum acceptable sewer slopes.

All sewers should be designed with such slopes that they will achieve a mean sewage flow velocity, when flowing full, of at least 0.6 m/s. In cases where the flow depth in the sewer, under peak flow, will not be 0.3 of the diameter or greater, the actual peak flow velocity should be calculated using hydraulic elements chart and the slope increased to achieve adequate flushing velocities. In certain circumstances, such as where increased slopes would require deepening of extensive sections of the sewage collection system or the addition of a pumping station, peak sewage flow velocities of less than 0.6 m/s may be acceptable provided that the municipality accepts that there may be increased maintenance requirements.

In sizing sanitary sewers and selecting sewer slopes, consideration must be given to possible sulphide generation problems. Sulphide problems can be minimized by designing for sewers to flow less that full under peak flow conditions and to flow at velocities of 0.6 m/s, or more. Reference should be made to the EPA publication "Sulphide Control in Sanitary Sewerage Systems" by D.K.B. Thistlethwayte for more information.

The velocities in sanitary sewer systems should not be more than 3 m/s, especially where high grit loads are expected. Higher velocities should be avoided unless special precautions are taken to protect against pipe displacement and pipe erosion.

All sewers should be designed and constructed to give minimum velocities, when flowing full, of not less than 0.6 m/s, based on Kutter's formula using an "n" value of 0.013. The following are the minimum slopes which should be provided:

Sewer Size	Minimum Slope in Metres per 100 Metres
NPS-6	0.52
NPS-8	0.40
NPS-10	0.28
NPS-12	0.22
NPS-14	0.17
NPS-15	0.15
NPS-16	0.14
NPS-18	0.12
NPS-21	0.10
NPS-24	0.08
NPS-27	0.067
NPS-30	0.058
NPS-36	0.046

Note: Nominal pipe size is indicated by an NPS designation number. The designation number is the nominal inch size of the pipe and follows the nomenclature in CSA B182 Series Standards.

Slopes less than those required for 0.6 m/s velocity when flowing full may be permitted when increasing of the slope would require deepening of extensive sections of the system or the addition of a pumping station. In such instances, the reduction of slope would only apply to NPS-8 and NPS-10 pipe and the minimum allowable slope would be 0.28% for NPS-8 pipe and 0.22% for NPS-10 pipe.

D 2.05 Minimum Size of Pipe

Minimum size of pipe shall be 200 mm diameter.

D 2.06 Minimum Depth of Pipe

Depth is measured from the final centerline finished road elevation to the top of the sanitary sewer:

- ✓ For residential, commercial and institutional areas, the minimum depth shall be 2.75 m.
- ✓ For industrial areas, the minimum depth shall be 2.15 m.

In all cases the proposed sanitary sewers shall be installed at sufficient depth to service lands external to the site as determined by the Town of Cobourg.

D 2.07 Sewer Alignment

All sanitary sewers shall be laid in a straight line between maintenance holes.

D 2.08 Maintenance Holes

Maintenance holes shall conform to current OPSD.

Maintenance holes shall be provided at each change in alignment, grade, pipe material and at all junctions, except where radius pipe is used in size 1050 mm and over.

Maintenance holes shall be spaced at a maximum of 90 m for pipe sizes 200 mm diameter to 750 mm diameter, a maximum of 125 m for pipe sizes 825 mm diameter to 1200 mm diameter and a maximum of 150 m for pipe sizes over 1200 mm diameter.

The type and size of maintenance hole shall be specified on the profile and a detail of the benching is to be shown on the plan portion of the engineering drawing for cases when the benching differs from the normal.

All maintenance hole chamber openings shall be located on the upstream side of the maintenance hole.

The maximum change in the direction of flow in any sanitary sewer maintenance hole shall be 90 degrees. A change of flow direction at acute interior angles shall not be permitted.

A maximum drop of 0.25 m will only be allowed 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 maintenance hole inlet and outlet will exceed 0.25 m, then a drop structure shall be required.

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

When pipe size does not change through a maintenance hole and the upstream flow velocity does not exceed 1.5. m/s, the following allowances shall be made to compensate for hydraulic losses:

ALIGNMENT CHANGE	DROP REQUIRED
straight run	Grade sewer
15-45 degrees	0.03 m
45-90 degrees	0.06 m
junctions and transitions*	

**When the upstream flow velocity exceeds 1.5 m/s, the drop required through a maintenance hole shall be calculated using Ministry of the Environment guidelines "Hydraulic Calculations for Junction and Transition Maintenance Holes" (see Appendix).*

For all junction and transition maintenance holes, the drop required shall be calculated using the ministry of the Environment guidelines "Hydraulic Calculations for Junction and Transition Maintenance Holes" (see Appendix).

The obvert(s) on the upstream side of a maintenance hole shall not be lower than the obvert(s) on the downstream side of the maintenance hole.

All maintenance holes shall be benched as detailed on the standard drawings for poured and precast maintenance holes.

The standard drawings provide details for maintenance holes up to certain maximum depths. The engineer shall analyze individually each application of the standards, related to soil conditions, loading and other pertinent factors, to determine structural suitability. In cases where the standards are not applicable, maintenance holes exceeds those on the standard drawings, the maintenance hole shall be individually designed and detailed.

Safety gratings shall be required in all maintenance holes greater than 5.0 m in depth. Safety gratings shall not be more than 5.0 m apart and shall be constructed in accordance with the standard drawings.

Whenever practical, a safety grating shall be located 0.5 m below the drop structure inlet pipe.

All maintenance holes located on easements in parks, in playgrounds or in other locations as deemed necessary shall be equipped with a secure watertight maintenance hole cover.

Ladders/steps shall be as per the most current Ontario Provincial Standard drawing.

D 2.09 Grades for Maintenance Hole Frame and Covers

All maintenance holes located within the travelled portions of the roadway shall have the rim elevation set flush with the surface of the future surface course of asphalt. The installation of risers, as approved by the Town of Cobourg, setting of the frame and cover shall be completed in accordance with the details provided in the Ontario Provincial Standards.

Maintenance Structure frames are to be set flush with base course pavement until final lift of pavement is applied.

D 2.10 Pipes

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

The use of radius pipe or deflected pipe will be permitted to achieve changes in horizontal alignment for sewer sizes 1050 mm diameter and larger. The minimum radius allowed for various pipe diameters shall be as detailed in the manufacturer specifications. When pipes are deflected at the joints, the angle of joint displacement shall not exceed 3 degrees.

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

Pipe bedding and class of pipe shall be designed to suit ultimate loading conditions and/or OPSD or MOEE.

The width of excavation shall not exceed 2.5 times the pipe diameter.

No service connections shall be permitted to sanitary sewers exceeding 7.60 m in depth. Depth is measured from the final center line finished road elevation to the top of the sanitary sewer.

PVC force mains shall be white.

Pipe stub locations and elevations shall be surveyed and accurately tied to permanent fixtures prior to backfilling.

D 3.00 MATERIALS

In non-industrial areas, polyvinyl chloride (PVC) pipe shall be used up to 600 mm diameter, reinforced concrete pipe shall be used for greater than 600 mm diameter.

PVC pipe shall have a dimension ratio (DR) of 35.

Where grades of local sewers are less than 0.5%, PVC pipe shall be DR21 and be white in color.

OPSS/OPSD standard bedding detail for PVC pipe shall be used for the sewers having a depth not exceeding the maximum allowable depth shown on Unified Soil Classification (see Appendix). For the depth in excess of the maximum allowable depth, a detailed design calculation and special drawings shall be submitted for approval. For the requirements for detailed design, the Town of Cobourg shall be contacted.

For PVC pipe, the maximum deflection measured not earlier than 24 hours after backfill shall not exceed 5.5% of average inside diameter (ID). The maximum deflection measured after one year installation, and prior to the end of maintenance period shall not exceed 7.0% of average ID.

D 4.00 EASEMENT REQUIREMENTS

The locations of sanitary sewers within easements or where deemed necessary by the Town of Cobourg, shall be indicated with marker sign and post. The contractor shall supply and install marker post, the location and spacing will be determined by the Town of Cobourg and shown on the contract drawings. All costs associated with the installation of marker signs and posts shall be borne by the contractor.

D 5.00 CAMERA INSPECTION OF SANITARY SEWERS

All camera inspections of sanitary sewers shall be carried out by Town of Cobourg forces.

D 6.00 CONCRETE ENCASEMENT

Concrete encasement is allowed on concrete pipe only. If concrete encasement of PVC pipe is necessary, a detailed design shall be submitted for approval. Concrete encasement shall be designed from maintenance hole to maintenance hole to prevent pipe shear. All concrete encased pipe shall be upsized one size to allow for potential future liners.

D 7.00 UTILITY CROSSINGS

Where sanitary sewers cross over or under utilities other than sewers or watermains, the clearance and type of crossing provided shall conform to the requirements of the particular utility involved and provide proper bedding and structural support of the sanitary sewer and utility.

D 8.00 OTHER

For all other conditions, refer to the Ministry of the Environment “Procedures to Govern Separation of Sewers and Watermains”

SECTION D - SANITARY SEWER CONNECTIONS

D 9.00 GENERAL

All sanitary sewer service connections for single family and semi-detached and townhouse dwellings shall be installed with a sanitary sewer cleanout as per the current OPSD.

Sanitary services shall be equipped with a locking cap.

The connection to the main sewer shall be made with an approved manufactured tee or approved saddle.

No service connection of a size greater than half the diameter of the main sewer shall be in accordance cut into the main sewer. A maintenance hole shall be installed on the main sewer at the intersection of a service connection, which has a size greater than half the diameter of the main sewer except as provided below:

A 150 mm service connection will be permitted to connect to a 200 mm and a 250 mm main sewer providing an approved manufactured tee is installed and providing the invert o f the service connection is above the spring line of the main sewer.

No sanitary sewer service shall connect directly into a maintenance hole.

D 9.01 Pipe Size

Service connections for single family and semi-detached units shall be 150mm diameter.

Service connections for multiple family and other blocks, commercial, institutional and industrial areas shall be sized individually according to intended use.

D 9.02 Location

Sanitary sewer service connections shall be installed on the high (uphill) side of the lot, a minimum of 1.5 m from the water service connection and terminating a minimum of 1.5 m inside the property line on private property. Connections installed to the rear of the building require a Town of Cobourg rear yard sanitary sewer agreement and are not maintained on private property by the Town of Cobourg.

The depth of sanitary sewer service connections for semi-detached units, at the property line, measured from the center line road elevation shall be:

- minimum shall be 2.50 m
- maximum shall be 3.00 m

Sanitary sewer service connections for single, semi-detached, and townhouse dwellings shall not be located in the driveway.

Risers shall be used when the obvert depth of the sanitary sewer main exceeds 4.50 m. The riser connection shall not exceed 3.0 m in depth.

After construction, the end of the connection shall be marked by a suitable length of 50 mm x 100 mm lumber extending from the invert of the connection to a point 0.9 m minimum above grade. The top of this marker shall be painted green and appropriately labeled.

D 9.03 Velocity and Grade

- Minimum low flow velocity shall be 0.60 m/s
- Minimum grade shall be 2%

D9.04 Maintenance Holes

Sanitary sewer connections to multiple family and other blocks shall require a maintenance hole installed on private property (1.50 m from property line to center of rim).

Sanitary sewer connections to commercial, industrial and institutional blocks shall require a maintenance hole located on private property 1.50 m from the property line to the center of rim.

D 9.05 Materials

For single family and semi-detached units, multiple family, and other blocks, the service connections shall be polyvinyl chloride (PVC).

PVC pipe shall be green in color.

D 9.06 Construction

Construction of sanitary sewer service connections in the Town of Cobourg shall be in accordance with the current and appropriate design specifications and standard drawings.

SECTION E – STORM DRAINAGE

E 1.00 DESIGN

As a minimum all Sediment and Erosion Control Plans should incorporate recommendations and protection measures pertaining to:

- Construction Scheduling
- Minimizing soil exposure and re-establishment or vegetative cover
- On-site sediment and erosion techniques
- Sit Supervision
- Monitoring and Maintenance
- Site Restoration
- Special Considerations(ie; in-stream construction/crossings, fisheries timing constraints)
- The OPSD drawings in Section 200 may assist in the erosion and sediment control specifications
- Location and protection measures of topsoil stockpile
- Sediment and Erosion Control by-law
- Location of temporary drainage swales and sediment ponds
- Site access and mud tracking control

E 2.00 WATERSHED AREA

The watershed area shall be determined from contour plans and shall include all areas that naturally drain into the system and any fringe areas not accommodated in adjacent storm drainage systems, as well as other areas which may become tributary by reason of regarding. This information shall be confirmed with the Ganaraska Region Conservation Authority prior to the start of the design of the internal servicing of the site.

E 3.00 STORM DRAINAGE PLANS

E3.01 External Drainage Plan

A plan shall be prepared to a scale that will fit a standard 'D' size sheet 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 the 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 area.

In lieu of precise information on development on the whole or any part of a watershed area, the latest zoning by-law and Official Plans issued by the Planning Department shall be used for all external areas in the design and to determine the specific areas to which these values apply.

This external drainage area plan shall be prepared and shall be submitted to the Director of Public Works at the functional report stage and prior to the commencement of the detailed storm sewer design.

E 3.02 Internal Drainage Plan

All internal storm drainage plans shall be prepared to a scale of 1:1000 and shall include all streets, lots, blocks and other lands within the development. The proposed storm sewer system shall be shown on this plan with all Maintenance Structures numbered consecutively from the outlet. These Maintenance Structures shall be the tributary points in the design, and the area contributing to each Maintenance Structure shall be clearly outlined on this plan. The area, in hectares, of each contributing area (to the nearest tenth) and the runoff co-efficient used shall be shown in a circle located within the contributing area. In cases where areas of different runoff co-efficients may be tributary to the same Maintenance Structure, the areas and the co-efficients shall be separately indicated on the plan.

In determining the tributary area to each Maintenance Structure, the proposed grading of the lots must be considered to maintain consistency in the design.

In the case of large areas under single ownership or blocks requiring future site plan agreements, the design shall be prepared on the basis of the whole area being contributory to one Maintenance Structure in the abutting storm sewer unless more than one private storm connection is necessary to serve the property in which case the appropriate area tributary to each connection shall be clearly shown and taken into account in the storm sewer design.

The length, size and grade of each section of storm sewer shall also be shown on the storm drainage plan.

E 4.00 STORM SEWER DESIGN

E 4.01 General

For additional requirements, refer to Technical and Engineering Guidelines for Stormwater Management Submissions, prepped by Ganaraska Region Conversation Authority.

E 4.02 Flow Velocities

Manning's formula shall be used in determining the velocity of all storm sewers. Flow in pipes should always be sub-critical; adjustments to the design and/or diameter shall be made in order to satisfy the table below.

Minimum acceptable velocity = 0.75m/sec.
Maximum acceptable velocity = 4.60m/sec.

Critical Slopes and Velocities

Critical Slope and Flow by Pipe Size			
Diameter (mm)	**Critical Slope (%)**	**Critical Velocity (m/s)**	**Critical Capacity At Slope (L/s)**
150	1.69	1.13	21
200	1.54	1.31	42
250	1.43	1.46	74
300	1.34	1.60	117
375	1.25	1.79	204
450	1.17	1.96	322
525	1.12	2.12	474
600	1.07	2.27	662
675	1.03	2.40	888
750	0.99	2.53	1,156
825	0.96	2.66	1,467
900	0.93	2.78	1,823
975	0.91	2.89	2,227
1050	0.89	3.00	2,681
1200	0.85	3.21	3,743
1350	0.81	3.40	5,025
1500	0.79	3.58	6,539
1650	0.76	3.76	8,298
1800	0.74	3.93	10,315
1950	0.72	4.09	12,600
2100	0.70	4.24	15,164
2250	0.69	4.39	18,019
2400	0.67	4.53	21,174
2550	0.66	4.67	24,639

E 4.03 Minimum Sizes

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

E 4.04 Minimum Grades

Regardless of flow velocities obtained, the minimum design grades for pipe storm sewers shall be as follows:

Sewer Size	**Minimum Grade**
Up to 375mm	0.50%
450mm to 525 mm	0.30%
600mm to 1200mm	0.20%
1200mm and Over	0.15%

The grade of the first leg of any sewer regardless of size, shall be 1.00%.

E 4.05 Minimum Cover

The depth of the storm sewer shall be sufficient to provide a suitable outlet for the building foundation weeping tiles. The minimum cover to the top outside pipe barrel of a shallow storm sewer system shall in no case be less than 1.4 m from the centreline of the roadway.
Frost protection shall be installed where minimum depths cannot be achieved, as approved by the Director of Public Works.

For estate subdivisions in rural areas, a shallow storm sewer system shall be permitted, provided the lot sizes are equal to or in excess of 0.20 hectares. The minimum cover to the top outside pipe barrel of a shallow storm sewer shall in no case be less than 1.3 m from the centreline of the roadway or proposed finished grade.

For lot sizes less than 0.20 hectare, a deep storm sewer system shall be constructed.

E 4.06 Location

The storm sewers shall be located under the curb line and shall incorporate catch basins and catchbasin manholes.

Any relocation from the standard location must have the approval of the Director of Public Works before construction.

E 4.07 Limits

All sewers shall be terminated at the subdivision limits when external drainage areas are considered in the design, with suitable provision in the design of the terminal Maintenance Structures 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 halfway across the frontage and/or flankage of any lot or block in the subdivision.

E 4.08 Sewer Alignment

All storm sewers shall be laid in a straight line between Maintenance Structures unless radial pipe has been approved. The maximum change in direction of flow in Maintenance Structures for sewer sizes 1000mm diameter and over shall be 45°.

E 4.09 Pipe Crossings

All pipe crossings are to be as per current Ontario Provincial Standard Drawings and the requirements of the operating authority (e.g. Bell, Gas and Cable)

E 4.10 Changes in Pipe Size

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

E 4.11 Head Losses

Suitable drops shall be provided across all Maintenance Structures 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 the outlet pipes to 0.6m per second.

Hydraulic calculations shall be submitted for all junction and transition Maintenance Structures on sewers where the outlet is 1050mm or greater. In addition, hydraulic calculations may be required for Maintenance Structures where the outlet pipe is less than 1050 mm diameter if, in the opinion of the Director of Public Works, there is insufficient invert drop provided across any Maintenance Structure.

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

The minimum drop across Maintenance Structures shall be as follows:

Change of Direction	**Minimum Drop**
0°	30 mm
1° to 45°	75 mm
46° to 90°	150 mm

E 5.00 SEWER PIPE

E 5.01 Materials

Storm sewer mains shall be constructed of concrete or PVC, meeting OPSS standards. 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.

Transition from one material to another shall be made at a maintenance structure.

PVC pipe shall be of the solid wall type construction, grade SDR 35 minimum, and may be used for all main line sewer up to 375 mm and for rear lot catchbasin leads. The ribbed style of PVC pipe, grade SDR 35 minimum, may be used with permission of the Town.

Concrete pipe shall conform to the requirements of CSA Specification A-257 for the particular classes as shown below:

(a) Extra strength non-reinforced concrete pipe, CSA Specification A-257-1
(b) Reinforced concrete pipe, CSA Specification A-257-2
(c) Concrete pipe to have a three bearing test completed on the pipe supplied to the site at the rate of 0.5% of the total length per class per size of pipe. There will be a minimum of 2 pipe lengths tested per size.

E 5.02 Pipe Bedding

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 the Ontario Provincial Standards. In general, the Type "2" bedding (crushed stone base with granular over the sewer) shall be used for storm sewers in new developments, and the class of pipe shall be selected to suit this bedding detail. The width of trench at the top of the pipe must be carefully controlled to ensure the maximum trench width is not exceeded unless additional bedding or higher strength pipe is used.

E 6.00 Maintenance Structures

E 6.01 General

Maintenance Structures shall be provided at each change in alignment, grade, pipe size and pipe material.

E 6.02 Maximum Spacing

The maximum spacing between Maintenance Structures shall be as follows:

Pipe Size	**Maximum Maintenance Structure Spacing**
300mm to 750mm	90 metres
825mm to 1200mm	100 metres
1200mm and over	125 metres

E 6.03 Maintenance Structure Types

Maintenance Structures to be constructed of precast concrete to Ontario Provincial Standards. In all cases where the Ontario Provincial Standards are not applicable, the Maintenance Structures shall be individually designed and detailed, as approved by the Director of Public Works.

A reference shall be made on all profile drawings to the type and size of all storm Maintenance Structures. In the case of the standard 1200mm precast Maintenance Structure, the size of the Maintenance Structure may be omitted and reference need only be made to the Ontario Provincial Standards.

Precast Maintenance Structures shall conform to A.S.T.M. Specification C-478M latest revision.

E 6.04 Maintenance Structure Design

(a) All Maintenance Structure chamber openings shall be located on the side of the Maintenance Structure parallel to the flow for straight run Maintenance Structures, or on the upstream side of the Maintenance Structure at all junctions.

(b) The direction of flow in any Maintenance Structure shall not be permitted at acute interior angles.

(c) Maintenance structures shall be provided at each change in alignment, grade, material and junction.

(d) Maintenance structures shall be provided at the beginning and end of prefabricated concrete pipe bends for storm sewers greater than 1050 mm.

(e) Safety gratings shall be provided in all Maintenance Structures when the depth of the Maintenance Structure exceeds 5m. The maximum spacing between safety gratings shall not exceed 4.5m.

(f) The obverts on the upstream side of Maintenance Structures shall not be lower than the obvert of the outlet pipe.

(g) The maximum change in direction of flow in Maintenance Structures for sewer sizes less than 1000 mm diameter shall be 90°.

(h) The maximum change in direction of flow in Maintenance Structures for sewer sizes 1000 mm diameter and over shall be 45°.

(i) Where the difference in elevation between the obvert of the inlet and outlet pipes exceeds 0.9m, an external drop structure, one size smaller than the sewer main line, with the minimum size being 250 mm, shall be placed on the inlet pipe with the invert of the drop pipe located at the spring line of the outlet pipe.

(j) All storm sewer Maintenance Structures shall be benched to the obvert of the outlet pipe on a vertical projection from the spring line of the sewer.

(k) The minimum width of benching in all Maintenance Structures shall be 230mm.

(l) Maintenance Structures in boulevards shall be located, wherever possible, a minimum of 1.5m distant from the face of curb or other service.

(m) Minimum size of any Maintenance Structure stack shall be 685mm x 685mm.

E 6.05 Grades for Maintenance Structure Frame and Covers

All Maintenance Structures located within the travelled portion of roadway shall have the rim elevation set flush with the surface of the future surface course asphalt. The installation of risers as approved by the Town of Cobourg and setting of the frame and cover shall be completed in accordance with the details provided in the Ontario Provincial Standards.

Maintenance Structure/Catchbasin frames shall be flush with base course pavement until final lift is applied.

Lockable maintenance covers, as per current OPSD, shall be used in parks, open space blocks and pumping stations.

E 7.00 CATCHBASINS

E 7.01 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 lot areas, lot grades, pavement

widths, road grades and intersection locations. The recommended maximum catchbasin spacing are as follows:

Pavement Width	Road Grade	Recommended Spacing
8.5m	Up to 4%	95 m
8.5m	Over 4%	69 m
10.0m	Up to 4%	84 m
10.0m	Over 4%	61 m
11.0m	Up to 3.5%	76 m
11.0m	Over 3.5%	53 m
14.0m	Up to 3%	61 m
14.0m	Over 3%	46 m

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, if at all possible.

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 to the catchbasin, from both directions, is less than 95m.

Rear lot catchbasins and connections shall be located as outlined in Section G of the Design Guidelines.

Rear lot catchbasins, where feasible, shall connect directly into a maintenance structure on the street.

Catchbasins in parks or open space blocks shall be located to minimize flow across pathways and provide positive drainage from park facilities.

The maximum area to be serviced by any catchbasin shall be 0.20 hectares of paved area, 0.50 hectares of sodded area and 0.30 hectares of undeveloped lands.

E 7.02 Catchbasin Types

All catchbasin structures shall be in accordance with all Ontario Provincial Standard Specifications and Drawings.

Special catchbasins and inlet structures may be used with permission of the Director of Public Works, but shall be fully designed and detailed by the Owners Consultant.

Catchbasins shall be precast.

Typical details for the single, double and rear lot type catchbasins are shown in the Ontario Provincial Standards.

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

E 7.03 Catchbasin Connections

For single catchbasins, the minimum size of connection shall be 300mm and the minimum grade shall be 1.0%.

For catchbasins located in parks or open space blocks, the minimum size of connection shall be 300mm and the minimum grade shall be 1.0%.

For double catchbasins, the minimum size of connection shall be 300mm and the minimum grade shall be 1.0%.

For rear lot catchbasins, the minimum size of the connection shall be 300 mm and the minimum grade shall be 1.0%.

In general, catchbasins shall have their leads connected to a Maintenance Structure.

The use of inlet control devices is discouraged.

E 7.04 Gratings

The frame and cover for catchbasins shall be as detailed in the Ontario Provincial Standards. In general, the 'bike-proof' catchbasin grate shall be required for all catchbasins located in roadway or walkway areas, the pyramidal type shall be used for parks, and the beehive type shall be used for ditch and rear lot catchbasins. Manufacturer must be approved by the Director of Public Works.

E 7.05 Grades for Castings and Adjustments

In roadways, the grade for the top of concrete shall be established as shown in the Ontario Provincial Standards. The adjustment to the final elevation shall be poured at the time of curb construction as detailed on the Standard Detail Drawings. Skirting shall not be permitted.

E 7.06 Catchbasins at Intersections

All catchbasins at street intersections shall be located on the tangent section of the curb, a minimum of 0.6m distant from the beginning or the end of the radial portion of the curb, and the grading of the intersection shall provide for drainage to the catchbasin location.

E 8.00 INLETS, OUTFALLS AND SPECIAL STRUCTURES

E 8.01 General

Inlet and outlet structures shall be fully designed on the engineering drawings. The details provided shall include the existing topography, proposed grading and the work necessary to protect against erosion and shall be approved by the Director of Public Works.

E 8.02 Inlets

For other than minor swales, where catchbasins with pyramidal or beehive tops are used, inlet structures shall be fully designed.

Inlet grates shall be prefabricated and conform to current OPSD. Wingwalls, rip-rap or concrete shall be provided at all inlets to protect against erosion and to channel the flow to the inlet structure.

E 8.03 Outlets

The Ontario Provincial Standards shall be used for all storm sewers up to 1800mm. For sewers over 1800mm in diameter, the headwalls shall be individually designed. All headwalls shall be equipped with a grating over the outlet end of the pipe and a railing across the top of the headwall for the protection of the public.

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.

Gabions, rip-rap, concrete or other erosion protection shall be provided at all outlets to prevent erosion of the watercourse and 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 the site conditions and the requirements of the Ganaraska Conservation Authority, if applicable.

The weep holes placed in the structures shall be left unobstructed to allow drainage from behind the structure. Weepers are to extend into the sewer bedding.

E 8.04 Open Channels

Open channels shall only be considered at the discretion of the Director of Public Works, in consultation with the Ganaraska Region Conservation Authority. All open channels should be designed to convey a 5 year flow flood event, with free board of 0.15 times the depth.

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

E 8.05 Construction

Construction of all storm sewers and appurtenances shall be in accordance with the specifications and Standard Detail Drawings of the Town of Cobourg at the time of approval of the Design Drawings by the Director of Public Works. All pipes, regardless of size, including rear lot catchbasin leads shall be video documented in a format acceptable to the Town, presented to the Town, for their review and acceptance before any maintenance dates can be set.

SECTION E - STORM DRAIN CONNECTIONS

E 9.00 SINGLE FAMILY AND SEMI-DETACHED LOTS

E 9.01 General

Each lot shall have a separate service.

The weeping tile foundation drains for single family and semi-detached lots shall be connected to the storm sewer.

In accordance with the Town of Cobourg by-law, the roof water leaders shall never be connected to the storm sewer.

E 9.02 Connection Size and Grade

The minimum size for storm drain connections shall be 150mm installed at a minimum grade of 2 %. Storm lateral from the storm sewer main in the road allowance shall be white in colour.

E 9.03 Location and Depth of Connection

Storm sewer service collections shall be installed on the high (uphill) side of the lot, 0.6 m from the sanitary sewer service connection and 2.1 m from the water service connection, and terminating a minimum of 1.5 m inside the property line, and shall be fitted with a manufactured watertight plug. Connections installed to the rear of the buildings require a Town of Cobourg storm sewer agreement and are not maintained on private property by the Town of Cobourg.

The depth of storm sewer service connections, at the property line, measured from the centre line road elevation shall be:

- Minimum shall be 2.0 m
- Maximum shall be 2.5 m

Storm sewer service connections for single, semi-detached, and townhouse dwellings shall not be located in the driveway.

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 as per the relevant and current OPSD.

After construction, the end of the connection shall be marked by a suitable length of 50 mm x 100 mm lumber extending from the invert of the connection to a point 0.9 m, minimum, above grade. The top of this marker shall be painted white and appropriately labelled.

E 9.04 Connection to the Storm Sewer

The connection of the storm drain to the storm sewer shall be made by means of a manufactured tee on the storm sewer line for storm sewer sizes up to and including 900mm. For storm sewers over 900mm, the connection is to be cored before the saddle is placed.

All connections are to be made at 45 degrees above the spring line.

Service connections shall not be connected into a catch basin.

No service connection shall connect directly into a maintenance hole.

E 9.05 Storm Drain Materials

Storm drain connections shall be constructed of concrete (C14-E.S.) or white polyvinyl chloride (SDR) 28) pipe.

E 9.06 As-Built Sketches

As-built sketches are to be produced for all storm sewer work and are to include a sketch of the road plan indicating lot lines and numbers. The storm sewer main is to be drawn on the plan indicating size, class and direction of flow in the pipe along with Maintenance Structure numbers.

All service and catch basin connections are to be shown on the drawings with a measurement along the sewer main between all service connections. The service at property line are to be tied in with distance between services and a measurement to a perpendicular projection from the Maintenance Structure. The inverts of all connections and stubs must be shown to two decimal places.

E 10.00 MULTI-FAMILY, HIGH RISE, INDUSTRIAL, INSTITUTIONAL, COMMERCIAL AND OTHER BLOCKS

E 10.01 General

All blocks of land within the plan of subdivision, intended for use other than for park purposes, shall have a storm drain installed from the storm sewer to the street limit. This service is to be used to provide site drainage until the property in question is built upon and shall be placed close to the low point of the property in anticipation of the future system draining to this point.

E 10.02 Connection Size and Grade

The storm drain connection to all multi-family, high rise and other blocks shall be sized individually according to the intended use of the lands.

The design and sizing of the connection shall be based on rainfall intensity, runoff co-efficient and total block area. The Consulting Engineer shall contact the Ganaraska Region Conservation Authority to confirm the correct data.

The minimum grade for a storm drain connection to any block shall be 0.5 percent.

E 10.03 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 1.4m.

E 10.04 Connection to Main Sewer

The connection of the storm drain to the storm sewer shall be made at a Maintenance Structure 1.5m on private property.

E 10.05 Storm Drain and Materials

Concrete pipe shall be used unless otherwise approved by the Director of Public Works.

E 10.06 Location and Timing of Construction

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 location 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 native earth material, thoroughly compacted, and the road base shall be restored.

E 11.00 BEDDING FOR STORM DRAIN CONNECTIONS

All storm drain connections shall be installed using Type 'B' bedding as shown in the Ontario Provincial Standard Drawings.

E 12.00 CONSTRUCTION

All storm drain connections shall be constructed in accordance with the Ontario Provincial Standard Drawings, current at the time of approval of the engineering drawings by the Town Engineer.

SECTION F - WATERMAINS AND APPURTENANCES

F 1.00 WATERMAIN CAPACITIES

Watermains shall be sized to carry the greater of maximum day plus fire flow or maximum hour demand. Fire flow shall be calculated as outlined in the current edition of "Water Supply for Fire protection, A Guide to Recommended Practice" issued by the Fire Underwriters Survey of the Insurance Bureau of Canada, unless otherwise approved by the Town of Cobourg.

The Minimum required fire flow for single family, detached dwellings is 1,800 L/min (475 US GPM).

The Consulting Engineer to contact LUSI directly to determine further requirements relating to watermain design.

F 1.01 Commercial and Institutional Water Demands

A population equivalent of 86 persons per hectare shall be used to estimate the water consumption for large commercial areas unless more specific data is available.

The following average daily consumption rates for individual commercial and institutional use:

Shopping Centers	2500 – 5000 L/day/1000m
Hospitals	900 – 1800 L/bed/day
Schools	70 - 140 L/student/day
Campgrounds	225 - 570 L/campsite/day

When using the above unit demands, maximum day and peak rate factors shall be developed. For establishments in operation for only a portion of the day, such as schools, shopping plazas, etc., the water usage shall also be factored accordingly. For instance, with schools operating for 8 hours per day the water usage rate will be at an average rate of 70 L/student/day * 24)*or 210 L/student over the 8 hour period of operation.

The water usage will drop to residential usage rates during the remainder of the day. Schools generally do not exhibit large maximum day to average day ratios and a factor of 1.5 will generally cover this variation. For estimation of peak demand rates, a fixture-unit approach shall be used.

The peak water usage rates in campgrounds varies with the type of facilities provided (showers, flush toilets, clothes washers, etc.) and the ratio of these facilities shall be applied to the average expected water usage at full occupancy of the campsite.

F 1.02 Industrial Water Demands

The industrial water demand shall be estimated in terms of water requirements per hectare of industrial development if more specific data are not available. An average day value of 45 m^3/ha/day shall be used with a maximum day figure of 90 m^3/ha/day.

F 2.00 WATER SUPPLY SYSTEM PRESSURES

The distribution system shall be sized to meet normal demands. The maximum sustained operating pressures shall not exceed 700 KPA. Under conditions of simultaneous maximum day and fire flow demands, the pressures shall not drop below 140 Kpa (20 PSI). Under normal operating conditions, the pressure shall not drop below 275 Kpa (40 PSI).

The Ontario Building Code requires, "where the static pressure exceeds 550 Kpa, a pressure reducing valve shall be installed to limit the maximum static pressure to not more than 550 Kpa in areas that may be occupied.

F 3.00 FRICTION FACTORS

The following "C" values shall be used in the Hazen Williams equation (see the following) for the design of water distribution systems unless actual pipe materials and "C" factors are known:

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

The Hazel Williams Equation is:
$Q = 0.84918\ CAR^{0.63}S^{0.54}$
C= Coefficient of Roughness
R= Hydraulic Radius (m)
S= Slope of the Energy Grade Line (m/m)
A= Cross-Sectional Flow Area (m^3)

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 run out conditions.

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

F 4.00 WATERMAINS

F 4.01 Minimum Size of Pipe

Sizes and looping of watermains shall be determined at the preliminary stage of the development. The following are the minimum size requirements:

- ✓ Residential areas shall be a minimum of 200 mm diameter
- ✓ Industrial, commercial and institutional areas shall be a minimum of 300 mmin diameter
- ✓ Pipes of 250mm, 350mm and 450mm diameter are no longer considered standard production sizes and shall not be used for the design of new distribution systems.

F 4.02 Minimum Depth of Pipe

Roads with curb and gutter shall have a minimum cover of 1.80m to the watermain measured from the top of pipe to the finished centre line road grade.

Roads with open ditches, the watermain shall have a minimum cover of 1.80m.

F 4.03 Dead Ends

Wherever possible, the distribution system will be designed to be looped to eliminate dead end sections. Where dead ends cannot be avoided, they shall be provided with a fire hydrant for flushing purposes. All fittings and joints encountered within the restraining length shall be restrained.

F 5.00 SEPARATION / LOCATION FOR WATERMAINS

F 5.01 Standard Road Allowances (20m)

Watermain shall be located 4.25m from the property line.

Watermain where possible, shall be located on the north or east side of the road.

Hydrants shall be located a minimum of 1.0m from the centreline of the hydrant secondary valve and 1.5m from the centreline of the watermain. Hydrants shall be located in the boulevard a minimum of 1.0m from all utilities. No other utilities shall be located between the watermain and the hydrant.

F 5.02 Reduced Road Allowances (less than 20m)

Watermains may be located in the road or boulevard a minimum of 0.5 m from a storm sewer catch basin. The distance shall be measured from the nearest edge.

Watermains located within 1.0 m of a storm sewer catchbasin shall be perimeter insulated with a minimum of 50 mm Styrofoam SM, extending a minimum of 0.60 m from the outer edges of the storm sewer.

Watermains where possible, shall be located on the north or east side of the road.

F 5.03 Parallel Installations

Under normal conditions, watermains shall be laid with at least 2.50m horizontal separation from any sewer or sewer maintenance hole, the distance shall be measured from the nearest edge.

F 5.04 Watermain and Sewer Crossings

Under normal conditions, watermains shall cross above sewers with sufficient vertical separation (minimum 0.3m) to allow for proper bedding and structural support of the watermain and sewer main.

When it is not possible for the watermain to cross above the sewer, the watermain passing under the sewer shall be protected by providing:

- ✓ A vertical separation of at least 0.5m between the invert of the sewer and the crown of the watermain
- ✓ Adequate structural support for the new sewer to prevent excessive deflection of joints and settings
- ✓ That the length of water pipe shall be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.
- ✓ Watermains located within 1.0 m of a storm sewer catchbasin shall be perimeter insulated with a minimum of 50 mm Styrofoam SM, extending a minimum of 0.60 m from the outer edges of the storm sewer.

A minimum clearance of 0.25m shall be maintained between the outside wall of the pipe barrels at the point of crossing for sanitary and storm sewers.

F 5.05 Utility Crossings

Where watermains cross over or under utilities other than sewers, the clearance and type of crossing provided shall conform to the requirements of the particular utility involved and provide proper bedding and structural support of the watermain and utility.

F 5.06 Other

For all other conditions, refer to MOE "Procedures to Govern the Separation of Sewers and Watermains".

F 6.00 VALVES

F 6.01 Mainline Valves

Resilient seat valves conforming to AWWA C509 (latest revision) shall be used on all watermains 300mm in diameter and less in size. Resilient seat gate valves conforming to AWWA C509 (latest revision) may be used on watermains 400mm in diameter, only on the specific approval of the Town of Cobourg. This decision shall be based on the location of the watermain, pipe material and whether the valve is to be installed on a new or existing watermain.

Butterfly valves conforming to AWWA C509 (latest revision) shall be used on all 400 mm and larger mains, with operating nuts opening counter clockwise.

All in-line valves shall be restrained.

F 6.02 Sizes

The size of the valve shall be the same size as the watermain up to and including 600mm diameter. Valves on 750mm diameter and larger watermains may be one size smaller than the water main size.

F 6.03 Number, Location and Spacing

Three valves are required at a tee intersection and four valves are required at a cross intersection. The valves shall be located at the point where the projection of the street line intersects the watermain. Valve boxes and chambers shall be located in boulevards whenever possible.

Line valves shall be located such that approximately 20 houses can be shut-off from another block and isolated from the system. In no case shall the spacing exceed 300m. Valves on feedermains shall be spaced from approximately 700m to 900m.

F 6.04 Air/Vacuum Valves

Air valves shall be placed at all significant high points on feedermains, as approved by the Town of Cobourg.

F 6.05 Drain Valves

Drain valves shall be located at the low points of all watermains 450 mm diameter and greater and shall be constructed in approved chamber.

F 6.06 Valve Boxes

All valves 400 mm diameter and smaller shall be installed in valve boxes and specified direct bury operators shall be used.

All valves larger than 400mm diameter shall be installed in valve chambers. All valves in chambers are to be installed with extension stems. Handwheels shall **NOT** be installed.

The tops of valve boxes and valve chambers maintenance hole covers shall be set flush with finished grade. The top of the roof slab of valve chambers shall be at least 0.60 m below the profile of the finished pavement.

F 6.07 Chambers

All watermain valve, drain valve and air/vacuum valve chambers shall be provided with a drain pipe connection to the storm sewer if feasible. No connections are permitted to the sanitary sewer. Storm sewer connections shall include a backflow preventer in an accessible location. The location of the storm sewer connection shall be shown on the contract drawings. All approved by the Town of Cobourg.

F 7.00 HYDRANTS

F 7.01 Numbers, Spacing and Type

For hydrant specifications refer to the Town of Cobourg Approved Manufactures' Product List.

Hydrants are to be century 2 hose 12B CSA with 112mm pumper nozzle (33B) or equivalent clow brigadier series M all hydrants to be draining with 150mm MJ base.

Hydrants shall be installed on all watermains 150mm diameter and larger with the following maximum allowable spacing:

- ✓ 150 m in residential areas, to provide for a maximum hose length of 75m
- ✓ 75m in industrial, commercial and institutional areas to provide for a maximum hose length of 37.5 m.

F 7.02 Branch Valve and Boxes

All hydrants installed on watermains shall be installed with 150mm diameter branch valve and box, the assembly is to be attached to the watermain with an anchor tee.

F 7.03 Anti-Tampering Devices

Anti-tampering devices shall be installed on hydrants designated by the Town of Cobourg. The device shall be installed by the Town of Cobourg and shall remain in place until the final acceptance certificate is issued or until building construction is complete.

A fee shall be charged to the developer to cover the cost of supply, installation and removal of the device.

F 8.00 WATER SYSTEM TESTING

All new watermains shall be cleaned by foam swabbing (up to and including 300mm) to remove all debris in the pipeline, hydrostatically tested, disinfected and flushed. Refer to the Town of Cobourg Standard Specifications for Construction of Sanitary Sewers, Watermain and Storm Sewers.

F 9.00 WATER SERVICE CONNECTIONS

F 9.01 General

The Consulting Engineer to contact LUSI directly to determine further requirement relating to water service design.

All water service connections for single and semi-detached and townhouse dwellings shall be individual service connections and shall be located at the mid-point of the frontage of a lot.

Water service connections for single, semi-detached, and townhouse dwellings shall not be located in the driveway.

The Ontario Building Code requires “where the static pressure exceeds 550 Kpa, a pressure reducing valve shall be installed to limit maximum static pressure to not more than 550 Kpa in areas that may be occupied”.

Connections to PVC watermains shall be by pressure tap connection using a stainless steel service saddle. Piping shall be connected at 45° above horizontal including a vertical gooseneck.

Connections to cast and ductile iron by direct tap or other methods as approved by LUSI;

Connections to transite by Smith Blair #313 or;

Minimum separation of 1 meter between connections.

No service connection shall be made to watermains greater than 400mm diameter.

Domestic water service connections for non-residential buildings may be connected to the existing fire line subject to the following Guidelines:

- ✓ If the fire line is 150mm diameter, the maximum size of the domestic connection shall not exceed 25mm diameter,
- ✓ Domestic service connections larger than 50mm diameter shall be connected directly to the water supply system.

F 9.02 Minimum Sizes of Pipe

The minimum size for service connections shall be 19mm diameter except when the length of the connection from the main to the building setback exceeds 30m the minimum size shall then be 25mm diameter.

Service connections for multiple family dwellings shall be sized to provide capacity equivalent to a 19mm diameter connection to each dwelling unit.

Service connections for blocks, commercial and institutional areas shall be sized according to the intended use.

Fire lines for industrial, commercial and institutional properties shall be sized and installed in accordance with the guidelines recommended by the Fire Insurance Advisory Organization.

Commercial, industrial, institutional and multi residential water service connections (domestic and/or fireline) shall be installed as approved by the Town of Cobourg standard drawings.

Commercial, industrial, institutional and multi residential water service connections (domestic and/or fireline) shall not become operational until documentation, including acceptable laboratory test results from an accredited laboratory is provided to the Town of Cobourg, verifying that all water system pipe on private property has been flushed, pressure tested, chlorinated, and tested for water quality according to the Town of Cobourg, Ontario Building Code and Ministry of the Environment requirements.

F 9.03 Location

Water service connections shall be installed 1.5 m right of the sanitary sewer service connection, terminating with curb stop and box at the property line.

After construction, the end of the connection shall be marked by a suitable length of 50 mm x 100 mm lumber extending from the invert connection to a point 0.9 m minimum above grade. The top of this marker shall be painted blue and appropriately labeled.

Water service connections shall **NOT** be located under a driveway. The location of water service connections for semi-detached lots shall suit the house style in accordance with the Town of Cobourg standard drawings.

F 9.04 Minimum Depth of Pipe

Roads with curb and gutter shall have water service connections installed 1.8m minimum below finished centerline road grade.

Open ditch roads and unimproved roads water service connections shall have a minimum cover of 1.8 m.

F 9.05 Mainstops

All domestic water service connection shall have mainstops installed at the watermain equal to the water service connection diameter.

F 9.06 Valves, Curb Stops and Boxes

All service connections less than 100mm diameter shall have curb stops and boxes installed at property line.

Valves for service connections 100mm diameter and greater shall be restrained and located at the property line complete with valve box, unless approved otherwise.

Temporary blow-offs for water service connections 100mm to 300mm in size shall be a 19mm copper pipe connection, complete with curb stop and copper pipe extension downstream of the valve.

F 9.07 Materials

For watermain service connection materials refer to the Town of Cobourg Approved Manufacturers' Product List.

Water service connections 50 mm diameter or less shall be type "K" copper. Water service connections larger than 50 mm diameter and less than 300 mm shall be PVC, 300 mm and larger shall be ductile iron.

F 9.08 Construction

Construction of all connections in the Town of Cobourg shall be in accordance with the current and appropriate design specifications and standard drawings.

F 10.00 MATERIALS

Watermains 150 mm to 200 mm diameter shall be constructed of polyvinyl chloride pipe (PVC). Unless otherwise specified by LUSI, watermains 400 mm diameter and larger shall be reinforced concrete pressure pipe.

Watermains greater than 200 mm but less than 400 mm diameter shall be ductile iron.

Ductile Iron Pipe (DI) may be allowed for feeder mains only on a site-specific basis as determined by the Town of Cobourg.

F 11.00 CATHODIC PROTECTION

F 11.01 Tracer Wire

A tracer wire shall be provided along the top of all PVC and CPP watermains to permit future field tracing. These tracer wires shall be attached to the top of the watermain as shown on the standard drawings and shall be looped inside each valve box (#8 AWG tracer wire required).

When tapping a copper service to a PVC watermain, the tracer wire shall be jumpered to the copper service to ensure continuity.

Tracer wires are not required on ductile iron watermains.

F 11.02 Copper Service Connections

One 5.4kg zinc anode shall be installed on all new copper service connections and all existing copper service connections that are exposed during any type of road reconstruction work.

F 11.03 Valves, Hydrants and Fittings on Non-Ferrous Watermains

One 5.4kg zinc anode shall be installed on every valve, hydrant and fitting connected to a non-ferrous watermain.

F 11.04 Valves, Hydrants and Fittings on Existing Ferrous Watermains

All valves and fittings installed on existing ferrous watermains shall be cathodically protected by a 14.5kg magnesium anode. Bonding cables shall be No.6, seven strand coated copper wire connection to the fittings and watermain by a thermite weld (Cadweld).

F 11.05 Connecting Non-Ferrous Watermains to Ferrous Watermains

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

F 11.06 Thermite Weld Coating

All thermite weld connections shall be coated with an approved coating material.

F 12.00 RESTRAINED JOINTS

Joint restrainers or concrete thrust blocks shall be used on all fittings. Joints to be restrained in all opposing direction of thrust forces. All joints encountered within the specified restraining length as indicated on the appropriate standard drawings, must be restrained. Poor soil conditions or watermain in earth fill conditions shall be restrained as directed by the Town of Cobourg. Any fittings, which are to be cut into an existing PVC watermain pipe, shall be specifically designed by the engineer to ensure that all existing and proposed pipe joints are adequately restrained.

F 13.00 CONCRETE ENCASEMENT

If concrete encasement of PVC pipe is necessary then a detailed design shall be submitted for approval.

F 14.00 WATER METERS

Commercial, industrial and institutional meters shall be installed in a meter utility room or in a location within the building in close proximity to the electrical meter. Where it is not feasible to locate the water meter in a utility room or building, other means of housing the water meter will be considered on a site specific basis. The location, size and type of water meter to be installed shall be determined by the Town of Cobourg. All water meters are to be purchased from the Town of Cobourg.

All proposed commercial, industrial, institutional and multi residential developments shall provide water flow demand rates.

For residential type metering water meters will be required for each unit and are to be purchased by the Town of Cobourg for installation by the developer.

LUSI may agree to the implementation of bulk metering of multi-residential or commercial units, provided that the design of the units employs plumbing fixtures and water conservation methods.

The meters are to be located in a readily accessible place with a minimum 3 ft. (0.91 m) of clear space in front of the meters to provide access for meter servicing and replacement. The meter is to be installed in a horizontal plane with isolation valves upstream and downstream of the meter. Outside heads, supplied with the meters, will be installed by the developer in close proximity to the electrical meter. Wiring for the outside heads is to be installed by the developer from the meter to the outside head location.

Meters 1.5 inches (38 mm) and larger must be furnished with a by-pass line of the same size, with isolation valves left in the closed position.

F 15.00 CROSS CONNECTION & BACKFLOW PREVENTION

F 15.01 General

A backflow prevention device shall be installed on a service pipe, pipe, fixture, appliance and/or fire line which may allow any source of pollution or contamination entering the Town of Cobourg's potable water system.

A backflow prevention device shall be installed on a service pipe, piping, fixture, appliance and/or a fire line by the Consumer where required by the Town of Cobourg.

Backflow prevention devices shall be selected, supplied, installed and tested at the owner's expense, in accordance with the Ontario Building Code, CSA B64 and NFPA 13/14 standards and specifications.

Backflow prevention devices shall be installed in a location that is readily accessible; capable of being reached for operation, renewal, servicing or inspection, without requiring the climbing over or removal of an obstacle or the use of a portable ladder.

Backflow prevention devices shall be located in a building, unless, the Town of Cobourg directs in writing that another location be used.

All facilities installed to house the backflow shall be constructed and maintained by the owner to allow free access by the Town of Cobourg and/or the Plumbing Inspector of an area municipality.

All proposed commercial, industrial, institutional and multi residential developments shall provide to the Town of Cobourg for approval, a plan showing backflow preventer size, type and location. The Town of Cobourg shall determine final means of fire line isolation.

A cross connection survey of an exisitng building shall be completed by approved personnel at the owner's expense if requested by the Town of Cobourg.

F 15.02 Fire Protection Systems

Where a Town of Cobourg water supply system services a fire protection system, the fire protection system shall be isolated by means of:

- ✓ A double check valve assembly where no water treatment chemicals or anti-freeze are added to the fire protection system.
- ✓ A reduced pressure backflow preventer where water treatment chemicals or anti-freeze solutions are added to the fire protection system.

Existing fire protection systems that do contain chemicals or anti-freeze solutions shall be protected with a reduced pressure principal backflow preventer.

Special note is to be given to the following requirements in NFPA 13/14:

All valves shall be listed indicating type and be supervised in the open position by the following methods:

- ✓ Valves on retrofitted existing fire lines shall be locked open,
- ✓ New construction, where a fire alarm system is required to have an annunciator, each valve controlling water supplies shall be equipped with an individual annunciation in the event of the movement of the valve handle,
- ✓ All proposed and existing fire line protection systems requiring the installation of a backflow device shall be hydraulically calculated by a qualified person to ensure that it will meet NFPA 13/14 requirements. A professional engineer shall verify that all calculations are correct. A letter verifying these calculations shall be sent to the Town of Cobourg and fire service.
- ✓ The fire service and fire alarm companies shall be notified prior to a fire protection system being shut down to facilitate testing. They shall also be notified on the system being restored.

F 15.03 Cross Connection Surveyors

Shall have a good working knowledge of a potable water system and have extensive experience (minimum 2 years) in cross connection surveys.

Shall have a trade or professional qualifications (e.g. plumbing certificate, professional engineer, technologist or equivalent status) or working under the authority of that person.

Shall have attended and passed an approved cross connection surveyors course.

Shall meet all requirements of the Town of Cobourg, including licensing and insurance requirements. That person or company shall show proof to the Town of Cobourg that they have the appropriate liability insurance.

A person may qualify as a cross connection surveyor prior to taking an approved course, but within 6 months show proof to the Town of Cobourg that he/she has taken and passed an approved cross connection surveyors course. That person must meet all other requirements prior to being placed on the approved cross connection surveyors' list. If proof is not shown within the 6 month period, that person will be removed from the approved list.

F 15.04 Installing and/or Repairing

Installer/Repair person shall have a plumbing certificate or professional qualifications or be under authority of that person.

Installer/Repair person shall meet all the requirements of the CSA B64 Standard.

Installer/Repair person shall meet all requirements of the Town of Cobourg, including licensing and insurance requirements.

F 15.05 Testers

Shall have attended and passed a course of study in backflow prevention device testing.

Shall meet all the requirements of the CSA B64 Standard.

Shall meet all the requirements of the Town of Cobourg, including licensing and insurance requirements.

Backflow prevention devices shall be tested upon installation and thereafter annually, or more often if required by the Town of Cobourg or the Plumbing Inspector of an area municipality.

The consumer shall submit a report on a form approved by the Town of Cobourg on any or all tests performed on a backflow device within 14 days after installation and within 30 days for annual tests on notification by the Town of Cobourg. A record card approved by the Town of Cobourg shall be displayed on or adjacent to the backflow preventer.

When results of a test show that a backflow device is not in good working condition, the consumer shall make repairs or replace the device within 7 working days of the test.

Backflow test guages shall be calibrated annually. Test guages shall only be used for testing backflow devices if they have been calibrated when purchased or on an annual basis. Calibrating results shall be sent to the Town of Cobourg within 30 days from the date of calibration.

SECTION G - LOT GRADING

G 1.00 GENERAL

The grading of all lots and blocks in a new development 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 Guidelines shall be used in the preparation of all lot grading plans for new developments in the Town of Cobourg.

In applying the Guidelines, while maximum limits are specified, the main objective is to ensure that the property owner (i.e. resident) will have maximum use of his/her property while still providing good drainage. Consequently, initial grading design shall avoid maximum grades unless there are no alternatives.

G 2.00 LOT GRADING PLAN

(a) Drawing size shall be A1 (594mm x 840mm).

(b) The scale for drawings shall be 1:500 for single family or semi-detached areas and 1:200 for multi-family areas.

(c) All lots and blocks within the subdivision shall be shown and shall be numbered in accordance with the plan proposed for registration.

(d) Existing contours are to be shown at maximum 0.5m intervals within the subdivision limits, and 30m beyond the subdivision limits.

(e) Proposed centreline road elevations shall be shown at 25m stations along all roads within and abutting the subdivision, and at all points of change in grade.

(f) Proposed and existing elevations shall be shown for all lot corners and proposed elevations shown at intermediate points of grade change. On larger blocks, a proposed elevation shall be shown at 15m intervals along the frontage of the block and at reasonable intervals along the sides and rear of the block to clearly illustrate the grading of the block in relation to the surrounding lands and house type.

(g) The specified lot grade shall be shown at a location 6.0m minimum from the street line. For 'split' type drainage patterns, the specified rear house grade shall also be shown. The specified minimum basement floor elevation for each lot and the grades around the building shall also be shown.

(h) 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.

(i) All swales, other than the normal side yard swales, shall be shown along

with the invert elevation of the swale at regular intervals (i.e. centreline of each lot for rear yard swales).

(j) All rear yard catchbasins shall be shown along with the rim elevation of the catchbasin grate and the invert elevation of the outlet pipe.

(k) All above ground infrastructure, including but not limited to curbs, sidewalks, catchbasins, valves, hydrants, fencing, entry gates, plantings and easements shall be shown on the lot grading plans. Easements must also be shown on the lot grading plans**.**

(l) Driveways must have a minimum 1.0m clearance to all utilities. Proposed driveway alignments are to be shown on a Utility Coordination Plan where possible to provide optimum streetscapes, utility coordination, street tree planting opportunities and on street parking spaces.

(m) All 3:1 slopes required (terracing) shall be shown with the intermediate grades specified.

(n) Existing elevations shall be shown on adjacent lands approximately 30m 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.

(o) The Lot Grading Plan shall make note of the Ontario Provincial Standard Drawings applicable to the grading of the development. The Town reserves the right to refuse any house design which is incompatible with the lot grading design specified for a lot.

(p) The grading along the limit of the subdivision shall be carefully controlled to avoid disturbance to the adjoining areas. A 0.6m strip shall be left undisturbed along the boundary of the subdivision, next to adjacent properties. Such strip must be indicated on the approved Lot Grading Plan.

(q) Temporary fencing shall be installed along the inside of the 0.6m undisturbed barrier strip and maintained for the duration of the contract until such time as sodding takes place. This fencing shall be noted on the grading plan.

(r) Indicate all semi-detached lots with "SD" on all drawings and townhouses with a “TH”.

(s) The lot grading plans shall show proposed locations for building envelopes, envelopes for private sewage disposal systems and private water supply systems for rural estate developments.

(t) All culverts shall be designed and shown on the lot grading plans identifying culvert diameter, gauge, minimum length and type.

(u) Typical sections for all proposed drainage courses.

(v) Identify by means of an asterisk, all lots or blocks on which a foundation control certificate will be required, to verify critical engineering elevations for flood protection, or other structural requirements.

(w) Any watercourse running through, or abutting the subject property, the regulatory flood line and elevations shall be shown on the drawing.

(x) The extent, top elevation, flow depth and static ponding depth of the 100 year major flow inundation shall be shown on the drawing.

G 3.00 LOT GRADING DESIGN

(a) Lot drainage shall be self-contained within the subdivision limits. All commercial, industrial, institutional, park and high density site drainage shall be self-contained. Drainage over lands abutting the subdivision will only be permitted in exceptional cases at the discretion of the Director of Public Works and with the written permission of the abutting land owners.

(b) The lot grading design shall provide for the temporary drainage of all blocks of land within the subdivision that are intended for further development under Site Plan Agreements.

(c) The maximum lot surface grade for rear yards, shall be 6%. A slope of 3:1 shall be used to take up any additional grade difference. Otherwise, the use of an approved retaining wall is required. In any case, the total grade differential of rear lots is not to exceed 15%, including retaining walls and 3:1 slopes. However, the rear yards are to have a minimum usable (continuous slope not exceeding 6%) depth of 6m from the rear of the house, irrespective of the 15%.

(d) All slopes are to be constructed on the lower property.

(e) The specified lot grade shall be calculated in accordance with the Lot Grading Detail Sections.

(f) All lot surfaces shall be constructed to a minimum grade of 2% (including swales).

(g) The front yards of all residential lots shall be graded to drain toward the street.

(h) The grade of any front walkway shall not exceed 8%.

(i) Driveways shall not be used as outlets for any swales.

(j) The maximum flow allowable to any side yard swale shall be from 4 rear yards or 0.1 hectare, whichever is less.

(k) The maximum area contributing to a rear yard swale that may be discharged directly onto a road allowance shall be that of 4 rear yards or 0.1 hectare, whichever is less. At the Director of Public Work's discretion rear yard catchbasins may be required where sidewalk icing may occur.

(l) The maximum length of a rear yard swale between outlets shall be 90m with a maximum of 8 rear yards contributing, whichever is the lesser.All swales shall have a minimum longitudinal slope of 2.0%.

(m) Maximum depth for rear yard swale shall be 500mm.

(n) Maximum depth for a side yard swale shall be 500mm.

(o) Maximum side slope on any swale shall be 3:1.

(p) The maximum change of direction of any swale shall be 45°.

(q) All drainage swales shall be located on one side of the common lot line between adjacent lots and not along the property line. The maximum distance from the centreline of a swale at any point, to the nearest property line shall not exceed 1.5m.

(r) A 0.6m wide path sloping 2% away from the house shall be constructed along one side of the building to allow proper access to rear yards.

(s) Lots under 12.2m in width require the use of rear lot catchbasins.

(t) Lot frontages less than 12.2m cannot use back to front drainage unless approved by the Director of Public Works.

(u) Rear yard catchbasins and outlet pipes shall be located such that the catchbasin is located entirely on one lot and the outlet pipe is located on the same lot at 0.35m offset from property line. The centre of the catchbasin should be located 1.0m from property lines. Rear yard catchbasin easements must be a minimum of 3.0 metres wide with 1.5m on either side of the lot line. Any variation must be approved by the Director of Public Works.

(v) Driveway grades shall not exceed 8%. This maximum grade is not recommended and should be employed only in exceptional cases. Driveways shall not slope downward from the street line to the house and shall have a minimum grade of 2% positive drainage away from the building. In preparing grading plans for house sitings, the engineer or architect shall establish maximum driveway grades which, allowing a 100mm construction tolerance for foundation control, will ensure the Town's maximum and minimum grades will be met.

(w) All existing drainage runoff entering the development from adjacent lands shall be accommodated by the grading and drainage design.

G 3.01 Retaining Walls

The use of retaining walls is discouraged. Where possible grading solutions will be utilized to avoid the use of retaining walls. Where retaining walls are absolutely necessary, they shall meet the following minimum Guidelines:

(a) Timber retaining walls shall be permitted only for internal grading of blocks or lots, and between adjacent residential properties.
(b) All other retaining walls shall be individually designed as structural walls and shall be approved by a licensed engineer. The design shall also be subject to the approval of the Town of Cobourg.
(c) All retaining walls shall be completely constructed on the higher property, adjacent to the property line unless otherwise approved by the Town of Cobourg.
(d) A minimum setback of 0.5m high shall be maintained from the tiebacks to the foundation of any structure.
(e) The location and construction details of all retaining walls must be noted on the engineering drawings and approved by the Town.

(f) All retaining walls 0.60m or higher require 1.5m high security barrier or chain link fencing as per Ontario Provincial Standard Drawings. This fencing shall extend to the nearest property line or as directed by the Director of Public Works.

(g) All retaining walls which require a fence/security barrier and/or by virtue of their location will be adjacent to a future fence line shall be designed and constructed such that the fence/barrier and/or future fence will not degrade the structural stability of the retaining wall.
The Developer's Engineer shall be responsible for the design, location and inspection of all walls during their construction, and shall provide the Town with written certification of each retaining walls conformance to the design and location as approved by the Town.

G 4.00 APPROVAL AND CERTIFICATION

(a) Prior to application for a building permit, individual site plans for each lot or group of lots shall be prepared based on approved grading plans and shall be submitted to the Consulting Engineer for approval. These site plans shall include all of the following:

- ✓ lot and plan identification including dimensioned property limits,
- ✓ house location including setbacks to all property lines,
- ✓ finished floor, basement top of foundation wall, and underside of footing elevations and driveway sill grades,
- ✓ lot grades at all corners and at intermediate locations as required to define grading of the lot,
- ✓ location and elevation of all drainage swales,
- ✓ all exterior entrances, decks and risers including the proposed grades at same,
- ✓ all yard catchbasins with rim elevations,
- ✓ driveway location and percent grade,
- ✓ rear yard percent grade,
- ✓ all 3 to 1 slopes,
- ✓ existing and/or proposed major plantings (i.e. trees to be retained) and lot grades at same,
- ✓ retaining walls, fencing and all above ground utilities,
- ✓ easements.

The lot site plans shall also show for Rural Estate Developments the proposed location of any private sewage disposal system, any private water supply system, and driveway entrance culverts including size, length, location and driveway grades.

The Consulting Engineer shall be responsible for reviewing the site plan for each lot and certifying that the plan conforms to the approved grading plans and Town of Cobourg Grading Standards and Guidelines. After approval and certification by the Consulting Engineer, the site plans shall be forwarded to the Building and Planning Department of the Town of Cobourg.

Before permits are issued, the Developer's Engineer will certify rear lot catchbasins are installed according to plan.

(b) Before house construction proceeds beyond the basement level, the Consulting Engineer or an Ontario Land Surveyor shall provide the Town with a certificate confirming that foundations are:

- ✓ in conformity with the footing and top of foundation wall elevations shown on the approved grading plan,
- ✓ sited entirely on the correct lot and conforms to the applicable Zoning By-law. Siting surveys are to be attached to the certificate. (Field notes in lieu of a siting survey will be accepted at this time to allow construction to proceed).

Certification of foundation elevations by the Consulting Engineer or Ontario Land Surveyor shall be taken to mean conformity with the approved grading plan with a tolerance of 100mm and will include verification of top of foundation wall, any steps in the foundation (if applicable) and the garage sill.

Non-conformance to either siting or foundation elevations shall be brought to the Town's attention for further direction prior to proceeding with any further construction.

(c) Prior to the laying of sod, the Consulting Engineer shall confirm that the grading is correct. At the time of inspection, all foundations shall be marked to illustrate final grade, and intermediate grade stakes shall be provided.
Subject to any changes required by the Town as a result of this inspection, the Consulting Engineer shall then provide the Town with preliminary lot certificates advising that the lot grading conforms to the approved grading plan and is approved for sodding.

(d) Prior to issuing the final lot grading certification, the Consulting Engineer shall provide the Town of Cobourg Engineering Department with one set of the site plan(s) showing as-built elevations marked in red.

(e) Prior to the releasing of any lot from the conditions of the Subdivision Agreement, the Consulting Engineer shall provide the Town of Cobourg Engineering Department final certification and as-built elevations on the grading plan(s).

G 5.00 AREA ROUGH GRADING PLAN

G 5.01 General

Where earth cuts and fills in excess of 0.5m are required, area rough grading must be performed in conjunction with the road construction and prior to the placement of the base course asphalt.

The area rough grading plan must identify all areas where the depth of fill sections and cut sections are in excess of 0.5m.

G 5.02 Construction Requirements

Prior to the commencement of rough grading, the Developer must enforce an erosion control program to the satisfaction of the Director of Public Works, and any other applicable agencies.

All sediment and erosion control as outlined on the Sediment and Erosion Control Plan are to be in place and functioning before any clearing, grubbing or earthwork operations begin.

Before placing imported fill material on registered lots where private sewage disposal systems are required, the Consulting Engineer must certify in writing to the local health unit and the Director of Public Works the following:

"That the imported fill material placed on Registered lots meets or exceeds the original ground's capability to support a private sewage disposal system as required by the Town of Cobourg Building Department."

SECTION H – SIGNS

H 1.00 PLAN

All street name and traffic control signs are to be shown on the General Plan of Services, Plan Profile Drawings and the Utility Coordination Plan(s). For projects developed under Site Plan Control, all signs and/or devices are to be shown on the Site plan(s).

H 2.00 STREET NAME SIGNS

All street name signs shall be purchased and installed by the Town of Cobourg at the developer's expense.

H 2.01 Location

Street name signs shall be placed at each intersection and shall identify each street at the intersection.

H 2.02 Type

The street name signs shall be two-way, and shall be reflectorized with high intensity scotchlite for STOP signs and medium reflectivity for all other signs. All lettering shall be white ***[black]***, upper case, on blue ***[white]*** reflectorized background.

Abbreviations for Ave. (Avenue), Blvd. (Boulevard), Cr. (Crescent), Ct. (Court), Dr. (Drive), Pl. (Place), Rd. (Road), St. (Street), to be 2-1/2" (65mm) in height and lettering for the street name and the North, South, East or West designation be 4" (100mm) in height.

Correct spacing must be adhered to in order that the message will be aesthetically correct.

Signs shall be made of utility grade 5052 half hard aluminum, alodine treated. Acid edging only is not acceptable.

Metal Gauge
- ✓ For signs under 24" to be 0.064
- ✓ For signs over 24" to be 0.81

Regulatory signs shall be reflectorized, and of shape and colour as recommended by the Canadian Government Specification Board and approved by the Manual of Uniform Traffic Control Devices of Canada.

Warning signs shall be of black lettering on yellow reflectorized background of standardized shape, as approved by the Canadian Government Specification Board.

H 2.03 Temporary Street Name Signs

To promote guidance of emergency vehicles within newly developed areas, while limiting potential losses due to ongoing construction activities, the Developer may choose to install temporary street name signage in lieu of the formal signs.

Temporary street name signs, consisting of a painted and legible sign on wood backing, fastened securely on a post 2.1m above ground level, shall be erected on all street intersections in the subdivision as soon as base course asphalt road construction is complete, and should be visible from both directions (i.e. double signed). The street name signs shall be maintained until such time as all grading of roads and boulevards has been completed to the satisfaction of the Director of Public Works. House numbers will be allotted by the Chief Building Official for the Town of Cobourg.

H 3.00 TRAFFIC CONTROL SIGNS

All traffic control signs shall be purchased and installed by the Town of Cobourg, after the placement of the wear course as approved by the Director of Public Works at the developer's expense.

H 3.01 Location

The location must be in conformance with the Roads and Transportation Association Manual for Uniform Traffic Control Devices in Canada, the Manual of Uniform Traffic Control Devices for Ontario, or the Highway Traffic Act Regulations for Ontario.

All signs shall be mounted approximately at right angles to the direction of and facing the traffic that they are intended to serve except parking control signs which shall be installed at 45°. On curved alignments, the angle of placement shall 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 shall not be placed closer together than 30m if it can be avoided.

H 3.02 Type

All traffic control signs shall conform to the current revised standards of the Ministry of Transportation of Ontario, Roads and Transportation Association Manual for Uniform Traffic Control Devices for Ontario.

Unless otherwise directed by municipal staff, all Traffic control signs must be erected upon completion of the placement of base course asphalt and must be maintained in a legible condition until the subdivision is formally accepted by the Town of Cobourg.

All traffic control signs shall be mounted on a 75mm diameter galvanized steel post, 10 gauge minimum, 3.65m in length.

Signs shall be made of a minimum H34 aluminum with the following thickness:

Metal Gauge
- ✓ For signs under 600 mm – 64 mm
- ✓ For signs over 600 mm – 81 mm

All signs shall have a minimum reflectivity conforming to the latest requirements of the American Society for Testing and Materials (ASTM) Specification D4956-90 for Type III materials.

H 3.03 Combined Street Name Sign and County Road Route Marker

For combined street name signs and the Northumberland County Road route marker, the County's specifications for blades, metal treatment, reflective material and requirements shall apply.

SECTION I – STREET TREE PLANTING

I 1.00 GENERAL REQUIREMENTS

This section has not been approved and shall be used as a general guideline only. The Consulting Engineer shall contact the Town of Cobourg Planning Department regarding tree-planting requirements and adhere to the Tree Preservation By-law.

SECTION J – PARKLANDS

J 1.00 PLAN

The Developer shall be responsible for preparing a detailed Grading Plan for all lands to be dedicated for park purposes in accordance with the Town's Department of Parks & Recreation Parks Section Design Guidelines Manual. This plan must be submitted to, and approved by, the Department of Parks & Recreation through the Director of Public Works prior to finalization of the Subdivision Agreement. 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.

The plan shall also show the layout of active sportsfield facilities required by the Town. The dimensions of the sportsfields shall conform to the following standards:

- Soccer Field 72m (240 feet) x 108m (360 feet)
- Baseball 105m (350 feet) x 105m (350 feet)
- Softball 75m (250 feet) x 75m (250 feet)

J 2.00 GRADING

The park shall be 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 100mm of approved, compacted, topsoil and shall be sodded and fertilized in accordance with the specifications of the Ontario Landscape Contractors Standard. All stones and debris shall be removed and disposed of prior to the sodding of any park.

J 3.00 TIMING OF CONSTRUCTION

All park blocks and boulevards shall be graded and sodded in conjunction with lot grading and sodding for residential homes.

Please note that Parklands or other similarly designated areas are not to be used to bury stumps, boulders or other construction material.

J 4.00 MAINTENANCE

The Town of Cobourg shall be responsible for the grass mowing on all park areas sodded, immediately upon the completion of the laying of sod in any given park location, provided, however, that the cutting of such grass by the Town in no way relieves the Developer from the obligation to maintain the sod for a maximum period of 90 days from the date of sodding of such areas. At the expiration of the 90 day period the developer shall contact the Town's Landscape Architect for an inspection prior to the Town undertaking the maintenance. Any deficiencies will have to be corrected prior to the Town commencing maintenance.

SECTION K – STREET LIGHTING

K 1.00 GENERAL

Street lighting systems for roadways in the Town of Cobourg shall meet the requirements of the Lakefront Utility Service Inc., in addition to those listed here. The location of street lighting poles and transformers shall be shown on the Street Furniture Plan.

K 1.01 Illuminance Levels

Average maintained luminance shall not be less than the values shown in the following table. The ratio of the average to the minimum maintained luminance shall not exceed 3 to 1, except on local residential streets where the ratio shall not exceed 4 to 1. The ratio of the maximum to minimum maintained illuminance shall not exceed 6 to 1, except on local residential streets where the ratio shall not exceed 8 to 1.

ROADWAY	AVERAGE MAINTAINED ILLUMINANCE
Local	0.6 fc (6.5 lux)
Collector	1.0 fc (11 lux)
Arterial	1.4 fc (15 lux)

Where possible, pole locations shall be placed opposite side lot lines. No street light pole shall be placed within 3.0m of a transformer. Staggered arrangement of street light poles is not accepted collector roads.

K 1.02 Poles

Street light poles shall be:

Bolt on heritage – STD MLE-415 15' tall
Direct buried heritage – POWCO 22', round black poles
Spun aluminum – should be in the Elgin-Burnham spec.

K 1.03 Brackets

Bracket shall be 1.8m (six feet) long with .9m (3 foot) rise tapered elliptical aluminum (or steel), single member type complete with pole plate USS - TERGMA, or equivalent.

K 1.04 Luminaires

Luminaires for local and collector roadways shall be:

Heritage – 100 watt – STD#MS3690-2-A-F3-100S-RCPP-DLR-HSS
– 200 watt – STD#MS3690-2-A-F3-200S-RCPP-DLR-HSS

Cooper Cobra Head – 70 watt – HSO70A2V120R
– 100 watt – OVZ15512RHTLA
– 250 watt – OVZ25SCF3E463

K 1.05 Cable

Cable assemblies from the transformer vault to pole hand holes shall consist of 2 single conductor #6 AWG copper and one single conductor #8 AWG bare copper manufactured to IPCEA S-66-524 latest edition. For residential collector and local roadways, cable shall be #12 AWG copper NMW-10.

K 1.06 Duct

For residential collector and local roadways, cable shall be in duct buried .75m below finished grade in the Joint Use Trench, except road crossings shall be encased as described above.

K 1.07 Grounding

A ground rod shall be installed adjacent to the last pole in each run (at least one for each 9 luminaries).

K 1.08 Pole Numbering

Poles are not to be numbered.

K 1.09 Fusing

Each street light shall be protected by a suitable sized in-line fuse type K7K (ATM) in a waterproof fuse holder in the street light base.

Street lights at signalized intersections shall not be metered.

SECTION L - MULTIPLE FAMILY DWELLING, COMMERCIAL INDUSTRIAL OR INSTITUTIONAL LANDS

L 1.00 SITE PLAN AGREEMENT

The Developer of all multiple family, commercial or institutional lands shall be required to enter into a 'Site Plan Agreement' with the Town of Cobourg prior to the commencement of construction of any building or service within the parcel of land.

L 2.00 TOWN OF COBOURG RESPONSIBILITY

The Town of Cobourg is responsible for all sanitary sewers, storm sewers and watermains that are constructed or proposed for construction on all road allowances and registered easements within the Town of Cobourg.

Drawings showing the location, size, grade invert elevations, material and bedding requirements for all sanitary sewers, storm sewer and watermain service connections shall be prepared and submitted to the Town of Cobourg for approval. Engineering drawings shall also be prepared for all sanitary sewers, storm sewers and watermains that are required to be constructed within road allowances or registered easements to service the subject property. These drawings shall be prepared to meet the Town of Cobourg's requirements.

The Public Utilities Commission is responsible for the collection of revenue for water consumption, and therefore, the 'metering' arrangement for the subject property shall also be approved by the Public Utilities Commission.

L 3.00 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 Engineer shall act as the Developers representative in all matters pertaining to the design and construction of the services in the development.

L 4.00 ENGINEERING DRAWINGS

L 4.01 Requirements

All drawings shall be referenced to Vertical Control Datum, based on 1978 adjustment, and Horizontal Transverse Mercator, (UTM) Zone 17, NAD 83 coordinates. The reference Geodetic Bench Mark, Site Bench Marks, reference Horizontal Control coordinates and site Horizontal Control coordinates to be used for construction, shall be identified on all drawings.

Refer to Appendix B for the checklist for Multiple Family Dwelling, Commercial, Industrial or Institutional Lands.

A minimum of 10 sets of engineering drawings shall be required for each development. The drawings included in each set shall be titled as follows:

(a) Site Plan
(b) Site Grading Plan
(c) Site Servicing Plan
(d) Landscaping Plan
(e) Parking Layout for Underground Garage (if applicable)
(f) Sedimentation and Erosion Control Plan as per Section N
(g) Electrical Distribution Plan

Additional engineering drawings shall be prepared where required, or when requested, by the Director of Public Works.

All engineering drawings shall be prepared from one base plan, at a minimum scale of 1:200 and shall contain the following information:

(a) survey plan,
(b) a key plan at a scale of 1:10000 showing the site location,
(c) a north arrow,
(d) the street names, lot and Registered Plan numbers, and property dimensions,
(e) the outline of all buildings indicating the building numbers, unit numbers and garage location within the unit,
(f) the roadway and driveways,
(g) adjacent lands, and
(h) existing land features (trees, municipal services, etc.)

L 4.02 Site Grading Plan

The site grading plan shall show the following information:

(a) Centreline grades at 15m intervals along all existing streets bounding the property, and existing grades.
(b) A legend indicating which are existing and which are proposed elevations.
(c) Contours at maximum 0.6m intervals to indicate the existing elevations of the site.
These contours shall extend to a minimum distance of 15m 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 these elevations
were obtained from field survey on a regular grid pattern with the interval not to exceed 15m.
(d) Cross sections and sketches, as required, to clarify the proposed grading, particularly in relation to adjacent lands, 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 shall be used to indicate direction of the surface drainage.
(e) All Maintenance Structures, catchbasins, hydrants and valves shall be shown by a symbol with a legend provided.
(f) All sidewalks and walkways.
(g) All building elevations shall be established and referenced to a 'Finished First Floor' or a 'Finished Entrance Floor' elevation and a 'Finished Basement Floor'elevation.
(h) Pavement structure design shall be provided .

(i) Roadway-driveway dimensions and curb radii including location and details of all existing adjoining curbs and pavements.
(j) The location of embankments, retaining walls, stairs.
(k) All trees, shrubs adjacent to roadways.
(l) Fencing.
(x) Traffic control signage and pavement markings.

L 4.03 Site Servicing Plan

The Site Services Plan shall show the following information:

(a) All existing underground services on the streets, and easements adjacent to the property.
(b) The location, size, grade, invert elevations of all storm and sanitary service connections to the property.
(c) The location and size of all watermain connections to the property.
(d) The basement floor elevations of all buildings to be constructed.
(e) Calculations and plans showing the location, size, length, grade, for all sanitary sewers, appurtenances and services to be constructed within the development.
(f) Calculations and plans showing the location, size, length, grade, for all storm sewers appurtenances and services to be constructed within the development.
(g) Calculations and plans showing the location, size for all watermains, appurtenances and services to be constructed within the development.
(h) The locations of all roof water leaders that are to be connected to the storm sewer.
(n) All construction notes required to describe the construction details or requirements.
(j) Traffic control signage and pavement markings.

L 4.04 Landscaping Plan

The Landscaping Plan shall be prepared by a qualified Landscape Architect. The Landscaping Plan shall show all landscaping details as required by the Site Plan Agreement.

The Landscape Plan shall show the details of all landscape proposals as required by the Town's Landscape Architect.

The Landscape Plans shall illustrate the following:

(a) Details of tree and shrub plantings (number, sizes, species, etc.) must be identified.
(b) Details of ground treatments (pavings, granulars, mulches etc.).
(c) Details of site furniture.
(d) Details of site features (gates, walls, steps, fences, fountains, sculptures, outbuildings, trellises, arbours, etc.).
(e) Existing site features to be preserved (vegetation, architecture, etc.).
(f) All grading details including contours describing landforms and spot elevations.
(g) Critical dimensions pertinent to the Landscape Design.
(h) All Maintenance Structures, catchbasins, hydrants, valves streetlights and other servicing features that appear above grade,
(i) Boulevard trees
(j) Location and size of all outdoor amenity areas

The landscaping plan shall be prepared in conjunction with the site servicing plan(s), particularly the storm drainage and grading plans, to avoid conflicts in purpose and function.

L 4.05 Electrical Services Plan

The Electrical Services Plan shall be prepared by a qualified Electrical Consultant, in consultation with LUSI. The Electrical Services Plan shall show all details of the electrical distribution system and the site morality lighting (on buildings). A separate street lighting plan shall be submitted.

The Electrical Services Plan shall be submitted to LUSI for approval.

L 5.00 DESIGN REQUIREMENTS

L 5.01 Site Grading Design

(a) The stormwater management/drainage of the site shall be self-contained.
(b) The grading of the site shall be compatible with the elevation of the surrounding lands.
(c) All grassed embankments shall have a maximum slope of 3:1 but 4:1 is preferred.
(d) The grade of grassed or other landscaped areas shall have a maximum slope of 10% and a minimum slope of 2%.
(e) Swales on grassed areas shall have a minimum slope of 2% and a maximum slope whereby the velocity for the flow contained does not exceed 5 m/sec.
(f) The maximum length for any drainage swale shall be 75m.
(g) The minimum depth for any drainage swale shall be 150mm.
(h) The maximum depth for any drainage swale shall be 0.5m.
(i) The maximum slope of any drainage swale shall be 3:1, but 4:1 is preferred.
(j) All driveways shall have positive drainage towards the roadway, minimum grade of 2%, maximum 8% and shall not be used as outlets for any swales.
(k) A Stormwater Management report shall be prepared addressing the site stormwater quality and quantity.
(l) Show Overland Flow Route for Major events.

L 5.02 Roadway Design

(a) All roadways shall be designed in accordance with the most recent engineering requirements of the Town of Cobourg.
(b) The minimum pavement design for all multiple family roadways shall be:
- ✓ subgrade compacted to 95% proctor density
- ✓ 300 mm compacted depth of Granular "B" (100% Compaction)
- ✓ 200mm compacted depth of Granular "A" or crushed limestone (100% Compaction)
- ✓ 50mm compacted depth of HL8 Asphalt base course
- ✓ 40mm compacted depth of HL3 Asphalt surface course

The minimum compacted depth of Granular "B" (compacted to 100% of Proctor Density) is to be 450mm for Commercial, Industrial and Institutional heavy duty pavement.

(c) All driveways in multiple family projects shall be paved with asphalt from the edge of the roadway to the garage. The minimum pavement design for all driveways shall be:
- ✓ subgrade compacted to 95% proctor density
- ✓ 200mm compacted depth of Granular "A" or crushed limestone
- ✓ 50mm compacted depth of HL3 asphalt (driveway mix)

(d) All roadways serving multiple family projects shall be designed to facilitate passage of emergency service vehicles with minimum 12m centre line radius. On dead end streets, provisions shall be made for turning movements of garbage, snow removal and emergency vehicles.

(e) The minimum grade for any multiple family roadway shall be 1% and the maximum grade shall be 6%.

(f) The minimum grade for any driveway in a multiple family project shall be 2% and the maximum grade shall be 8%. This maximum grade creates an undesirable condition and should be used only when necessary due to site conditions.

L 5.03 Site Servicing Design

(a) All sanitary and storm sewers shall be designed in accordance with the requirements of the Ministry of the Environment, the Ontario Building Code and the Town of Cobourg.

(b) Storm sewer and Storm Water Management Facilities shall be designed as per the Storm Water Management Practices and Planning and Design Manual published by the MOEE and the Town of Cobourg Design Guidelines.

(c) All storm sewers in residential developments shall be located within the limits of the roadway. Roof leaders shall discharge to the ground surface, subject to no adverse impact to the safety of pedestrians and traffic. The building design shall be completed with due care to avoid roof leaders discharge directly on walkway/driveway. Foundation drains shall be connected to the storm sewer.

(d) Sewers shall be located a minimum distance of 3.0m from the face of the building.

(e) Watermain shall be designed as per LUSI's requirements.

(f) Electrical shall be designed as per LUSI's requirements.

(g) Rear yard catchbasins shall be provided where required for drainage of landscaped areas.

(h) Catchbasin manholes may be used for roadway drainage.

(i) Maximum spacing of catchbasins for roadway drainage shall match road criteria.

L 5.04 Landscaping Design

Proposals for design and materials contained within the Landscape Plans shall meet the approval of the Town. The Landscape Consultant shall contact the Town Planning Department to resolve and agree upon design reflecting the requirements of the Town.

L 5.05 Electrical Design Requirements

The requirements for the design of the electrical distribution system and the street lighting shall be agreed upon with the Lakefront Utilities services Inc. prior to the commencement of the design.

L 6.00 INSPECTION DURING CONSTRUCTION

It is the duty of the owner's Engineer to demonstrate adequate inspection of major and minor works through the submission of an inspection plan.

Monitoring of inspection shall be performed by the Public Works Division.

The owner's Engineer shall submit an inspection plan, for approval by the Director of Public Works, outlining inspection methods for major and minor works.

Plans shall include, but not be limited to:
- qualified on site inspector complete with contact information
- individuals certifying satisfactory installation of works, complete with contact information.
- time allocation of staff performing inspections or certifications.
- all testing to be performed and testing frequency.
- Third party sub-contractor performing inspection, certifying or testing of works, including, but not limited to: materials, installation, compaction, compactions testing and site grading.
- Any other relevant inspection or certifying activity.

Inspection of site servicing works will be performed by the Engineering section.

All watermains are to be pressure tested in accordance with the requirements of NFPA 24 (Standard for the Installation of Fire Service Mains and their Appurtenances), the Town of Cobourg Guidelines and the Ontario Building Code.

Fire lines from the property line to the backflow preventer and all domestic watermains are to be disinfected to meet the requirements of the Northumberland County and the satisfaction of the Town of Cobourg.

L 7.00 AS CONSTRUCTED - SERVICES DRAWINGS

After all construction is complete, the design drawings shall be amended to incorporate the changes and alterations made during construction, and submitted to the Town of Cobourg for their records. All above ground features (maintenance structures, CB's, valves, etc) shall have two measurements of reference.

L 8.00 FINAL INSPECTION

Upon completion of all construction, the Town of Cobourg shall conduct 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 Town of Cobourg and shall in no way relieve the Developer of his obligations under the Condominium Act and the Site Plan Agreement.

L 9.00 CERTIFICATION

Upon completion of construction the Consulting Engineers shall provide the proper certification to the Town of Cobourg that all works have been constructed in accordance with the approved plans and specifications, and in accordance with good engineering practices.

SECTION M – MINIMUM TESTING REQUIREMENTS

M 1.00 COMPACTION

AREA	% COMPACTION	FREQUENCY	TEST LOCATION IDENTIFICATION
Mainline Sewer Trench	95 % (514.07.08)	15m, 0.6m max. lift	Street, distance from downstream MAP, i.e. MH23+30m
Mainline Watermain Trench	95% (514.07.08)	15m, 0.6m max. lift	Street, station and offset
Road Subgrade	98% (top 1m) (501.08.02)	15m 'Z' pattern	Street, station, and offset, i.e. 0+105, 3.5mL
Service Trenches	Same as road Subgrade	Random selection	Lot number
Watermain Crossings	Same as road	Each crossing	Street, station
Utility Trenches*	98% (subgrade) (501.08.02)	Each crossing	Street, station or adjacent lot number
Curbline Bedding	100% (501.08.02)	15m	Street, station and left or right, i.e. 0+030 R
Granular "B"	100% (510.05.02)	15m 'Z' Pattern	Street, station and offset, i.e. +120,3.5m R
Granular "A"	100% (510.08.02)	15m 'Z' Pattern	Street, station and offset, i.e. +120,3.5m R
Granular "A" (driveways)	100%	✓ 1 test/driveway ✓ random location on driveway ✓ random selection of 1/3 of the driveways	Lot or house number, distance form curb or garage
Asphalt ** (HL3 & HL8)	96% (310.07.02.11)	15m each lane	Street, station and left or right, i.e. 0+120 south
Asphalt** (driveways)	96% (310.07.02.11)	Same as Granular "A" (driveways)	Same as Granular "A" (driveways)

* NOTE: Utility crossings are installed prior to base asphalt.

** NOTE: Recycled asphalt may be accepted by the Town of Cobourg up to 25% in base asphalt only.

M 2.00 CONCRETE

ITEM	FREQUENCY	TEST LOCATION IDENTIFICATION
Curb and Gutter	✓ 3 locations/500m of curb, min 3 cylinders/location to break at 7 and 28 days ✓ slump and air tests at each sampling location ✓ conformity with OPSS 1350 except air to be 7% ± 1.5	Station, left, right, or station north , south etc.
Sidewalk	✓ 3 locations/500m of sidewalk ✓ min. of 3 samples/location to break at 7 and 28 days ✓ slump and air tests at each sampling location ✓ conformity with OPSS 1350 except air to be 7% ± 1.5	Station, left, right, or station north, south etc.

M 3.00 ASPHALT

ITEM	FREQUENCY	TEST LOCATION IDENTIFICATION
HL3 and HL8	✓ samples to be taken every 150m each lane, & temp. recorded ✓ 2 marshal tests and 2 extraction tests/full day of paving (local residential roads) ✓ conformity to OPSS 1003, 1101, 1150 (AADT>5000) required ✓ samples to be taken every 100m on industrial and collector roads ✓ for failures, further testing will be done of the samples to define the limits of the failure ✓ corrective action will depend on the nature and extent of the failures	Street, station, left, right, or adjacent lot #, north lane etc.

M 4.00 GRANULAR GRADATION VERIFICATION

(a) All granular materials shall be tested at the source prior to delivery on-site to verify that gradation requirements have been met for each type of granular. Gradation to conform to current OPSS.
(b) All granular materials shall be sampled on-site not less than one gradation check/100m of road for an 8.5m road.

NOTES:

(a) Additional testing may be require by the Town of Cobourg, depending on site conditions.
(b) Results of compaction tests shall be plotted on plan/profile drawing for review at the site as well as being submitted to the Town, in tabular form.
(c) Subgrade shall be rolled in the presence of the Developer's Engineer. The Soils Consultant shall issue a certificate of compaction and approval prior to the placement of granular materials, stating that the trenches, services and road subgrade have been backfilled, compacted and tested in

accordance with the Town's testing Guidelines and is suitable for the placement of granular materials.

(d) The Soils Consultant shall issue a certificate of compaction and approval of granular materials prior to the placement of hot mix asphalt.
(e) A copy of all testing results is to be submitted to the Town, unless otherwise indicated by the Director of Public Works.

SECTION N – SEDIMENT AND EROSION CONTROL

N 1.00 SCOPE

In general, new urban developments produce an increased amount of sediment to the surrounding streams and other waterways, particularly during construction. In order to avoid the side effects from development (ie; poor water quality, restricted channel conveyance, et.), sediment control measures must be employed. Sediment traps (temporary or permanent), vegetation screens, catchbasin filter bags, etc., are some acceptable means of sediment control. In all cases, it is recommended that the guidelines published by the local conservation authority be adopted.

Regulations governing sediment and erosion control fall under the jurisdiction of all levels of government and agencies and include, but are not limited to the following legislation:

- Federal Fisheries Act
- Navigable Waters Protection Act (NWPA)
- Canadian Environmental Assessment Act (CEAA)
- Species at Risk Act
- Lakes and Rivers Act
- Provincial Policy Statements
- Planning Acts
- Ontario Water Resources Act (OWRA)
- Oak Ridges Moraine Conservation Plan Act
- Conservation Authorities Act (CAA)

The Sediment and Erosion Control Plan is to show all calculations and requirements for erosion and sediment control before, during and after construction.

It is the Owner's responsibility to obtain the most current version of the by-law and permit requirements, and submit them to the Planning and Development Department.

N 2.00 PROCEDURE

The base drawing for this Plan is to be the Lot and Rough Grading Plan. Superimposed on these drawings, the Engineer is to indicate any temporary and/or permanent control devises and/or ditches and ponds required to keep all materials and surface runoff contained on site.

Quantity calculations, dimensions, and construction materials shall be shown on the Sediment and Erosion Control Plan.

All permanent sediment and erosion control devices are to be shown on the Plan and Profile Drawing while any temporary construction is to be shown on the Sediment and Erosion Control Plan.

N 3.00 IMPLEMENTATION

The Sediment and Erosion Control Plan must be submitted with the final submission of the Plan and Profile Drawings. The Plan must also be approved by the Ganaraska Region Conservation Authority before any earthwork begins on the site.

SECTION O – STREET FURNITURE

O 1.00 UTILITY COORDINATION PLAN

O 1.01 Scope

In order to identify and coordinate all utility work within new developments with municipal roads, a Utility Coordination Plan is required. The Utility Coordination Plan shall be prepared and stamped by the Consultants engineer, the purpose of which is to establish the location of all aboveground works in a coordinated manner. It shall formally recognise and provide for the requirements of the hardware needed for the delivery or the various utility services as well as the functions which occur both on the road and within the municipal right of way.

O 1.02 Procedure

The Consultant is responsible for meeting with all utilities and other companies who may wish to place structures on the road allowance.

In the case of utility companies, the Street Furniture Plan will indicate all above ground plant and pedestals in their final location, tied with a dimension to a property line or other property control point. Hydro equipment, such as transformers and street lighting poles, are to be shown with ties to property corners or other property control points.

The Consultant will also coordinate the placing of all Super Mailboxes and verify no interference with other existing structures.

The Consultant will also be responsible for:

- Coordinating the placement of all utility ducts and above ground structures in the location and quantities as directed by the utility companies;
- Verifying that their placement will function properly, and not interfere with any other existing and/or proposed utilities as well as any development ideas (ie; traffic controls, entry gates, fencing, street trees, etc.);
- Inspecting the construction and installation of the various utilities to ensure compliance;
- Providing the Town with an “as constructed” version of the Utility Coordination Plan upon the completion of the work within the project.

O 1.03 Plan

The Utility Coordination Plan is to be based on the grading plans at a scale of 1:500 (unless otherwise approved by the Town) and shall include but not be limited to:

- The road alignment with all property lines,
- The proposed lot and block fabric and identification numbering,

- The proposed underground and above ground hardware for:
  - ✓ Telephone and/or telecommunication companies
  - ✓ Television programming delivery companies
  - ✓ Natural gas delivery companies
  - ✓ Electricity delivery services
  - ✓ Water distribution companies
  - ✓ Boulevard landscaping
  - ✓ Traffic controls (signage and physical works i.e. speed bumps)
  - ✓ Property access, i.e. proposed driveway locations
  - ✓ All Maintenance Structures, catchbasins, hydrants and water valves

The Utility Coordination Plan is to indicate and identify the aboveground and related belowground utility works in their final locations and dimensioned to a property line or other property control point.

The Utility Coordination Plan will be submitted to the Town prior building permit issuance.

The Utility Coordination Plan may also include a listing of all tree planting required for the subdivision if there is not enough warrant for a Landscaping Plan. A sample chart form is shown previously which would describe type, size and location of the trees. This work will only be done with the approval of the Director of Public Works.

Street	Type	Size	Location
Street Name	Common and Latin Name	Size in mm	Distance from side and front property lines.

The Street Furniture Plan is to be submitted with the final submission drawings for approval by the Town.

APPENDIX A

Checklist for Subdivision Design

A. APPROVALS AND PLANNING ISSUES

- Review draft plan and conditions ( )
- Tree preservation report and recommendation ( )
- Fencing requirements ( )
- Buffer screening or planting ( )
- Obtain Zoning By-Law and By-Law Map ( )
- Traffic report and recommendations ( )
- Conceptual SWM report ( )
- Functional report ( )
- Noise report ( )
- Phasing information ( )
- Construction access ( )
- Potential approval agencies
  – GRCA, County of Northumberland, MOE, MNR, MTO, Utility Companies ( )
- Internal departmental approvals
  – Planning Section, Parks and Recreation, Operations Transit, Fire and Emergency Services ( )

B. GENERAL

- Check submission documents in accordance with Town requirements ( )
- Check all drawings meet requirements ( )
- List of drawings and key plan on cover sheet ( )
- Standard notes shown ( )
- Compare Draft Plan with engineering drawings and R-Plan to ensure compatibility ( )
- Services to lands/lots adjacent to subdivision ( )
- Easement widths to be adequate for maintenance and conform to Zoning ( )
- Walkway widths ( )

C. ROADS

- Review traffic report ( )
- Check pavement structures with soils report ( )
- Check geometrics (same as draft plan) ( )
- Check minimum curb radii ( )
- Check correct R.O.W. cross section, services at correct location ( )
- Pavement and R.O.W. dimensions on plan ( )
- Profile – gradients, vertical curves (spot check elevations) ( )
- Road centerline station at 25 metre on the plan ( )
- Catchbasin locations/spacings ( )
- Depressed curb at intersection and walkway crossing ( )

D. STORM DRAINAGE SYSTEM

- Review drainage system and drainage area drawings (ensure external areas accounted for ( )
- Review servicing report ( )
- Compare sewer calculations and drainage area drawings ( )
- Check calculation sheets (sewer and MH hydraulics) ( )
- Check MAP spacing and location – pipe location/alignment ( )

- Alignment of CB and lot connections ( )
- Sewer profile – spot check pipe size and gradient with calculation sheets, min. pipe cover and house connections ( )
- Pipe strength and bedding, special bedding requirements for pipe fill areas ( )
- Check for conflicts of pipe crossings (especially at intersections) ( )
- Check overland flow calculations and compare the flow routing with lot grading ( )
- Check 25 Yr. HGL computations and compare with the Plan Profile Drawings ( )
- MAP benching details – structural information if applicable ( )
- Check radius pipe data ( )

E. STORM WATER MANAGEMENT

- Storm Water Management Report will normally be reviewed separately – review recommendations( )
- Compare Rational Method on sewer calculations to Storm Water Management report to ensure compatibility ( )
- Check detention pond volume, hydraulics of inflow and outflow structures ( )
- Storm water quality issues – siltation basin and future maintenance access ( )
- Use the "Reviewer's Checklist" on the MPEE 1994 SWMP Manual to review the design concept of various storm water management control facilities and measures ( )

F. LOT GRADING

- Overland flow route and capacity – check street cross section and swale capacity Calculations, compare swale and road grades to OTTSWM Report where appropriate ( )
- Park and SWM pond grading drawings to include details of landscaping and planting prepared by the landscape architect ( )
- Overland flow easement and swale cross section shown ( )
- Check all lots:
  - ✓ As per standards ( )
  - ✓ Street line, high lot corner elevations ( )
  - ✓ Specified house grade ( )
  - ✓ Side and rear lot line elevations ( )
  - ✓ Retaining wall heights (fence required) ( )
  - ✓ Check minimum basement elevations – to be minimum 0.15 m Above 25 Yr. HGL ( )
  - ✓ Ensure boundary elevations compatible with adjacent properties, overland flow routes maintained, ponding not created, lot swales not discharging to adjacent properties ( )
  - ✓ Compare to plan/profiles to ensure compatibility ( )
  - ✓ Noise barriers and vibration mitigation as per noise report ( )
  - ✓ Check 'Erosion & Sediment Plan' drawing to ensure natural drainage is maintained as per environmental report ( )

G. UTILITY COORDINATING DRAWING

- Driveway locations compared to lot grading plan drawings ( )
- Compare with general plans, re: light poles, transformers and aboveground site services ( )
- Highlight potential conflict with street tree plantings ( )

APPENDIX B

Checklist for Multiple Family Dwelling, Commercial, Industrial or Institutional Lands

TITLE: Submission ☐

A. GENERAL

- ♦ Check drawing requirements as per Town Standard Section 'J' ( )
- ♦ Fencing requirements ( )
- ♦ Buffer screening and tree planting ( )
- ♦ Traffic Management report and recommendations (if applicable) ( )
- ♦ Stormwater management report (if applicable) ( )
- ♦ Functional servicing report (if applicable) ( )
- ♦ Noise report (if applicable) ( )
- ♦ Easement width adequate for maintenance ( )
- ♦ Tree removals to be approved ( )
- ♦ Garbage enclosure location and details ( )
- ♦ Engineering drawings to be approved by subdivision design consultant for overall compatibility (for sites located in approved subdivision) ( )
- ♦ Cost estimates for engineering features (i.e. retaining wall, and privacy Fences, etc.) ( )

B. TRAFFIC/PARKING

- ♦ Roadway, driveway & curb radii dimensions (entrance geometry) ( )
- ♦ Refer to Planner for parking requirements ( )
- ♦ Check pavement structure ( )
- ♦ Traffic signage and pavement markings to be shown ( )
- ♦ Sidewalk locations ( )

C. STORM DRAINAGE SYSTEM

- ♦ Check downstream capacity ( )
- ♦ Review servicing report ( )
- ♦ Review external drainage areas ( )
- ♦ Review storm sewer calculations and drainage area drawings (pipe sizes, slopes, pipe length, and pipe material) ( )
- ♦ Check calculation sheets (sewer and MH hydraulics) ( )
- ♦ Check MAP spacing and location – pipe location/alignment ( )
- ♦ Alignment of CB and lot connections ( )
- ♦ Pipe strength and bedding, special bedding requirements for pipe in fill areas, minimum pipe cover ( )
- ♦ Check for conflicts of pipe crossings ( )
- ♦ Compare overland flow routes with lot grading ( )
- ♦ Check as-built drawings for location and inverts of existing stubs (sewer and water services) ( )

D. STORM WATER MANAGEMENT

- Reference to area storm water management report for appropriate requirements ( )
- Review on-site and roof storage capability, type of control etc. ( )
- Design include any roof top, surface/underground storage; MAP type grit separators will require MOE approval. Outlet control device should operate under head (i.e. be lower than storage) ( )

E. LOT GRADING

- Silt and erosion controls (or notes) ( )
- Paved parking area grades – Min. 1% Max. 8% ( )
- Landscape areas
  - ✓ Sod grades 2% to 10%
  - ✓ Embankment (slopes) to be max. 3:1 ( )
- Driveway grade – Min. 2% Max. 8% ( )
- Existing and proposed grades ( )
- Direction of surface water runoff, slope in % indicated with arrows ( )
- Ensure boundary elevations compatible with adjacent properties
  - ✓ Overland flow routes maintained (i.e. watercourse/creeks)
  - ✓ Pounding not created
  - ✓ Swales not discharging to adjacent properties ( )
- Show existing elevations on adjacent properties ( )
- Any terracing required must be shown on the plan ( )
- Noise barriers and vibration mitigation as per noise report ( )
- Show all easements ( )
  - Check all notes ( )

APPENDIX C

Engineering Design Formula:

EQUATION	VARIABLE DESCRIPTION	UNIT
Rational Formula:		
$Q = CIA$	Q = flow C = runoff coefficient I = rainfall intensity A = area	Cfs Dimensions Inches/hour acres
$Q = \frac{CIA}{360}$	Q = flow C = runoff coefficient I = rainfall intensity A = area	Cubic m./sec. Dimensions cm./hour hectares
Headloss Across Manholes:		
$H = \frac{k(V2^2 - V1^2)}{2g}$	H = head loss K = coefficient V1 = entrance velocity V2 = exit velocity G = acceleration due to gravity	Metres (feet) Dimensionless m./sec. (ft./sec.) m./sec. (ft./sec.) m./sec./sec. (ft./sec./sec.)
Catchbasins Inlet Capacity:		
$Q = CA\sqrt{2}gH\ X\ 0.667$	Q = flow C = orifice coefficient = 0.6 for square edged openings =0.8 for round edged openings g = acceleration due to gravity H = allowable head 0.667 = clogging factor A = area of openings	Cubic m./sec m./sec./sec. (ft./sec./sec.) m. (ft.) sq. m. (sq. ft.)
Manning Formula:		
$V = \frac{1.486}{N} R^{\frac{2}{3}} S^{\frac{1}{2}}$	V = velocity N = Manning roughness coefficient R = hydraulic radius S = hydraulic gradient	Ft./sec. Dimensionless Ft Feet/foot
$V = \frac{1}{N} R^{\frac{2}{3}} S^{\frac{1}{2}}$	V = velocity N = Manning roughness coefficient R = hydraulic radius S = hydraulic gradient	m./sec. Dimensionless Metres m./m.
Kutter Formula:		
$C = \frac{41.65 + \frac{0.00281}{S} + \frac{1.811}{n}}{1 + \frac{n}{\sqrt{R}}\left(41.65 + \frac{0.00281}{S}\right)}$	V = velocity N = Kutter roughness coefficient R=hydraulic radius S = energy gradeline slope	Ft./sec. Dimensionless Feet Feet/ft.
$C = \frac{23 + \frac{0.00155}{S} + \frac{1}{n}}{1 + \frac{n}{\sqrt{R}}\left(23 + \frac{0.00155}{S}\right)}$	V = velocity N = Kutter roughness coefficient R=hydraulic radius S = energy gradeline slope	m./sec. Dimensionless Metres Metres/m.

C.U.A. Fire Flow Formula		
$G = 850\sqrt{P}(1 - 0.01\sqrt{P})$	G = required fire flow P = population	Imperial 1gpm Thousands
Babbitt Peaking Factor:		
$K8 = \frac{5}{p^{o}.20}$	K = Babbitt peaking factor P = population	Dimensionless Thousands
Harmon Peaking Factor:		
$K_H = 1 + \frac{14}{4 + p^{0.5}}$	K = Harmon peaking factor P = population	Dimensionless Thousands
Hazen-Williams Formula:		
$V = 1.32CR^{0.63}S^{0.54}$	V = velocity C = Hazen-Williams Coefficient R = hydraulic radius S = hydraulic gradient	Ft./sec. Dimensionless Ft. Feet/foot
$V = 0.85CR^{0.63}S^{0.54}$	V = velocity C = Hazen-Williams Coefficient R = hydraulic radius S = hydraulic gradient	m./sec. Dimensionless Metres m./m.