



CITY OF KITCHENER

DEVELOPMENT MANUAL

Updated:

Summer 2021

Preamble

The purpose of the City of Kitchener Development Manual is to outline the City's current engineering requirements, guidelines, specifications and standards, which guide the design and construction of public infrastructure. It also outlines the expectations and requirements for obtaining engineering approvals associated with development applications with specific regard to Site Plans and Plans of Subdivision.

The Manual is to be used by City staff and the development industry including Developers, Builders and their Consultants and Contractors, to prepare and evaluate engineering submissions associated with the construction of infrastructure. Items covered by the manual include: roads, watermains, sanitary sewers, storm sewers, stormwater management facilities, street lighting, natural gas, utilities, lot grading, erosion and sediment control, parks and community trails.

There are numerous references throughout this manual to the MOE. This refers to the Ministry of the Environment and any successor thereof. For example, as of the date of publication for this current version of the manual the MOE refers to Ministry of Environment, Conservation and Parks.

Contents

A	ADMINISTRATION - SUBDIVISION	1
A.1	General	1
A.1.1	Site Alteration and Tree Conservation	1
A.1.1.1	Site Alteration By-law.....	1
A.1.1.2	Tree Conservation By-law	1
A.2	Subdivision Review and Approval Process	2
A.2.1	Pre-Submission Consultation.....	2
A.2.1.1	Geotechnical/Hydrogeological Investigation(s).....	2
A.2.1.2	Functional Servicing Report.....	3
A.2.1.3	Water Distribution Report	3
A.2.1.4	Preliminary Grading Plan.....	3
A.2.1.5	Stormwater Management Report	3
A.2.1.6	Transportation Impact Study (TIS).....	3
A.2.1.7	Environmental Site Assessment (ESA).....	3
A.2.1.8	Archaeological Assessment.....	4
A.2.1.9	Tree Management – At Time of Application.....	4
A.2.1.10	Streetscape Plan and Urban Forest Soils Report	4
A.2.1.11	Noise Study	4
A.2.2	Application Submission and Review	4
A.2.3	Draft Approval.....	4
A.2.4	Modifications to Draft Plan Approval	5
A.3	Subdivision Agreement	5
A.4	Release for Registration	5
A.5	Engineering Submissions	5
A.5.1	First Submission	5
A.5.2	Second and Subsequent Submissions	5
A.5.3	Final Submission.....	6
A.5.4	Digital Document Submission	6
A.6	Pre-Grading Request	6
A.7	Pre-Servicing Request	7
A.8	Plans and Drawings	7
A.8.1	General Drawing Requirements.....	7
A.8.1.1	Title Sheet	7
A.8.1.2	General Plan of Services	8
A.8.1.3	General Notes Sheet	8
A.8.1.4	Traffic Control Plan	8
A.8.1.5	Urban Forest Asset – Streetscape Plan.....	8
A.8.1.6	Signal Wiring Plan and Signalized Intersection Plan.....	8
A.8.1.7	Staging Plan	8
A.8.1.8	Sanitary Drainage Area Plan	9
A.8.1.9	Storm Drainage Area	9
A.8.1.10	Park, Open Space, Multi-Use Pathway Development and Grading Plans	9
A.8.1.11	Lot Grading Plans.....	9
A.8.1.12	“Plan and Profile” Drawings	12

A.8.1.13	Streetlighting and Electrical Distribution Drawings	13
A.8.1.14	Detail Sheet	13
A.8.2	Coordination of Drawings.....	13
A.9	Fees and Securities	14
A.9.1	Cost Estimate.....	14
A.9.2	Engineering Fees.....	14
A.9.3	Parkland Dedication – Cash-in-Lieu.....	14
A.9.4	Perpetual Maintenance Fees	14
A.9.5	Insurance	15
A.9.6	Security Requirements.....	15
A.9.6.1	Security Reductions.....	16
A.9.6.2	Letters of Credit	16
A.9.6.3	Stormwater Management Ponds	16
A.10	Construction.....	16
A.10.1	Road Closures/Detours.....	17
A.11	Inspections and Testing	17
A.11.1	Inspection Form	17
A.11.2	Inspection Checklist	18
A.11.3	Typical Deficiencies	18
A.11.4	Reports Submission (Digital).....	20
A.12	Inspection and Letter of Credit (LC) Reduction process.....	21
A.12.1	General	21
A.12.2	Definitions	22
A.12.2.1	Underground services to base asphalt	22
A.12.2.2	Surface works.....	22
A.12.3	Initial Inspection and 60% Letter of Credit Reduction Process.....	23
A.12.4	Final Inspection and remaining Letter of Credit reduction process.....	26
A.12.5	Obligations during Maintenance Period	27
A.13	As Recorded Drawings	29
A.13.2	As Recorded and Asset Drawing Submissions.....	31
A.14	Release of Building Permits	32
A.14.1	100% Securities Required for Building Permits (Option 1)	32
A.14.2	100% Securities Required for Building Permits (Option 2)	33
A.14.3	Individual Lot Grading Plans (Sitings)	33
A.14.4	Lot Grading Inspection and Certification	34
B	ADMINISTRATION – SITE PLAN	35
B.1	General.....	35
B.2	Site Plan Review Process.....	35
B.2.1	Pre-Submission Consultation.....	35
B.2.2	Application Submission and Review	36
B.2.3	Site Plan Approval	36
B.2.3.1	Phase 1 – Approval in Principle	36
B.2.3.2	Phase 2 – Full Site Plan Approval	36
B.3	Engineering Requirements for Site Plan Approval	36
B.3.1	Submission Requirements	36
B.3.2	Engineer’s Qualifications.....	37

B.3.3	Coordination of Drawings.....	37
B.3.4	Stormwater Management (SWM)	37
B.3.5	Environmental Site Assessment (ESA).....	38
B.3.6	Geotechnical Investigation	38
B.3.7	Fire Flow Analysis.....	38
B.3.8	Letter of Credit and Certification.....	39
B.3.9	Off-site Works Process	39
B.3.10	Municipal Servicing Extension	39
C	STREETS	40
C.1	General.....	40
C.2	Geometric Standards	40
C.3	Street Pavement Design	42
C.4	Traffic Calming/Diversion	44
C.5	Roundabouts	44
C.6	Street Allowance Cross Section.....	45
C.7	Street Sub-Drains	45
C.8	Intersection Visibility.....	45
C.9	Curbs	45
C.10	Boulevards.....	46
C.11	Sidewalks.....	46
C.12	Trail Connections	47
C.12.1	Trail Connections – Emergency Access.....	47
C.13	Multi-Use Trails	47
C.14	Cycling Facilities (On Road).....	48
C.15	Cul-de-Sacs	48
C.16	Intersections.....	49
C.17	On-Street Parking	49
C.18	Traffic Control – Signs and Pavement Markings	49
C.18.1	Traffic Signage Plan.....	49
C.18.2	Street Name Signage.....	49
C.18.3	Wayfinding, Pedestrian and Bicycle Control Signs.....	49
C.18.4	Open Space Signs	50
C.18.5	Pavement Markings	50
C.18.6	Signage & Pavement Markings Installation Process.....	50
C.18.7	Traffic Signals	51
C.19	Driveway Entrances	51
C.20	Noise Attenuation.....	52
C.20.1	General Philosophy of Noise Attenuation.....	52
C.20.2	Noise Barriers	52
C.21	Entrance Features	53

C.22	Fencing	53
C.23	Streetscape and Landscaping	54
C.24	Utility Installation	54
C.25	Inspection and Testing	54
D	WATERMAINS	55
D.1	Design Guidelines	55
D.1.1	Hydrants (DGSSMS B.2.7)	55
D.1.1.1	Location (DGSSMS B.2.7.3)	55
D.1.1.2	Minimum Clearance (DGSSMS B.2.7.5)	55
D.1.2	Services (DGSSMS B.2.12)	56
D.1.2.1	Sizing (DGSSMS B.2.12.1)	56
D.1.2.2	Location (DGSSMS B.2.12.2)	56
D.1.2.3	Number of Services Per Property (DGSSMS B.2.12.3)	56
D.1.2.4	Valving (DGSSMS B.2.12.6)	56
D.1.2.5	Metering (DGSSMS B.2.12.7)	56
D.2	Material Specifications	56
D.2.1	Concrete Pressure Pipe (DGSSMS C.2.1.2)	56
D.2.2	Hydrants (DGSSMS C.2.8)	57
D.2.3	Easements (DGSSMS C.2.16)	57
D.3	Construction Specifications	57
D.3.1	Hydrant, Valve and Chamber Installation (DGSSMS D.2.6)	57
D.3.1.1	Setting of Hydrants (DGSSMS D.2.6.1)	57
D.3.2	Service Connections (DGSSMS D.2.7)	57
D.3.2.1	Live Tapping (DGSSMS D.2.7.2)	57
D.3.2.2	Tapping for Connections 100mm and Larger (DGSSMS D.2.7.3)	57
D.3.3	Commissioning (DGSSMS D.2.8)	57
D.3.3.1	Final Connection to Existing Water System (DGSSMS D.2.8.7)	57
E	SANITARY SEWERS	58
E.1	Design Guidelines	58
E.1.1	Residential (DGSSMS B.3.1.2.1)	58
E.1.2	Infiltration (DGSSMS B.3.1.2.6)	59
E.1.3	Pipe Slope (DGSSMS B.3.1.6)	59
E.1.4	Flow Velocities (DGSSMS B.3.1.7)	59
E.1.5	Pipe Depth (DGSSMS B.3.1.10)	59
E.1.6	Services (DGSSMS B.3.3)	59
E.1.7	Easements	59
E.1.8	Inspection and Testing	59
E.1.8.1	Material Removal	61
E.1.8.2	Material Disposal	61
E.1.9	CCTV Inspection	61
E.1.9.1	Cleaning/Flushing Precautions	61
E.1.9.2	Flow Control and Bypass Pumping	61
E.1.9.3	Camera Equipment	62
E.1.9.4	Digital Images/Instant Photos	62
E.1.9.5	Re-Inspection	62
E.1.9.6	Maintenance hole Inspections	62

E.1.9.7	Report.....	62
E.1.9.8	Sewer Inspection Screen Information.....	62
E.1.9.9	Defect Coding.....	63
F	STORM SEWERS.....	64
F.1	Design Guidelines.....	64
F.1.1	Design Flow Calculations (DGSSMS B.4.2.1).....	65
F.1.2	Rainfall Intensity (DGSSMS B.4.2.1.1).....	65
F.1.3	Pipe Slope (DGSSMS B.4.2.4).....	66
F.1.4	Flow Velocities (DGSSMS B.4.2.5).....	66
F.1.5	Head Walls (DGSSMS B.4.2.13).....	66
F.1.6	Maintenance Holes (DGSSMS B.4.3).....	66
F.1.6.1	Structure (DGSSMS B.4.3.1).....	66
F.1.6.2	Tee Maintenance Holes (DGSSMS B.4.3.4).....	66
F.1.7	Catchbasins (DGSSMS B.4.4).....	66
F.1.7.1	Catchbasin with Curb Inlet Overflow (DGSSMS B.4.4.6).....	66
F.1.8	Services (DGSSMS B.4.5).....	66
F.1.8.1	Minimum Diameter (DGSSMS B.4.5.1).....	66
F.1.9	Open Ditch and Culvert Design (DGSSMS B.4.7).....	66
F.1.10	Easements.....	67
F.1.11	Outfalls.....	67
F.1.12	Inspection and Testing.....	67
F.1.13	CCTV Inspection (Storm).....	68
G	STORMWATER MANAGEMENT.....	69
G.1	Introduction.....	69
G.2	Stormwater Management Design Criteria.....	70
G.2.1	Minor System.....	70
G.2.1.1	Storm Sewers.....	70
G.2.1.2	Inlet Systems - Catchbasins.....	70
G.2.1.3	Outlet Treatment.....	70
G.2.2	Major System.....	71
G.2.2.1	Roadway Conveyance.....	71
G.2.2.2	Overland Flow Routes.....	71
G.3	Watercourse Systems (in relation to Stormwater Outlets).....	72
G.3.1	Design Approach and Principles.....	72
G.3.2	Setbacks.....	72
G.3.3	Access/Maintenance.....	73
G.4	Watercourse/Channel Design.....	73
G.4.1	Design Documentation for Watercourse/Channel Design.....	74
G.4.2	Roadway Crossings.....	75
G.5	Stormwater Quantity and Quality Controls.....	76
G.5.1	Encouraged Source Controls.....	78
G.5.2	Conveyance Controls.....	79
G.5.3	End-of-Pipe Techniques.....	80
G.5.3.1	Stormwater Management Fee (Previously Cash-in-Lieu) for Infill and Redevelopment.....	81
G.5.4	Spill Prevention and Control.....	81

G.6	Stormwater Management Facility Designs.....	82
G.6.1	New Development and Redevelopment.....	82
G.6.2	Temporary Stormwater Facilities.....	86
G.6.3	Infill Developments.....	86
G.7	Analytical Methods.....	87
G.7.1	Hydrology.....	87
G.7.1.1	Rainfall.....	87
G.7.1.2	Rational Method	87
G.7.1.3	Event Based Hydrologic Models.....	87
G.7.2	Hydraulic Capacity	89
G.8	Flood Management.....	90
G.9	Stormwater Management Erosion Control/GEOMORPHOLOGY.....	91
G.10	Quality Management.....	92
G.11	Monitoring.....	93
G.11.1	Introduction	93
G.11.2	Purpose	93
G.11.3	Types of Monitoring Plans.....	94
G.11.4	Process/Protocol.....	94
G.11.5	Monitoring Periods.....	94
G.11.6	What is Monitored.....	95
G.11.7	Monitoring Plans for Stormwater Management Facilities	96
G.11.7.1	Post-Construction Monitoring.....	96
G.11.7.2	Introduction.....	96
G.11.7.3	Monitoring Criteria	96
G.11.8	Monitoring Plans for Infiltration Facilities	97
G.11.9	Enforcement	98
G.12	Engineering Submissions	98
G.12.1	Stormwater Management Report.....	98
G.12.1.1	Preliminary Stormwater Management Report.....	99
G.12.1.2	Final Design – Stormwater Management Report.....	99
G.12.2	Ministry of the Environment ECA Applications for SWM Facilities.....	99
G.12.3	Electronic Submission of As-Recorded Stormwater Management Works.....	100
G.12.3.1	Design tracking spreadsheet	100
G.12.3.2	As-recorded Engineering Drawings	100
G.12.3.3	SWM Facility Topographical Survey	100
G.12.4	Operations and Maintenance Manual	100
G.12.5	Annual SWM Facility Monitoring Reports.....	102
G.13	SWM Acceptance Requirements	102
G.13.1	Initial SWM Facility Acceptance Requirements.....	102
G.13.2	Final SWM Facility Acceptance Requirements	103
G.13.3	Initial Front Yard Infiltration Gallery (FYIG) Acceptance Requirements (Upper Blair Creek) 104	
G.13.4	Final FYIG Acceptance Requirements (Upper Blair Creek)	104
H	STREETLIGHTING.....	106
H.1	Ornamental Streetlighting	106
H.1.1	Approval.....	106

H.1.2	Financial	107
H.1.3	Design.....	107
H.1.4	Construction.....	109
H.1.5	Material Selection	109
I	NATURAL GAS	115
I.1	Natural Gas Servicing Design	115
I.2	Easements.....	115
I.3	Timing of Installation	115
J	LOT GRADING	116
J.1	Purpose	116
J.2	General.....	116
J.3	Rear Yard Catchbasins.....	117
J.4	Swales	117
J.5	Roof Leaders and Sump Pumps.....	118
J.6	Groundwater	118
K	EROSION AND SEDIMENT CONTROL	119
K.1	Erosion and Sediment Control	119
K.2	Topsoil Stockpile Protection.....	120
K.3	Erosion and Sediment Control Inspection.....	120
L	PARKS, OPEN SPACE AND MULTI-USE PATHWAYS	121
L.1	Introduction	121
L.2	Park Block Selection	122
L.3	Park(s), Trail(s) and Open Space Development Requirements	123
L.4	Park, Trail and Open Space Development Options.....	125
L.4.1	Park Construction Capital Budgets	125
L.4.1.1	Option 1 – Base Development, City-built Process	126
L.4.1.2	Option 2 – Front-Ended, Developer-built Process	126
L.4.2	Enhanced Level of Development – Entry Features, Additional Structures, Etc.	127
L.5	Park, Trail and Open Space Development Process.....	128
L.5.1	Pre-Submission “Visioning” Consultation	129
L.5.2	The Park/Trail and Open Space Development Letter of Intent (PTOSLOI).....	129
L.5.3	Prior to Draft Plan of Subdivision Application Submission.....	130
L.5.4	Engineering Submission Process (A.9).....	130
L.5.5	Prior to or at Time of Registration of Applicable Stage of Subdivision.....	131
L.5.6	Within One (1) Year of Registration or Servicing – Whichever Occurs First OR as specified in the PDF/PTOSDFA.....	131
L.5.7	Construction Contract Administration (CCA).....	132
L.5.8	Initial Acceptance (IA)	132
L.5.9	During Warranty Period.....	132

L.5.10	Final Acceptance (FA)	132
L.6	Park(s), Trail(s) and Open Space Design Requirements	133
L.6.1	Park Design	133
L.6.2	Accessibility	134
L.6.3	Topsoil Testing and Amending.....	135
L.6.4	Park, Trail and Open Space Grading and Certification.....	135
L.6.5	Park Servicing.....	136
L.6.6	Circulation – Pedestrian and Vehicular	137
L.6.7	Trails.....	138
L.6.8	Topsoil/Approved Growing Medium and Seeding/Sodding.....	139
L.6.9	Tree Planting.....	140
L.6.10	Parks Facilities.....	141
L.6.11	Parking Areas	141
L.6.12	Barriers	142
L.6.13	Sportsfields, Informal Playing Fields and Ice Rinks.....	142
L.6.14	Signage (Regulation and Wayfinding).....	142
L.6.15	Naturalization of Parklands and Open Spaces.....	143
L.7	Park, Trail and Open Space Construction Requirements.....	144
L.7.1	Construction Process for Park, Trail and Open Space Projects	144
L.7.2	Setting Out.....	145
L.7.3	Site Protection.....	145
L.7.4	Tree and Shrub Protection	145
L.7.5	Clearing and Grubbing.....	146
L.7.6	Soils Testing and Topsoil Stripping	146
L.7.7	Rough Grading	146
L.7.8	Topsoil and Fine Grading.....	146
L.7.9	Site Servicing and Grading Report and Certifications	147
L.7.10	Seeding and Sodding.....	147
L.7.11	Planting.....	148
L.7.12	Playground Structures	148
L.7.13	Asphalt and Concrete	148
L.8	Park, Trail and Open Space Releases	148
M	URBAN FOREST – TREE PLANTING & ESTABLISHMENT	150
M.1	General.....	150
M.2	Urban Forest Requirements.....	150
M.2.1	New Residential (post 1980) - Street Tree Planting Minimum Requirements.....	150
M.2.2	Old Residential (pre 1980) - Street Tree Planting Minimum Requirements.....	151
M.2.3	Multi-Residential and Lot-less Blocks - Street Tree Planting Minimum Requirements 151	151
M.2.4	New Development – Active Parkland Minimum Requirements	151
M.2.5	Letter of Credit	151
M.2.6	Cash-in-Lieu Payments.....	151
M.2.7	Minimum Soil Volumes	152
M.2.8	Soil and Topsoil Depth.....	152
M.2.9	Urban Forest Soils Report.....	153
M.2.10	Species Diversity & Selection	154
M.3	Pre Construction Process	154

M.3.1	Draft Plan Review	154
M.3.2	Engineering & Utility Design.....	155
M.4	Construction & Materials.....	157
M.4.1	Creation of Soil Habitat Zones, Root Pathways, Soils, Tree Planting.....	157
M.4.2	'A' Horizon Soil Habitat – Boulevard	158
M.4.3	'B' Horizon Soil Habitat – Front Yard.....	158
M.4.4	'A' Horizon Soil Habitat – Front Yard.....	158
M.5	Post Construction Process.....	159
M.5.1	Initial Acceptance.....	159
M.5.2	Maintenance & Warranty	160
M.5.3	As-Recorded Submission	160
M.5.4	Final Acceptance	161

LIST OF TABLES:

Table 1: TYPICAL DEFICIENCIES	18
Table 2: GEOMETRIC STANDARDS.....	40
Table 3: PAINT SPECIFICATIONS.....	50
Table 4: RESIDENTIAL ZONING CRITERIA	59
Table 5: CITY OF KITCHENER DESIGN STORM PARAMETERS <6hrs	65
Table 6: CITY OF KITCHENER DESIGN STORM PARAMETERS ≥6hrs	66
Table 7: MINISTRY OF TRANSPORTATION DESIGN FLOOD CRITERIA FOR BRIDGES AND CULVERTS.....	75
Table 8: COMPREHENSIVE LIST OF AVAILABLE SWMP's	76
Table 9: SWM POND MONITORED PARAMETERS	95
Table 10: EASEMENT REQUIREMENTS.....	117
Table 11: PARKS, TRAILS and OPEN SPACE SUBMITTAL PROCESS SUMMARY.....	128
Table 12: MATURE TREE SIZE.....	150
Table 13: MINIMUM SOIL VOLUMES FOR MATURE TREES – SOIL HABITAT ZONES.....	152
Table 14: SOIL ASSESSMENT & SPECIFICATIONS.....	153
Table 15: TREE PLANTING REQUIREMENT SUMMARY.....	155
Table 16: SUBMISSION REQUIREMENTS	157
Table 17: STREET TREE CONSTRUCTED ASSET DATA REQUIREMENTS	160

LIST OF APPENDICES:

APPENDIX A: Standard Drawings & LID X-Sections

APPENDIX B: Urban Forest Details – Tree Planting & Establishment Best Practices

APPENDIX C: City of Kitchener – Standard Specifications

APPENDIX D: Procedure for Off-Site Works Permit by Private Contractors

APPENDIX E: Site Plan Engineering Guidelines

APPENDIX F: Grading, Servicing and Surface Works Approvals Checklists

A ADMINISTRATION - SUBDIVISION

A.1 GENERAL

A Plan of Subdivision is used to create separately conveyable parcels of land together with new municipal roads, parks and associated infrastructure. Plans of Subdivision are approved under Section 51 of the Planning Act, RSO 1990 c.P 13. The City of Kitchener is the delegated approval authority for Plans of Subdivision. The City's Planning Division oversees the administration of Subdivision approvals for the City of Kitchener. Plans of Subdivision will be reviewed in accordance with s.17.E.23 of the Official Plan ([Official Plan website](#)).

When considering applications for Plans of Subdivision, the City will have regard to the provisions of the Planning Act and related Provincial policies and Plans, along with Regional, City and Grand River Conservation Authority policies and procedures, policies of the Official Plan, policies of Council, and approved Master Plans.

Through the Subdivision Review and Approval process, the City, together with related review authorities (including but not limited to Provincial Ministries and Boards, the Region of Waterloo, the Grand River Conservation Authority, utility providers, and others) will review and coordinate:

- overall subdivision layout and design
- conservation of natural heritage
- provision of parkland, trails and urban forest
- provision of pedestrian, cycling, transit and roadway infrastructure
- sanitary sewers, storm sewers and water services
- stormwater management facilities
- utilities and street lighting
- grading

A.1.1 Site Alteration and Tree Conservation

Prior to any work taking place on private or public property, the following By-laws must be taken into consideration:

A.1.1.1 Site Alteration By-law

The City of Kitchener has a By-law prohibiting or regulating the placing or dumping of fill, the removal of soil and the alteration of the grade of land. Under this By-law 'site alteration' activities may require a Site Alteration Permit be obtained. Site Alteration Permits are administered by the Engineering Services Division and are not considered for lands where there is a development application in process. Additional information can be found at [City of Kitchener Site Alteration By-Law website](#).

A.1.1.2 Tree Conservation By-law

The City of Kitchener has a By-law prohibiting or regulating the destruction or injuring of tree(s). Under this By-law the destruction or injuring of a tree(s) may require a Tree Conservation Permit to be obtained. Tree Conservation Permits are administered by the Planning Department and will not generally be considered for lands where there is a development application in process. Additional information can be found at [City of Kitchener Tree Conservation and Management website](#).

A.2 SUBDIVISION REVIEW AND APPROVAL PROCESS

General information regarding the Plan of Subdivision application and review process is outlined below. Additional information is available on the [City of Kitchener Plan of Subdivision website](#), or by contacting the Planning Division phone (519-741 2426).

A.2.1 Pre-Submission Consultation

An owner/applicant will be required to participate in a Pre-Submission Consultation Meeting prior to the submission of an application for a Plan of Subdivision. The purpose of the Pre-Submission Consultation Meeting is to discuss and receive feedback on the proposed development from applicable review authorities, and to identify any other information and materials necessary to review the application. This allows the City and other commenting authorities to make well-informed recommendations and decisions within the timeframe provided by the Planning Act.

Following the Pre-Submission Consultation Meeting the applicant will be provided with a Record of Consultation. The Record of Pre-Submission consultation will summarize feedback and comments and include a list of the information and materials required to be submitted to form of Complete Application. Schedule B to the Official Plan (Other Information and Materials) contains a complete list of the reports and studies, which may be required ([City of Kitchener Official Plan website](#)). The comments included in the Record of Consultation will identify which plans, studies, reports and materials are required, will outline submission expectations, and how to obtain general or project specific Terms of Reference, where required appropriate.

For more information regarding Pre-Submission consultation, please visit the [City of Kitchener website on pre-submission consultation](#), or contact the Planning Division by phone (519-741 2426).

The following is a list of commonly requested engineering reports and studies, and the associated expectations:

A.2.1.1 Geotechnical/Hydrogeological Investigation(s)

A Geotechnical Investigation must accompany all proposed plans of subdivisions. A competent consulting engineer shall carry out the investigation in order to assess soil conditions with respect to the proposed infrastructure and building construction.

The purpose of the investigation is to determine the type of soil, its engineering properties, bearing capacity, soil permeability, location of groundwater, and to verify whether contamination is present. Soil investigation work is to take place after determining the proposed sewer or watermain alignment, so that the required boreholes and test pits follow the same alignment.

Soil test borings will be placed at suitable spacing to provide adequate representation of the soil conditions. Additional boreholes may be required to establish the water table for stormwater management ponds and to design the foundations of outfall structures. In fill areas or areas close to water courses, piles may be required to achieve satisfactory bearing strength to support any proposed infrastructure. Bedrock profiles are required to be submitted where applicable.

The report will make recommendations for the design of the road base, pipe bedding, construction methods, and soil infiltration rates. One paper copy of the geotechnical report will be submitted together with an electronic copy in PDF format to be catalogued and stored by the City for future reference. Groundwater monitoring may be required if deemed applicable. Advancing boreholes including monitoring wells on the site can carry out pre-development groundwater monitoring. See Section J.6 for

further subdivision groundwater requirements. Typically, general information from base mapping etc. will not be sufficient.

A.2.1.2 Functional Servicing Report

The Functional Servicing Report is to be submitted at the time of application for Draft Plan of Subdivision to the satisfaction of Development Engineering. The intent of this technical report is to evaluate the effects of a proposed change in land use or development on the City's municipal servicing infrastructure and watercourses. It should outline the design assumptions and overall impact on local municipal service capacities including stormwater management facilities, etc. The report should also address the adverse impacts, if any, of providing this servicing on any environmentally sensitive features (e.g., Areas of Natural and Scientific Interest, Environmental Sensitive Areas and hydrologically sensitive areas).

The report shall include a preliminary plan for sanitary sewer servicing, and another separate plan for preliminary storm sewer servicing. Each plan is to include pipe inverts (or obverts), to illustrate the functionality of proposed and existing services, calculations, supporting documentation and references to previous studies, for each component of the development.

A.2.1.3 Water Distribution Report

The Water Distribution report is to be submitted at the time of application for Draft Plan of Subdivision to the satisfaction of Kitchener Utilities.

The report shall address water distribution systems, pressure zones, water consumption – estimated consumption, current capacities, phasing, net impact due to the proposed change in land use or development, need for expansion and/or any upgrades.

A.2.1.4 Preliminary Grading Plan

A Preliminary Grading Plan must accompany all proposed plans of subdivisions. This plan shall include proposed grades and elevations at key locations to show how the proposed subdivision will meet lot grading, parks, trails and roadway grading requirements. Existing condition elevations are to be shown where matching proposed grades. Cross-sections shall show how the site will be graded.

The design and calculation of overland flow routes are to be included to understand impacts on the proposed and surrounding lands.

A.2.1.5 Stormwater Management Report

A Preliminary Stormwater Management Report is to be submitted at the time of application for Draft Plan of Subdivision. Refer to Section G Stormwater Management for requirements.

A.2.1.6 Transportation Impact Study (TIS)

Consideration should be given to the impact of new traffic from the proposed subdivision on the adjacent road system. City of Kitchener, MTO or the Region of Waterloo may request that a Transportation Impact Study (TIS) or report be undertaken should it be deemed necessary.

The City of Kitchener utilizes the Regional Municipality of Waterloo's Transportation Impact Study (TIS) Guidelines adopted November 2008 and can be found on the Region's website.

A.2.1.7 Environmental Site Assessment (ESA)

An Environmental Site Assessment (ESA) shall be undertaken when a portion of the site is to be dedicated to the City free of encumbrances. When lands are to be dedicated to the City of Kitchener, a Phase I/II Environmental Site Assessment must be completed in accordance with either CSA Standard Z768-01 or Schedule D of Ontario Regulation 153/04. Depending on the findings of the Phase I ESA, a

Phase II ESA and possibly a record of site condition (RSC) may be required on the portion of the land that is to be dedicated to the City in accordance with Ontario Regulation 153/04. The Building Division may also require a RSC when a property is changing the land use through a Site Plan application, Building Permit, or completing a zoning by-law amendment. Under Ontario Regulation 153/04, an RSC will be required if the proposed development will change the site to a more sensitive land use.

A.2.1.8 Archaeological Assessment

An Archaeological Assessment of the proposed development may be required from a licensed Archaeologist. They will assess the site, to ensure preservation or resource removal and documentation of any significant archaeological resources found on site.

A.2.1.9 Tree Management – At Time of Application

The City's Council-adopted *Tree Management Policy* is designed to encourage the provision of relevant environmental information and tree data early in the planning process.

Under this policy, studies/plans are required to be submitted and approved: at the time of application for Draft Plan of Subdivision (*General Vegetation Overview*); prior to commencement of any grading or servicing or prior to the final approval (registration) of the Plan of Subdivision (*Detailed Vegetation Plan*) whichever comes first.

A.2.1.10 Streetscape Plan and Urban Forest Soils Report

Refer to Section M, Urban Forest - Tree Planting & Establishment. The requirements of Section M are to be adhered to and may vary depending on the application's urban context.

A.2.1.11 Noise Study

A noise study may be required in support of a development application. Refer to Section C.20 of this manual for further information.

A.2.2 Application Submission and Review

An application for a Draft Approval of a Plan of Subdivision is submitted to the Planning Division. This submission will include plans, studies, reports and other materials as identified through the Pre-Submission Consultation. Once the application is deemed complete, it will be circulated to the various review authorities for comment.

Upon completion of the review, Planning Staff will provide a post-circulation letter outlining all comments, questions, concerns and other matters, which may require resolution. A post circulation meeting(s) may also be arranged. Resolution of issues may require resubmission of materials, additional work and studies be undertaken, and revisions to the proposed Draft Plan. Commenting authorities may also require and request certain conditions of Draft Approval, which will be provided to the Planning Division.

A.2.3 Draft Approval

Once issues have been resolved, the Planning Division will prepare a Planning Report containing a Recommendation to the Committee of Council dealing with Planning matters. This report will include the Conditions of Draft Plan Approval. The Conditions of Draft Plan Approval outline the work that must be completed by the Subdivider, prior to certain milestones (typically prior to grading, servicing, registration, issuance of building permit).

Once the decision on the proposed Draft Plan of Subdivision is finally approved, the Subdivider may request that the Subdivision Agreement be prepared. Once fully executed it will be registered on title.

A.2.4 Modifications to Draft Plan Approval

A Subdivider may make a request to the Planning Division to modify a Draft Approved Plan of Subdivision, or the Draft Approval Conditions. Application forms and submission requirements are available on the [City of Kitchener Plan of Subdivision website](#). The process associated with the modification will vary by the complexity and nature of the requested changes. For more information, please contact the Planning Division by phone (519-741-2426).

A.3 SUBDIVISION AGREEMENT

Following the lapse of the Draft Plan Approval appeal period (20 days), the Subdivider may contact the City's Legal Department to request preparation of the Subdivision Agreement for signature. Once fully executed, the Subdivision Agreement will be registered on title. The Subdivision Agreement must be registered prior to approval of Pre-Grading or Pre-Servicing.

A.4 RELEASE FOR REGISTRATION

Prior to Registration of the approved Draft Plan of Subdivision, the Subdivider is required to fulfill conditions of Final Approval as included in the Council Approved Conditions of Draft Plan Approval. At the time of registration lots, blocks and roads are created, any parcels that are to be dedicated to a public authority will be conveyed, and easements are transferred. Registration is required prior to the issuance of Building Permits. For more information regarding the Release for Registration please contact the Planning Division (519-741-2426).

A.5 ENGINEERING SUBMISSIONS

All required information listed below must be submitted with each engineering submission or the submission will be returned to the applicant. Each submission must be accompanied by a checklist confirming that the submission has been checked for completeness, accuracy, and includes all required items.

A.5.1 First Submission

Please visit the City's website [checklist](#) for all requirements of the first (1st) engineering submission after Draft Approval.

Development Engineering staff will circulate to City stakeholders and provide their response back to the Consultant within six (6) weeks.

A.5.2 Second and Subsequent Submissions

The second and subsequent submissions shall be a revision of the previous submission based on the City's and Agency's comments. The Consultant shall submit the subsequent submission(s) to Development Engineering staff once the revisions have been made. A letter addressing the comments, concerns and a description of any additional changes should be included. The City will provide response to these submissions within four (4) weeks.

The Consultant shall circulate the second submission (after all revisions from the first submission have been addressed) to all utility companies for comment and provide Development Engineering copies of the letters sent as part of the complete second submission.

A.5.3 Final Submission

After final approval by the City of the submissions, the following is required:

- Two (2) complete sets of drawings;
- Two (2) complete sets of drawings in 11 x 17 format;
- Two (2) mylar sets of grading plans;
- One (1) complete set of sewer design sheets;
- One (1) digital copy of all drawings in *.PDF format.

The above are required for approval of the engineering drawings. Approved engineering drawings are a single requirement for construction approval. For construction approval requirements refer to Section A.10.

A.5.4 Digital Document Submission

Engineering will accept the following documents in PDF format:

- Water Distribution Reports
- Final SWM Reports (Digital and Hardcopy required)
- Geotechnical Reports (Digital and Hardcopy required)
- Hydrogeological Reports (Digital and Hardcopy required)
- Hydrological Reports (can be included in the SWM report)
- Archaeological Reports
- Environmental Reports and Environmental Impact Studies
- Environmental Site Assessment
- External Correspondences (Ex. GRCA, Hydro, etc.)
- Noise Reports
- MOE Approvals

Electronic documents (i.e. dwg, docx,) must be converted directly into a PDF format for submission so the file is word searchable and resolution is maintained. Hand-drawn plans and manual calculations must be scanned, and skewing prevented. Scan those documents in full 300 dpi colour. Scanned documents that are prohibitively large may be rejected. Non-compliant submissions will be returned to the sender.

A.6 PRE-GRADING REQUEST

It is preferred by the City that area grading occur after registration of the plan of subdivision and approval of the grading drawings. However, the Subdivider may make a request to grade the subdivision lands before the registration of the plan of subdivision has occurred. This request requires the registration of the Subdivision Agreement and is only permitted after Draft Plan Approval has been granted. The Director of Engineering Services may authorize the pre-grading subject to conditions outlined in the Subdivision Agreement and the Approval to Area Grade Checklist in Appendix F.

Where the property to be graded is adjacent to, or is designated under the Ontario Heritage Act, or listed on the Heritage Kitchener Inventory of Historic Buildings or listed as a non-designated property of cultural heritage value or interest on the Municipal Heritage Register, pre-grading shall not be authorized until approval is obtained by the Director of Engineering in consultation with the Director of Planning. All pre-

grading can commence once Development Engineering has issued a letter to the Subdivider's Consultant allowing them to pre-grade.

A.7 PRE-SERVICING REQUEST

The Subdivider may proceed to service the proposed subdivision in advance of the registration of the Plan of Subdivision provided a subdivision agreement has been registered and after Draft Plan Approval. The Subdivider's Consultant shall make a written request for pre-servicing to Development Engineering and is subject to the fulfillment of the Approval to Service Checklist in Appendix F.

Planning will provide clearance for pre-servicing to Development Engineering once satisfied that all items in the subdivision agreement and in the checklist are met. Development Engineering staff will issue a letter to the Subdivider's Consultants allowing them to pre-service. Pre-servicing is at the Subdivider's risk and any changes required are at the Subdivider's expense.

Servicing approvals will expire after two (2) years of the issuance date for those works which have not been completed under the approval. The Consultant will be required to ensure any environmental compliance approvals issued by the Ministry of Environment are up to date.

A.8 PLANS AND DRAWINGS

A.8.1 General Drawing Requirements

All drawings shall have the following:

- a) List 30T and 58M numbers if applicable;
- b) Legend;
- c) All works shall be performed in reference to an official geodetic control monumentation. All drawings referring such work shall also reference the geodetic control used in the subject work;
- d) A local benchmark note shall appear in each drawing;
- e) Existing information shall be shown in background or light line weight;
- f) Proposed information shall be bolded or foreground line weight;
- g) North arrow shall be referenced on all drawings;
- h) Chainage on a plan-profile shall increase from left to right;
- i) Plan and Profile drawings to have a key plan drawn to 1:10000 scale;
- j) All drawings are to be stamped and signed by a registered Professional Engineer, Landscape Architect or relevant professional as required;
- k) All Lot Grading Plans and Erosion Sedimentation Control Plans shall be certified by the Environmental Consultant/Landscape Architect as per the Tree Management Policy.

A.8.1.1 Title Sheet

The Title Sheet will include the following:

- a) Name of the Development;
- b) Name of the Subdivider;
- c) City of Kitchener logo;
- d) Name of the Consulting Engineer;
- e) Key Plan at an appropriate scale indicating the location of the proposed development and the proposed new street alignment;
- f) Index to each drawing constituting the complete set indicating drawing number and title;
- g) Approvals (30T and 58M numbers if applicable), and

- h) Submission type and description i.e. Area Grading versus Servicing, update block and stage identification to match the most current approved plan of subdivision and 1st Submission, 2nd Submission, etc.

A.8.1.2 General Plan of Services

To a scale of 1:1,000, unless otherwise approved by the City, showing the following:

- a) Roads, blocks, lots and their numbers;
- b) Sanitary and storm sewers including pipe diameter and direction of flow and SWM facilities (where applicable);
- c) Watermains, hydrants and valves;
- d) Maintenance holes and catchbasins;
- e) Culverts and easements;
- f) Existing streets and services surrounding the development and their relation to the proposed work, and
- g) Location and description of all available benchmarks.

A.8.1.3 General Notes Sheet

This Sheet shall list the following notes:

- General City of Kitchener design criteria and construction specifications that apply to all sheets. The pertinent notes for the project can be extracted from the design criteria chapter (i.e. lot service, pipe sizes, curb type, catch basin grate type, etc.);
- Special warnings from utility companies and government agencies (i.e. existing structures and buried services), and
- General City policies and by-laws which apply to the construction activity (i.e. hours of work, mud tracking, fire permits, construction access, etc.).

A.8.1.4 Traffic Control Plan

Traffic Control Plan(s) to be drawn to a scale of 1:1,000 or larger and shall show proposed land uses (e.g. Residential, commercial, parks etc.), road layout, sidewalk, bicycle paths, bicycle lanes, multi-use trails, entrances to parks and open space areas, signage for bicycle circulation, pedestrian routing, storage and tapers for turn lanes, traffic control signs including stop bars and other painted lines, on-street parking (0.5 parking spaces per lot) and any traffic calming measures (if proposed/required).

A.8.1.5 Urban Forest Asset – Streetscape Plan

Urban Forest Asset – Street Tree Planting Plans are to demonstrate and provide planting locations for trees within the public realm. This plan must clearly show the soil volumes available to each tree, their species and locations. The Urban Forest Asset – Street Tree Planting Plan is to be a scale of 1:500.

Refer to Section M of this manual for all tree planting and soil habitat soil zone requirements.

A.8.1.6 Signal Wiring Plan and Signalized Intersection Plan

In coordination with the Region of Waterloo, should traffic signals be required, a separate Signal Wiring Plan; and Signalized Intersection Plan showing location of all poles and mounted hardware, hand wells, ducts/cables, the controller, and full turn lanes (storage and taper). The plans shall be submitted at a scale of 1:500.

A.8.1.7 Staging Plan

If a phase within a plan of subdivision is to be developed in stages, a Staging Plan showing current and future stages is to be prepared at a scale of 1:1,000, unless otherwise approved by the City. The City

may request specific scales in order to create composite plans with other developments. If this information can be clearly shown on the General Plan of Services, the two drawings can be combined.

The Staging Plan's function must be substantiated with an interim Stormwater Management and Transportation Report (and other reports as required by the City).

A.8.1.8 Sanitary Drainage Area Plan

To a scale of 1:1,000, unless otherwise approved by the City, showing the following:

- a) Proposed sanitary sewers, maintenance holes and appurtenances, indicating grade, pipe size, length of each section of pipe and direction of flow;
- b) Drainage areas within the development and the limits of outside areas within the development and the limits of outside areas draining into the proposed system, and
- c) Catchment area in hectares, direction of flow and section population or population density shall be indicated on all drainage areas.

A.8.1.9 Storm Drainage Area

Storm drainage plans are to be drawn to a scale of 1:1,000 or larger. If large external drainage areas affect the development, a separate External Drainage Area Plan is to be produced. The Plan should be to a scale of 1:5,000 and indicate the total area to be drained by the proposed storm sewers. The Storm Drainage Plan is to be compatible with the Grading Plan and must indicate the following:

- a) Existing contours (0.5 m intervals);
- b) Drainage patterns of adjacent lands and a breakdown of contributing external areas;
- c) The run-off coefficients and area of tributary areas internal and external to the development for each section of the storm sewers within the development;
- d) Direction of run-off (overland flow), including emergency overland flow routes;
- e) Street names;
- f) Manhole and Catchbasin numbers;
- g) Sewer sizes – Diameter and length;
- h) Grade and directions of flow in the sewers;
- i) Any infrastructure off of the right of way to be accepted by the City e.g.: rear lot catchbasins or swales, on lots, parks or blocks, required to accept storm runoff, and
- j) Complete major and minor storm systems.

A.8.1.10 Park, Open Space, Multi-Use Pathway Development and Grading Plans

Park/Multi-Use Pathway Development Plans are to demonstrate that the proposed park facility program, including buffers, can be satisfactorily achieved. Both Park/Multi-Use Pathway Development Plan and Park/Multi-Use Pathway Grading Plan are to be a scale of 1:500. Refer to Section L of this manual for all specific design requirements.

A.8.1.11 Lot Grading Plans

Grading plans for all lots and blocks are to be drawn to a scale of 1:500 showing existing contours (0.5 m intervals), established from elevations taken in the field.

Grading plans will only be reviewed in conjunction with the submission of servicing and SWM design details. The overall subdivision grading plan is to include enough elevations and grades on the interior of blocks to illustrate how the surface drainage will be managed/directed until it is later developed through the Site Plan process. This design must consider drainage impacts from these large contributing block areas during this interim condition period, which could have negative affects to existing/future houses and roads. Positive drainage is required on the block itself to ensure water is not ponding. Where

required, catchbasins/ditch inlets/hickenbottoms are to be installed on the blocks in order to capture this surface flow before it is directed onto the road. These structures are placed on private property, without easements, connected to the storm services which are to be provided to the block through the road servicing. The structures are temporary and will be removed when the site is developed.

The City would like to see grading plans without retaining wall construction in new developments. Sometimes it may be necessary to have retaining walls on multiple properties that are reliant on one another and to meet parkland and trail grading requirements. Retaining walls spanning more than one private property are to be avoided if possible and shall be considered only if there is a mechanism in place to ensure long-term maintenance and future repairs by the landowners. The Building Division should be contacted where a retaining wall permit is required.

Where a retaining wall is designed adjacent to public property, the wall shall be placed on the private property side of the property line. Retaining walls on or adjacent to public property shall be designed with a minimum design life of 75 years, through an approved wall design sealed, signed, and dated by a qualified Structural Engineer. The construction of the retaining wall shall be inspected and certified by a qualified Structural Engineer. Where the wall is adjacent to a structure or building, a minimum of 1.2 m clearance must be provided between the face of the retaining wall and the face of the building or structure. Retaining walls exceeding 0.6m in exposed height shall be protected by guards on all open sides where the public has access. Guards shall be installed on the retaining wall as per Standard Drawing 507, OPSD 972.132, OPSD 980.101, or as approved by the Director of Engineering. The Subdivider will be responsible to provide a letter of credit for the retaining wall as outlined in the Development Agreement and shall guarantee the retaining wall for a period of two years after City acceptance of the structural certification.

Retaining walls are to be constructed on private property unless approved otherwise by the Director of Engineering.

Where a retaining wall is on private property a clause shall be included within the Development Agreement which will be registered on title of the affected Lots. Said agreement shall implement the following clause with respect to the retaining wall located on these lots and must be included in all offers of purchase/sale and tenancy agreements:

“Purchasers/tenants are advised that a retaining wall is located at the rear/side of this property. The owner of this property owns his/her section of the retaining wall. The retaining wall is not in public ownership. Monitoring, maintenance, inspection, repair and replacement of this retaining wall, including any associated costs, are the sole responsibility of the property owner. The City of Kitchener has no responsibility for this retaining wall. Should this retaining wall fail, it is the property owner’s responsibility to repair or replace his/her section of the wall, at his/her cost. If the repair and/or failure of the retaining wall is deemed by the City to be a public safety hazard, the city will issue a work order on the affected property. If the repair/replacement of the retaining wall is not started and completed as outlined in the notice, the City will undertake and complete the work. The cost of the work will be added to the property’s taxes.”

Existing Elevations shall be shown at:

- a) The corners of each lot and block;
- b) External elevations extending to a minimum 30m perimeter external to the Plan;
- c) Overland flow direction for external drainage;

- d) The base of all large trees 10cm or more in diameter plus their drip line, and the composite drip line of all contiguous vegetated areas such as woodlands, hedgerows, etc. (see *Tree Management Policy* for specific requirements), and
- e) Regular intervals within any woodlands or other natural blocks where deemed necessary to determine the effect of grade change on tree preservation.

Proposed Elevations shall be shown at:

- a) Intervals along the centreline of all proposed roads (maximum 20.0 m spacing); the slope of each road section is to be noted;
- b) All high points (split drainage, rear and side yards, top and bottom of slopes);
- c) The corners of each lot and block;
- d) The front and rear of each building;
- e) 15.0 m intervals along cut-off swales and ditches;
- f) The top and bottom elevation of retaining structures;
- g) Any other points necessary to properly represent the proposed drainage scheme including tops of catchbasins and bottoms of swales and associated easements;
- h) Critical transition points adjacent to walkways or existing lots or (provide section details where useful);
- i) Accessible ramps, and
- j) Top of grate elevations for rear yard catchbasins.

Other Required Information shall show:

- a) Lot fabric and dimensions;
- b) Driveway ramp locations;
- c) Easements;
- d) Blocks and lot numbers;
- e) Surface features including road structures (catchbasins and manholes, fire hydrants and valves, telecom pedestals, hydro transformers and streetlights);
- f) Direction of gutter flow at intersections;
- g) Direction of overland flow routes including points of outlet and ponding limits for the 100-year event;
- h) Label all lots with a drainage type and refer to a detail on the detail drawings;
- i) Label all lots that will have infiltration facilities and other characteristics like structural fill or pressure reducing valves;
- j) Indicate existing trees and proposed tree saving limits; indicate provisions for the preservation of any existing trees where identified for retention (see requirements of the *Tree Management Policy*);
- k) Detail retaining walls and structures where required, including top of wall and bottom of wall elevations;
- l) Show all fencing, easements and noise attenuation structures;
- m) Indicate the regulatory flood limits of watercourses;
- n) Provide percent grade where swales are at a minimum slope or are otherwise critical;
- o) Specify run vs. rise ratio where slopes are created with a slope greater than 10% (**Note:** maximum slope = 3:1);
- p) Minimum underside of footing elevation for lots close to groundwater;
- q) Slopes and slope arrows alongside lot lines;
- r) Signature block for City approval within the title block;
- s) Environmental Consultant certification as per the *Tree Management Policy*, and
- t) Soil habitat zone for street trees.

Should there be changes made to the Grading Plan, the Consultant shall submit the updated Overall Grading Plan to Engineering for Approval.

A.8.1.12 “Plan and Profile” Drawings General Requirements

- a) All plan and profile drawings are to be drawn at scales of
 - i. 1:500 horizontally
 - ii. 1:50 vertically
- b) The sewer, storm and watermain profiles shall be drawn so that each street and easement may be filed separately;
- c) Refer all datum to a benchmark of geodetic origin;
- d) Show all existing and proposed lot numbers and blocks;
- e) Show all existing and proposed curbs, road allowances and street names and indicate it as such;
- f) Show all existing sidewalks, walkways, and trails;
- g) Where two or more sheets are required for one street, match lines must be used and there are to be no overlaps or duplication of information;
- h) Where intersecting streets are shown on a plan and profile drawing, only the diameter of the pipe and direction of flow of the intersecting sewers are to be shown. This also applies to easements for which a separate plan and profile drawing has been drawn;
- i) Pavement designs for the roadway are to be indicated on the plan and profile drawing or on the General Notes Plan;
- j) Boreholes should be located on the plan. The detail information from all the borehole logs is to be plotted on the profile and should contain a brief description of soils and the water level, and
- k) Where roundabouts are provided, the drawing shall indicate detailed design dimensions including radius, lane width, etc. The roundabout design shall be in accordance with the Region of Waterloo and the TAC Design Manual.

Plan View

The following information and details are to be included:

- a) Street names;
- b) Block/lot number and frontage dimension;
- c) Block/lot type (single, semi, multiple);
- d) Servicing locations for storm, sanitary and water;
- e) All existing (as needed) and proposed sewers and watermains, manholes, catchbasins (incl. inverts);
- f) Third pipe systems;
- g) Valve chambers;
- h) Hydrants;
- i) Sidewalk;
- j) Centreline chainage (every 20.0 m);
- k) Road allowance and pavement dimensions;
- l) Curb radii;
- m) Easements;
- n) Reserves;
- o) Road sections where clarification is required;
- p) Detail gutter grades on large radius bends (ensuring the minimum 0.5% can be achieved), and cul-de-sacs (minimum 1.0%);
- q) Light standard and transformer locations, and

- r) Type, length, slope and diameter of the sewers.

Profile View

- a) Existing and proposed watermain, sanitary and storm sewer including the diameter, length, material grade and class of pipe;
- b) Where possibility of a conflict with other services exists, connections are to be plotted on the profile (i.e. watermain);
- c) Dimension the depth of cover for watermain;
- d) Indicate the road profile, existing and proposed. Any structural fill areas are to be hatched in;
- e) Provide centreline chainage and elevations. Indicate the elevation at grade changes and provide the slope and length of each section;
- f) Provide all vertical curve data on the top of the profile view;
- g) Provide existing (as needed) and proposed manhole information, including type which shall be shown in detail on the Detail drawing sheet, pipe inverts at entry and exit, and drop structure details. Indicate safety platforms and elevations where required;
- h) Provide detailed information for all outfalls external to development, and
- i) Borehole data including soils and water table.

A.8.1.13 Streetlighting and Electrical Distribution Drawings

To a scale of 1:1,000 showing the following:

- a) Roads, lots and their numbers;
- b) The position of all new light standards within the development;
- c) The position of existing light standards surrounding the development and their relation to the proposed work, and
- d) A detail of and tabulated specifications for the type of luminaries proposed.

Streetlighting designs including ornamental to be as per Section H of this manual. All electrical, street and ornamental lighting design will be done with awareness to the proposed street tree locations and the minimum tree planting and soil volume requirements identified in Section M. Temporary hydro pole locations shall be approved by Kitchener-Wilmot Hydro in conjunction with the Engineering Consultant.

A.8.1.14 Detail Sheet

These drawing sheets should comprise of detailed drawings of any detail referenced on any of the preceding drawings or any additional drawing.

Grading details and Engineering details shall be shown on separate drawing sheets. Grading detail drawings shall include details with respect to lot grading type, swales, etc. while Engineering details drawings shall include manhole types, infrastructure details etc.

A.8.2 Coordination of Drawings

In accordance with Section c.15 of the [Urban Design Manual](#) the Professional (Civil) Engineer, will be required to certify that the Landscape Plans and the Site Grading, Drainage and Erosion Control Plans, as well as associated Details Plans are coordinated. Conversely, the Landscape Architect will be required to certify the Engineering Plans.

A.9 FEES AND SECURITIES

A.9.1 Cost Estimate

An itemized cost estimate (Schedule D of the submission documents) for the construction of all works in the standard form is required along with a breakdown of any items designated to be cost-shared.

A proposed construction schedule for all construction activities is to be provided to Development Engineering staff. During the progress of the work, any revisions to the original schedule shall be forwarded to the City.

A.9.2 Engineering Fees

The total Subdivision Engineering fees for services provided by the City are to be determined as a percentage of the final estimated construction costs. The percentage to be used is stated in the Subdivision Agreement. These fees shall cover City staff review, processing and inspection time.

Initially the Consultant will determine the preliminary construction cost estimate at the time of first Engineering drawing submission. One half of the calculated Engineering Fees derived from the cost estimate will be submitted to Development Engineering Staff, in the form of a cheque made payable to the Corporation of the City of Kitchener along with the first submissions drawings.

Prior to final approval of the Engineering drawings, the Consultant shall provide a copy of the executed contract for the construction. The remaining Engineering fees to be submitted to Development Staff is calculated as the percentage of the actual contract cost less the Engineering fee paid upon first submission.

A.9.3 Parkland Dedication – Cash-in-Lieu

Refer to Council Approved Parkland Dedication Policy. Lands acceptable to Parks and Cemeteries must be dedicated to the City for park purposes, free and clear of any encumbrance. Undeveloped land, stormwater management facilities or hazard lands will not be accepted as parkland dedication as such lands cannot be developed for active park purposes and may be unsafe for recreational uses. Lands must be dedicated upon registration of the plan of subdivision.

Details regarding the development of Parklands and Multi-Use Pathways can be found in Section L of this Manual.

In cases where parkland dedication is impractical, cash in lieu of parkland dedication may be acceptable. This is at the discretion of the City in accordance with the Planning Act. The Subdivider is responsible to provide the City with a valuation report from a competent and qualified appraiser approved by the City.

A.9.4 Perpetual Maintenance Fees

The City shall collect 'Perpetual Maintenance Fees' from Subdividers when a Subdivision Agreement is entered into for landscape design elements placed on City Property. These 'Fees' are required to offset costs of long-term maintenance, potential removal, and/or replacement. Maintenance Fees will be applied to design elements in the landscape, including but not limited to, subdivision entry features/walls, decorative perimeter fencing, and planted traffic islands.

The 'Fee' will be held specifically to pay for maintenance, removal and/or replacement of those elements ultimately assumed by the City. The 'Fee' amount is based upon the type of materials utilized in the construction of the element. The 'Fee' will be collected as cash or certified cheque and will be non-refundable. The City will have the ability to remove the design element if, after assumption of the Subdivision, the design element maintenance costs are exceeded. Warning clauses in purchase and sale agreements are necessary to ensure the future Homeowner is made aware of this.

Any of these elements must be itemized separately within the landscape cost estimates.

The Subdivider is required to maintain these landscape elements until the subdivision servicing is completed and all lots within the subdivision are sold. At that time the City will assume maintenance responsibility.

All tree planting for landscape design elements will meet all tree and soil habitat zones requirements identified in Section M of this Manual.

The Subdivider shall pay the City the estimated cost to maintain the feature for 5 years following the acceptance by the City, **AND** half the cost to replace the feature (based on installation cost).

A.9.5 Insurance

The Contract Document shall include: all addenda and the Form of Tender, an insurance certificate addressed to the City of Kitchener with five (5) million dollars liability insurance with the City (and other affected local authorities and Consulting Engineer all named as additional insured), contain a 30day written cancellation notice, and Workplace Safety and Insurance Board.

In addition to the above, the Engineering Consultant shall submit an insurance certificate addressed to the City of Kitchener with: five (5) million dollars liability insurance with the City (and other affected local authorities named as additional insured), 30 day written cancellation notice, described for the particular project.

A.9.6 Security Requirements

The Subdivider shall deposit with Development Engineering 60% security of the total actual construction costs of all the works, including the Consultant engineering fee and contingencies costs plus applicable taxes, in the form of:

- An irrevocable Letter of Credit satisfactory to the City Treasurer from any financial institution approved by the City Treasurer in accordance with City Policy **or**
- Cash **or**
- Certified cheque.

When a cash deposit is given, the City Treasurer shall deposit same in a chartered Bank or subject to Section 286(1)(b) of the Municipal Act, 2001, as amended, in any similar financial institution.

Should the Subdivider fail to complete the works or fail to pay for works completed, the City shall draw upon the deposited security for the purpose of paying these costs.

The Development Engineering staff shall, from time to time, review the security deposited by the Subdivider and the City may, from time to time, demand an increase in the sums deposited in accordance with the increase in the actual cost of performing the works required. The Subdivider shall

deposit such further and other sums as the City deems reasonably necessary to ensure the completion of the outstanding works.

A.9.6.1 Security Reductions

Security Reductions may be requested throughout the construction of the subdivision. Each reduction must be made in writing to the City and will not be utilized until inspections of the works have been completed and any deficiencies repaired to the satisfaction of the City. Upon request the Developer may be required to provide proof of payment to the contractor involved to the satisfaction of the City's Director of Engineering.

A.9.6.2 Letters of Credit

Initial Reduction

The initial reduction of the Letter of Credit shall be to 15% of the total value or to \$25,000, whichever is the greater and shall occur after initial acceptance of works. Only two (2) reductions to the Letter of Credit per stage will be permitted a year. A fee of \$1,000 will be applied for each additional Letter of Credit reduction after the permitted yearly amount.

For further information, please see Section A.12 of the Manual.

Final Reduction

The final reduction of the Letter of Credit shall be to zero dollars and shall occur after Final acceptance has been issued by the City.

A.9.6.3 Stormwater Management Ponds

Where a new subdivision will outlet to an existing or proposed SWM pond, a cleanout maintenance security will be required, and will form part of the Subdivider's Letter of Credit. The amount required for the maintenance security will be Development Engineering's estimated cost to clean out the pond one (1) time. Additionally, new subdivisions outletting to an existing SWM pond will be required to add the estimated cost to flush the storm sewers up to the SWM pond one (1) time. The estimated cost will be based on the City's current sewer flushing rate per meter of pipe.

A.10 CONSTRUCTION

Prior to any Servicing works starting on-site, the Consultant must receive a servicing approval letter signed by the Manager of Development Engineering. This letter will also provide formal approval of the Subdivider's Contractor, and the Engineering Design. Once clearance of the items found on the checklists found in Appendix F have been finalized, the Development Engineering staff will recommend issuance of the servicing approval letter from the Manager of Development Engineering.

Note, not all of the clearances may apply to all projects. The clearances may occur after or simultaneous to the Final Drawing Submission (see Section A.5.3). Prior to the start of construction, the Subdivider's Consulting Engineer shall arrange for a preconstruction meeting with City staff in attendance.

* One (1) complete original set of executed contract documents including tender form and specifications with insurance certificate and City of Kitchener named as additional insured, plus one (1) photocopy of this complete document.

** City signature is required for MOE approvals. A signed MOE application as per the MOE submission form for each Storm Sewer, Sanitary Sewer, and Stormwater Management facilities is to be submitted to Development Engineering for sign off.

*** Record of Watermains Authorized as a Future Alteration. The prescribed fee must be payable to the City of Kitchener.

A.10.1 Road Closures/Detours

Where a development requires the closure of a City street or detouring of traffic, a Road Closure/Detour Work Permit is required prior to commencement of the related works. In order to obtain this permit, the following process will apply:

Notification to the City's Traffic Project Coordinator, Transportation Services by the Consultant/Contractor as early as possible to schedule any road works/impacts on the neighbourhood and advise of upcoming works (this includes letter of notification to existing adjacent residents). Please visit the City's [road construction website](#) for all relevant information and process.

A.11 INSPECTIONS AND TESTING

A.11.1 Inspection Form

Daily Inspection and Monitoring reports from the Consulting Engineer shall be submitted to Engineering Services prior to the certification of works. The diary must at a minimum contain the following information:

- Weather Conditions;
- General Progress of Work; where the Contractor is working and what he is doing;
- Equipment being moved or arriving on the job and its purpose;
- Visits to the site by the City or Regional Officials and any specific instruction they may have given;
- Instructions given to the Contractor;
- Contractor's claims or complaints;
- Compaction efforts for trench backfill, granular road bedding and asphalt;
- Trench conditions;
- All discussions or dealings with Property Subdividers;
- Work performed on the site involving the installation of public utilities;
- Stoppage of work by the Contractor with full description of why the work stopped;
- Extra works and miscellaneous happenings;
- Complete descriptions of how excavations were executed, type of equipment used and difficulties due to either improper equipment or nature of material;
- Indicate where all fill materials came from, such as the lot or station of the cut or name of the borrow site;
- Number of loads of material where possible without consulting with the Weighman on the Contractors records;
- All equipment that is on site must be recorded;
- The actual hours worked;
- The actual hours not worked;
- The actual area of work;
- Location and length of time of any stoppages;
- Particular attention must be taken with watering equipment and the number of loads of water applied per day must be recorded as well as the number of hours the equipment worked;

- The time of arrival and departure of the Consultant’s Inspector, and
- All pertinent information relating to Quality Assurance of the works.

A.11.2 Inspection Checklist

The Inspection Checklists shall include:

- Daily Report for full time inspection;
- Part time inspection report;
- Weekly Report;
- Erosion and Sediment Control Inspection Report, and
- Water System Inspection Report.

A.11.3 Typical Deficiencies

Below is a list of typical deficiencies that could be requested for repair or replacement (**Note:** deficiencies are not limited to the items listed below):

Table 1: TYPICAL DEFICIENCIES	
Items	Deficiencies
Sidewalks	<ul style="list-style-type: none"> • Cracks • Chunks missing • Heaving • Settlement/ponding • Spalling, blisters, pop-outs, flaking/scaling • Trip hazards >19mm • Marks in the surface of the concrete e.g.: names, footprints, scratches etc. as per OPS 351.07.09. 2001Amending O.Reg 239/02) • Overall sidewalk thickness • Blind markings • Insufficient truncated dome plates at crossings (to cover full drop)
Boulevards	<ul style="list-style-type: none"> • Dead grass • Stones/ rocks in the boulevards • Settlement • Improper grading (ie. “humping”) • Approved growing medium thickness • Rutting/depressions
Curb and gutter	<ul style="list-style-type: none"> • Cracks • Chunks missing • Heaving • Settlement/ponding • Gouges deeper than 1 inch in the face of the curb • No sections of curb shorter than 3 feet (1m) remaining as a result of curb repair • Saw cutting <1m apart as a result of a curb repair • Sections of missing curb at tie-ins • Insufficient temporary asphalt curbing
Driveway ramps	<ul style="list-style-type: none"> • Settlement in the top of the driveway ramp and the sidewalk or curb >19mm

Table 1: TYPICAL DEFICIENCIES	
Items	Deficiencies
	<ul style="list-style-type: none"> • Heaving • Overall ramp thickness • Cracking, chunks missing, spalling, blisters, popouts, flaking/scaling • Insufficient apron flaring
Base asphalt & surface asphalt	<ul style="list-style-type: none"> • Cracks in the asphalt such as progressive edge cracking, alligator & bleeding • Grass/ weeds growing at the edge of the asphalt between the curb and asphalt • Settlements/dips in the asphalt • Rutting • Corrugations/shoving • Potholes • Ravelling • Polished aggregates • Aggregate segregation • Failed test results • Full area repairs are to be completed as marked and agreed by City staff and Consultant • Minimize repair joints/edges for reflective cracking (square up repair areas) • Overall pavement thickness • Asphalt breaking up around self-adjusting frames • Winter paving – not meeting OPS temps, paving on ice and snow • Crossfall grades • Grade matching at curb • Ramping base asphalt to finished grade at all pedestrian crossings • Centreline joint cracking • Settlement at structure adjustments • Self-levelling castings not being used
Sanitary pipes, Storm pipes and CCTV Inspection Reports	<p>As per NASSCO's Pipeline Assessment & Certification Program</p> <ul style="list-style-type: none"> • Cracks • Fractures • Sags • Broken pipes • Deformed pipes • Joint offsets or separation • Debris, blockages • Out of specs CCTV Inspection Report: foggy, no surveying/stopping at a service, no zooming in on a deficiency, camera not centred • Benching must be completed prior to videoing • Poor/unreliable mandrel testing equipment (damaged/bent)
Sewers Structures	<ul style="list-style-type: none"> • Debris, gravel, concrete, asphalt, broken moduloc, etc. inside the structures • Concrete on ladder rungs • No benching

Table 1: TYPICAL DEFICIENCIES	
Items	Deficiencies
	<ul style="list-style-type: none"> • Benching finish • No moduloc tape • Moduloc not per OPSD • No parging at casting or structure • Not using round moduloc for a round opening • Not using square moduloc for a square opening • Do not parge covered moduloc • Broken moduloc sections • More than 3 sections of moduloc at surface asphalt • Missing ladder rungs • Incorrect frame and cover • Damaged/broken frame and cover • Infiltration
Trees	<ul style="list-style-type: none"> • Wounds • Trees planted too deep or high • Poor tree vigor due to inadequate watering • Mulching deficiencies (i.e. volcano, insufficient depth, etc.)
Watermains	<ul style="list-style-type: none"> • Cracks • Fractures • Leaks • Valve boxes broken/chipped • Wrong number of turns on valves, hydrants etc. • Tracer wire – provide continuous loop, not attached to fitting or fire hydrant • Hydrant colouring • Break-away flanges at grade • Greasing of hydrants • Road levelers are NOT permitted • Internal threaded top sections are NOT permitted • Main line valves and water box services not plumb • No pre-cast thrust blocks • Cathodic protection not installed • Fire hydrant not draining • Valve guide plates are to be removed • High heads (key is to be at a normal operating height) • No clear stone • Proper 3 stage Denso wrapping of all metallic appurtenances MUST be completed • Frost collars missing (waterboxes) • Set screw extensions are NOT permitted • Red-line drawing submissions to Kitchener Utilities

A.11.4 Reports Submission (Digital)

Engineering will accept the following documents in PDF format:

- E & S Inspection Reports
- Daily Inspection Reports
- Test Reports (Ex. Testing of granular materials, asphalt, concrete, etc.)

- External Correspondances (Ex. GRCA, Hydro, etc.)
- Acceptance Letters for above surface items only (Add Electronic Copy Only above the date of the letter)

Electronic documents (i.e. dwg, docx,) must be converted directly into a PDF format for submission so the file is word searchable and resolution is maintained. Hand-drawn plans and manual calculations must be scanned, and skewing prevented. Scan those documents in full 300 dpi colour. Acceptance Letters if scanned should have a resolution of 400 dpi colour. Scanned documents that are prohibitively large may be rejected. Non-compliant submissions will be returned to the sender.

A.12 INSPECTION AND LETTER OF CREDIT (LC) REDUCTION PROCESS

A.12.1 General

All subdivisions are subject to two inspections, Initial and Final. Engineering will charge the Subdivider for each additional inspection over the first four (4) inspections for the same stage. The four inspections are a sum of two (2) initial and two (2) final inspections, not four (4) for each. The cost of the charge is listed in the City's user fee schedule posted on the City's website and updated annually. Completion of repairs shall not exceed a maximum of six months in order to finalize an acceptance; all deficiencies are to be rectified:

1. Initial Inspection:

- *Purpose* – to ensure all underground services to base asphalt and surface works are built to City of Kitchener standards and to identify any structural or safety deficiencies which have to be rectified immediately at the Subdivider's expense. It also represents the time from which the Subdivider is responsible for the warranty of the constructed works until final inspection. This time period is also known as the Maintenance period. The Maintenance period starts the date package is accepted by Development Engineering. The Consultant has three months to submit the Initial Acceptance package to Development Engineering.
- *Timing* – inspection is performed once the installation of all underground services to base asphalt and/or surface works have been completed and prior to release of building permits. The Subdivider's Consultant initiates inspection request.

2. Final Inspection:

- *Purpose* – to ensure that all deficiencies or damage that has occurred within the maintenance period, as determined by the City staff, are identified and rectified at the Subdivider's expense. Once final acceptance has been given, the City assumes the infrastructures within the right of way and is responsible for its maintenance and replacement.
- *Timing* – Timing – inspection is conducted after a minimum two-year maintenance period and is initiated by the Subdivider's Consultant.

All inspections shall be coordinated through Development Engineering who will contact the required City Departments regarding inspection times and date requests. Due to winter conditions, no scheduled inspections will be conducted between December 1st and March 1st. Beyond these dates, weather depending, inspections may be arranged at the City's discretion. Items to be inspected must be 100% visible and clear of snow and ice.

All underground services are accepted on a stage by stage basis while all aboveground infrastructures are accepted on a street by street basis for both initial and final acceptance. If works within that stage or

street are not completed within the limits of a street in a stage, then that item will not be accepted at initial inspection or assumed at final inspection.

Kitchener Utilities will charge the Subdivider for each additional inspection over the first four (4) inspections for the same stage. The four inspections are a sum of two (2) initial and two (2) final inspections, not four for each. Please ensure all water valves, water boxes, hydrants etc. are in good working condition prior to requesting inspection of watermain services. The valves/hydrants/etc. can only be operated by Kitchener Utility staff, but a visual inspection can be completed as well as making sure the valve boxes are accessible, keys fit on, hydrants meet the standards (e.g. painting, break away flanges) prior to requesting an inspection of watermain services. During an inspection if it is apparent the Contractor/Consultant did not review the above-mentioned details prior to the inspection, the inspection will not continue. The Consultant needs to review the Watermain Inspection Guideline to understand what Kitchener Utilities looks for during an inspection.

A.12.2 Definitions

A.12.2.1 Underground services to base asphalt

This includes the following:

- Sanitary sewers, connections and it's appurtenances;
- Watermains, connections and it's appurtenances (valves, hydrants, water boxes);
- Storm sewer, connections and it's appurtenances;
- Groundwater collection systems;
- Front yard infiltration galleries (if applicable, refer to subdivision agreement and watershed requirements);
- Base asphalt;
- Granular 'A' and Granular 'B';
- Sub-grade preparation;
- Curb and Gutter, and
- LID Infrastructure

A.12.2.2 Surface works

This includes the following:

- Surface asphalt;
- Driveway ramps;
- Islands including sodding;
- Boulevards including sodding;
- Trees & Soil Habitat Zone;
- Sidewalks;
- Fences;
- Geodetic Monumentation;
- Walkway blocks;
- Traffic signage;
- Noise barriers, and
- Parks and Open Spaces
- Trails
- Landscaping Works
- Maintenance Access (natural areas and open spaces)

A.12.3 Initial Inspection and 60% Letter of Credit Reduction Process

Step 1: Subdivider's inspection

Participants: Subdivider
Consultant
Contractor

Once the underground and/or above ground infrastructures have been installed, the Consultant will inspect said infrastructure for completeness and adherence to the City of Kitchener specifications and standards. Any deficiencies in terms of incompleteness of the works or deviations from the approved plans noted by the Consultant shall be reported to the Subdivider who shall endeavour to hire a qualified Contractor to rectify noted deficiencies to the Consultant's satisfaction.

Once the Consultant is satisfied that all noted deficiencies have been rectified and that the works, especially all sewers, manholes and catchbasins have been parged and cleared of debris, the CCTV can take place, and an inspection request shall be sent via email to Development Engineering Staff.

Step 2A: Underground services to base asphalt and/or Stormwater Management Facility onsite inspection

Participants: Consultant
City Staff (Development Engineering, Operations (as required), SWM Utility, Kitchener Utilities, Parks and Cemeteries, Transportation Planning)

Once an email request for an onsite initial inspection has been received by Development Engineering Staff from the Consultant, Development Staff will endeavour to schedule an inspection date and time within two (2) weeks of receiving the request. In the inspection request, the Consultant shall include the following:

- 30T and 58M numbers and name of the Subdivision;
- list of specific items to be inspected on a street by street basis or as per Blocks;
- 8.5" x 11" drawings indicating the limits of the inspection, and
- Meeting location.

Development Engineering Staff will contact the required City Departments (Operations, Parks and Cemeteries, Transportation Planning, SWM Utility, Parks, and Kitchener Utilities) regarding inspection times and date requests. Once a time has been established, an email will be sent by Development Engineering Staff to the Consultant confirming the meeting time and location.

The Consultant and City staff (comprising of Development Engineering Staff and other as required departments) shall meet onsite at the determined time and location and will conduct a visual inspection of the catchbasins, manholes, base asphalt and curb and gutter to ensure that is has been constructed to the City of Kitchener standards and specifications and as per the approved drawings. Deficiencies will be marked in orange or white paint by City staff.

All structural and safety deficiencies will be noted by the Consultant and City staff and will need to be rectified prior to City approving works be put onto maintenance. A deficiency list shall be prepared and circulated by the Consultant to the Development Engineering Staff, within five (5) business days, which will be reviewed and agreed to by Development Staff. Any deficiencies of an aesthetic nature may be deferred until final inspection.

Catchbasins, manholes, valve boxes, etc. shall be flush to the base asphalt grade and will be raised once surface asphalt is placed. When demarcating curb repairs, Development Engineering Staff should ensure that there are no sections of curb shorter than 3 feet (1.0m) remaining as a result of curb repair.

The Consultant shall endeavour to coordinate the repairs and deficiencies by a Contractor within four (4) months of the deficiencies being noted. Once deficiencies have been repaired, City staff will be invited onsite again to inspect the repairs. If the time taken to repair the deficiencies is greater than four (4) months, then the re-inspection of all the infrastructure item that was repaired (on a street by street basis) is at the discretion of the Development Engineering Staff. This process will continue until the City Staff is satisfied that all structural and safety deficiencies have been rectified.

The Consultant shall send an email/letter to Development Engineering Staff, within five (5) business days of the onsite inspection, confirming initial acceptance of inspected works related to their particular department:

- Kitchener Utilities - acceptance of the water distribution system;
- SWM Utility – acceptance of SWM facility infrastructure;
- Engineering – acceptance of CCTV inspection, acceptance of the underground infrastructure and/or SWM facility infrastructure and above ground infrastructure;
- Parks and Cemeteries - acceptance of walkway blocks, landscaping, SWM facility landscaping, buffers, trees, etc.
- Transportation – street names, traffic signs and pavement markings

In addition to forwarding these emails/letters/Memos to the Consultant, Development Engineering Staff shall also follow up, within five (5) business days of the onsite inspection, with an email confirming in writing that items inspected have been accepted by City staff.

Consultants shall include these emails/letters/memos as part of the Maintenance Package to be submitted to the City.

Step 2B: Surface works onsite inspection

Participants: Consultant
City Staff (Development Engineering, Operations (as required), Parks)

Like Step 2A however surface works will be inspected. Refer to Section M for the inspection and acceptance for all tree planting and soil habitat zones identified.

Surface asphalt cannot be placed until the base asphalt and curb and gutter have been given final acceptance inspection clearance from Development Engineering, and 95% house build out is complete for the streets. Prior to placement of surface asphalt, all base asphalt and curb and gutter repairs are to be complete and inspected by Development Engineering. All manholes, catchbasins, valve boxes, etc. must be raised to surface asphalt grade. During the initial acceptance inspection of the surface asphalt, all structures within the roadway will be checked for proper adjustment including gas valves. Water service curb stops for the empty lots noted during the final acceptance of the underground works will be inspected as part of the surface asphalt initial acceptance, and any related deficiencies will need to be rectified prior to surface asphalt initial acceptance.

Step 3: Underground Servicing and Primary Road Works Maintenance Package

Participants: Consultant
City Staff (Development Engineering, Administration)

The Consultant shall submit a Maintenance Package, within four (4) months of receiving the emails from Development Engineering Staff confirming that inspected items have been accepted by City Staff. The package shall be sent to Development Engineering Staff with a covering letter which certifies that all the works within the phase have been completed to City of Kitchener standards, and lists all the items included. It should be noted that test results shall be submitted via email to Development Engineering Staff as soon as it is available during construction, however, a hardcopy of these results shall be included as part of the Maintenance Package.

If a test result is marginally “out of spec”, Development Engineering Staff may request the Consultant to provide a written explanation from the party responsible for the material testing, indicating what the potential problems could be over the long- term and suggest ways to mitigate (plan of action). Development Engineering Staff will review the explanation to determine whether to accept the works or not. Any future problems would be referred to the Consultant for resolution.

Refer to the Maintenance Package Check List for instructions on submitting Kitchener Utilities required documentation prior to requesting watermain inspections. In order to assist the Consultant in preparing the Maintenance Package, a [checklist](#) has been provided on the Development Manual webpage.

If the Maintenance Package is sent after four (4) months of the inspection, it is at the City’s discretion whether a re-inspection of all the works will be conducted. Acceptance dates for acceptance packages received after four (4) months of the inspection will be the date the package is received by Development Engineering. Development Engineering Staff will review the Maintenance Package within thirty (30) calendar days of receiving the package. All incomplete packages will be returned to the Consultant.

The request to reduce the Letter of Credit (LC) cannot be submitted along with the Maintenance Package. See Step 4 below regarding when it can be submitted

Step 4: Request for Letter of Credit reduction by Consultant

Participants: Consultant
City Staff (Development Engineering, Administration, Legal Services)

Once the initial acceptance letter has been received by the Consultant, and the As-Recorded information including the asset drawing has been approved, the process for requesting the Letter of Credit reduction can commence.

Reductions less than \$5000.00 will NOT be processed and will be returned to the Consultant unless otherwise approved by the City prior to the request. Only two (2) Letter of Credit reduction requests can be submitted per stage per year.

The Subdivider may request the Letter of Credit be reduced to 15% of the accepted works and the remaining balance of the Letter of Credit will be reduced. The minimum value of a letter of credit to be held shall not be less than \$25,000.

In order to reduce the Letter of Credit, the Consultant must provide a Letter of Credit reduction request package which contains the following documentation:

- Written letter requesting the reduction in Letter of Credit;
- Subdivision name including appropriate stage and phase i.e. 30T and 58M
- Initial and Final acceptance summary spreadsheet;
- Detailed background information in the form of an itemized calculation spreadsheet on an item by item, street by street basis; and

- Any acceptance letters pertaining to the specific requested Letter of Credit reduction.

Incomplete packages will be returned to the Consultant.

A.12.4 Final Inspection and remaining Letter of Credit reduction process

Final inspections on items can only be requested at a minimum of two (2) years after the initial acceptance date.

Step 1 & Step 2:

These steps will be like Section A.12.3 above except for CCTV inspections process.

For Final inspection, the Consultant will hire a Contractor to flush the pipes and complete a CCTV inspection and corresponding report at the Subdivider's expense. Development Engineering shall review the video inspection and corresponding report within ten (10) business days of receiving the documents and report all deficiencies. A copy of the video along with a deficiency list shall be forwarded to the Consultant by the Development Engineering Staff. A CCTV re-inspection, at the Subdivider's costs, initiated by the Consultant, will be conducted once all the deficiencies have been addressed. The Development Engineering Staff will review the re-inspection and all repairs to the deficiencies shall be to their satisfaction. Refer to E.B.3.6.

An acceptance email/letter/memo shall be sent by staff, to the Consultant to be included in the Assumption Package.

For subdivisions Initially Accepted after June 2010 the new process will apply. For any older subdivisions that were Initially Accepted prior to June 2010 the following will apply. Prior to the final acceptance of the underground services, the Consultant shall ensure all as-recorded information has been received by the City, including: mylars, ".tiff" files, AutoCAD files within six (6) months of the watermain final connection.

Through collaborated efforts the City of Kitchener and the Region of Waterloo ensure water distributions pressures are within an acceptable range. To help ensure new development and future development pressures are adequate, the water pressure model used, requires updated data as new developments advance. Prior to the inspection of the watermain for Final Acceptance, Hydrant Fire Flow Test(s) (B.9.13) results are to be submitted to Kitchener Utilities. The number of tests required (minimum of one) will depend on the development being constructed (i.e. large subdivision with rolling topography vs. final remaining cul-de-sac bulb). Kitchener Utilities should be consulted prior to arranging the tests to determine the extent of the tests needed.

If initial or final acceptance of surface asphalt is requested by the Consultant and the underground services have previously been assumed by the City, the surface asphalt acceptance inspection will include inspection for any deficiencies of the underground structures. Any deficiencies noted and related costs will be the responsibility of the Subdivider to rectify, in order to receive surface asphalt acceptance.

Step 3: Assumption Package Submission by Consultant

Participants: Consultant

City Staff (Development Engineering, Administration)

The Consultant shall submit the Assumption Package, within four (4) months of receiving the emails from Development Engineering, Kitchener Utilities, Transportation Planning, Operations, and Parks Staff confirming that inspected items have been accepted by City staff. The package shall be sent to Development Engineering Staff with a covering letter which certifies that all the works within the

particular phase have been completed to City of Kitchener standards. Development Engineering Staff will review the Assumption Package within thirty (30) business days of receiving the package for:

- Completeness (Please note, all incomplete packages will be returned to the Consultant), and
- The attached signoffs from all the various City departments.

A typical Assumption Package would include the following:

- Cover letter requesting final acceptance;
- Certification letter;
- The attached signoffs from all the various City departments;
- Letter is to include initial acceptance date;
- Attached copy of initial acceptance letter.

If the Assumption Package is sent four (4) months after the inspection, it is at the City's discretion whether a re-inspection of all the works will be conducted.

The request to reduce the Letter of Credit cannot be submitted along with the Maintenance Package. See Step 4 below regarding when it can be submitted.

Step 4: Request for Letter of Credit reduction by Consultant

Participants: Subdivider's Consultant
City Staff (Development Engineering, Administration, Legal)

Once the final acceptance letter has been received from the Consultant, and the As-Recorded information, including the asset drawing, has been approved, the process for requesting the Letter of Credit reduction can commence like Step 4 in Section A.12.3.

The surface asphalt LC calculation is to include: cost of surface asphalt, all estimated costs associated with raising structures and valves located within the pavement and the estimated cost to repair each water service curb stop for the street.

Note: Reductions less than \$5000.00 will NOT be processed and will be returned to the Consultant unless it is approved by the City prior to the request.

A.12.5 Obligations during Maintenance Period

The Subdivider shall make good in a permanent manner satisfactory to the Development Engineering Staff, any and all damage to the work during the maintenance period. Any deficiencies or defects noted during the maintenance period are the responsibility of the Subdivider and all complaints and concerns will be deferred to the Consultant for resolution. This shall be on an ongoing basis throughout the terms of this agreement. This obligation shall be at an end with respect to each street within the subdivision once all construction of dwellings on such street has been completed with the requisite certification of compliance with the Site Grading Plan for all such dwellings having been provided to the City. The Subdivider on receiving either written or oral notification from the City that works are required, shall immediately undertake such necessary work. If the Subdivider fails to comply, the City may arrange for such work to be undertaken at the expense of the Subdivider. The monies for this work may be drawn from the securities under the subdivision agreement.

It is important to note that the standard maintenance period is 2 years, however this term maybe extended in some instances if the buildout requirements have not been met and where significant deficiencies have existed and been left unattended.

The Subdivider's obligations include the following:

- Shall maintain or cause to be maintained all underground and surface works and every part thereof in working order and in good repair for a period of not less than two (2) years from the date of the maintenance period acceptance.
- Regardless if the underground sewers have received final acceptance, the Subdivider shall be responsible for sewer flushing maintenance until initial acceptance of the surface asphalt.
- Subdivider will ensure that storm sewer system, which includes catchbasins, manholes, infiltration trenches, soakaway pits and other quality control features, and appurtenances in a satisfactory working condition and free from debris, silt, etc. Should the efficiency of the storm sewer become reduced due to building activity the Subdivider shall be responsible for any cleaning, flushing, etc. necessary to restore the storm sewer to full capacity for the duration of building activity. If the City determines a Subdivider is not ensuring that the storm sewer is kept free of debris, silt, due to builder activity, a work order will be emailed to the Subdivider. If the storm sewer is not cleaned within five (5) business days, the City will arrange to have the storm sewer cleaned, and the work will be invoiced to the Subdivider.
- The Subdivider shall maintain all road allowances, lots, blocks and SWM blocks within the vicinity of the works within the subdivision free of mud, dust, litter, construction debris, construction materials and obstruction that may occur directly or indirectly on account of construction or illegal dumping by others within the subdivision. All subdivision streets will be swept once a month or more frequently as conditions warrant during construction. During home building activities, the streets need to be scraped daily and swept weekly. Sweeping may be required daily if conditions warrant. The Subdivider will also ensure that abutting streets affected by the subdivision activity are also cleaned when they have been impacted. Road conditions shall be inspected on a regular basis by the Engineering Consultant and all necessary arrangements shall be made to ensure the streets are kept cleaned, free of construction materials and unsafe conditions. City staff will inspect the road condition on a periodic basis and/or on a complaint basis. If it is determined by the City that the Subdivider is not adhering to the street sweeping requirements, they will be emailed a work order by the City to clean the streets. The Subdivider will have 48 hours to comply with the work order. Should the City deem it necessary to respond to a cleanup of the subdivision streets and / or abutting streets after having notified the Subdivider, this work will be invoiced to the Subdivider.
- The Subdivider is responsible for the cost of the pavement marking for the initial painting after the placement of base asphalt and again when surface asphalt is placed.
- The Subdivider shall maintain or cause to be maintained, all surface and landscaping works and every part thereof in acceptable order and in good repair for a period of not less than two (2) years from the date of the Maintenance Period Acceptance.
- All storm water management facilities must be inspected within 24 hours after each significant rainfall event (>25 mm) and an inspection report shall be sent to Development Staff for review
- The Subdivider shall maintain or cause to be maintained, all landscaping works (including boulevards adjacent to open spaces and parks, and street trees) and every part thereof in acceptable order and in good repair for a period of not less than two (2) years from the date of the Maintenance Period Acceptance to the satisfaction of the City. It is recognized that within a subdivision, there may be a variety of Maintenance Period Acceptance dates.
- The Subdivider shall meet all of tree planting requirements identified in Section M of this manual.

The City's obligations include the following:

- Respond and carry out emergency repairs on an as needed basis at the Subdivider's expense, and the Subdivider will be notified of these repairs within 24 hours;
- Responsible for the operation of all water valves and the supply and erection of all traffic operation devices (street signs, stop signs, pavement markings, etc.), and
- Once streets, sidewalks (on or fronting City property), walkway, and trails have been put on maintenance after initial inspection, the City assumes winter snow removal.
- Boulevards/sod fronting or on City owned land may be accepted separately from the current on street per street basis process (100% buildout).

A.13 AS RECORDED DRAWINGS

As recorded drawings shall be submitted to Development Engineering along with the Maintenance Package and the drawings shall conform to the following criteria:

a) "As Recorded" General Servicing Plans

Prior to the release of any Letters of Credit of any services, the required location plans for "As Recorded" measurements are to be completed and submitted to Development Engineering showing all necessary details for underground service installations.

"As Recorded" General Services Plans are required for the following:

i. Sanitary Sewers and Services

- Engineering Consultant is to provide the City with as-recorded inverts at property line.
- As recorded sewer pipe lengths, percent grade, pipe size, type, class, bedding

ii. Storm Sewers, Services and Catchbasins

- Engineering Consultant is to provide the City with as-recorded inverts at property line.
- As recorded sewer pipe lengths, percent grade, pipe size, type, class, bedding

Watermain, Services, Valves, Tees and Appurtenances

- a. Location of watermain valve box and valve chambers are to be dimensioned up or down the road from the nearest maintenance hole and an offset distance from the centreline of the road or back of curb;
- b. Water main stops are to be dimensioned along the alignment of the watermain from the nearest valve and curb stops, and boxes are to be dimensioned from lot corners;
- c. "As Recorded" watermain obvert elevation at 50.0 m intervals
- d. The drawings shall incorporate information shown on standard drawings 204, 205 and 206. In addition, the manufacturer, make and model of the following must be provided:
 - Pipe (mains, services & fire hydrant leads)
 - Joint Restrainers
 - Fire Hydrants
 - Valves
 - Curb Stops

- Main Stops
- Saddles
- Anodes
- Tracer Wire
- Pipe Fittings
- Water Boxes (curbstop at mainline)

Where watermains are not within road allowances or near sewers, ties to property corner shall be used.

b) “As Recorded” Drawings

“As Recorded” Drawings constitute the original Engineering Drawings which have been plotted again to show “As Recorded” conditions. The “As Recorded” drawing mylar and a copy of the AutoCAD drawing files on a USB thumb drive, CD, or a digital copy shall be submitted to the City for permanent records.

“As Recorded” Field Survey

The “As Recorded” Records revisions shall be based upon an “As Recorded Records” survey of all the development services and shall include a field check of the following items:

- Location of maintenance holes for utilities;
- Location of catchbasins;
- Location of hydrants;
- Location of valve chambers and valve boxes;
- Location of streetlights;
- Maintenance hole inverts and lid elevations;
- Pipe inverts;
- Distance between maintenance holes;
- Special maintenance hole details;
- Catchbasin inverts.
- Road centreline elevations at 20.0m intervals
- Location, lid and invert elevations for all rear yard and lot catchbasins, and
- Location of all services to all lots and blocks and location of connections from the nearest downstream maintenance holes.

“As Recorded” Records Drawings

The “As Recorded Records” drawings for all Municipal Services shall incorporate all revisions found in completing the “As Recorded Records” field survey and include a check of the following items and incorporation of the necessary revisions:

- Sewers - Percent grade, pipe size, type, class, bedding and length;
- Invert elevations – sewer at maintenance holes, at plugs for future extensions;
- Top of pipe and/or invert elevations – watermains, where necessary (i.e. Where watermain has been varied from normal depth requirements) in field, to avoid conflict with other buried services, and
- Obvert of watermain and sanitary sewer at centreline of creek crossing;

Original design information (inverts, grades, etc.) are to be removed from the drawing and replaced by the “As Recorded” Records information:

- a) Pipe type, class and bedding;
- b) Service connections **at street line** – sanitary, storm and water;
- c) Label “As Recorded Records Drawings” (shown in revisions column with date), and on cover sheet;
- d) Registered Plan Number is to be shown on plan view of each drawing including general plans;
- e) Lot and block numbers shall be in conformity with the registered plan;
- f) Street names shall be in conformity with the registered plan or as approved by the City, and
- g) Benchmark.

A.13.2 As Recorded and Asset Drawing Submissions

Upon completion of the construction of the services, the Subdivider’s Consultants shall obtain the “As Recorded” field information and revise the original drawings accordingly. Any changes in the original drawing by the Consultant Engineer or Landscape Architect are subject to the approval by the Director of Engineering Services. For Park Multi-Use Pathways, and Urban Forest Asset, any changes in the original drawing by the Consultant Engineer or Landscape Architect are subject to the approval by the Supervisor of Site Development.

“As Recorded” and Asset drawings are to accurately reflect, both graphically and numerically, the true conditions of the work described. If items described in the drawings were constructed in variance to the designs illustrated in the approved proposed construction drawings, then the “As Recorded” submissions should be revised and/or edited to accurately reflect how the work in question was recorded/built. Text and numerical information included in the drawings shall also be edited as required in conjunction with the graphics in their entirety.

These drawings shall show the location both horizontally and vertically of everything which is on, and under the lands to be accepted by the City.

All municipal services including house connections are to be shown on these plans as required hereinafter and inverts at the property line must be shown in table form for each lot and block on its respective plan/profile drawing.

One (1) set of “As Recorded” drawings as per the following shall be submitted to Development Engineering for the Manager of Development Engineering’s review.

- 1 Hard Paper Copy (Review)
- 1 Mylar Copy (Final)
- 1 Digital AutoCAD Drawing (Final) – Eng sends to GIS
- 1 Digital *.PDF (Final) – Eng sends to GIS
- 1 Digital Development Asset Drawing (Final) – Eng sends to GIS

These drawings will be submitted prior to the first Letter of Credit (LOC) Reduction Request. The LOC reduction will not be processed until the as recorded and asset drawing information has been received and approved by Development Engineering.

Any changes following initial acceptance and prior to final acceptance must be submitted to the Manager of Development Engineering for approval.

If as a result of final acceptance, changes are made to the developments recorded “As Recorded” condition, a new set of plans showing “As Recorded” details must be submitted to the Director of Engineering Services for approval within four (4) months of final acceptance.

The white paper hardcopy and the mylar copy “As Recorded” submission will contain the following listed stand-alone drawings:

- General Plan of Services;
- Streetscape Plan;
- Signal Wiring Plan and Signalized Intersection Plan (as required);
- Stormwater Management Pond plan including Planting plans and profile drawings;
- Watermain tie-ins;
- Plan and Profile Drawings;
- Street Lighting and Electrical Distribution (as required), and
- Detail Sheet

In supplement to “As Recorded” drawings a digital Development Asset Data drawing in AutoCAD format must be completed and submitted to Development Engineering Staff (refer to CAD Standards Manual and Constructed Asset Data Submission Manual under the Development Manual Webpage). The graphics in the drawing must be geographically positioned to third order accuracy and the following spatial characteristics shall apply:

Map Projection: *Universal Transverse Mercator*
Horizontal Datum: *NAD83 Zone 17 North*
Horizontal Units: *Metres*

The Development Asset Data drawing must be completed if corresponding infrastructure was constructed, except for bridges or culverts 3m or greater, which will require an Ontario Structure Inspection Manual (OSIM) standard form (pages 1 and 4 only). Pumping Stations are also an exception and will require a separate form. Both forms can be found on the Development Manual Webpage under the Constructed Asset Data Submission Section. The Consultant shall refer to the Development Manual webpage to download the latest templates, forms, manuals, and frequently asked questions. Out of date forms and templates will not be accepted.

All digital copies are to be delivered to GIS by Development Engineering staff for final processing.

If any information from any submission is incorrect or incomplete the City reserves the right to reject the submission and the Subdividers Consultant shall be required to resubmit the corrected submission prior to the reduction of any Letter of Credit.

A.14 RELEASE OF BUILDING PERMITS

The Subdivider shall make requests for Building Permits to Building staff. Building staff shall issue permits once conditions stated in Part 4 of the signed Subdivision Agreement have been completed by the Subdivider and accepted by the City.

As part of this process, the mylars for the approved Lot Grading Control Plans, signed by the Manager of Development Engineering, are forwarded to Building staff in order to release building permits.

A.14.1 100% Securities Required for Building Permits (Option 1)

Where roads are constructed up to base asphalt and curb & gutter:

- i) Registration has occurred.

- ii) Consultant sends correspondence to Engineering Staff (email is acceptable) requesting verification of bump up (BU) amount to achieve 100% security for Building Permits.
- iii) After roads are constructed up to base asphalt and curb & gutter; Consultant sends in a package to Engineering containing: letter (original) requesting Engineering Release hold on Building Permits, last Payment Certificate to Contractor confirming over 40% paid, letter or affidavit from Contractor (original) stating the amount they have been paid;
- iv) Developer deposits security (in a form acceptable to Legal Services) to Legal Services or it is brought in with the request letter from the Consultant. Engineering Staff inspects and confirms the works are complete and signs off on request package;
- v) Engineering staff notifies Legal Services of the information in the package and attaches all information needed to have the LC brought down to 60%.
- vi) Legal Services notifies Engineering and Building Division that City is able to release the Engineering hold on Building Permits;
- vii) Legal Services returns the 40%.

A.14.2 100% Securities Required for Building Permits (Option 2)

Where roads are NOT constructed up to base asphalt and curb & gutter:

- i) Registration has occurred.
- ii) Consultant sends correspondence to Engineering Staff (email is acceptable) requesting verification of bump up (BU) amount to achieve 100% security for Building Permits.
- iii) Consultant sends in original signed letter requesting BU with calculations for LC to 100%;
- iv) Developer deposits security (in a form acceptable to Legal Services) to Legal Services or it is brought in with the request letter from the Consultant;
- v) Engineering Staff notifies Legal Services explaining the bump up and to deposit securities until such time as undergrounds receive Initial Acceptance or roads are constructed up to base asphalt and curb & gutter.
- vi) Legal Services notifies Engineering and Building Division that City is in possession of 100% of the securities for the subdivision. This triggers Building to release the Engineering hold on Building Permits;
- vii) Security is held until undergrounds receive Initial Acceptance or roads are constructed up to base asphalt and curb & gutter and the Contractor has been paid.

A.14.3 Individual Lot Grading Plans (Sitings)

Detailed individual Lot Grading Plans (2 copies) must accompany all building permit applications submitted to the Building division. Building permits will not be issued until the City has approved the subdivision Lot Grading Plan.

The individual Lot Grading Plans must conform to the overall subdivision Lot Grading Plan, as approved.

Sitings for single homes and semis shall be prepared as one lot per sheet at a scale of 250:1. Sheet size of 8.5" X 14".

Sitings for townhouse blocks shall be prepared as one block per sheet at a scale of 250:1. Sheet size of 11" X 17".

Provide a title block with the name of building/Subdivider/subdivision/registered plan number, lot number and municipal address (if available), architect/designer company, scale of drawing and date of preparation.

The plan is to show the following:

- a) Elevation of culverts, drainage ditches, sidewalks and easements;
- b) The existing elevations as per topographical survey indicating existing buildings, drainage patterns and finished first floor elevations for all buildings on adjacent lands;
- c) The surface runoff for all adjacent and proposed lots, use arrows to show the direction of flow;
- d) The house type and elevations of the finished first floor top of foundation wall, basement floor and underside of the footings;
- e) The proposed elevations at the lot corners, landings, garage slab and all entrances (indicating the number of risers), the existing roads and catchbasins;
- f) The location, length and percent slope of proposed driveways;
- g) Type and details of proposed retaining walls, including top and bottom of wall elevations, and
- h) Infiltration galleries location, size and details (where infiltration galleries are required on the individual lots).
- i) Water Pressure Reducing Valve if applicable.

All elevations are to be referred to a geodetic City benchmark.

For additional information on individual lot grading plans, please visit the Building Division's website.

Note: Lots submitted within unassumed subdivisions must be approved by the Subdivider's Consultant for conformity with the overall subdivision design. The individual lot grading plans must be stamped with the following wording prior to being reviewed by the City:

"We certify that the proposed grades are correct, and that the lot grading of the subject lot is in conformity to the approved subdivision lot grading plans and City standards and will not adversely affect any adjacent property."

A.14.4 Lot Grading Inspection and Certification

Once the house is fully constructed and the property is fine graded, top-soiled and sodded the Subdivider will secure the services of the Consultant responsible for reviewing all the data and the Consultant will either certify or reject the lot grading upon inspection.

If the inspection reveals any deficiencies, the Subdivider's Consultant will notify the Subdivider what further work is required. It is the Subdivider's responsibility to ensure the required work is completed in accordance with their Consultant's recommendations.

Upon completion of the required work, the Subdivider's Consultant will re-inspect the property. This process will continue until the Consultant certifies the work conforms to the detailed individual Lot Grading Plan.

B ADMINISTRATION – SITE PLAN

B.1 GENERAL

Site Plan Control is a tool used to achieve appropriate siting and massing of a development on a site and to ensure safety, accessibility, attractiveness and compatibility of a development with the site context and overall urban landscape. It is also used by the City to secure land for road widenings and implement streetscape improvements in public boulevards adjoining development sites, and ensure that important site works such as driveways, parking, stormwater management, provision of sewer, water and utilities are planned and designed properly. Site Plans are reviewed and approved pursuant to Section 41 of the Planning Act, R.S.O 1990 and the Site Plan Control By-law (Chapter 683 of the Municipal Code) which designates all lands within the boundaries of Kitchener as a Site Plan Control Area. The Manager of Site Development and Customer Service has delegated authority to approve Site Plans.

When considering applications for Site Plan Approval, the City will have regard for the provisions of the Planning Act and related Provincial policies and Plans, along with Regional, City and Grand River Conservation Authority policies and procedures, the Official Plan, Zoning By-law, Urban Design Manual, and other Council policy and approved master plans, and this Development Manual.

Through the Site Plan review and approval process, the City, together with related review authorities (including, but not limited to, Provincial ministries and boards, the Region of Waterloo, the Grand River Conservation Authority, and utility providers) will review:

- Compliance with provisions of the Zoning By-law
- Overall site layout and building design and massing in accordance with the Urban Design Manual
- Parkland dedication
- Dedication of road widenings
- Provision of street trees and protection of the urban forest
- Design and provision of pedestrian, cycling, transit and vehicular facilities, including the design and layout of driveways and parking
- Provision, design and location of sanitary, storm and water services in accordance with applicable regulations and policies
- Stormwater Management in accordance with the City's Integrated Stormwater Management Master Plan (ISWM-MP)
- Site grading
- Landscape and lighting design
- Sustainability measures
- Site accessibility

B.2 SITE PLAN REVIEW PROCESS

General information regarding the Site Plan Application and review process is outlined below. Additional information is available on the [City of Kitchener Site Plans website](#), or by contacting the Planning Division by phone (519-741 2426).

B.2.1 Pre-Submission Consultation

An owner/applicant will be required to participate in a Pre-Submission Consultation Meeting prior to the submission of an application for Site Plan Approval. The purpose of the Pre-Submission Consultation Meeting is to identify and discuss the proposed development plan, and to identify any other information

and materials, which may be necessary and required to review the application. The required information and material allow the City to make a well-informed decision within the timeframe provided by the Planning Act. Following the Pre-Submission Consultation Meeting the applicant will be provided with a Record of Consultation, which will specify complete application requirements. For more information please visit the [City of Kitchener Pre-Submission Consultation website](#), or contact the Planning Division by phone (519-741 2426).

B.2.2 Application Submission and Review

An application for Site Plan Approval is submitted to the Planning Division. There are various application types depending on scope and complexity of the Site Plan approval that is required. Please contact the Planning Division for more information.

Site Plan applications will generally require the submission of various plans, studies, reports and other materials as identified through the Pre-Submission Consultation. Once the application has been deemed complete, it will be circulated to the various review authorities for comment and will be considered at a meeting with the City's Site Plan Review Committee (SPRC). Additional information with respect to the Site Plan Review process and timing, types of Site Plan Approval, application forms and fees, digital submission requirements can be found on the City's [Site Plan website](#).

B.2.3 Site Plan Approval

Site Plan approval in the City of Kitchener is separated into two phases and Building Permits will only be granted once full Site Plan Approval is achieved.

B.2.3.1 Phase 1 – Approval in Principle

Approval in Principle (AIP) confirms the proposed site layout and the conditions required to be satisfied in order to obtain full Site Plan Approval and the conditions to be registered on title in a Section 41 Development Agreement. A complete list of all the potential conditions of AIP are available on the City's website. Special conditions may be applied on a site-specific basis.

B.2.3.2 Phase 2 – Full Site Plan Approval

To achieve full Site Plan Approval the applicant must fulfil all conditions of AIP and the s. 41 Development Agreement must be registered on title. A sample s. 41 Development Agreement listing all potential conditions is available on the City's website.

B.3 ENGINEERING REQUIREMENTS FOR SITE PLAN APPROVAL

Formal Engineering approval must be received prior to Full Site Plan Approval being granted and thus issuance of a Building Permit for the site. Further, detailed Engineering review will not commence until "AIP" is granted due to potentially significant revisions/changes to the site plan.

B.3.1 Submission Requirements

The following information is to be included as part of the submission requirements to be provided to the City of Kitchener Engineering Services in order to satisfy the Grading, Servicing and Stormwater Management conditions as stated in the Section 41 Development Agreement.

The City of Kitchener Report Formats/Submission Requirements and required information to be shown on the drawings are listed in Appendix E "Site Plan Engineering Guidelines" found on the City's website as well as other relevant sections of this manual.

The typical list of drawings and reports (but not limited to) is as follows:

- Existing Conditions Plan
- Removals Plan (this plan can be combined with the Existing Conditions plan so long as legibility is not compromised)
- Erosion and Sediment Control Plan
- Site Grading Plan (Erosion and Sediment Control features can be included on this plan so long as legibility is not compromised)
- Site Servicing Plan
- Notes and Details Plan
- Stormwater Management Report
- Geotechnical Report
- Functional Servicing Report (for zoning by-law amendment applications)
- On-site Letter of Credit (LC)
- Off-site Works Process
- Certification of Works
- Development Asset Drawing (.dwg)

B.3.2 Engineer's Qualifications

A registered Professional (Civil) Engineer, specializing in Municipal/Hydrology must endorse all design drawings and reports for Grading, Erosion and Sedimentation Control, Site Servicing and Stormwater Management. A registered Professional Engineer must endorse any geotechnical analysis. If a hydrogeological analysis is required, a P.Eng or P.Geo. specializing in hydrogeological studies must endorse the work. All engineers must be operating under a Certificate of Authorization issued by the Professional Engineers of Ontario.

All drawings and reports prepared by the professional engineer are to be sealed, signed and dated.

As the grading and stormwater management designs are inter-related it is recommended that the engineer and/or engineering firm that designed the site grading also develop the stormwater management scheme.

B.3.3 Coordination of Drawings

In accordance with Section c.15 of the [Urban Design Manual](#) the Professional (Civil) Engineer, will be required to certify that the Landscape Plans and the Site Grading, Drainage and Erosion Control Plans, as well as associated Details Plans are coordinated. Conversely, the Landscape Architect will be required to certify the Engineering Plans. Refer to the Site Plan Engineering Guidelines for more information.

B.3.4 Stormwater Management (SWM)

In order to satisfy site plan conditions, a detailed Stormwater Management Report is required. For a complete list of the applicable studies and policies that dictate the stormwater management criteria refer to Section G of this manual and the Site Plan Engineering Guidelines on the City's website.

MOE Certificate of Approvals are required if a development is zoned industrial, or directly discharges to a watercourse.

B.3.5 Environmental Site Assessment (ESA)

An Environmental Site Assessment shall be undertaken for the Site when a portion of the site, including parkland, is to be dedicated to the City free of encumbrances. When lands that are to be dedicated to the City of Kitchener, a Phase I/II Environmental Site Assessment must be completed in accordance with either CSA Standard Z768-01 or Schedule D of Ontario Regulation 153/04. The Building Division may also require a RSC when a property is changing the land use through a Site Plan application, zone by-law amendment or, Building Permit. Under Ontario Regulation 153/04, a RSC will be required if the proposed development will change the site to a more sensitive land use.

B.3.6 Geotechnical Investigation

A geotechnical investigation is required to be completed by a competent consulting engineer in order to assess soils condition with respect to the proposed infrastructure, building construction and dedicated parkland. The geotechnical report will need to identify the soil's hydraulic conductivity, presence and elevation of groundwater table, and/or any other site-specific constraints.

B.3.7 Fire Flow Analysis

The Fire Flow Analysis Report is to demonstrate that the fire load for the development, including existing buildings, will not exceed the water available for fire protection from the municipal distribution system.

The following is the minimum requirements of the Fire Flow Analysis Report for review by Kitchener Utilities:

- Site plan detailing the water service, nearest municipal hydrants on the street, test hydrants, private hydrants, etc.;
- Description of the building construction materials and intended use;
- Calculation of fire load of the entire site development including new and existing buildings (summary only for sprinkler calculations);
- Details of hydrant fire flow test including time and date of test, persons conducting test, residual and pito pressure readings, graph of results (minimum three flow points plus static pressure), clear sketch of flow and residual test hydrant locations;
- Use metric units (L/min for flow and kPa for pressure);
- Due to the possibility of discoloured water, notify Kitchener Utilities or any key customers in the area if completing a private hydrant flow test. Plot the fire load on the hydrant fire flow test results graph. For sprinkler systems, provide the envelope of flow and pressure requirements including simultaneous fire department needs at private and municipal fire hydrants;
- List the application of codes, standards and/or guidelines used in the report preparation. The Fire Underwriters Survey is the City's standard;
- Unless otherwise demanded by sprinklered system, the fire load must be supplied by the water distribution at a minimum pressure of 140 kPa in the main at the fire hydrant (municipal or private) to provide fire protection. This minimum pressure must be available on the day of the year with the maximum system demand;
- If the fire load is within 70kPa of the water pressure available, the City of Kitchener reserves the right to request additional flow tests, hydraulic calculations, computer modelling, etc., to ensure that the water distribution system can satisfy the fire flow during the maximum day system demand;
- Signed by an individual deemed competent to perform fire flow calculations such as a Professional Engineer. In doing so, this individual is attesting that:

- The fire flow analysis is representative of the building to be constructed. Subsequent modification of the building will require the resubmission of the fire flow analysis.
- All codes, standards and guidelines used in the report have been applied appropriately, and
- If the proposed development is adjacent to a relatively large municipal watermain and the fire load is comparatively small, then the applicant may submit an abbreviated Fire Flow Analysis Report. This condensed report would comply with the above conditions excluding any computer modelling or hydrant flow test requirement, for consideration to waive a full fire flow analysis.

B.3.8 Letter of Credit and Certification

Prior to Site Plan Approval the Developer must submit and receive acceptance of a cost estimate for the on-site works from City Engineering and Planning staff. Further, Planning staff must receive a Letter of Credit (LC) and review fee in the amounts determined through the completion of the cost estimate. More information for the on-site LC process can be found on the [City of Kitchener Site Plan website](#).

Upon completion of the project a letter of certification and Site Works Notification Form (found on the City's website) is required from the Professional Engineer who completed the grading and Stormwater Management design for the site prior to release of the LC. The Developer must provide written commitment from any new Engineer of record to certify installations installed to date. Once these are submitted to Development Engineering, a site inspection will be completed to confirm the site was built as per the design. If City staff find deficiencies in the construction, a fee, as defined by the City's approved fee schedule will be charged to the Developer for the third (3rd) and any subsequent inspections as required.

B.3.9 Off-site Works Process

Review of the Site Servicing Plan will indicate the need for the removal of redundant service connections or the installation of new ones within the municipal right-of-way. Refer to Appendix D "Procedure for Off-Site Works Permit by Private Contractors" for the step-by-step process and required documents.

This process needs to be completed prior to Site Plan Approval.

B.3.10 Municipal Servicing Extension

If a development application is made that requires municipal services be extended in order to service the property, those municipal services will need to extend up to and across the full frontage of the property at the Developer's sole expense and be approved by the Director of Engineering.

Please note, if the site is in the City's Central Neighbourhood Boundary and a sewer or watermain extension or capacity upgrade is required, the works may be eligible for funding by the City in accordance with the Central Neighbourhoods Intensification Funding Guidelines. For further information please visit the City's website or contact the assigned staff in the Development Engineering Division.

C STREETS

C.1 GENERAL

The geometric design of municipal streets shall conform with standards set out in the city's Complete Streets document, and be consistent with the latest edition of the "Geometric Design Guide for Canadian Roads and Streets" issued by the Transportation Association of Canada (TAC), and the Ontario Provincial Standards (OPS), or as amended herein.

The City's Complete Streets approach requires all streets to be safe, comfortable and convenient for all ages, abilities and modes of travel, including pedestrians, cyclists, transit riders and motorists.

Streets are classified as local, minor collector, major collector or arterial as defined in the City of Kitchener's Official Plan and Complete Streets guidelines. Local streets provide access to properties and are not intended to carry high volumes of through motorized traffic. Minor collector streets prioritize active neighbourhood life, multi-modal connections and facilitate movement within neighbourhoods. Major collector streets balance the mobility of people between neighbourhoods with land accesses. Arterial streets provide mobility for people and goods throughout the city while also providing a positive image of the city and fostering economic development. The City of Kitchener prefers a grid network pattern for the transportation network system.

The City's Complete Streets guidelines provide a preferred cross-section for each street classification, as well as several alternatives depending on the local context, built form and connections to the larger transportation network.

C.2 GEOMETRIC STANDARDS

Parameters	Local Street	Minor Collector Street	Major Collector Street	Arterial Street
Right of Way (R.O.W.)	18.0m	20.0m	26.0m	30.0m
Sidewalk Width	1.8m*	1.8m	1.8m	1.8m (up to 3.0m in dense areas)
Cycling Facilities	Share the street. Additional traffic calming/diversion if part of Cycling & Trails Master Plan (CTMP).	Share the street. Additional traffic calming/diversion or dedicated facilities if part of CTMP.	Dedicated Facilities	Dedicated Facilities
Pavement Width for Preferred Cross-Section	7.0m**	7.0m**	9.0m**	12.9m**
Design Speed	40km/h	40km/h	50 - 60km/h	50 - 60km/h
Posted Speed	40km/h	40km/h	50km/h	50km/h

Table 2: GEOMETRIC STANDARDS				
Parameters	Local Street	Minor Collector Street	Major Collector Street	Arterial Street
AADT	Up to 2,000	2,000 - 8,000	8,000 - 12,000	12,000 - 20,000
Curb Radius at Intersection with Arterial Street***	6.0m	6.0m	7.5-8.0m	8.0-10.0m (up to 15.0m in industrial)
Curb Radius at Intersection with Major Collector Street***	6.0m	6.0m	7.5m	8.0m
Curb Radius at intersection with Minor Collector Street & Local Street***	6.0m	6.0m	6.0m	6.0m
Minimum Grade	0.5%	0.5%	0.5%	0.5%
Maximum Grade	8.0%	6.0%	6.0%	5.0%
Maximum Grade for Through Streets at Intersection	3.5%	3.0%	3.0%	3.0%
Vertical alignment/ cross slope at intersection	In accordance with TAC criteria	TAC criteria	TAC criteria	TAC criteria
Maximum Grade for Stop Streets at Intersection	2.5%	1.5%	1.5%	1.5%
Minimum Curb Grade (in cul-de-sac bulb)	0.5% (1.0%)	0.5%	0.5%	0.5%
Minimum Curb Grade at Radius of Intersections	0.8%	0.8%	0.8%	0.8%
Cul-de-Sac Minimum Outside Curb Radius (distance from the centre of the cul-de-sac bulb to the back of curb on the outside circumference cul-de-sac)	15.75m	N/A	N/A	N/A

Parameters	Local Street	Minor Collector Street	Major Collector Street	Arterial Street
Minimum Centreline Radius	60m****	80m	115-185m	185-400m
Vertical Curve Min. sight stopping distance LVC = KA(MUTC) K. for Sag K. for Crest	85m 12 8	85m 20 15	85m 20 15	85-140m 9 or 16 13 or 36
Horizontal Curve Minimum Sight Stopping Distance	85m	85m	85m	85-140m
Maximum Superelevation	N/A	N/A	As Required	As Required
Intersection Angle	70-110° at local, 80-100° at collector and arterial*****	80-100°*****	80-100°*****	90°
Minimum Intersection Spacing Between Adjacent Intersections measured from centreline to centreline of the intersections	60.0m	60.0m	60.0m	200.0m

*A 1.5m wide concrete sidewalk is an acceptable alternative on residential cul-de-sacs or crescents that provide direct access to less than 50 residential units and does not provide direct access to community parks, trails or public walkway connections.

** See standard drawings and Complete Streets for more details and alternative cross-sections. Measured edge of pavement to edge of pavement. Includes parking and on-road cycling facilities if present.

*** All bus routes are to have a minimum 8.0m curb radius on streets intersecting with other bus route streets, regardless of classification.

**** Except at 90° corners for crescents and courts.

***** All streets are to intersect at 90° unless existing road alignments or property restrictions require otherwise.

C.3 STREET PAVEMENT DESIGN

The pavement design for arterial streets will be considered on an individual basis. The composition and construction thickness of the pavement shall be designed based upon the following factors as outlined in the geotechnical soils report:

- Mechanical analysis of the subgrade soil;
- Drainage;
- Frost susceptibility;
- The future volume and class of traffic expected to use the pavement, and
- Street at base asphalt should be designed and constructed for the final level of service (capable of supporting the future volume and class of traffic).

Pavements shall be designed for a minimum ADT - 1000 vehicles and an anticipated life of 25 years.

Local	40mmHL3 80mm HL4 210mm Granular 'A' 400mm Granular 'B'	Surface Course Binder Course Base Base
Local (Transit Route)	40mm HL3 100mm HL4 200mm Granular 'A' 470mm Granular 'B'	Surface Course Binder Course Base Base
Collector	40mm HL3 80mm HL4 210mm Granular 'A' 450mm Granular 'B'	Surface Course Binder Course Base Base
Collector (Transit Route)	40mm HL3 100mm HL4 200mm Granular 'A' 520mm Granular 'B'	Surface Course Binder Course Base Base
Local, Collector and Arterial (Industrial)	40mm HL3 100mm HL4 200mm Granular 'A' 520mm Granular 'B'	Surface Course Binder Course Base Base
Arterial	40mm HL3 100mm HL4 200mm Granular 'A' 520mm Granular 'B'	Surface Course Binder Course Base Base

The above are minimum design requirements. The Subdivider is required to engage a Geotechnical Consultant with experience in pavement design to confirm the minimum design based on results of the geotechnical investigation.

On streets that are designated Arterial, a concrete edge strip or "kill strip" shall be constructed as per Region of Waterloo Standard Drawing 211, Boulevard Concrete Edge Strip Detail.

Bus bays shall be in accordance with the TAC Geometric Design Guidelines for Canadian Roads.

Binder course of asphalt at crosswalk locations shall be ramped to the finished surface grade edge of the concrete gutter during binder course paving operations to prevent the creation of a trip hazard. Asphalt ramping to be machine placed, hand placed will not be acceptable. Ramping shall be placed the entire

length between the curb drops at all crosswalks. This asphalt will be milled just prior to surface asphalt placement so that the surface course can be applied uniformly.

All paving works shall adhere to the most current OPS (Placing Hot Mix Asphalt) standards, most notably with respect to acceptable paving temperatures and conditions.

Colder temperature paving works outside of the acceptable OPS standards will require City approval prior to commencing (binder or surface). In addition, the use of an approved Road Dryer, centreline joint heater equipment and tack coating are required to assist with achieving the required OPS paving conditions. Upon request, photos must be provided to confirm conformance of the above.

C.4 TRAFFIC CALMING/DIVERSION

The primary functions of Traffic Calming measures are to reduce speeds, deter non-residential traffic from the area and reduce the incidence of collisions, thereby increasing safety for all users within the right-of-way. In addition, Traffic Calming measures can enhance a neighbourhood's appearance and the quality of life for its residents.

The City of Kitchener Traffic Calming Policy and Complete Streets guidelines expect Subdividers to incorporate traffic calming measures in new plans of development:

- Integrate traffic calming into a street design, to ensure target traffic speeds are realized and to avoid costly retrofits in future years.
- Measures to slow speeds include curb extensions, chicanes, speed humps, traffic circles*, pedestrian refuge islands, raised crosswalks/crossrides, and raised intersections. These measures may divert traffic to higher volume streets as well.
- Measures to lower traffic volume include raised medians, right-in right out islands, full closures, intersection channelization, directional closures and diverters.
- Break up long stretches of straight roadways with a variety of traffic calming elements. The maximum length without some form of traffic calming element for Local and Minor Collector Streets is 200 m.
- Accommodate the needs of emergency services and operations vehicles.
- Avoid negative impacts to cycling or transit.

*Turning circles are a traffic calming or beautification tool, typically on Local or Minor Collector Streets, and can be proposed as part of subdivision plans. See the Canadian Guide to Traffic Calming – Second Edition (2018) for traffic circle design standards. Traffic circles do not require an ICS. In contrast, roundabouts are a traffic control tool, typically in place of traffic signals on high volume streets. Further guidance on roundabouts is found in Section C.5.

A new street should not require more aggressive traffic calming elements like speed humps or other vertical measures, which can have negative impacts to cycling, transit, emergency services, and operations vehicles. Approval from Transportation Services and Emergency Services is required for any proposed vertical traffic calming measures.

C.5 ROUNDBABOUTS

At intersections where traffic signals are warranted, the Regional Municipality of Waterloo roundabout policy and related process is applicable, and the City of Kitchener will consider the installation of roundabouts at these locations.

All Collector/Arterial Streets intersecting with other Collector/Arterial should be considered for the installation of a roundabout. All roundabouts are to be designed by a qualified roundabout design Engineer.

Prior to the undertaking of a detailed Intersection Control Study (ICS) to determine the feasibility of a roundabout, an initial Screening must be completed. The **Initial Screening** shall involve the following:

- Determine impact to pedestrian and cycling facilities;
- Determine the scope of the intersection improvements to implement the traffic signals and other turning lanes and scope of work to implement a roundabout;
- Complete a Traffic Flow worksheet and preliminary lane configuration for the proposed roundabout;
- Develop a preliminary cost estimate to implement each of the traffic control alternatives (roundabouts and signals), and
- Develop a 20-year injury collision costs and implementation costs for each alternative, adjusted to Present Value and compare the results.

The design of roundabouts shall include a property line setback from the back of the curb with adequate space to locate utilities in their standard location.

The Region of Waterloo includes information on roundabouts on their website.

C.6 STREET ALLOWANCE CROSS SECTION

The typical street allowance cross-section shall be as per standard drawings and Complete Streets. A preferred cross-section for each street classification is provided, as well as several alternatives depending on the local context, built form, travel modes and connections to the larger transportation network.

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.7 STREET SUB-DRAINS

Sub-drains are required to run continuous along both sides of all streets, as per OPSD 216.021. Perforated PVC sub-drain shall be 150mm in diameter, and below road base.

Refer to the DGSSMS Section B.4.4.9 for more information regarding sub-drains.

C.8 INTERSECTION VISIBILITY

Transportation Services staff in consultation with Development Engineering staff may require the dedication of property for intersection daylighting triangles if deemed necessary. For further information, refer to the current City of Kitchener Zoning By-law.

C.9 CURBS

Barrier curb with standard gutter as shown on Ontario Provincial Standard Drawing OPSD 600.040 shall be used on all streets including cul-de-sacs islands except with reverse slope gutter. Saw cutting of curb or entrance depressions will be allowed. "Capping" of curb depressions is not permitted. All depressions not used as property entrances shall be replaced with full barrier type curbing.

Mountable curbs with standard gutter as per OPSD 600.060 may be used along the outer radius in the bulb section of the cul-de-sacs and for a 3.0m section on the cul-de-sac island aligning with the perpendicular sawcut spacing for maintenance purposes (refer to standard drawing 104 for detail). Mountable curbing may also be used in specific situations and/or areas approved by Development Engineering staff in consultation with Transportation Services staff.

Construction of curbs should follow City of Kitchener Standard Specification (CKSS) 353 including additional width when adjacent to sidewalk and driveway ramps. All curbs to have perpendicular sawcuts at 3.0m spacing.

C.10 BOULEVARDS

For boulevards where trees will be planted, as identified on the Street Tree Planting Plan the approved growing medium will be installed to a depth of 450mm per the requirements of Section M of the manual and sodded with No. 1 nursery sod. All construction debris and surplus granular material will be removed to the required depth and replaced with parent material compacted to 85% proctor. For boulevards where trees will not be planted, at least 150mm of approved growing medium will be placed in the boulevard and sodded with No. 1 nursery sod.

C.11 SIDEWALKS

Concrete sidewalks within the City of Kitchener are to be in accordance with CKSS 351, CKSS 1350 and the following:

- 1.8m width, with adjacent boulevard, or 2.0m – 3.0m in dense urban areas;
- 1.8m width, with adjacent curb;
- 1.5m width on the narrow side of the asymmetrical 18.0m Local street is an acceptable alternative on residential cul-de-sacs or crescents that provide direct access to less than 50 residential units and do not provide direct access to community parks, trails or public walkway connections;
- Minimum depth of 150mm Granular 'A';
- Concrete sidewalk to be 125mm thick across boulevards, residential driveways and adjacent to curbs;
- At intersections a minimum of 200mm thick concrete shall be used for ramps and sidewalks to the property lines projected out on either side;
- Intersection ramps shall be in accordance with Region of Waterloo standards RWSS 14 and RMW drawings 224 to 228;
- Sidewalks at driveway ramps within Commercial, Industrial and High-Density Residential areas shall be a minimum of 200 mm thick concrete;
- Where trees have been identified on the Street Tree Planting Plan the required root pathways will be placed in the parent material prior to the installation of sidewalks to meet all of the requirements of the Street Tree Planting Plan and Section M of this manual.

Concrete sidewalks are:

- Required along both sides of all streets, including perimeters of cul-de-sacs;
- Not required on public lanes;
- Not required on designated scenic streets, and
- Provided in accordance with the respective District approved policies, for roadways contained within a Heritage Conservation District.

A Multi-Use Trail can be substituted for a sidewalk, if appropriate to the street and land use context.

For further information and sidewalk accessibility requirements please refer to the City of Kitchener Sidewalk Policy and the City of Kitchener Barrier Free Accessibility Guidelines. For further pedestrian street design guidance, please see the Complete Streets Guidelines.

C.12 TRAIL CONNECTIONS

All Trail Connections (previously known as Walkways) between streets shall be a minimum of 6.0m in width unless otherwise noted. The Subdivider will construct a 3.0m wide asphalt multi-use trail to City of Kitchener current specifications. On both sides of the trail the Subdivider will place a minimum 150mm of the specified approved growing medium and fine grade to achieve positive drainage in accordance with the Approved Grading Plan, and sod using No. 1 Nursery grown sod. At the property lines, both sides, the Subdivider will construct on Active Transportation Connections property a fence as specified in the most current City of Kitchener Standard Drawings 1200.2.1, 1200.3.1 and 1200.4.1.

For Trail Connections longer than 30m, with a slope of 1% or less, a 2% crossfall should be considered to help facilitate drainage.

Curb ramps are required where the Trail Connection intersects with the roadway to facilitate cycling access.

C.12.1 Trail Connections – Emergency Access

All Trail Connections – Emergency Access Blocks shall be a minimum of 6.0m in width unless otherwise noted. The Subdivider will construct a minimum 4.0m wide emergency vehicle carriageway with a 500mm sodded shoulder on both sides. The shoulders will have a maximum slope of 2%. The carriageway will consist of a hot laid asphalt paved driving surface comprised of a 50mm thick HL4 binder course and 40mm thick HL3 wearing course to achieve a total 90mm pavement over a minimum 300mm compacted Granular “A” base. On both sides of the carriageway the Subdivider will place a minimum 150mm of the specified approved growing medium and fine grade to achieve positive drainage in accordance with the Approved Grading Plan, and sod using # 1 Nursery grown sod. At the property lines, both sides, the Subdivider will construct on Active Transportation Connections – Emergency Access Block property a fence as specified in the most current City of Kitchener Standard Drawings 1200.2.1, 1200.3.1 and 1200.4.1.

A concrete low median is to be installed by the Subdivider at the trailheads to deter unauthorized vehicles. The low median area is a semi-oval or triangular shape area maximum of 1.0m wide and minimum of 2.0m long. The low median area should be implemented such that it provides for a minimum of 2.0m wide pathway along the trail corridor on both sides of the low median. The low median should employ semi-mountable curbs in order to reduce the likelihood of severe injury to cyclists and other trail users in the event of bicycle tire impact. The top of the proposed low median should be paved using coloured concrete to differentiate it from the adjacent trail pavement.

C.13 MULTI-USE TRAILS

For details regarding the multi-use trails, refer to Section L and Complete Streets.

C.14 CYCLING FACILITIES (ON ROAD)

The City's Complete Streets guidelines prefers these forms of cycling facilities: cycle tracks, separated bike lanes, boulevard multi-use trails and bicycle greenways. Choosing the most appropriate type of bicycle infrastructure is based on a variety of factors, including land use, network connectivity, pedestrian volumes and crossings, motor vehicle volumes, motor vehicle speeds, and intersection design and function.

Cycle tracks are located outside of the travelled portion of the roadway and include barrier curb separation. Desired width is 1.8m. When located next to the sidewalk, provide a 0.2m hatched sidewalk (concrete) as a visual and tactile warning marker for pedestrians. Cycle tracks shall have the same structural base as the adjacent sidewalk.

Separated bike lanes provide space within the roadway exclusively for bicycles and include a form of physical separation from motorized vehicles, such as bollards, curbs, planter boxes, raised medians or parking. Desired width is 2.5m for the bike lane and 1.0m for the buffer.

Boulevard multi-use trails provide two-way travel for both pedestrians and cyclists, in a shared space, in the boulevard adjacent to the roadway. The desired width is 3.6 - 4.0m, especially if the BMUT is only on one side of the street. A lower limit of 3.0m is appropriate in lower volume areas or if the BMUT is on both sides of the street. Structural base is built according to standards in Section L. Signage and pavement markings are required for all boulevard multi-use trails, according to the standards found on the city's website.

Bicycle Greenways are quiet, local streets that can be enjoyed by all ages and abilities without designated space. Bicycles are assigned priority by applying additional speed and volume treatments to reduce the level of stress for cyclists. Design the street to reach low motor vehicle volumes (less than 1,000 per day) and low motor vehicle speeds (less than 40km/h).

Painted bike lanes may be used as a supporting feature of the cycling network to connect lower-density neighbourhoods to higher order cycling infrastructure. The minimum width is 1.8m. If providing a buffer, the width can vary between 0.5m – 1.4m.

Separated and painted bicycle lanes shall have the same structural standard as the street base.

All cycling facilities require appropriate markings and signage, according to Ontario Traffic Manual Book 18 for cycle tracks, separated bike lanes, bicycle greenways, and painted bike lanes, and according to the Complete Streets Guidelines for boulevard multi-use trails. During the final design, the bicycle markings and signage will be approved by Transportation Services.

C.15 CUL-DE-SACS

All local streets which permanently terminate at one end (dead end streets) shall be provided with a turning circle (cul-de-sac) of sufficient area to enable the turning of garbage trucks, snow removal equipment and emergency vehicles. A street allowance with a 20.0 m radius will be required for a cul-de-sac with a pavement radius of 15.25 m. Cul-de-sacs shall be in conformance with the Emergency Services Policy.

Where an emergency access is required in accordance with the provision of the Emergency Services Policy, the emergency access shall be constructed as per Section C.12.1, Trail Connections - Emergency Access.

C.16 INTERSECTIONS

Refer to Complete Streets for maintaining pedestrian, cyclist and motor vehicle safety through intersections, in conjunction with, the latest edition of the “Geometric Design Guide for Canadian Roads and Streets” issued by the Transportation Association of Canada (TAC), and section 2.3.2.3 Vertical Alignment and Cross Slope for requirements regarding intersection drainage and intersection cross falls.

C.17 ON-STREET PARKING

Design must adhere to the City of Kitchener’s On-Street Parking Policy and Complete Streets. An On-Street Parking Plan may be required in support of an application for a Plan of Subdivision in accordance with the Design Brief for Suburban Development and Neighbourhood Mixed Use Centres.

C.18 TRAFFIC CONTROL – SIGNS AND PAVEMENT MARKINGS

C.18.1 Traffic Signage Plan

As part of the subdivision review process, the Subdivider shall provide a Traffic Signage & Pavement Marking Plan that will include all proposed traffic signs and pavement markings for the subdivision. The Traffic Signage & Pavement Marking Plan should conform to all specifications and standards as outlined in the Ontario Traffic Manual. Transportation Services staff will review, comment on and approve these plans.

Once the plan is approved, the Subdivider (or their Consultant) will be required to coordinate with Transportation Services staff to place a request for the production and supply of all the required traffic signs. The City of Kitchener’s Sign Manufacturing Facility will provide the signs (allow 4 to 6 weeks timing), and the Subdivider will be responsible for the pick-up of the signs once the order has been completed. The costs and installation of all traffic signs will be the sole responsibility of the Subdivider.

Signs and sign infrastructure will be added to a Letter of Credit in the amount of \$150.00 per sign, \$45.00 per U-channel post (includes 5’ and 10’ posts) and \$350.00 per decorative post. This is to ensure the proper installation, maintenance and repair of the required signs until such time that the City of Kitchener takes ownership of the infrastructure. This Letter of Credit will be included as part of the surface works process.

C.18.2 Street Name Signage

The Subdivider (or their Consultant) will be required to coordinate with Transportation Services staff to place a request for the production and supply of all the required street name signs. The City of Kitchener’s Sign Manufacturing Facility will provide the signs, and the Subdivider will be responsible for the pick-up of the signs once the order has been completed. The costs and installation of all street name signs will be the sole responsibility of the Subdivider.

C.18.3 Wayfinding, Pedestrian and Bicycle Control Signs

The City is responsible for approving and supplying all wayfinding, pedestrian and bicycle control signs. Prior to the commencement of the maintenance period for the corresponding subdivision, the Subdivider will be responsible for the costs, installation, geocoding and scanning of, as well as, maintenance of the signs for a period of two years.

C.18.4 Open Space Signs

The City is responsible for approving and supplying all interpretive and regulatory signage related to the public use of woodlands, stormwater facilities, trails and open space. Prior to the commencement of the maintenance period for the corresponding subdivision, the Subdivider will be responsible for the costs, installation, geocoding and scanning of, as well as, maintenance of the signs until final acceptance.

C.18.5 Pavement Markings

The Subdivider will be responsible for the installation of all temporary and permanent pavement markings outlined in the approved Traffic Signage & Pavement Markings Plan. Additionally, the Subdivider will also be responsible for the maintenance of all pavement markings until such time that the City can issue final acceptance of the infrastructure. The costs and installation of all pavement markings will be the sole responsibility of the Subdivider. A letter of credit will be taken by the City for these works.

The Subdivider shall use the following traffic paint for all necessary pavement markings, sourced from the identified supplier or an approved equivalent as approved by Transportation Services.

Table 3: PAINT SPECIFICATIONS	
Supplier Name: Ennis Paint Canada ULC	
White Water Base (WB) Traffic Paint (20L Pail)	996402-20LP or approved equivalent
Yellow WB Traffic Paint (20L Pail)	EF620034-20LP or approved equivalent
White WB Traffic Paint (1100L Steel Tote)	996402-CQE1100 or approved equivalent
Yellow WB Traffic Paint (1100L Steel Tote)	EF620034-CQE1100 or approved equivalent

C.18.6 Signage & Pavement Markings Installation Process

All sign installations shall meet the specifications as outlined in the Ontario Traffic Manual and, as well, the signs shall meet the City of Kitchener standards for material usage. All signs are to be installed as per the approved Traffic Signage & Pavement Markings Plan.

Traffic Operations staff will apply a barcode sticker to all required signs that are ordered through the Sign Manufacturing Facility.

Once the signs have been installed, the Subdivider (or their Consultant) is required to contact Development Engineering staff to arrange an on-site inspection carried out by Transportation Services staff. This inspection will ensure that all signs and pavement markings have been installed correctly and according to the approved plan. Written confirmation from Transportation Services of a satisfactory inspection must be submitted as part of the Maintenance Package for Initial Acceptance of the surface works. The traffic signs can then be put on maintenance for the minimum two-year duration.

The following items must be installed in order to satisfy the Initial Acceptance inspection:

- All stop bars and lead-in lines
- Stop signs, street name signs, object markers, roundabout signage (including Pedestrian Crossover signage)

All traffic signs and poles/posts must be entered into the digital Constructed Asset Data drawing in AutoCAD following the initial acceptance of the underground services and prior to any release, partial or otherwise, of the Letter of Credit. Digital submission should be provided to Development Engineering staff (please refer to the CAD Standards Manual and the Construction Asset Data Submission Manual which

illustrates the data attributes that must be logged for each traffic sign or pole/post that are located on the Development Manual webpage on the City of Kitchener’s website).

Please refer to the Development Manual webpage in order to download the most up-to-date forms and manuals and reference the most Frequently Asked Questions (FAQs). Any forms that are out of date will not be accepted. If any information from any submission is incorrect or incomplete, the City reserves the right to reject the submission and the Subdivider shall be required to re-submit the correct submission prior to release of the initial Letter of Credit reduction.

During the maintenance period, the Subdivider will be solely responsible for the maintenance of all traffic signs, sign infrastructure and pavement markings (temporary and permanent). O.Reg 239/02 “Minimum Maintenance Standards for Municipal Highways” must be adhered to.

Further, should a traffic sign become damaged during the maintenance period, the replacement or repair of said traffic sign should be completed within the prescribed time outlined in the regulation. In the event of a traffic sign situation deemed unsatisfactorily addressed as per the City or the City receives an emergency off-hour request for repairs or replacement, the City reserves the right to correct the unsafe situation and invoice the Subdivider directly for the material and labour costs.

Upon completion of the two-year maintenance period and the City receiving a request for final acceptance, Transportation Services and Traffic Operations staff will complete another inspection. If any deficiencies are noted, the Subdivider is solely responsible to rectify them prior to the issuance of final acceptance. Upon successful inspection, the City will then take ownership of all traffic signs and pavement markings and release the remaining traffic Letter of Credit.

C.18.7 Traffic Signals

The Region of Waterloo is responsible for the design and installation of all traffic signals.

C.19 DRIVEWAY ENTRANCES

The Subdivider is required to provide for the excavation, paving and maintenance in good condition, until Final Acceptance, of each driveway from the travelled portion of the road to the lot line if there is no sidewalk. If there is sidewalk, the limit shall be from the travelled portion of the road to the sidewalk (ramp). All driveway ramps in new development shall be constructed of concrete. Where there is no curb and gutter on the road, or where there is no sidewalk, asphalt or concrete pavement can be used for the ramp construction.

Residential ramps are to be in accordance with Standard Drawing 109, whereas high-density residential, commercial and industrial entrances are to be in accordance with OPSD 350.010.

Where paired driveways are constructed between two adjoining properties and where the barrier curb is less than 1.0m between driveways, the curb cut-out shall be continuous.

Where a driveway ramp is located on a stubbed street, a minimum of 6m between the ramp and dead-end-barricade is to be provided for snow maintenance. This area must be included within the phase of the project and within the registered Plan of Subdivision. The number of lots allowed to front onto a stub street shall not exceed one per side. Any temporary roads or turning circles must be contained within the subject registered Plan of Subdivision.

The following minimum standards apply to driveway entrances:

Concrete (City of Kitchener Standard Specifications applies to this item)

Residential – 150mm concrete and 150mm for Granular 'A' base, High-Density Residential, Commercial & Industrial – 200mm concrete and 200mm Granular 'A' base.

Driveway entrance repairs shall be like for like material and completed as per the following:

Asphalt Ramps – Full replacement of the ramp if repairs are required. Patches and crack sealing are not acceptable.

Concrete Ramps – If repairs are required, only full individual panel replacements are acceptable.

If any of the repairs fail full ramp replacement is required prior to final assumption by the City.

C.20 NOISE ATTENUATION

As required, a Noise Study must be prepared by a Consultant who is currently registered on the Region of Waterloo's list of Pre-qualified Consultants for Noise Studies. If the Noise Study was not prepared by a Pre-qualified Consultant, the Consultant's declaration must be co-signed by a Consultant who is registered on the List.

All reports must follow the Regional Guidelines "Implementation Guidelines for Noise Policies" (Regional Municipality of Waterloo, 1999) and the Environmental Noise Guideline, Stationary and Transportation Sources – Approval and Planning, Publication NPC-300 put out by the Ministry of the Environment (MOE). In addition the Ministry of the Environment requires the use of the Ontario Road Noise Analysis Method for Environment and Transportation (ORNAMENT) to assess the noise impact from existing roadways on planned residential land uses, to assess the noise impact of roadway projects, to establish the ambient noise sources, and for compliant investigation.

C.20.1 General Philosophy of Noise Attenuation

The Environmental Protection Act empowers local municipalities to regulate or prohibit the emissions of sounds or vibrations. Municipal by-laws can prescribe maximum permissible levels of sound or vibration and prescribe procedures for determining the levels of sounds or vibrations.

The Ministry of the Environment Guideline "Noise Assessment Criteria in Land Usage Planning" outlines the position of the Ministry of the Environment on noise criteria for planning of sensitive land uses.

For further detail refer to the Regional Municipality of Waterloo Requirements.

C.20.2 Noise Barriers

The maximum barrier wall height shall be 2.4 m; total barrier height may be increased by use of a berm and wall combination; barrier heights greater than 2.4 m require approval by the City.

The minimum noise barrier wall height shall be 1.8 m.

The minimum density of the noise barrier wall shall be 20 kg/m² with no holes or gaps.

The aesthetics and finish of the noise barrier wall shall be determined through development application review (site plan or subdivision process) while maintaining the required attenuation measures as prescribed through the approved study.

Where a noise wall is warranted; to protect multiple lots, the wall will be in public ownership and will be placed on public property whenever possible. If site constraints exist, forcing the wall to be placed on private property it will be done so in an appropriately sized easement. The easement size will be determined by Engineering Services and Operations staff through review of the grading plans ensuring that it is sufficiently sized to provide for future maintenance. Title on those lots having a noise wall will include wording such that the homeowner cannot alter or affect the efficiency of the wall that is on their property for perpetuity. The Subdivider will be responsible to provide a letter of credit for the noise barrier wall as outlined in the Development Agreement and shall guarantee the noise barrier wall for a period of two years after City acceptance of the Engineering Consultant certification. The construction of the noise barrier wall shall be inspected and certified by the Engineering Consultant. Further to the letter of credit, the Subdivider will also provide to the City a one-time payment of a “Perpetual Maintenance Fee” for 55% of the construction cost to build the wall prior to registration. This fee will serve as funds for future work required to the wall. The City reserves the right to review and adjust the percentage value for this fee from time to time, as it sees warranted.

C.21 ENTRANCE FEATURES

The City of Kitchener encourages entrance features. A Subdivider may submit for approval a design proposal for entrance features which may consist of walls, gates, fences, trees, shrubs, flowers and other related components. The Subdivider will be required to enter into an agreement with the City for the construction and maintenance of entrance features within the Subdivision Agreement.

The Subdivider shall maintain the entrance feature indemnifying the City for all claims until the development has been assumed or as otherwise specified in the Agreement.

The Subdivider shall provide a payment for “Perpetual Maintenance Fees” and securities in accordance with the Subdivision Agreement.

The City reserves the right to remove all or any element of the entrance feature at its discretion.

Entrance features may be located within the public street allowance in centre median islands only or on a separate block adjacent to daylighting triangles. The features shall be designed to accommodate active transportation and maintain proper sight distances and turning movements at driveway accesses and intersections. The design of the entrance feature shall be submitted for approval to the City. Refer to the City of Kitchener, Urban Design Manual for further design details.

All tree planting for entrance features will meet all tree and soil habitat zone requirements identified in Section M of this Manual.

C.22 FENCING

Fencing shall conform to current City of Kitchener By-laws and Section C of the City of Kitchener Urban Design Manual.

C.23 STREETSCAPE AND LANDSCAPING

Tree planting will meet all tree and soil habitat zone requirements as shown on the approved plans identified in Section M of this Manual.

A Streetscape Plan may be required in support of an application for a Plan of Subdivision in accordance with the Design Brief for Suburban Development and Neighbourhood Mixed Use Centres.

C.24 UTILITY INSTALLATION

Location and installation details for utilities must be approved by the City prior to the installation.

All utility trenches within the street allowance are to be backfilled and compacted to 95% Standard Proctor Density.

The Subdivider is responsible to ensure that there is no conflict of plants and appurtenances with other utilities, driveways, tree planting pits, etc.

A Streetscape Plan may be required in support of an application for a Plan of Subdivision in accordance with the Design Brief for Suburban Development and Neighbourhood Mixed Use Centres which would identify the location of all street furniture, driveway cut locations, entrance features, street trees, utility locations, traffic calming features and fencing/landscaping details for corner lots.

C.25 INSPECTION AND TESTING

Full time inspection is required for all street works from undergrounds up to and including surface asphalt. Street specific inspections will consider pavement markings as well as signs.

The following are the minimum tests required for street construction:

- i) Sieve Analysis shall be performed in order to assure that the granular base courses meet the current City of Kitchener specifications. Representative samples are to be obtained by the Consultant prior to and during the street construction operation.
- ii) "Density Tests" shall be performed in order to assure that the granular base courses have been properly compacted to the current City of Kitchener Standard Specifications. Density Tests on the street subgrade shall be performed as directed by the geotechnical engineer.
- iii) A "Proof Roll" of the street subgrade shall be performed under the supervision of the geotechnical engineer to assure unsuitable subgrade material is removed, refer to City of Kitchener Standard Specifications.
- iv) "Asphalt Tests" shall be performed in order to assure that the binder and surface asphalt meets the current City of Kitchener Standard Specifications and design mixture tolerances.
- v) "Concrete Tests" shall be performed on curbs, sidewalks and driveway ramps in order to assure that the concrete meets the current City of Kitchener Standard Specifications.

D WATERMAINS

The City of Kitchener’s Development Manual is to be read in conjunction with the Region of Waterloo and Area Municipal Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS). In the case that the Development Manual differs from the DGSSMS, the Development Manual will supersede the DGSSMS.

Section D, Watermains, of the Development Manual has been structured to match the section headings of the DGSSMS. The DGSSMS reference for each item is within the brackets at the end of the heading.

The Safe Drinking Water Act, 2002, section 12 requires that “No person shall operate a municipal drinking-water system or a regulated non-municipal drinking water system unless the person holds a valid operator’s certificate issued in accordance with the regulations”. **Only certified City of Kitchener Utilities operators can operate the drinking water system, once bacteriological testing is complete and the new watermain is connected to the municipal system.**

Watermains and appurtenances shall be on all streets, designed and constructed in accordance with the most recently revised specifications of the DGSSMS and Development Manual.

A separate water service connection shall be provided from the watermain to the edge of the street allowance for each property within the City.

All watermains, appurtenances and service connections shall be guaranteed for a minimum period of two (2) years after initial acceptance by the City.

The initial acceptance of the watermain system shall only take place after the base course of asphalt has been installed on the roads and all applicable water valve boxes have been raised to base asphalt grade.

D.1 DESIGN GUIDELINES

The Region of Waterloo and Area Municipal Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS) Part B – Design Guidelines shall form the basis of the design criteria except as extended or amended herein. The following outlines the supplementary design criteria to be applied to the design of Watermain works for development in the City of Kitchener.

D.1.1 Hydrants (DGSSMS B.2.7)

For hydrant installation refer to City of Kitchener Standard Drawing 203.

D.1.1.1 Location (DGSSMS B.2.7.3) – The City will allow hydrant installation in cul-de-sac islands provided there is a 4.0m buffer for snowplows and a hydrant flag is installed.

D.1.1.2 Minimum Clearance (DGSSMS B.2.7.5) – Minimum offset clearance from the back of curb to the face of a hydrant shall be a minimum of 1.0m. All other clearances shall be as per DGSSMS. Driveway ramps do not constitute an obstruction with respect to clearance determination.

D.1.2 Services (DGSSMS B.2.12)

D.1.2.1 Sizing (DGSSMS B.2.12.1) – The City will no longer accept 38mm diameter size services. A 50mm diameter service is to be used from the main to the curb stop after which (private side) a reducer may be used to bring it to the desired 38mm diameter.

At no time shall the service pipe diameter be larger than the diameter of the watermain it is being connected to.

D.1.2.2 Location (DGSSMS B.2.12.2) - Service boxes should be located at the street property line. Where the water distribution system has been assumed by the City, Kitchener Utilities is responsible for water services up to the property line, after which the water service between the property line and the building becomes the responsibility of the property owner.

Service boxes in new construction shall be installed in the grassed area of the property frontage along the property line where possible. Consideration should be given to minimize landscaping features in the direct vicinity of the curb stop to facilitate operation and any necessary future repairs.

All stakes/wood markers from initial servicing works are to be removed, not buried.

Stop and Drain type curb stop service connections are not permitted within the City of Kitchener.

D.1.2.3 Number of Services Per Property (DGSSMS B.2.12.3) – Only 1 service shall be permitted per property in the City of Kitchener unless a second service is required as per the Ontario Building Code (OBC 3.2.9.7.(4)). If the OBC second service is required, backflow prevention shall be installed on both services as close to the property as possible.

NEW – for site plans/demolitions, only 1 service is permitted, the applicant shall remove all other services at the main. If reuse of the existing service is proposed, development must occur within 2 years of the demolition, the existing pipe size must be the appropriate one for the redevelopment and the service pipe must be less than 50 years old.

D.1.2.4 Valving (DGSSMS B.2.12.6) – For services that are 100mm diameter and larger there will be two (2) valves installed on the service. One valve shall be located at the property line and the other valve at the main.

D.1.2.5 Metering (DGSSMS B.2.12.7) – Refer to Kitchener Utility Forms for standard meter set drawings. Kitchener Utilities does not permit the installation of water meters in chamber (pits), see Kitchener Utilities Metering – Multi Metering Requirements, Duplexes and Chambers – Standard on the Kitchener Utilities Website. For properties requiring multiple meters, see Properties Requiring Multiple Meters.

D.2 MATERIAL SPECIFICATIONS

The Region of Waterloo and Area Municipal Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS) Part C – Material Specifications shall form the basis for material selection except as extended or amended herein. The following outlines the supplementary specifications to be applied to the design and construction of Watermain works for development in the City of Kitchener.

D.2.1 Concrete Pressure Pipe (DGSSMS C.2.1.2) – Concrete pressure pipe may only be used on a case-by-case basis if approval is obtained from the Director of Development Engineering Services.

D.2.2 Hydrants (DGSSMS C.2.8) – The hydrants shall be painted with a high gloss exterior paint over a quick dry oxide primer. The barrel shall be painted yellow and the bonnet and hose nozzle caps red. Stortz connections shall be painted black.

D.2.3 Easements (DGSSMS C.2.16) – City of Kitchener requires 5.0 m or 2 times the depth (where depth is from the proposed final grade to the invert rounded up to the nearest half meter), whichever is the greater.

D.3 CONSTRUCTION SPECIFICATIONS

The Region of Waterloo and Area Municipal Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS) Part D – Construction Specifications shall form the basis for construction except as extended or amended herein. The following outlines the supplementary specifications to be applied to the design and construction of Watermain works for development in the City of Kitchener.

D.3.1 Hydrant, Valve and Chamber Installation (DGSSMS D.2.6)

D.3.1.1 Setting of Hydrants (DGSSMS D.2.6.1) - Refer to Standard Drawing 203 for standard hydrant installation (including tracer wire).

D.3.2 Service Connections (DGSSMS D.2.7)

D.3.2.1 Live Tapping (DGSSMS D.2.7.2) – Kitchener Utilities must complete all tapplings on live watermain.

D.3.2.2 Tapping for Connections 100mm and Larger (DGSSMS D.2.7.3) – Kitchener Utilities must complete all tapplings on live watermain.

D.3.3 Commissioning (DGSSMS D.2.8)

D.3.3.1 Final Connection to Existing Water System (DGSSMS D.2.8.7) – Kitchener Utilities must witness all cut and caps and new connections. Contractor Inspection Request Forms must be requested from the City of Kitchener Development Engineering Inspector or Kitchener Utilities, completed and submitted to Kitchener Utilities to schedule the inspection.

E SANITARY SEWERS

The City of Kitchener's Development Manual is to be read in conjunction with the Region of Waterloo and Area Municipal Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS). In the case that the Development Manual differs from the DGSSMS, the Development Manual will supersede the DGSSMS.

Section E, Sanitary Sewers, of the Development Manual has been structured to match the sections headings of the DGSSMS. The DGSSMS reference for each item is within the brackets at the end of the heading.

Sanitary sewers designed and constructed in accordance with the most recently revised specifications of the City of Kitchener Development Manual and the DGSSMS shall be required in all residential subdivisions unless specifically exempted from this requirement by the City. All sanitary sewers shall be designed in such a manner and be of adequate size and depth to provide for the service of adjacent lands where so required by the Director of Engineering Services. A lateral sewer connection from the sewer main to the edge of the road allowance shall be constructed for each property in the plan of subdivision.

Where new construction will connect to existing stubs, the existing stub will be plugged at the nearest maintenance hole; that does not interfere with existing homes or businesses, until such time that the new infrastructure (underground works) has been initially accepted by the City and any cleaning of the new infrastructure has occurred. This will ensure the existing system will not receive any flow, debris or otherwise from the construction activity.

All sanitary sewers, appurtenances and connections shall be guaranteed for a minimum period of two (2) years after initial inspection and acceptance of all underground services by the City but shall not be released from the maintenance period until the sewers have been inspected by video inspection and finally accepted by the City.

Prior to commencement of the maintenance period for sanitary connections, invert elevations at the property line in table form shall be provided to Development Engineering staff.

E.1 DESIGN GUIDELINES

The Region of Waterloo and Area Municipal Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS) Part B – Design Guidelines shall form the basis of the design criteria except as extended or amended herein. The following outlines the supplementary design criteria to be applied to the design of Sanitary Sewer works for development in the City of Kitchener.

E.1.1 Residential (DGSSMS B.3.1.2.1) – Average flow shall be calculated to the current City of Kitchener standard of 305 L/c/d. The Harmon Formula is to be used for calculating the peak average flow.

Table 4: RESIDENTIAL ZONING CRITERIA

<u>Zoning Category</u>	<u>People/hectare</u>
R1	Not Serviceable
R2	36
R3	72
R4	143
R5	143
R6	196
R7	312
R8	387
R9	775

E.1.2 Infiltration (DGSSMS B.3.1.2.6) – The current City of Kitchener value is 0.15 L/s/ha.

Note: Person Per Unit (ppu) densities are not to be used for sanitary flow calculations.

Should the design flow of proposed sewers, using flow from zoning calculations result in undersized downstream sewers that were designed using different methodology; the City may consider evaluating the downstream sewers with alternative design standard methodologies.

Note: trunk sewers (375mm diameter and larger) to be designed to maximum 85% of full pipe capacity. Local sewers are not to be designed over 95% of full pipe capacity.

E.1.3 Pipe Slope (DGSSMS B.3.1.6) – Refer to DGSSMS for first reach of permanent dead-end sewer. All other slopes shall be determined as a function of the flow velocity (described below) for each specific run.

E.1.4 Flow Velocities (DGSSMS B.3.1.7) – All sanitary sewers shall be designed to have a minimum flow velocity, when flowing full, of at least 0.8m/s. Velocities in sanitary sewers shall not be greater than 3.0m/s.

E.1.5 Pipe Depth (DGSSMS B.3.1.10) – The maximum depth of cover over sanitary sewers is 9.0m unless approved by the Director of Engineering.

E.1.6 Services (DGSSMS B.3.3)

All sanitary sewer connections shall be inspected and tested at the same time as the sanitary sewer mains. All abandoned services are to be capped at the property line with a pre-manufactured end cap.

All sanitary sewer connections shall be guaranteed for a period of two (2) years. This guarantee period shall commence at the same time that the sanitary sewer mains are placed on Maintenance Guarantee.

E.1.7 Easements

City of Kitchener requires 5.0 m wide or two (2) times the depth (where depth is from the proposed final grade to the invert rounded up to the nearest half meter), whichever is the greater.

E.1.8 Inspection and Testing

The following inspection and testing work shall be carried out during and after construction of services.

- i) "Sieve Analysis" of the pipe bedding material to assure that the material meets City of Kitchener Standard Specifications. Representative samples are to be obtained by the Consultant prior to and during construction operations.
- ii) "Density Tests" shall be performed to assure that the pipe bedding material has been compacted properly.
- iii) "Density Tests" shall be performed on the backfill material to ensure proper compaction.
- iv) All sewers and maintenance holes must be flushed and cleaned prior to testing.
- v) A mandrel test shall be performed on all flexible pipe sanitary sewer mains and forcemains in accordance with the latest OPSS 410 standard.
- vi) All sanitary sewers shall be tested for "Exfiltration or Infiltration" to assure that all joints and manholes are properly installed in accordance to the latest OPSS 410 standard.
- vii) Flushing and CCTV Inspections are required for initial and final acceptance of the undergrounds. The flushing and CCTV inspection shall be as per OPSS 409, OPSS 410 and Section E.B.3.6.1. below. The CCTV inspection shall include all sanitary mains. The CCTV inspection reports submitted to the City shall be free of defects and debris. The Consultant shall ensure that all sewers lengths are inspected and accounted for. Include with the CCTV Inspection Report, a general service plan which highlights the inspected sanitary sewer.
- viii) Full time inspection of all underground work during construction.
- ix) Physical/Visual inspection of all work after construction to ensure all defects are rectified prior to the City's inspections. The Consultant's Inspector is responsible for the following: To bring the general site servicing drawing and/or the as recorded drawings to the inspection; to provide all labour and equipment to assist City staff during the inspection and to ensure all structures have been pre-inspected and all imperfect work has been rectified by the Contractor. Failure to comply with any of the above will result in cancellation of the inspection and a charge to the Subdivider.
- x) If any issues (Such as cracks, breaks, blockages, sags etc.), are encountered with the lateral service connections within the public road allowance after final acceptance has been granted and within two years of the occupancy date, the City shall require that the Subdivider contact its agents and rectify the matter immediately at the Subdivider's cost.

The City of Kitchener, acting reasonably, may require the Subdivider to complete sanitary sewer lateral CCTV Video Inspections, of certain portions of the development that are suspected of sanitary or storm sewer lateral damages (e.g. cracks, breaks, blockage, sags, etc.), such as:

- Infiltration determined by the municipality as a result of sanitary flow monitoring of the development, in combination with evidence from the Subdivider's videos of the sanitary sewer line, and/or
- Suspect slope challenges of less than 2% on the sanitary sewer lateral due to other services adjacent to it; and/or
- Sewage back-up complaints received from Lot/Block owners in the development.

If the municipality determines through the sewer lateral videos that there is damage to one or more sewer laterals within the public road allowance, then the Subdivider will be required to complete the work

to repair the damage to the satisfaction of the Director of Engineering, prior to final acceptance and the City taking ownership of the infrastructure.

E.1.8.1 Material Removal

Debris such as dirt, sand, rocks, grease, and other solid or semi-solid materials, which is a result of cleaning or construction activities, shall be removed at the downstream manhole of the section being cleaned. Passing material from manhole to manhole will not be permitted due to risk of line plugging. This material shall be removed using the vacuum system on a combination unit.

E.1.8.2 Material Disposal

Upon request, the Contractor shall provide a Ministry of Environment approved dumpsite for all material removed from the sewers during the cleaning operation.

E.1.9 CCTV Inspection

The Developer's Consultant shall ensure that the Equipment Operators are fully conversant with all aspects of sewer inspections and capable of accurate observation and reporting of all conditions found. All Operators must possess PACP certification. Upon request by Development Engineering, a copy of each pipeline inspector's certification document must be provided.

The internal pipe inspection shall be carried out using specifically designed cameras, video recording equipment and synchronized computer data recording. A continuous visual record of the internal condition of the piping system shall be provided in a digital format, with a playback visual resolution equivalent to the camera's recording resolution. The digital submission will also include the associated PDF report of the inspections and will be forwarded to the City of Kitchener as they are completed for review. At the end of the contract the Contractor will provide a separate database for each sewer type (sanitary, storm) in PACP format which will contain all inspection data collected during the contract.

E.1.9.1 Cleaning/Flushing Precautions

During cleaning operations, satisfactory precautions shall be taken to ensure that the water flow volumes and pressures created do not damage or cause flooding of any public or private property, while still ensuring satisfactory cleansing of the interior of the pipe for inspection. When possible, the flow of sewage in the sewer shall be utilized to aid in the cleaning process. A maximum pressure of 1800psi shall be used in all locations to prevent damage to the sewer lines or flooding into private structures. It shall be at the Contractor's discretion and judgment that flow volumes and cleaning pressures are adjusted appropriately for the age, condition, and circumstances of the inspection site. If in the Contractor's opinion "normal" cleaning procedures cannot be undertaken, or satisfactory results cannot be achieved in any section of sewer, the CCTV Contractor must report the findings to the Engineering Consultant and City staff.

E.1.9.2 Flow Control and Bypass Pumping

When interruption of sewer line flows are necessary to effectively conduct the inspection operations, the CCTV Contractor shall, subject to the approval of the City, control flows using plugging and blocking methods. The City reserves the right, when necessary, to request bypass and de-watering of a sewer to be viewed to ensure that the full diameter of the pipe is visible. The CCTV Contractor may also be required to conduct some CCTV inspection during non-peak flow periods; as such this will result in some work being required at late night time periods outside of established high flow periods.

E.1.9.3 Camera Equipment

Camera equipment shall consist of a self-contained, closed-circuit pan and tilt video camera and monitoring unit (OPSS 409). The unit shall have an adjustable lighting system capable of providing a clear monitor picture and a minimum illumination level of 100- foot candles. The camera travel speed shall be as per OPSS 409. CCTV videos not meeting the camera speed will be rejected.

E.1.9.4 Digital Images/Instant Photos

The inspection unit shall be equipped with all equipment required for recording and producing colour digital still image captures of the inspection video image appearing on the operator's monitor during the course of the inspection.

E.1.9.5 Re-Inspection

If in the opinion of the City of Kitchener, re-inspection of the sewer is required as a result of inadequate cleaning, camera travel speed, quality of the CCTV video and inspection reports, the Contractor shall re-clean and re-inspect the sewer at no cost to the City.

E.1.9.6 Maintenance hole Inspections

The CCTV Contractor will not be responsible for inspection or condition reporting of maintenance holes during the performance of this contract, except for reporting blockages or obstructions which may be deemed as potentially causing any flow restriction or backups.

E.1.9.7 Report

All reports will be submitted in English and be in a computer-generated, typed-format. The following information will be required to appear on the Front Cover of the Report.

1st Line	City of Kitchener
2nd Line	Consultant's Name
3rd Line	Developer's Name
4th Line	Subdivision's Name or Project Name, Phase, Stage, 30T# and 58M#
5th Line	Sewer Type (Sanitary or Storm Video Inspection)
6th Line	Report Number #
7th Line	Date of Report DD/MM/YYYY

E.1.9.8 Sewer Inspection Screen Information

While the camera is stationary, at the beginning of the section, the following should appear on the screen:

1st Line	From M.H.# to M.H.# (Structure Number from drawings)
2nd Line	Street Name
3rd Line	Distance from center of maintenance hole base
4th Line	Flow Direction – Upstream vs. Downstream
5th Line	Size of pipe, type of pipe, (IIMS Pipe Structure #)
6th Line	Date of inspection (MM/DD/YY)

While the camera is travelling the following information must appear at the bottom left hand of the screen.

1st Line	From M.H.# to M.H.# (Structure number from drawings)
2nd Line	Street Name
3rd Line	Distance from center of maintenance hole base in meters

E.1.9.9 Defect Coding

When a defect is encountered during the inspection the camera shall be stopped for a reasonable period of time and the defect code will be displayed at the top left-hand corner of the screen. These defects will be coded at time of inspection in strict adherence to PACP v6 codes. A complete list of codes can be provided upon request.

F STORM SEWERS

The City of Kitchener's Development Manual is to be read in conjunction with the Region of Waterloo and Area Municipal Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS). In the case that the Development Manual differs from the DGSSMS, the Development Manual will supersede the DGSSMS.

Section F, Storm Sewers, of the Development Manual has been structured to match the sections headings of the DGSSMS. The DGSSMS reference for each item is within the brackets at the end of the heading.

Storm sewers designed and constructed in accordance with the most recently revised specifications of the City of Kitchener Development Manual shall be required on every street within all plans of residential subdivision. All storm sewers shall be designed in such a manner and be of adequate size and depth to provide for the development of lands lying upstream within the watershed and/or to provide for the drainage of such areas as may be designated by the Director of Engineering Services. All storm drainage shall be conveyed to an outlet considered adequate in the opinion of the Director of Engineering Services.

Any channel improvements, bridges, culverts and all other drainage structures or improvements shall be designed and constructed in accordance with the specifications and to the approval of the Director of Engineering Services.

All storm sewers, appurtenances and connections shall be guaranteed for a minimum period of two (2) years after initial inspection and acceptance of all underground services by the City, but shall not be released from the maintenance period until the sewers have been inspected and finally accepted by the City.

Prior to commencement of the maintenance period for storm connections, invert elevations at the property line in table form must be provided to Development Engineering staff.

F.1 DESIGN GUIDELINES

The Region of Waterloo and Area Municipal Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS) Part B – Design Guidelines shall form the basis of the design criteria except as extended or amended herein. The following outlines the supplementary design criteria to be applied to the design of Storm Sewer works for development in the City of Kitchener.

Approved Master Drainage Plans (MDP's) and/or Subwatershed Plans, which have established storm sewer sizing criteria other than 1 in 5-year return storm event standard will govern. The decision process will be as follows:

- Does a Master Drainage Plan exist?
 - If YES, is it approved and current?
 - If approved and current the storm sizing criteria from that MDP applies.
 - If it is not approved and current update the MDP and establish criteria.
 - If NO, what type of development is proposed?
 - For Infill, on-site 1:5-year storm sewer capacity and the outlet should not negatively impact the receiving system.
 - For Greenfield, use 1:5-year storm sewer sizing.

In the absence of approved MDP's, storm sewers shall be designed to a minimum 1 in 5-year return storm event.

Flows to receiving existing storm systems shall not be increased from pre-development flows.

F.1.1 Design Flow Calculations (DGSSMS B.4.2.1)

For all severe storm events exceeding the designed storm sewer capacity, the roadway shall be utilized in the design for conveyance of these flows. Refer to section G.2.2.1 Roadway Conveyance of the City of Kitchener Development Manual.

Note: trunk sewers (larger than 1200mm diameter) to be designed to maximum 85% of full pipe capacity. Local sewers are not to be designed over 95% of full pipe capacity.

F.1.2 Rainfall Intensity (DGSSMS B.4.2.1.1)

Values of rainfall intensity (I) shall be determined by:

$I = A / (T_c + B)^c$, where

A, B, & C are defined as follows:

- i) The existing City of Kitchener IDF curves, for events ranging from 12.5mm to 100 years and with a duration less than 6 hours. When calculating the 12.5mm or 25mm event the storm duration is to be 4 hours.

Table 5: CITY OF KITCHENER DESIGN STORM PARAMETERS <6hrs			
Return Period	A	B	C
12.5mm	254.1	6	0.7989
25mm	509	6	0.7989
2 Year	743	6	0.7989
5 Year	1593	11	0.8789
10 Year	2221	12	0.9080
25 Year	3158	15	0.9355
50 Year	3886	16	0.9495
100 Year	4688	17	0.9624

- ii) For design storms with a duration of 6 hours or more.

Return Period	A	B	C
2 Year	521.3	3.75	0.7400
5 Year	1371.0	12.90	0.8400
10 Year	1471.9	11.44	0.8225
25 Year	1499.1	9.63	0.7963
50 Year	1498.1	8.38	0.7775
100 Year	1479.1	7.20	0.7613

T_c (time of concentration) and inlet time shall conform to the latest Ministry of the Environment's guidelines.

F.1.3 Pipe Slope (DGSSMS B.4.2.4) - Refer to the DGSSMS for the first reach of permanent dead-end sewer. All other slopes shall be determined as a function of the flow velocity (described below) for each specific run.

F.1.4 Flow Velocities (DGSSMS B.4.2.5) - All storm sewers to have a minimum flow velocity, when flowing full, of at least 0.8m/s. Velocities in storm sewers shall not be greater than 6.0m/s.

F.1.5 Head Walls (DGSSMS B.4.2.13) - Refer to DGSSMS. A pedestrian guardrail as per OPSD 980.101 shall be installed around headwalls.

F.1.6 Maintenance Holes (DGSSMS B.4.3)

F.1.6.1 Structure (DGSSMS B.4.3.1) – All catchbasin maintenance holes and maintenance hole structures are to be benched regardless of pipe diameter except those structures that are part of a perforated pipe exfiltration LID system. Pre-benching is preferred in new development.

F.1.6.2 Tee Maintenance Holes (DGSSMS B.4.3.4) – Refer to DGSSMS and OPSD 707.010.

F.1.7 Catchbasins (DGSSMS B.4.4)

F.1.7.1 Catchbasin with Curb Inlet Overflow (DGSSMS B.4.4.6) – Curb inlets in addition to CB lids to be installed in low points where double catchbasins are required as per DGSSMS.

F.1.8 Services (DGSSMS B.4.5)

F.1.8.1 Minimum Diameter (DGSSMS B.4.5.1) - Storm sewer services shall be provided for each property requiring a sump pump in residential development.

F.1.9 Open Ditch and Culvert Design (DGSSMS B.4.7)

The minimum allowable culvert size shall be 450mm in diameter.

F.1.10 Easements

City of Kitchener requires 5.0m or 2 times the depth (where depth is from the proposed final grade to the invert rounded up to the nearest half meter), whichever is the greater.

F.1.11 Outfalls

All storm sewers outletting to the natural environment shall conform to section G.2.1.3 Outlet Treatment of the City of Kitchener Development Manual.

F.1.12 Inspection and Testing

The following inspection and testing work shall be carried out during and after construction of services.

- i) "Sieve Analysis" of the pipe bedding material to assure that the material meets City of Kitchener Specifications. Representative samples are to be obtained by the Consultant prior to and during construction operations.
- ii) "Density Tests" shall be performed to ensure that the pipe bedding material has been compacted properly.
- iii) "Density Test" shall be performed on the backfill material to ensure proper compaction.
- iv) All storm sewer, maintenance holes and catchbasins must be flushed and cleaned prior to testing.
- v) A mandrel test shall be performed on all flexible pipe sewer mains and catchbasin leads greater than 2 meters in length and not having bends in accordance with the latest OPSS 410 standard.
- vi) All storm sewers, including catchbasin leads, shall be tested for "Exfiltration or Infiltration" to assure that all joints and manholes are properly installed in accordance with the latest OPSS 410 standard.
- vii) Flushing and CCTV Inspections are required for initial and final acceptance of the storm sewers. The flushing and CCTV inspection shall be as per OPSS 409, OPSS 410 and Section E.B.3.6.1. The CCTV inspection shall include all mains, catchbasin leads greater than 2 meters in length and rear yard leads. The CCTV inspection reports submitted to the City shall be free of defects, debris and soil materials. The Consultant shall ensure that all sewer's lengths are inspected and accounted for. Include with the CCTV Inspection Report, a general service plan which highlights the inspected storm sewer.
- viii) Full time inspection of all work during construction.
- ix) Physical/Visual inspection of all work after construction to ensure all defects are rectified prior to the City's inspections. The Consultant's Inspector is responsible for the following: To bring the general site servicing drawing and/or the as recorded drawings to the inspection; to provide all labour and equipment to assist City staff during the inspection and ensure all structures have been pre-inspected ensuring all imperfect work has been rectified by the Contractor. Failure to comply with any of the above will result in cancellation of the inspection and a charge to the Subdivider.

- x) If any issues (Such as cracks, breaks, blockages, sags etc.), are encountered with the lateral service connections within the public road allowance after final acceptance has been granted and within two years of the occupancy date, the City shall require that the Subdivider contacts it's agents and rectify the matter immediately at the Subdivider's cost.

The City of Kitchener, acting reasonably, may require the Subdivider to complete storm sewer lateral CCTV Video Inspections of certain portions of the development that are suspected of storm sewer lateral damages (e.g. cracks, breaks, blockage, sags, etc.), such as:

- Infiltration determined by the municipality as a result of flow monitoring of the development, in combination with evidence from the Subdivider's videos of the storm sewer line, and/or
- Suspect slope challenges of less than 2% on the storm sewer lateral due to other services adjacent to it; and/or
- Sewer back-up complaints received from Lot/Block owners in the development.

If the City determines through the sewer lateral videos that there is damage to one or more sewer laterals within the public road allowance, the Subdivider will be required to complete the work to repair the damage to the satisfaction of the Director of Engineering, prior to final acceptance and the City taking ownership of the infrastructure.

F.1.13 CCTV Inspection (Storm)

Refer to CCTV sections E.1.9

G STORMWATER MANAGEMENT

G.1 INTRODUCTION

The City of Kitchener has adopted a Watershed Planning Process for development within the City. As part of this process, the City of Kitchener Integrated Stormwater Management Master Plan (ISWM-MP) documents primary goals and objectives for stormwater management within the City of Kitchener as follows:

- Outline criteria to be used to design storm drainage infrastructure within the City of Kitchener;
- Specify storm drainage criteria to be applied to all storm infrastructure design including municipal projects and new land development, as well as re-development of existing lands;
- Specify design guidelines for storm drainage design and reporting at various stages of the land development process, and
- Provide reference and context to applicable Federal, Provincial, and Municipal policies and regulations which must be considered when planning or designing storm drainage systems.

There are several companion documents which support this manual including the City of Kitchener Official Plan, as well as numerous Federal and Provincial publications.

The most notable documents are:

- Urban Drainage Policy - City of Kitchener;
- The City of Kitchener Sewage System By-law: Chapter 930 of the Municipal Code;
- Stormwater Management Planning and Design Manual, MOE, 2003;
- Ontario Ministry of Natural Resources Natural Hazards Technical Guides, 2001;
- Erosion and Sediment Control Guideline for Urban Construction, GHHA CA, December 2006;
- Low Impact Development Stormwater Management Planning and Design Guide, CVC & TRCA, 2010.

The Developer is responsible for obtaining all other necessary permits and approvals from some or all of the following agencies:

- Grand River Conservation Authority;
- Region of Waterloo;
- Ontario Ministry of Transportation;
- Ontario Ministry of the Environment ;
- Ontario Ministry of Natural Resources;
- Federal Department of Fisheries and Oceans, and
- Environment Canada (federal).

When designing the storm systems and the stormwater management facilities, the criteria within the relevant following Watershed Studies and/or Master Drainage Plans are to be adhered to:

- Alder Creek Watershed Study and Upper Strasburg Creek Subwatershed Plan update;
- Blair, Bechtel and Bauman Creek Subwatershed Plan;
- Cedar Creek Scoped Subwatershed Study (2002);
- Detweiler Drainage Study;
- Doon South Creek Sub-Watershed Management Plan;
- East Side Lands (Stage 1) Freepoint Creek and Tributary to the Grand Subwatershed Study (2013);

- Idlewood Creek Master Drainage Plan;
- Laurel Creek Watershed Study;
- Laurentian West Master Drainage Plan;
- Melitzer Creek Master Drainage Plan;
- Strasburg Creek Master Watershed Plan – September 1996;
- Strasburg Creek Master Watershed Plan (1991) and Implementation Report (1996);
- Upper Blair Creek Functional Drainage Study;
- Upper Shoemaker Creek Watershed Study;
- Upper Strasburg Creek Subwatershed Plan;
- Or any new (Sub)watershed Study or Master Drainage Plan applicable to lands with the City of Kitchener.

Reference should be made to the “Schneider Creek Floodline Mapping Study”, completed on behalf of the Grand River Conservation Authority (GRCA), in conjunction with the abovementioned studies, for supplementary details regarding Stormwater Management criteria for those watersheds which are tributaries of the Schneider Creek.

All users of the City of Kitchener Development Manual Stormwater Management Design are required to use the most recent updates to the companion documents that support this document and the list of studies contained herein. The City of Kitchener will update the City of Kitchener Development Manual Stormwater Management Design periodically, as required.

G.2 STORMWATER MANAGEMENT DESIGN CRITERIA

G.2.1 Minor System

The minor system (ditches, sewers, etc.) shall be designed according to the following design principles and criteria.

G.2.1.1 Storm Sewers

Refer to Section F in the City of Kitchener Development Manual.

G.2.1.2 Inlet Systems - Catchbasins

The minor system shall be designed so that conveyance capacity complements inlet capacity. Refer to Section F.B.4.4.6 of the City of Kitchener Development Manual.

G.2.1.3 Outlet Treatment

All storm sewer outfalls shall be designed to prevent erosion. Where discharging to a watercourse it should blend into the natural surroundings, in an environmentally acceptable and aesthetically pleasing manner, given the size and location.

An access road with a minimum width of 4.0 m and cross fall of 2% shall be provided to outfalls.

Outfalls shall be provided with safeguards to prevent entry by unauthorized personnel into the outfall. Current City Standards use the Ontario Provincial Standard Drawings (OPSD), which shall be followed to determine what outfall sizes require grating to prevent unauthorized entry.

The invert of the outlet shall be located above the receiving watercourse five (5) year flood elevation (or where not available, the approved otherwise high water level), and the invert of the overflow weir shall be above the less frequent design storm flood elevation (eg. 100yr storm event) of the receiving

watercourse. The highest design storm water elevation within the pond shall be below the underside of footing elevations of the surrounding buildings. The outfall shall be adequately protected from erosive forces in the receiving watercourse to prevent scouring and undermining.

The outlet should be positioned no greater than 45 degrees in order to minimize the outlet angle to normal creek flow and the outlet should be, if possible, located flush with the creek bank for minor creeks with no valley flow and at the intersection of the overbank area/valley wall for major creeks. Reference Section K “Erosion and Sediment Control” of the Development Manual and the Erosion and Sediment Control Guidelines published by the Grand River Conservation Authority and the Greater Golden Horseshoe Area Conservation Authorities (“Erosion & Sediment Control Guidelines for Urban Construction, December 2006”).

Storm sewer outfalls to regulated watercourses require a permit from the Grand River Conservation Authority, who must be consulted on this matter. Storm sewer outfall design is to be submitted to the City as part of the full engineering submission.

G.2.2 Major System

G.2.2.1 Roadway Conveyance

Major roadways and local streets often convey runoff during severe storm events and, as such, shall be incorporated as elements of the major drainage system. For new development, road grades shall be constructed to provide positive conveyance to major watercourses or storm sewer inlets. The depth and extent of street flooding in new developments, including all road classifications, shall be limited to 0.15m above the centerline elevation in order to protect property and public safety, and allow emergency vehicle access.

The roadway major system interface between existing and proposed development shall, whenever possible, be positively graded to convey roadway overland drainage to the flow capacity of the existing roadway system while maintaining roadway flooding depths to the foregoing standards. Should overland flows from the proposed development be above the existing receiving overland flow system, storage of overland flow or other methods of reducing flows to the receiver flow capacity will be required. Should a positively graded major system interface not be possible under normal site grading conditions, as demonstrated by the Subdivider, then alternative grading and/or methods of conveying the overland flow such as, but not restricted to, sag roadways (saw tooth grading), overland relief points and enlarged storm sewers, shall be reviewed with the City. It shall be demonstrated to the City that street flooding depths are maintained at/or below the foregoing roadway standards.

Road reconstruction projects within the City of Kitchener shall not negatively impact the existing overland flow system. Should road reconstruction projects propose to increase pavement area resulting in overland flow depths above acceptable guidelines, alternative forms of stormwater management should be investigated such as minor system or off-line storage.

G.2.2.2 Overland Flow Routes

All overland flow from rear yards shall be conveyed to roadways via swales or rear yard catch basins with connecting leads. The overland flow routes, through and from lots, shall be designed such that water levels remain below the finished yard grade adjacent to the swale. All overland flow routes shall be designed to convey the 100-year event within the confines of the overland flow route (in easements where applicable) and shall maintain flow velocities below the erosion threshold for the swale. The detailed design must show how the overland flow route will convey the flows within the subdivision and all contributing upstream areas. Overland flow routes are to be identified during the preliminary stormwater management design.

Roads that are proposed to be used as an overland flow route shall be designed as stated within the foregoing Section G.2.2.1.

Overland flow routes such as natural channel systems shall adhere to the criteria outlined within Section G.4.

G.3 WATERCOURSE SYSTEMS (IN RELATION TO STORMWATER OUTLETS)

Behind all catchbasins and catchbasin maintenance holes, "No Dumping" fish style plates are to be placed in the concrete curb adjacent to the structures in accordance with CKSS 353.02.07. The City will distribute the plates to the Developer or Contractor.

Where watercourse alterations are proposed as part of a development, the design of such alterations shall consider and incorporate the following:

G.3.1 Design Approach and Principles

Channel design is to be based on natural channel forming processes to achieve a dynamically stable system. The channel evaluation methodology and design approach is to be consistent with the most current Provincial guidelines (ref. Ontario Ministry of Natural Resources Natural Hazards Technical Guides, March 2003 and "Adaptive Management of Stream Corridors in Ontario", MNR, 2001).

Alteration to a regulated watercourse will require a permit from the Grand River Conservation Authority (Development, Interference with Wetlands and Alterations to Shorelines and Watercourses) and potentially clearance/authorization from the Federal Department of Fisheries and Oceans (Fisheries Act) and Ontario Ministry of Natural Resources (Lakes and Rivers Improvement Act).

Remedial works shall incorporate fish habitat protection/mitigation or compensation in accordance with the requirements of the Federal Department of Fisheries and Oceans (DFO) and Ontario Ministry of Natural Resources (MNR), related to stream type and significance.

Remedial works shall incorporate the requirements of the governing Official Plan (Region of Waterloo and/or City of Kitchener), as well as the requirements of provincial Ministries and other public agencies for the protection of natural heritage features and ecological functions such as:

- City of Kitchener;
- Regional Municipality of Waterloo;
- The Grand River Conservation Authority;
- Ontario Ministry of Natural Resources;
- Transport Canada for Navigable Waters Permit;
- Fisheries and Oceans Canada, and
- Ontario Ministry of Tourism, Culture and Recreation.

G.3.2 Setbacks

The size of setbacks from the watercourse edge to developable lands is typically a function of the significance of the valley form, the sensitivity of the watercourse and the type of development (building or other).

The Grand River Conservation Authority requires that setbacks from watercourse shorelines, and/or wetlands be established through watershed; subwatershed studies (Comprehensive EIS), scoped EIS or

through a full EIS. The Grand River Conservation Authority may establish setbacks using “Technical Guide, River and Stream Systems: Erosion Hazard Limit OMNR 2002” to define the erosion hazard limit using stable slope allowances. Consultants should be aware that watercourse setbacks will typically be established by the Conservation Authority using the greater of the fisheries, valley and floodplain setbacks. Further guidance on establishing setbacks is provided within the Grand River Conservation Authority policies relating to Ontario Regulation 150/06.

In addition to the GRCA, the City may have requirements (Ecological Restoration Areas (ERAs)) for watercourse setbacks and the need to complete an EIS.

G.3.3 Access/Maintenance

Prior to Draft Plan Approval the Developer/Consultants must demonstrate that the storm drainage is directed to a legal outlet and that easements have been obtained if appropriate. Land dedication for watercourses adjacent to private land in new developments may require fencing to prevent human access and encroachment. The need for the fencing or demarcation requirements shall be assessed on a development-by-development basis based on the Environmental Impact Study or the General Vegetation Overview recommendations. Should fencing be required, it shall be on public property, 150 mm from the property line. Private access gates to creek block areas are not allowed. Refer to Section C.22 of the City of Kitchener Development Manual.

Natural channel design shall consider channel maintenance requirements by incorporating access routes. Access routes may be located within the appropriate top of bank setback limit or adjacent to the low flow area in appropriately designated areas.

G.4 WATERCOURSE/CHANNEL DESIGN

Watercourse/Channel Design should be applied and/or considered under the following circumstances:

- Channel realignment;
- Watercourse erosion/stabilization works, and
- New creek corridors.

Watercourse/channel design involves numerous disciplines such as qualified geomorphologists, water resources engineers, terrestrial specialists and fisheries biologists to interpret existing watercourse / channel conditions and to develop, through an integrated design approach, a ‘successful’ channel design. The watercourse / channel design has to incorporate hydrology, stream hydraulics, fluvial morphology and fisheries habitat assessment. Each discipline has to determine design parameters which will be beneficial in the integrated design approach. Design approaches should consider the following characteristics as a guideline (not exhaustive) to developing a watercourse/channel design:

Physical (Watershed and Watercourse/Channel) Characteristics

- Run-off characteristics;
- Flow regimes;
- Channel geometry;
- Floodplains;
- Alignment and meandering;
- Bed-forms, riffles and pools;
- Slopes;
- Soils;

- Erosions and tractive forces;
- Channel roughness, and
- Light penetration.

Chemical Characteristics

- Sediment load;
- Suspended sediment;
- pH;
- Hardness;
- Temperature;
- Dissolved oxygen;
- Nutrient levels, and
- Toxic substances.

Biological Characteristics

- Fisheries and fish habitat (including habitat potential);
- presence of plants and macroscopic animal life;
- other terrestrial, riparian characteristics, and
- Stream bank cover.

There are numerous guidelines which consider the foregoing characterization in developing a natural channel design, such as the following examples:

- 1994 MNR Natural Channel Design Manual;
- Dr. Dave Rosgen, Applied River Morphology, 1994;
- Dr. William Annable, Morphologic Relationships of Rural Watercourses in Southern Ontario and Selected Field Methods in Fluvial Geomorphology, August 1996;
- Dr. Robert Newbury, Canadian Stream Reference Book (Ongoing);
- 2001 MNR, and
- Adaptive Management of Stream Corridors in Ontario, Natural Hazards Technical Guidelines, MNR, 2003.

The Consultants should demonstrate that due care has been taken in establishing the watercourse / channel design to the satisfaction of the City of Kitchener's Director of Engineering.

G.4.1 Design Documentation for Watercourse/Channel Design

The following is considered a minimum for documentation of watercourse/channel design and is not intended to be exhaustive:

- The Consultant should provide the background existing and proposed hydrologic data.
- The Consultant should provide plans outlining the following:
 - a. existing and proposed plan and profile;
 - b. existing and proposed channel sections;
 - c. details for proposed typical channel sections;
 - d. sediment and erosion controls;
 - e. staging plans;
 - f. seeding and landscaping plan, and
 - g. floodline delineation – existing and proposed.

- The Consultant should document how the proposed watercourse/channel design matches and/or enhances existing watercourse/channel characteristics.
- The Consultant should document how the proposed watercourse /channel will function within the watercourse block/valley system.
- The Consultant should document existing and proposed watercourse channel hydraulics, including storage discharge relationships.
- The Consultant should, document potential impacts on both the existing terrestrial and fisheries conditions.
- The Consultant should provide a monitoring program outlining monitoring requirements for the various design disciplines.

In addition to the watercourse/channel design, the following should be incorporated:

- Access will be required consisting of a 4.0m wide pathway with cross fall not to exceed 4%;
- Special consideration must be given to the vegetation; landscape plan must be designed by a member of OALA in good standing;
- Area must be posted as naturalized area and wording within the purchase and sales agreement should reflect this requirement, and
- No access gates permitted directly from private properties.

G.4.2 Roadway Crossings

Waterway openings for culverts and bridge crossings shall be designed in accordance with the Ministry of Transportation Ontario (MTO) policies and guidelines outlined in below

Road¹ Classification	Total Span² Up to 6.0 m	Total Span² Greater than 6.0 m
Trunk Urban Arterial	50 year	100 year
Rural Arterial Collector	25 year	50 year
Local	10 year	25 year
Temporary Detours	1 to 5 year	1 to 10 year

1. Road classifications are defined as follows (Note: more detailed description provided in the governing MTO Drainage Manual):

Trunk - - a road under Provincial jurisdiction which provides inter-regional or provincial service.

Arterial Road - - a road primarily for through traffic.

Collector Road - - a road whose function is to collect and distribute traffic between Local, Collector & Arterial.

Local Road - - a road primarily for access to property.

2. For purposes of selecting design flood criteria, total span is defined as the sum of the individual clear spans or diameters, measured parallel to the centreline of roadway in the case of a bridge, and a perpendicular to the longitudinal axis in the case of a culvert.

Arterial and collector roadways in new developments should be, where possible, the only road classifications permitted to cross a watercourse having a drainage area in excess of 125 ha. Spacing and location of roadway crossings other than arterial or collector roads may be considered by the City when documented within the Stormwater Management Plan. Freeboard and clearance (as defined in the

governing MTO manuals and the Ontario Bridge Code) requirements for watercourse crossings should be based on current MTO criteria.

Culvert replacements may require a Class Environmental Assessment as outlined within the MEA Municipal Class Environmental Assessment document, October 2000, as amended in 2007.

G.5 STORMWATER QUANTITY AND QUALITY CONTROLS

Current stormwater management practice advocates the consideration of Stormwater Management Practices (SWMP's) on a hierarchical basis, whereby more pro-active techniques are considered first. The SWMP's are grouped under the following headings in order of preferred application:

1. Lot Level Techniques and Source Controls
2. Transport or Conveyance Controls
3. End-of-Pipe Controls

The philosophy behind this hierarchy is that stormwater management techniques are usually more effective when applied at the source. The City of Kitchener supports Source Control and Water Balancing using available appropriate stormwater management techniques, such as LID BMPs.

The City of Kitchener supports the progressive implementation of a wide range of stormwater management techniques. This range is expected to increase and change over time, as long-term monitoring results indicating the level of success of various techniques, become available. The Region of Waterloo may have some criteria and restriction within a specific area (e.g. due to it being a wellhead protection area) that could affect the applicability of the stormwater management techniques being proposed. Please refer to the Region's website for further information.

The City of Kitchener supports the integration of stormwater management facilities with passive recreational opportunities, where the intended function of either is not impaired in accordance with the Parkland Dedication Policy– i.e. stormwater management facilities will not be considered as part of parkland dedication. Where proposed, a review of the potential for integration of such facilities with recreational use will be review between the City and the Consultant and may be reviewed at a neighbourhood meeting as part of the planning process with the general public.

The following table provides the current perspective of the City of Kitchener regarding available stormwater management practices, as well as special supporting documentation which is required for implementation of each technique.

Table 8: COMPREHENSIVE LIST OF AVAILABLE SWMP's		
Stormwater Management Technique	City of Kitchener Perspective	Special Supporting Documentation Required to Verify Suitability
Lot Level Techniques and Source Controls		
Reduced Lot Grades	Not currently endorsed (ref. Lot Grading Standard)	N/A
Roof Leader Discharge to Surface	Encouraged	Address winter icing concerns

Table 8: COMPREHENSIVE LIST OF AVAILABLE SWMP's		
Stormwater Management Technique	City of Kitchener Perspective	Special Supporting Documentation Required to Verify Suitability
Roof Leader Discharge to Infiltration Facilities	Encouraged	Geotechnical and on-site soil assessment
Rear Yard Ponding	Discouraged in residential land use due to maintenance and impacts on use of rear yards	N/A
Rooftop Storage	Acceptable for commercial, industrial or multi residential buildings. Green roofs can be discussed with the City.	Maintenance agreement and restrictive covenant with owner to prevent alteration to system
Parking Lot Storage	Acceptable to a maximum of 0.3m ponding depth	SWM report
Permeable Pavement (asphalt, concrete, pavers etc.)	Encouraged where applicable	SWM report, O&M manual
Conveyance Controls		
Perforated Pipe Systems	Encouraged	SWM report, O&M manual
Pervious Catchbasins	Not currently endorsed	N/A
Enhanced Grassed Swales/Bioretenion	Encouraged where applicable	SWM report, O&M manual
Oversized Pipes (Superpipes)	Appropriate in redevelopment of existing areas	Need to demonstrate no other suitable alternative
End-of-Pipe Controls		
Structural		
<ul style="list-style-type: none"> • Wetlands • Hybrid Wet Pond/Wetland • Wet Ponds 	Applicable for water quality/quantity treatment	SWM report, O&M manual
Dry Ponds	Applicable for water quantity control only	SWM report, O&M manual
Infiltration Facilities	Encouraged	Geotechnical and on-site soil assessment, SWM report, O&M manual
Filter Strips	Part of 'Treatment 'Train' only	N/A
Buffer Strips	Part of 'Treatment 'Train' only	N/A
Sand Filters	Limited application	Geotechnical and maintenance assessment
Oil/Grit Separators	Part of 'Treatment 'Train' only – generally only for areas less	Sizing software output

Table 8: COMPREHENSIVE LIST OF AVAILABLE SWMP's		
Stormwater Management Technique	City of Kitchener Perspective	Special Supporting Documentation Required to Verify Suitability
	than 2 hectares. Applicable primarily for quality control for Commercial/Industrial land use, quantity control needs to be addressed	
<i>Non-Structural</i>		
Stormwater Management Fee of On-Site Stormwater Management	To be applied where the requirements of the Stormwater Infiltration in the context of Source Protection Planning and the Stormwater Targets and Volume Criteria are unable to be fully achieved due to technical constraints. May also be applied where a site's discharge is not fully capable of onsite quality control after maximum extent possible effort has been attempted.	This is only a feasible option if the requisite SWM criteria are not technically achievable as per Part C of Council Policy MUN-UTI-2003.

G.5.1 Encouraged Source Controls

As noted, the City of Kitchener supports the implementation of source controls where feasible. The feasibility and overall benefit to be derived from implementing source controls would typically be determined in a Subwatershed Study or other form of Master Plan. Where such studies do not exist or are not applicable to the proposed development, the Consultant shall consider the application of source controls as a Best Management Practice (BMP).

The following BMP's should be designed in accordance with the most recent MOE design guidelines and Credit Valley Conservation Low Impact Development Guidelines.

Roof Leader Discharge to Surface/Infiltration facilities

Roof leader discharge shall be directed to surface except where infiltration galleries are required. The Stormwater Management Planning and Design Manual, MOE 2003 (MOE 2003 guidelines) describe the possibility of roof leader discharge to ponding areas. The City of Kitchener does not endorse ponding areas for roof leader discharge, due to lot grading standards, however, soakaway pits are applicable in areas where infiltration is required. Subwatershed Studies or Master Plans may establish the feasibility of soakaway pits and should be followed in establishing subdivision detail design to the satisfaction of City staff. Soakaway pits identified within Subwatershed Studies or Master Plans may be used to serve residential lots, commercial and industrial lands. Front yard infiltration facilities will only be constructed under a City easement and be maintained by the City where a Subwatershed Study or Master Plan has determined this to be mandatory requirement of development. All other infiltration facilities are to be located in rear yards and have to be maintained by the property owner. Water going into the soakaway

pits is typically only roof drainage, therefore, no pre-treatment is required. Where roof drainage is not directed to soakaway pits, roof leaders shall discharge to the surface using splash pads.

All infiltration galleries must be protected during construction. It is recommended that infiltration galleries be installed after foundation and brick work unless there are safety concerns with excavations.

Where redevelopment is proposed and where roof leaders within the existing development are currently directly connected to storm sewers, the roof leaders within the redevelopment shall be disconnected from the storm sewers.

Rooftop Storage

Rooftop storage is accepted within the City of Kitchener for large flat rooftop commercial, industrial, multi-residential and institutional buildings for reducing post-development flow rates to storm sewer systems. Green roof technologies may be discussed with City staff, but it should be noted that this technology is not considered typical rooftop storage.

Parking Lot Storage

Commercial, industrial, multi-residential and institutional developments have used parking lot storage to control post development flows to receiving storm sewer systems. Parking lot storage design shall limit ponding depths to a maximum of 0.30m. Ponding depths within loading bay areas should be designed to a maximum of 0.30m.

Permeable Pavement

Permeable pavement includes pervious concrete, porous asphalt and permeable interlocking concrete pavers. Permeable pavement can be used in place of conventional asphalt or concrete where applicable. These alternatives allow stormwater to pass through the surface into a stone base where it is temporarily stored prior to infiltrating into the underlying native soils. Permeable pavements are ideally suited to areas with light vehicle traffic, including parking lots, parking lay-bys, laneways, shoulders, cycle paths, sidewalks and pedestrian areas.

G.5.2 Conveyance Controls

The following BMP's should be designed in accordance with the most recent MOE design guidelines and Credit Valley Conservation Low Impact Development Guidelines

Perforated Pipes

Perforated Pipe systems are comprised of a perforated storm pipe that is laid within a linear stone trench. These systems are designed for both conveyance and infiltration of stormwater runoff depending on the size of the rainfall event. Typically, the design allows for all the stormwater to infiltrate during smaller storm events whereas the system will perform in the same fashion as a typical storm sewer during larger rainfall events. Constraints in the use of perforated pipe systems include challenging topography, water table depth, and the presence of shallow bedrock. Perforated pipes can be installed either beneath the roadway surface or within the boulevard.

Enhanced Grassed Swales and Bioretention

The City supports the use of enhanced grassed swales, where applicable, for stormwater quality treatment, provided that minimum length, velocity, flow depth and slope criteria are met for full functionality.

Oversized (Super) Pipes

Super pipes provide subsurface storage to reduce post development peak flow rates to receiving storm sewer systems. The City of Kitchener may permit the use of oversized pipes on private properties to provide quantity control only for redevelopment, infill areas, and some smaller developments, when no other practical alternative exists.

G.5.3 End-of-Pipe Techniques

Wetlands

Constructed wetlands based on suitable soil conditions are suitable for providing stormwater quality control/enhancement for drainage areas 5 ha or greater in size. The application of BMP's would typically be developed through a Subwatershed Study and the detailed design established through a Stormwater Management Plan for proposed development.

Wet Ponds

Wet ponds are similar to wetlands, but typically are less land intensive. Wet ponds also require a minimum 5 ha drainage area to function effectively. Subwatershed plans typically provide the required guidelines for the Stormwater Management Practices in conjunction with the MOE guidelines, but should a subwatershed plan not exist, the most recent MOE design guidelines shall be followed.

Dry Ponds

Dry ponds only provide erosion and flood control. Dry ponds do not have a permanent pool component, therefore, any water quality protection/enhancement, would only be as a function of the facility's detention time and therefore would not be considered as effective as a wetland or wet pond.

Hybrid Wet Pond/Wetland

Hybrid wet pond/wetland systems consist of a wet pond, in series with a wetland. The permanent pool is approximately 50% within each element. The hybrid requires a forebay sized only to serve the wet pond.

Infiltration Methods

In general, there are areas within the City of Kitchener where stormwater infiltration is critical to maintain downstream ecosystem integrity and groundwater regimes. The application of this best management practice would typically be the subject of a subwatershed study or other form of detailed local master plan.

Infiltration is required on all sites where conditions permit it. Refer to the ISWM-MP Implementation Plan for designated areas of the City where constraints occur with descriptions of land use and best practices for infiltration in those areas. Other examples of constraints for infiltration are high groundwater or shallow bedrock. **Note:** Slower percolation rate of soil (<15mm/hr) is not considered a constraint. Drawdown times for infiltration facilities may be extended to 96 hours.

Developments shall provide site-specific soils investigations, confirming the potential effectiveness of infiltration techniques and the impacts on groundwater recharge (quantity) and quality. This may require the implementation of a ground and/or surface water monitoring program.

Infiltration facilities typically can be implemented for small drainage areas (< 2 ha) and are suited for residential, commercial and industrial land use. Infiltration systems are best suited for high density housing such as townhouses, where several homes can drain to one trench. Townhouse condominium complexes will require infiltration trench maintenance requirements and ownership details to be included within the property title agreement. Subsurface conditions should provide suitable infiltration capacity.

Filter Strips

Filter strips are only considered appropriate for low-density development, roads and small drainage areas (< 2 ha). Vegetated filter strips should be located adjacent to watercourses and drainage swales, as these systems can receive the sheet flow produced by the filter strip.

Buffer Strips

Buffer strips comprise of natural or naturalized areas located between development and the receiving water system or natural area. Buffer strips should be established and defined at the subwatershed planning level, through an Environmental Impact Study or other stormwater assessment processes, with input from the Grand River Conservation Authority, City and provincial agencies such as Ministry of Natural Resources.

Sand Filters

Sand filters shall be limited to a drainage area less than 5 ha. Sand filters require a form of pre-treatment and shall not be used as a stand-alone SWMP. The type of filter shall consider the surrounding soil condition and the possibility of being connected to the proposed storm system.

Oil/Grit Separators

Oil/grit separators are most appropriate for commercial/industrial land use and shall not be used as a standalone Stormwater Management Plan, but rather part of a “treatment train” approach to achieve the required water quality treatment. Oil/grit separators typically serve drainage areas under 2 ha and are predominantly encouraged by the City to be used for spill control. In situations that involve spill management controls, effluent from oil/grit separators is governed by the Sewer Use By-Law. Oil/grit separators are also appropriate for providing water quality control for redevelopment, or infill areas which typically have space limitations. Oil/grit separator manufacturer’s technical guidelines and the City of Kitchener’s OGS sizing tool shall be consulted in the sizing of a unit.

The type of Oil/Grit Separator units that are accepted by the City of Kitchener are Environmental Technology Verification (ETV) certified units unless approved otherwise by the Director of Engineering.

G.5.3.1 Stormwater Management Fee (Previously Cash-in-Lieu) for Infill and Redevelopment

A Stormwater Management Fee (formerly Cash-in-lieu) has been established such that a development proponent shall provide a designated financial contribution at the current per hectare rate as defined by the City of Kitchener, as amended from time to time, where the requirements of the Stormwater Infiltration in the Context of Source Protection Planning and the Stormwater Targets and Volume Criteria are not being fully achieved. It may also apply to sites, in lieu of quality control, for the portion that isn’t treatable considering that maximum extent possible was attempted. This fee will be applied towards off-site stormwater management elsewhere in the city, in conformance with the recommended approaches of the ISWM-MP. Funds will be collected by the City of Kitchener SWM Utility until such time as a suitable project or program is identified for partial or full funding.

To determine the Stormwater Management Fee, refer to the Stormwater Management Policy, MUN-UTI-2003.

G.5.4 Spill Prevention and Control

Spill prevention and control measures shall be implemented for all industrial and commercial developments that process, store or refine products that would be considered a contaminant within the receiving stormwater system, to ensure that spills or leaks do not impact downstream water quality. The information shall be included as part of the Site Stormwater Management Plan. Please review the Source

water protection policy within the Regional Official Plan to ensure the proposed measures are being adhered to the Region of Waterloo's criteria.

Examples of spill controls used for the prevention of the discharge of pollutants to the stormwater system are:

- Oil/grit separators;
- Spill containment tanks;
- Stormwater facility shutoff valves;
- Vehicle loading area covering;
- Vehicle loading procedures, and
- External storage area containment.

In addition to Ontario Regulation 224/07, both the Region of Waterloo and the City of Kitchener require that industrial and commercial developments develop a spill prevention and control plan incorporating appropriate preventative spill measures, identification of spill areas, material handling procedures and spill response procedures. Refer to the most current version of the "Site Grading, Erosion Control, Servicing & Stormwater Management Guidelines – Section 41 Development Agreements" on The City of Kitchener website for more detailed information and requirements.

G.6 STORMWATER MANAGEMENT FACILITY DESIGNS

SWM facilities are to be centralized to provide a more cost-effective approach through lower capital costs and long-term maintenance costs. New subdivisions are to take into consideration upstream developable lands, future road widenings, and future roads, with coordinated efforts between all affected landowners. SWM facilities and related sewers should be designed to accommodate post development flows from the surrounding undeveloped lands within the overall catchment area, such that when the surrounding subdivisions within said catchment area develop, additional ponds are not required. After 95% build out of a Subdivider's Plan of Subdivision is achieved and all SWM conditions have been met, the Subdivider can be released from the maintenance responsibilities of such facility.

If a new Subdivision will outlet to an existing downstream SWM facility, the Subdivider must be responsible for the maintenance, performance (quality and quantity), and plantings (including aquatic plantings) of such facility until 95% of the Subdivider's Plan of Subdivision is built out and all SWM conditions including monitoring have been met.

G.6.1 New Development and Redevelopment

The following design guidance is considered to complement the documents and manuals as mentioned in section G.1.

1. Facility Storage Requirements

Permanent pool volume, quality control (including extended detention), and length to width ratio (minimum 3:1) requirements shall be based on the MOE Stormwater Management Planning & Design Manual, or as specified within Master Servicing Plans, Master Drainage Plans or Master Stormwater Management Plans.

Quantity control shall be based on criteria established in the City's ISWM-MP, Master Servicing Plans, Master Drainage Plans or Subwatershed reports.

2. Forebay

Where groundwater interference or contamination is determined to be an issue, lining will be required (as recommended by a Geotechnical Consultant). The Consultant shall outline how access to the forebay is to be provided for the purpose of maintenance (see G.6.1.8 below). In addition, the Consultant should determine sediment removal frequency and how sediment removal would be conducted (i.e. equipment, forebay design). Prior to sediment removal, the forebay is to be dewatered. Dewatering procedures shall be provided as part of the Operation and Maintenance Manual.

3. Standard Water Depths

Refer to the City of Kitchener's standards, "Stormwater Management Facilities" provided in the "City of Kitchener, Urban Design Standards and Policies Manual".

4. Berming

Berming around the perimeter of a facility shall be designed with a minimum top width of 1.5 m (where trail or maintenance access is not located on berm). The top of berm elevation shall be established at a minimum 0.3m above the 100-year storm quantity control water level or the highest water level. Geotechnical considerations should be discussed in the design of the facility berming. Retaining walls within the stormwater block are typically not acceptable to the City, since the land designated for stormwater management systems should be established on the basis of no man-made retaining systems, although in special circumstances such as stormwater management retrofits, the City may consider the use of retaining walls.

5. Inlet Structures

Headwalls and grating shall conform to OPSD. A geodetic monument shall be established on the top of the inlet concrete headwall to assist in monitoring future water levels. The monument shall have horizontal and vertical controls in accordance with City standards.

Erosion protection shall be provided between the inlet headwall and forebay bottom to prevent localized scouring. Erosion protection shall match the headwall width at the inlet and shall extend a minimum 1.5 m on either side of the headwall at the forebay bottom. Protection material shall consist of rip rap or river stone underlain with geotextile or other erosion protection schemes. The protection size and depth may be based on Engineering Consultant recommendations and subject to review and acceptance by the City.

The invert of the inlet shall be located above the five (5) year flood elevation (or where not available, the approved otherwise high-water level). The highest design storm water elevation within the stormwater management facility shall be below the underside of footing elevations of the surrounding buildings.

6. Outlet Structures

The minimum allowable diameter for an outlet orifice is 75mm (minimum 50mm orifice if protected with a perforated riser pipe design with smaller perforations). Reverse slope pipe or perforated riser pipe outlet structures shall be used for both constructed wetland and wet pond facilities unless the Consultant can demonstrate to the City and approval agencies that alternative outlet structures could be used. No geotextile wrapping is required for these structures. For stormwater management facilities located downstream of areas with a high susceptibility for the occurrence of spills, a shut-off on the outlet

structure may be required. Maintenance pipes shall be installed to allow the facility to drain by gravity flow whenever possible. Maintenance access roadways shall provide access to outlet structures.

A weir outfall/spillway shall be considered for discharge of less frequent events in combination with the ditch inlet type of structure. Spillway erosion protection shall be consistent with attributes described herein. Erosion protection for outfalls shall generally consist of a combination of rip rap or river stone and vegetation, with the size and depth of stone based on calculations completed by the Consultant and subject to City approval. Outfalls to Environmentally Significant Areas are discouraged and in the rare instances when required they may require site-specific treatment as dictated by the City and the Grand River Conservation Authority and/or as stipulated within Master Servicing Plans, and/or Environmental Reports.

7. Emergency Overflow Spillway

Each stormwater management facility shall provide an emergency overflow spillway to allow drainage to safely exit the facility should the outfall structure fail to function or should the storm event have a frequency lower than the 100 year or maximum design storm return period. The overflow spillway shall convey the Regional Event or design storm event post-development controlled peak flow whichever is the greater. An additional 0.3 m freeboard is required above the maximum peak flow flood level.

The design of the spillway shall be based on calculations provided by the Consultant and are subject to review and approval by the City. Erosion protection shall be provided on the entirety of the spillway. Erosion protection may consist of a soil reinforcement system with a natural vegetated surface treatment or alternative protection measures as specified within the Consultant recommendations and approval by the City. When access roads cross the top of the spillway, the surface treatment and base will be consistent with the maintenance access road design. Side slopes at the top of the spillway shall be 3:1 maximum, and shall have a maximum slope of 10%, if used as an access roadway.

8. Maintenance Access Roadways

Maintenance access roadways shall have a minimum width of 4.0m, a minimum 10.0m turning radius (inside radius), a flat 10.0m loading area and a slope not to exceed 10% with a maximum crossfall of 4.0%. The access shall be comprised of 300mm compacted Granular "A"; 50mm HL4 binder course and 40mm HL3 surface course asphalt.

Turfstone in the SWM block is only to be utilized under the five (5) year stormwater storage elevation.

9. Sediment Drying Area

A sediment drying area is to be provided immediately adjacent to the maintenance access road and to the sediment forebay to facilitate ease of access for sediment removal from the forebay and sediment storage. The area should be graded to allow positive drainage to the forebay at a minimum slope of 2.0%. The sediment drying area shall be designed to facilitate a 1.0m maximum storage depth and an angle of repose of 4:1 of the excavated sediment. The drying area shall be rehabilitated at the time of maintenance.

10. Major System Flow Routes

Major system flow routes shall be designed to safely convey the 100-year peak overland flow into the facility but should not be directed into the sediment forebay area. Overland flow routes shall be flat bottomed channels with maximum 3:1 side slopes, maximum flow depth of 0.3m and 0.1m of freeboard.

Overland flow routes should be designed using standard hand calculations and/or hydraulic analytical techniques acceptable to the City. Overland flow route erosion protection may consist of a soil reinforcement system with a natural vegetated surface treatment, based on the Engineering Consultant and/or the City's recommendations, and subject to City approval.

11. Existing Groundwater Elevation

Within the stormwater block, at least one borehole shall be located near the centre of the block as part of the geotechnical investigation, to assess the nature of existing soils and the groundwater elevation. The groundwater elevation shall be compared to the proposed permanent pool water elevation within the facility. Where soil conditions are very permeable and the groundwater elevation is below the permanent pool water level, lining of the permanent pool area with an impermeable material may be required to ensure permanent pool levels are maintained. A liner may also be required when groundwater contamination may be a result of the permeable soils and the water quality within the stormwater management facility. The type and thickness of lining material shall be based on geotechnical recommendations; however, a clay liner is preferred over synthetic materials for stormwater management facilities.

If a plastic or man-made liner is proposed a rock layer is required over the liner as a warning to avoid damage to the liner during cleanout. Rock layer shall be constructed 400mm thick with 150 – 200mm diameter round stone, and a concrete sump provided in the forebay to facilitate forebay dewatering. The liner shall be shown on the design drawings and shall be designed in such a way as to prevent planting puncture.

Where the groundwater elevation is above the permanent pool water elevation, an investigation shall be undertaken to assess the impacts of a localized reduction in groundwater levels, potential impacts to groundwater aquifer systems and flow regimes, watercourse baseflow quantity and temperature, and to assess potential slope stability and groundwater seepage concerns within the facility. The groundwater assessment will consider implications to include existing data collected from source water protection plans. The scope of this investigation will be determined based on site specific conditions. The Consultant shall consider all feasible design alternatives to limit or negate any impact to local groundwater levels to the satisfaction of the City.

12. Land Requirements

The City shall require that the design of stormwater blocks considers the stormwater management function and integration into surrounding land uses. Where residential lots back onto a SWM facility, demarcation posts shall be provided by the City. The Developer will install them in the locations and frequencies as prescribed by the City between the lots and the SWM block.

The City prefers the use of centralized end-of-pipe systems rather than smaller distributed systems. However, the feasibility of implementing a centralized system is dependent upon such factors as the need for up-front planning, development phasing, and the cost to small developments.

13. SWMF Planting

The City requires a Landscape Plan for the stormwater management facilities be submitted for review and approval by the Manager of Design and Development prior to the registration of the Plan of Subdivision.

All landscaping of areas above the SWMF permanent pool level shall be installed at the Subdivider's cost, in accordance with the approved plan prior to initial acceptance of the landscape work. SWM plantings

above the permanent pool level is to occur during the growing season either prior to or immediately following approval by Engineering for first occupancy.

For SWM ponds requiring a liner, no trees or deep rooted species are to be planted where the roots may penetrate the liner. The plant selection to be located over the liner shall be stoloniferous and shallow rooted species. The SWMF planting plan is to clearly show the furthest extent of the pond liner in plan and to provide a cross section detail illustrating the actual depth of approved planting medium over the liner with proposed plants is to be included with the planting details. Refer to Urban Design Guidelines, Part C, 14.0 Stormwater Management Facilities for planting requirements and recommended plant lists.

The Subdivider shall maintain the planting above the permanent pool level for a period of two years from the completion of final planting. Landscape plans are to be prepared by an Environmental Professional acceptable to the City.

Prior to the start of the two year, post construction monitoring, the Developer's Engineering Consultant is to coordinate the planting of the aquatics with the Landscape Consultant. All aquatic plantings are to be installed during the growing season after the final dredging. The Landscape Consultant is to document installation of the aquatic plantings and to provide a copy of the planting purchase order for submittal with the request for planting inspection review.

14. Community Trails

All Community trails located within a SWM facility are to be located either above the maximum extended detention level or 5-year storm level, whichever is greater. Refer to Urban Design Guidelines, Part C, 14.0 Stormwater Management Facilities.

G.6.2 Temporary Stormwater Facilities

In development situations where the ultimate downstream facilities have not been constructed and/or where trunk sewers have not been completed to convey storm drainage to the ultimate facility, an interim or temporary on-site facility(ies) may be considered by the City. Temporary facilities shall provide an equivalent level of quality and quantity control as per the ultimate facility. Temporary facilities shall remain in place until the ultimate facilities and trunk sewers are constructed and approved by the City.

Site plan or subdivision agreements will be established to require the Developers to be solely responsible for maintenance and operation of temporary facilities, as well as any works associated with decommissioning of the temporary facility, including possible disposal of collected sediments according to Provincial guidelines and regulations. The cost for a temporary stormwater facility including its removal shall be borne solely by the Developer.

The design criteria may be modified from those for ultimate/permanent facilities, as follows for temporary facilities:

- 3:1 max. side slopes from facility bottom to top of berm, and
- facility perimeter to be fenced with 1.8m chain link on all sides with lockable access gate in accordance with OPSD.

G.6.3 Infill Developments

All new development regardless of location or size will have some impact on the runoff regime (quality/quantity). The impacts can be more or less depending on the sensitivity of the receiver. Medium

and large greenfield developments will, in all cases, be accompanied by stormwater management plans which either prescribe on-site measures or some form of centralized management strategy. Smaller greenfield settings and infill developments within existing urban areas need to consider their location in the drainage network, size relative to the balance of the existing developed area and the nature of the receiving system. These factors tend to direct the Developer for an infill development to the specific form of stormwater management.

Prior to finalizing the Preliminary Stormwater Management Report for new stormwater management facilities, the Consultant is to contact the City to obtain pond identification number(s) and include this information in the title of the report.

G.7 ANALYTICAL METHODS

Analytical methods can be divided into two categories, hydrology and hydraulics, representing the establishment of flows and flow levels, respectively. Hydrology typically precedes the determination of hydraulics for all new development and redevelopment, as flows are required to establish the hydraulic characteristics of open and closed systems.

For both hydrology and hydraulics, there are numerous available analytical methods. The analytic methods provided in this document represent established techniques that are considered acceptable by the City. The Consultant is not limited to the methods herein, although discussion with the City and review agencies would be required to confirm the appropriateness of using alternative hydrologic and hydraulic analytical techniques, prior to their use

G.7.1 Hydrology

G.7.1.1 Rainfall *Intensity – Duration – Frequency (IDF)*

The most recent IDF Curves/Hyetographs for the design storm events shall be used to design storm infrastructure.

G.7.1.2 Rational Method

The City will not accept the Rational Method. The Rational Method is a conservative approach calculation with many assumptions built in. The Rational Method provides the designer with a peak discharge value but does not provide a time series of flow or flow volume. The City must ensure the specific flow restrictions proposed on the site work with the entire modeling system.

G.7.1.3 Event Based Hydrologic Models Single Event Modeling

A list of event based hydrologic models considered appropriate has been provided below. The list will be periodically reviewed (every 5 years) to include either new hydrologic models or models considered appropriate at the time of preparation. Should a Consultant wish to use another model, documentation as to the validity of the model should be provided to City staff for review prior to use.

LIST OF APPROVED HYDROLOGIC MODELS

1. SWMHYMO/OTTHYMO
2. VISUAL OTTHYMO

3. SWMM
4. XP-SWMM
5. MIKE SWMM
6. MOUSE (DHI)
7. HSPF/WINHSPF
8. GAWSER
9. MIDUSS

LIST OF APPROVED HYDRAULIC MODELS

1. XP-SWMM
2. SWMM
3. MOUSE (DHI)
4. HEC-RAS (If HEC-2 used, it should be converted to HEC-RAS)
5. Flow Master
6. Culvert Master

Both the Flood Plain Management in Ontario Technical Guidelines, Ontario Ministry of Natural Resources, 2001 and the Drainage Management Manual Parts 3 and 4, Ministry of Transportation, 1997 provide general guidelines on the selection of hydrologic models. The Ministry of Transportation document lists the characteristics of each model, from which the Consultant can evaluate the appropriateness of certain event based hydrologic models.

Sound hydrologic modelling standards of practice should be followed in developing an event based hydrologic model. The following standards of practice are intended to guide general model preparation for most hydrologic programs and techniques; however, this list should not be considered exhaustive:

- The modeller should provide the purpose for developing the hydrologic model, such as determining flow rates, runoff volumes, flow routing effects for proposed development, existing land use conditions etc.
- The modeller should provide the study objectives and how they relate to the hydrologic modelling.
- The modeller should provide the model selection criteria and how the model matches the criteria.
- The modeller should provide the basis for the storm design information, outlining how the design storm has been selected.
- The modeller should provide drainage area plans outlining both internal and external catchments, modelling schematics and tables providing drainage area parameters.
- Background information on the selection of the drainage area parameters should be provided to assist the City in understanding on the assumptions leading to the drainage area parameters.
- Background data on overland and minor storm systems should be provided with plans clearly presenting and labelling both systems.
- Data should be provided on routing through natural and manmade storage systems, with detailed plans and calculations outlining how the stage/discharge relationship has been developed.
- Sensitivity analysis should be conducted on a minimum number of parameters which varies with model complexity.
- Verification or validation of results should be provided through various methods such as calibration to recorded streamflow, unit flow rates and runoff volume comparisons using the techniques such as the MTO index method or equivalent. The application of the validation technique (number and type) will depend on the availability of data and the sensitivity of the analysis.
- The modeller should provide all input and output details in a logical manner, with an explanation for potential errors.

Continuous Event Modelling

Continuous models differ from event based hydrologic models in that rather than using a synthetic design storm based on IDF data, a long term time series of historical meteorological data is used for the input driving function. In addition to historical rainfall data, continuous models typically require seasonal state variables. Continuous models are usually more complex than event based hydrologic models, as typically the models consider more processes including temperature, evapotranspiration, snow conditions and groundwater. Notwithstanding, the modelling standards of practice for event based hydrologic models also apply to continuous models. Continuous models are typically used but are not limited to higher level studies such as watershed and subwatershed studies. Continuous modelling may also be used for studies with a scope requiring historical data inclusion.

In addition to the standards of practice for event based hydrologic models, the Consultant should demonstrate that the historical meteorological time series selected has been obtained from the nearest rainfall gauge to the Consultant's study area. This will often lead to a trade-off between duration of record and proximity. Typically, the minimum duration for meaningful continuous simulation is 20 to 25 years. Historical rainfall data is available from the City, Grand River Conservation Authority and Environment Canada.

The Consultant in selecting a continuous hydrologic model usually intends to develop frequency flows for the historical data period. The Consultant should specify the assumptions and methodology for determining the frequency flows and typical year hydrographs. The Consultant should provide validation of the selected probability distribution by using statistical tests.

The Consultant should select the continuous model giving consideration to development and/or redevelopment characteristics to the satisfaction of the City. In addition approval agencies (i.e. Grand River Conservation Authority, MNR, MTO and others) other than the City should be consulted to determine modelling requirements.

G.7.2 Hydraulic Capacity

Drainage systems can be subdivided into both closed and open systems. The hydraulic capacity of the receiving minor and major storm system is to be determined to verify that drainage can be safely conveyed as proposed. For each system various analytical techniques can be employed. The Consultant is not limited to the methods herein, although discussion with the City and review agencies (Conservation Authorities, Ministry of Natural Resources, Ministry of Transportation and others) would be required to confirm the appropriateness of using alternative hydraulic analytical techniques.

The hydraulic capacity of a storm system can be determined through hydraulic modelling and for certain applications through the use of standard 'hand calculations'. As for hydraulic modelling, standards of practice relate to the use of various techniques. The following standards of practice are intended to provide direction:

- The Consultant should clearly identify the study objectives and how they relate to the hydraulic modelling.
- The Consultant should provide the purpose for the hydraulic modelling.
- The modeller should provide the model selection criteria and how the model matches the criteria.
- The Consultant should provide plans clearly presenting the closed and/or open hydraulic system.
- For plans describing open systems, the Consultant should note cross-sections, study limits, land use, crossing details, spill areas, ineffective flow areas, and flooding limits and elevations for the appropriate design event(s).

- For plans describing closed systems such as storm sewers, the Consultant should note the storm sewer network details including manhole numbers, storm sewer size, length, study limits, land use, slope, and sewer and ground elevations.
- For combined hydrologic/hydraulic models such as SWMM, the Consultant should provide plans that not only describe the closed system but also the contributing drainage areas and overland flow system.
- For all hydraulic models, the Consultant should provide the downstream and, if applicable, the upstream boundary conditions for each storm modeled and the assumptions used to define the boundary conditions.
- For all hydraulic models, the Consultant should document the parameters established for hydraulic losses such as Manning's 'n', inlet and outlet losses and other appropriate losses.
- The Consultant should summarize the selection of procedures for determining the computed energy grade line and water surface elevations.
- The Consultant should document the hydraulic results in summary form for the relevant storm events.
- The Consultant should prepare the model of an open system such that it fully contains the modeled flows without exceeding the hydraulic cross-section. Should it not be possible to contain the flows within the defined geometry of the open storm system, the Consultant should provide details on the spill characteristics. In the event of a spill, a rationale should be provided on whether or not to include a flow loss in the calculation.
- The Consultant should document potential impacts on existing infrastructure and possible mitigative measures.
- Sensitivity analysis should be conducted on a limited number of parameters depending on the model type and complexity.
- The Consultant should, if possible, verify hydraulic results for an existing closed/open storm system by documenting historical flood elevations for specific storm events and comparing the hydraulic modelling results to the historical data; calibration of losses should be included, if sufficient data exists.
- The Consultant should provide the input and output data in a logical manner with an explanation of the potential error.

The hydraulic capacity of storm sewers is to be determined using the Region of Waterloo and Area Municipal Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS) storm sewer design sheet and the MOE design guidelines. In addition, the Consultant should document, in both plans and text, the hydrology for the storm sewer design. The storm sewer design should be conducted using the City of Kitchener's 5 year IDF storm data of the City's approved storm event for the study area (regardless of the return period used previously to size downstream storm sewers).

G.8 FLOOD MANAGEMENT

All newly developing or redeveloping areas must assess their potential impacts on local and regional flooding, and mitigate accordingly. In areas where no watershed plan has been completed, it is City policy to require that runoff peak flows are controlled to pre-development levels or less. In certain site-specific circumstances, the City may require that post development flows be controlled to less than pre-development levels. As such, discussion regarding the over-control of post development flows would be required with the City.

Where Subwatershed or Master Drainage Plans have been completed, the Consultant will be required to comply with the recommendations of the specific plan. Any variations will need to be appropriately supported by detailed analysis and also be approved by any agencies having jurisdiction.

Sizing flood management controls (i.e. stormwater management quantity control facilities) is typically an iterative procedure. The Consultant should develop a stage/storage/discharge curve for a stormwater management control facility by determining the required runoff volume to be detained for various storm events.

The procedure for runoff determination typically requires the modeller to use either an event based or a continuous hydrologic model. The modeller should determine which modelling methodology to use. The first step in methodology selection should be whether or not a Subwatershed, Master Drainage Plan or similar previous study has been completed and the type of modelling used. If no previous study has established the modelling requirements, the following should be considered in selection of a methodology:

- The sensitivity of the watercourse from fisheries and erosion perspectives;
- The availability of stream flow data, and
- The potential for stormwater management long-term monitoring.

In providing the City details on flood management, the Consultant should follow standard codes of practice. The following standards are intended as a guide of requirements; however, this list should not be considered exhaustive:

- The Consultant shall provide the background hydrology behind the pre-development, post-development and controlled post-development scenarios (ref. hydrologic modelling Section G.7.1.3);
- The Consultant shall provide a table on the stage/storage/discharge relationship of the flood control facility. Methodology of determining the relationship shall be provided;
- The Consultant shall provide cross-sections of the facility and details of the inlet(s) and outlet(s);
- The facility shall have an overflow weir which is typically required for flows greater than the controlled storm events;
- The facility shall have a maintenance access for both the inlet(s) and outlet(s), and
- The Consultant shall provide landscaping details.

G.9 STORMWATER MANAGEMENT EROSION CONTROL/GEOMORPHOLOGY

Depending on the downstream water level and the nature of the soil strata affected, stream banks can be subject to increased erosion. In these cases, the Consultant(s) will be required to provide appropriate protection in accordance with the appropriate Watershed, Subwatershed or Master Drainage Plan, as well as the Stormwater Management Planning and Design Manual, Ministry of the Environment, 2003 (Section 3.4)

In areas where no Subwatershed Plan exists, it shall be the responsibility of the Consultant to provide adequate erosion protection in accordance with the Grand River Conservation Authority and Provincial Guidelines, unless it can be demonstrated through appropriate modelling and/or analysis that stream stability will not be adversely affected by the proposed development.

Erosion control and management involves one of the following:

- Extended Detention storage for the “Simplified or Detailed Design Approach” or the 25mm storm event as outlined in the Provincial Guidelines (ref. Stormwater Management Planning and Design Manual, Ministry of the Environment, 2003), in the absence of specific direction from a Subwatershed or Watershed Plan.
- Assessment of downstream erosion susceptibility and critical flow values in conjunction with event modelling.

- Assessment of downstream erosion critical velocity or shear forces in conjunction with continuous simulation techniques (duration analysis).

In areas where the downstream receiving watercourse is determined to be unstable, or where control/over control of flow rates is ineffective or not feasible, design of channel alterations may be considered, subject to design in accordance with natural channel design principles (ref. Ontario Ministry of Natural Resources Natural Hazards Technical Guidelines, March 2006).

Storm sewer outfalls in watercourses should be provided with proper protection against erosion which includes appropriate bank scouring protection on either side of the outfall and watercourse. When storm sewer outfalls outlet to steep and/or deep valleys, drop structures should be designed in such a manner as to provide integral bank stability. Such local erosion protection measures should be designed so as not to interfere with the watercourse forming processes of the receiving watercourse system or the system's ecological features or functions.

The Consultant should consider the following standard codes of practice in providing erosion control documentation:

- The Consultant shall provide the rationale and background information for the methodology used in assessing the required erosion controls.
- The Consultant shall provide downstream erosion threshold parameters based upon field investigation and background information.
- The Consultant shall demonstrate how the erosion controls have adequately addressed downstream erosion conditions.
- The Consultant shall, in the case of an erosion control stormwater management facility, provide:
 - (i) Stage/storage/discharge details and calculations;
 - (ii) Outlet control details;
 - (iii) Facility plan and cross-sections, and
 - (iv) Watercourse configuration at outlet.
- The Consultant shall document any proposed mitigation measures and provide the calculations performed in determining the measures.

G.10 QUALITY MANAGEMENT

Water quality treatment will be required for all new and infill development within the City of Kitchener. Exception to this may be considered if the size of the site or limit of disturbance is under the minimum threshold for stormwater management (0.1 ha.). Water quality treatment performance shall conform to MOE **Enhanced** level protection (corresponding to the end-of-pipe storage volumes required for the long-term removal of 80% of suspended solids) and risk assessment according to Policy RW-CW-19 in the Grand River Source Protection Plan to determine if the facility is a threat to drinking water sources, including measures to mitigate the threats.

The following shall be considered general guidelines in providing stormwater quality management for the City's review; however, it should not be considered exhaustive:

- The Consultant must provide the background hydrologic data for the stormwater quality management control being proposed.
- The Consultant must indicate the criteria that the quality management control is being developed from, whether it is Ministry of the Environment 2003 guidelines, a Subwatershed Study or other.
- The Consultant must provide plans of the quality management measure(s) with cross-sections of the facility(ies), details of inlets, outlets, maintenance access, berm construction and landscaping.

- The Consultant must provide calculations for stormwater quality control facilities such as the following:
 - volumetric sizing
 - stage/storage/discharge relationship
 - volume calculations at various facility stages
 - outlet control calculations – drawdown time
 - forebay dispersion length
 - minimum forebay deep zone bottom width
 - length/width ratios
 - maintenance requirements
- The Consultant must provide dimensions for all facility attributes and provide verification that the facility meets minimum Ministry of the Environment 2003 guidelines.
- The Consultant must provide a landscape plan for all applicable facilities, which would include background text and comparison to Ministry of the Environment 2003 guidelines and Urban Design Guidelines.
- The Consultant must provide soils information for the facility site and, in the case of proposed infiltration, document the quantity and quality impacts to groundwater recharge.
- The Consultant must minimize external drainage area overland flow impacts on the proposed stormwater quality control facility.
- The Consultant must indicate proposed flow by-pass conditions and impacts on stormwater quality.
- The Consultant must provide a maintenance and operation manual with the detail design of the facility, which outlines requirements for the City.
- The Consultant must develop a monitoring program for all applicable stormwater quality control facilities, which not only fulfills Ministry of the Environment requirements, but also the requirements of the City, the Grand River Conservation Authority and other relevant approval agencies.
- The Consultant must address winter operations for the proposed stormwater quality control facility (ref. Stormwater Management Planning and Design Manual, MOE, 2003).

G.11 MONITORING

G.11.1 Introduction

All land use change without (and often with) mitigation works, causes an impact to the runoff regime. Stormwater management measures are intended to reduce or eliminate adverse impacts to surface water, groundwater and receiving systems resulting from changes to runoff quality and quantity. The theoretical performance and function of stormwater management works has been relatively well documented. However, unique conditions are associated with each development, such as: topography, land use, soils, groundwater levels, design approach, construction methods, etc. All of these factors can combine to reduce the predictability of the performance of stormwater management infrastructure, leading to the need for at least a minimum level of monitoring, prior to, and possibly after, assumption by the City.

G.11.2 Purpose

The purpose of the Monitoring Plan is to:

1. Evaluate the performance and effectiveness of the Stormwater and Environmental Management System (i.e. design and stormwater quantity and quality mitigation techniques). This does not include the storm sewer system.
2. Provide the necessary information to adjust and/or optimize the plan recommendations through a process of Adaptive Environmental Management. Adaptive Environmental Management is a

process of monitoring various environmental parameters established within a monitoring plan for a development site. Based on monitoring results, necessary adjustments to the site's environmental management controls would be made to meet the environmental objectives for the site by the Developer until Final acceptance by the City.

G.11.3 Types of Monitoring Plans

Generally, there are two types of monitoring. The first is a "Development level" plan prepared for a single development and its associated infrastructure. The details of this type of plan would be part of the Preliminary and Detailed Stormwater Management Design Reports and may be discussed in an EIS. The scope is normally limited to direct on-site infrastructure that is part of the development, however off-site monitoring may be required to determine the effectiveness of the stormwater management infrastructure and possible impacts on the receiving system. This type of monitoring plan and implementation is paid for by the Subdivider.

The second type of monitoring would be part of a Master Planning document, such as a Watershed Plan, Subwatershed Plan, Master Drainage Plan or Class Environmental Assessment. Its scope typically includes numerous environmental indicators and infrastructure elements as determined through consultation with stakeholders and agencies. Such a plan is normally paid for by the Development Community. The monitoring recommendations contained within these Master Planning documents will provide direction for "System Level" as well as "Development Level" monitoring programs.

G.11.4 Process/Protocol

Each Consultant will be responsible to ensure that a Monitoring Plan is in place and is satisfactory to the City. If the subject development is part of an area where a Master Plan has been completed, the Consultant shall document how the subject development, its infrastructure and its Development Impact Monitoring Plan complies within the Master Plan recommendations.

Monitoring plans shall be established for all greenfield developments. Where the subject development is 'non-greenfield' (i.e. typically infill or 'brownfield') and is not part of an area covered by a Master Monitoring Plan, the Consultant shall consult with Development Engineering and Environmental Planning staff during the pre-consultation stage to determine if monitoring is required. The monitoring plan should be established to determine the potential development impacts on-site and within the receiving system to the satisfaction of Development Engineering and Environmental Planning staff. It should be noted that monitoring plans for infill development shall not be as extensive as required for 'greenfield' development. Costs of the monitoring program would be borne entirely by the Developer.

The Subdivider's Consultant, who shall be a qualified Professional Engineer or Environmental Professional acceptable to the City, as appropriate, will be responsible to prepare and submit at a minimum, annual reports, or as required by Master Monitoring Plan (as outlined in Watershed, Subwatershed or Master Drainage Plans), to demonstrate that the monitoring has been completed to the satisfaction of Engineering and Environmental Planning staff. More frequent reporting may be required to monitor the performance of the stormwater management infrastructure.

G.11.5 Monitoring Periods

Important factors for development impact monitoring include pre-construction, during construction and post-construction or substantially developed requirements. Subdivision Agreements and/or supporting studies to Development Applications detail the time periods for, and frequency of, monitoring. The monitoring plan will need to be detailed in the Preliminary and Detailed Stormwater Management Report.

G.11.6 What is Monitored

The actual specifics of what is monitored, and the length of the monitoring program, relate largely to the characteristics of the development and in-situ conditions, including the sensitivity of the local receiving system and the availability of existing information. While not intended to be exhaustive or mandatory, the following general list provides some guidance. The ultimate decision with regard to monitoring scope requirements rests with Development Engineering and Environmental Planning staff and commenting agencies, through the review of the Preliminary and Detailed Stormwater Management Reports and EIS where applicable. DFO will require monitoring plans should a project constitute a Harmful Alteration, Disruption or Destruction (HADD) of fish habitat and are typically a minimum length of two (2) to three (3) years.

Monitoring requirements should follow the recommendations of the relevant Watershed study, or Subwatershed study. In the absence of this type of study, monitoring shall include the water quality parameters as noted in the most recent Stormwater Annual Audit Report from the City. When the recommendations of the relevant Watershed study or Subwatershed study do not include the water quality parameters as noted in the most recent Stormwater Annual Audit, then those parameters are to be added to the scope of monitoring. Reporting shall be on a yearly basis and provided to the City as a digital submission. The digital submission may require entering the water quality results in a spreadsheet or database.

Table 9: SWM POND MONITORED PARAMETERS

Hydrometeorologic

- Rainfall - Continuous
- Streamflow- Storm Response
- Groundwater - Levels
- Baseflow – Flow Rate (Spot)

Water Quantity

- Inflow/Outflow at stormwater management facilities – Wet Event Response, Facility Storage- Discharge Relationship

Water Quality & Aquatic Habitat

- Benthic Invertebrates – Community Structure
- Water Temperature – Continuous
- Surface and Groundwater Chemistry – Standard Parameters including Nutrients, Metals and Bacteria
- Sediment- Total Suspended Solids
- Fisheries- presence/absence, relative abundance
- Stream baseflow and related groundwater systems

Fluvial Geomorphology

- Stream Cross-sections (Controls)
- Sediment Transport – (Substrate Composition)
- Erosion pins (Tractive Force, Critical Shear Stress)
- Bank Properties (Height, Angle, Material, Vegetation, Root Depth, Undercuts and In-situ Shear Strength)
- Long Profile Survey (Energy Gradient, Top and Bottom Riffles, Max Pool Depth)

Natural Heritage System

- Community Structure/Health – Ecological Integrity, Habitat Boundary Integrity, Problem Species, Overall Species and Habitat Diversity, Buffer Effectiveness, Human Activity Impacts
- Local Hydrology, Hydrogeology (ground and surface water levels, soil etc.)

G.11.7 Monitoring Plans for Stormwater Management Facilities

G.11.7.1 Post-Construction Monitoring

G.11.7.2 Introduction

At 95% build-out and after the facility has been cleaned-out, the Developer must request in writing, approval to begin the post-construction monitoring program.

The purpose of the post-construction monitoring program is to ensure that the stormwater management facility including end of pipe infiltration facilities continues to satisfy the design criteria specified in the subwatershed study, SWM report and MOE ECA certificate. It is also in place to identify any specific additional maintenance requirements and remedial works that may be necessary.

The post-construction monitoring program must be in place for a minimum of 2 years prior to Final Acceptance of the SWM facility, and is a continuation of the pre and during-construction. The reports shall be submitted to the City at the end of the first year of monitoring, as well as a final report after the second year.

Should the monitoring results show that the SWM facility is not functioning as outlined per the MOE ECA certificate, the Developer is responsible to remediate the SWM facility in order to meet the outlined objectives at the Developer's own expense.

G.11.7.3 Monitoring Criteria

1. Criteria Comparison

The monitoring reports must compare results to the specified subwatershed criteria, the MOE ECA certificate and the SWM report.

At a minimum, the monitoring reports must indicate the designed Total Suspended Solids (TSS) removal percentage compared to the actual removal percentage, the temperature mitigation, and facility outflow.

2. Monitoring Locations

The locations selected for monitoring should be at the inlet and outlet of the facility, as well as upstream and downstream of the receiving watercourse should the subwatershed require that the outletting water not influence the existing watercourse.

The locations of the monitoring equipment should be such that ambient temperature and other physical characteristics do not misrepresent the data. During the monitoring period, if it is found that the data is being influenced by other conditions (ambient air temperatures etc.), the monitoring equipment shall be relocated to give an accurate representation of the SWM facility condition, with the relocation reflected in the monitoring report.

3. Testing Parameters and Frequency

The parameters and frequency of testing should be sufficient to provide an accurate depiction of how the facility is functioning.

TSS: Water samples shall be taken at the inlet and outlet of the facility and tested at an accredited laboratory to determine the facility's removal of TSS. The minimum annual testing shall be as outlined in the City of Kitchener's Annual SWM Monitoring Program; however more stringent monitoring may be required per the subwatershed study.

The recommended annual grab sampling frequency shall be as follows:

- 4 wet weather sampling events
- 5 dry weather sampling events
- 1 melt/wet weather event

Wet samples are collected during the rising limb of a significant storm event (typically greater than 10mm). Dry weather sampling is limited to days without rain events and is not conducted within 48 hours of a significant storm event.

Flow Monitoring: To determine the outflow of the facility, flow measuring equipment must be installed at the inlet and outlet of the facility.

Detention Time: For all types of SWM Facilities including infiltration facilities, the detention time must be recorded to determine functionality of the facility.

Temperature: Where temperature mitigation techniques are part of the facility's design, temperature measuring equipment must be installed at the inlet of the facility, inlet of any cooling devices, and outlet of the facility to show the facility's ability to reduce the water temperature. If the devices are placed in such a way as to be influenced by external sources, the locations must be adjusted to provide the most accurate readings.

Chlorides: Where end of pipe infiltration facilities exist with winter by-pass systems, grab samples for chlorides should be taken at the infiltration facility both during and after the by-pass system is active to determine if the by-pass system is diverting chlorides from the end of pipe infiltration cells.

4. Analysis of Test Results

The results of the monitoring report shall be summarized and compared to the criteria, and the raw data must be provided. If the data is shown to be exceeding the criteria in the first year of testing, an explanation as to why there are exceedances should be included, as well as implementation of proposed methods to mitigate the exceedances for the following year. If the test results still show exceedances to the criteria after the final year of monitoring, retrofit options must be implemented by the Developer at their cost prior to final assumption by the City. The monitoring reports shall include current sediment volume and storage summaries, as well as indicate when any clean-outs have taken place.

G.11.8 Monitoring Plans for Infiltration Facilities

Visual inspection: Annual inspections of all infiltration galleries to ensure no sediment accumulation and to ensure observation ports are not destroyed/covered.

Water level: Annual water level monitoring in sample of galleries (2% of total – one per street within a Stage and Phase), must be more than one and located in different areas. The data needs to be captured by a water level logger inserted at the bottom of the gallery through the observation port.

The report needs to show data represented in chart proving design drawdown achieved with annual rain events and drawdown shown. If monitoring shows targets are not met, recommendations to be provided by Consulting Engineer how to meet the SWM criteria including use of contingency lands.

G.11.9 Enforcement

As part of the requisite development agreements, the City will require an item for monitoring in the Letter of Credit as security to ensure that the whole of the monitoring program is completed, as detailed in the accompanying Stormwater Management Report. Should the Consultant's annual reporting not be considered appropriate or compliant, and no action is taken by the Developer, the City may exercise the Letter of Credit and have the monitoring program completed by accredited professionals. The securities may also be used by the City to adjust channels and stormwater management facilities to the satisfaction of the City, Grand River Conservation Authority and the Department of Fisheries and Oceans.

G.12 ENGINEERING SUBMISSIONS

The Engineering submissions that relate to Stormwater Management and must be submitted and approved by the City prior to final acceptance are:

- Preliminary Stormwater Management report;
- SWMF Planting Plans;
- Final Design - Stormwater Management report;
- Detailed Stormwater Management facility engineering drawings;
- MOE ECA Application for Stormwater Management facilities;
- Electronic submission of as-recorded Stormwater Management Works, as-recorded Planting Plans, Operations and Maintenance Manual; and
- Annual SWM facility monitoring reports.

G.12.1 Stormwater Management Report

The Stormwater Management Report shall include the following list of items viewed as a generic list applicable to both preliminary and detailed stormwater management reports.

1. Plans showing:
 - (a) Project name and facility ID number(s) (as applicable);
 - (b) 30T or 58M numbers (if subdivisions);
 - (c) Lot and road layout with land use;
 - (d) elevations at key points (in a contour map);
 - (e) any surveyed constraint lines (e.g. top of bank, floodlines, wetlands);
 - (f) minor drainage system, with storm sewers, manholes, catchbasins;
 - (g) major drainage system with overland flow routes at key points;
 - (h) Overland flow routes;
 - (i) details of stormwater management practices, e.g. storage facilities, and
 - (j) erosion and sediment controls.
2. Descriptions of:
 - (a) receiving system and outlet including confirmation of legal status;
 - (b) classification of site and downstream aquatic habitat per DFO/MNR/MOE guidelines;
 - (c) SWM criteria for quantity, quality, flooding and erosion control;
 - (d) hydraulic analysis, as required of floodplains for major flow elements;
 - (e) design of SWMPs to meet applicable criteria, policies and guidelines;
 - (f) erosion and sediment control plan describing existing site conditions, erosion potential, down gradient risk assessment, and anticipated erosion and sediment controls, including staging
 - (g) maintenance and monitoring

3. Tables showing:
 - (a) hydrologic parameters for existing and future land use;
 - (b) pre and post-development peak flows and volumes at all outlets;
 - (c) stage/storage/discharge relationships for SWMPs, and
 - (d) overland flow depths and velocities at key points on roads and at outfalls.

4. Figures/drawings showing:
 - (a) general location plan
 - (b) drainage catchment areas for existing and future land use including all external areas
 - (c) details of overland flow routes
 - (d) details of SWMP facility appurtenances (inlets and outlets)
 - (e) details of erosion and sediment controls
 - (f) schematic of computer models

Note: all plans and reports are to be stamped and signed by a Professional Engineer licensed in Ontario

Software

The MIDUSS software shall be the preferred software for hydrologic modelling however other software may be used. Refer to G.7.1.3 for the comprehensive list.

Water Balance (Groundwater)

As required by applicable subwatershed studies to ensure post development infiltration targets are met as specified in the appropriate Master Drainage Plan or Subwatershed Study. An as recorded drawing shall be provided to the satisfaction of the Director of Engineering. These plans will include all locations where infrastructure for the purpose of groundwater recharge were installed and all pertinent details of said infrastructure including dimensions of galleries, gallery construction (typical stone versus chambers), piping, inverts, observation well construction and locations etc.

G.12.1.1 Preliminary Stormwater Management Report

Preliminary stormwater management reports precede detailed stormwater management reports and typically are a level of detail below the detailed stormwater management reports. Preliminary stormwater management reports should be provided at the time of Draft Plan of Subdivision Application for the review and approval of Development Engineering staff.

The Consultant, before submitting a detailed stormwater management report, should receive approval of the submitted preliminary Stormwater Management report from the City, Grand River Conservation Authority and Region.

G.12.1.2 Final Design – Stormwater Management Report

The outline for a detailed stormwater management report is the same as the preliminary stormwater management report, but with proposed design detail documentation. The Detailed Final SWM report is submitted with the first Engineering Submission for the review and approval of Development Engineering staff.

G.12.2 Ministry of the Environment ECA Applications for SWM Facilities

The Consultant shall prepare and submit to Development Engineering four (4) copies of the MOE ECA applications for Storm services and SWM facilities. The applicant on this form shall be the Subdivider and their signature(s) and company information shall be incorporated with the application.

Submit checklist with each application.

Prior to final acceptance of the stormwater management facility by the City, the ownership of the ECA certificate shall be changed from the Developer to the City by providing a signed letter from the previous owner authorizing the transfer of ownership.

G.12.3 Electronic Submission of As-Recorded Stormwater Management Works

The Consultant shall certify that the stormwater management facility has been constructed and is operating in general conformance with the Consultant's plans and design report. Should the City or Consultant determine that the facility is not performing according to the Engineer's design, the Consultant shall provide recommendations for the constructed facility to be retrofitted by the Developer. The Consultant should circulate the as-constructed survey, stormwater management certification and excel spreadsheet documenting as-built information to Development Engineering staff.

G.12.3.1 Design tracking spreadsheet

The design tracking spreadsheet is an excel spreadsheet that documents as-constructed information regarding the SWM facility. It shall be filled in by the Consultants and submitted along with the request for initial acceptance to Development Engineering in both hardcopy and electronic.

G.12.3.2 As-recorded Engineering Drawings

Includes plan and profiles, as well as, details of stormwater management infrastructure.

G.12.3.3 SWM Facility Topographical Survey

An as-constructed topographic survey incorporated into the stormwater facility engineering plans shall be provided along with the engineering calculations to determine and verify the following:

- permanent pool volume;
- active storage volume;
- berm construction;
- inlet and outfall structure details; and
- SWMF planting plan

G.12.4 Operations and Maintenance Manual

A separate "Operations and Maintenance Manual" must accompany the submission of the Final Design – Stormwater Management Report, which will outline the site-specific operational and maintenance procedures required to ensure the proper functioning of the facility as defined within the report, and comply with the Environmental Compliance Approval requirements. This Manual is to be followed by the Developer during the maintenance period and include recommendations for the City of Kitchener after final acceptance of the facility. The Consultant, in addition to reviewing materials herein and the most recent Ministry of the Environment guidelines, may also review the document *Stormwater Management Facility Sediment Maintenance Guide, 1999 by Greenland International Consulting Inc.* for typical operations and maintenance requirements. The following provides the minimum requirement for the format and content of the Operations & Maintenance Manual:

(a) Facility Design Brief

Include general design information about the facility including but not limited to:

- the main function of the stormwater system

- any site-specific characteristics of the facility that need to be taken into consideration during operation and maintenance (e.g. vehicular access constraints, presence or suspected species at risk in area, presence of invasive species in or around site etc.)
- expected quantity and quality performance of the facility under varying conditions such as dry weather conditions, winter conditions, frequent rainstorms and rainfall events exceeding the design capacity etc.
- presence and operation of any stormwater maintenance or by-pass valves

(b) Inspections

Consideration shall be given to the safety of the public, property damage and the performance of the facility with respect to the design objectives and the Environmental Compliance Approval. It shall include what to inspect for, proposed method of inspection for sediment accumulation, proposed frequency of inspection and actions to be taken with respect to certain findings.

This section shall be separated into the following categories:

- During construction development inspections
- Post-construction development inspections
- Post development inspections

(c) Scheduled Maintenance

The anticipated maintenance activities for each facility should be listed and outlined in detail. The steps to be followed by the Developer during and post-construction, and recommendations for the City to follow after final acceptance should be provided. The activities specified shall be site-specific and include any specialized equipment needed, seasonal preparation if applicable, and frequency of maintenance for each activity. The list of activities shall include but not be limited to:

- (i) Litter/Debris Removal
- (ii) Access Path Maintenance
- (iii) Vegetation Maintenance
- (iv) Invasive Species Maintenance – Include a strategy to follow for treatment and removal of invasive species anticipated
- (v) Infiltration Cell Maintenance
- (vi) Valve Maintenance – Provide number of turns to open/close
- (vii) Sediment Measurement
- (viii) Sediment Removal
 - 1. Forebay Sediment Removal
 - 2. Main Cell Sediment Removal

(d) Spills Action Plan

Although each facility should operate uninterrupted with a comprehensive preventative maintenance program, there may be unexpected failures that can lead to spills. Each SWM facility shall have a plan outlined specific to the facility that the Developer's Consultants will follow during construction, post-construction, and the City after final acceptance. This plan shall consider the type of potential failure events (oil spill, sediment breach due to construction etc.), determine whether it is to be considered an emergency, identify who should be notified during regular hours and after regular hours and what actions should be taken in the interim.

This plan shall outline the recommendations on how to contain the spill at the stormwater management facility to prevent further release downstream and include note of outlets to plug or valves to operate. If the facility includes infiltration cells, the plan shall specify the risks associated with the various types of spills and include preventative measures specifically for the infiltration cells.

(e) **Cost**

The "*Operations and Maintenance Manual*" shall include a breakdown of estimated annual maintenance and operating costs.

G.12.5 Annual SWM Facility Monitoring Reports

The annual post-construction monitoring reports (minimum 2 years) must be reviewed and approved by the City of Kitchener's Stormwater Utility. Refer to Section G.11.7, G.11.8 and G.13.2 for further detail.

G.13 SWM ACCEPTANCE REQUIREMENTS

G.13.1 Initial SWM Facility Acceptance Requirements

The initial SWM facility acceptance process is broken down into two sections, the SWM facility undergrounds and SWM facility surface works.

SWM Facility Undergrounds includes the following:

- Inlet piping and structures within the SWM block (Splitter MHs, Headwalls, etc.);
- Outlet piping and structures (Weirs, Quantity and Quality control structures, etc.);
- Cooling Trenches;
- Infiltration structures;
- Earth works required within the SWM Block;
- Erosion protection such as gabion mats, rip rap treatment, etc.
- Forebay weir;
- Spillway; and
- Maintenance access (asphalt/concrete/turfstone).

SWM Facility Surface Works includes the following:

- Landscaping above the 5 year elevation (tree types broken out); Refer to Section L;
- Landscaping below the 5 year elevation (tree types/aquatics broken out); Refer to Section L;
- Sod;
- Seed;
- Approved Growing Medium;
- Fine grading;
- Walkways (stone dust/asphalt etc. to be broken out separately);
- Fencing (types to be broken out separately);
- Gates or entrance features;
- Retaining walls (to be avoided where possible);
- Other infrastructure within the pond; and
- Surface asphalt.

The Subdivider shall install all landscaping of SWM areas above the five (5) year storm level in accordance with the approved plan, during the first planting season after occupancy of the first unit.

Prior to Initial Acceptance of SWM facility undergrounds, the following conditions are to be met:

- a) Satisfactory inspections from Development Engineering and SWM Utility;
- b) All test results (e.g. compaction, geotechnical, asphalt, concrete, CCTV etc.) are found to be satisfactory from City staff;
- c) Daily inspection and E&S reports supplied and reviewed by City staff;
- d) Certification letter provided to City staff to confirm the facility construction was as per the approved drawings (inverts, orifice plates, elevations of facility bottom, berm and soil materials, pond liner etc.); and
- e) An as-recorded survey of the SWM facility.

The stormwater management facility is considered part of the road and underground works. In order to accept the road and underground works, the SWM facility must be initially accepted either prior to, or in conjunction with the road and underground works acceptance.

Where SWM facilities require seasonal valve operation, the Subdivider is responsible to operate the valves during the maintenance period, and to provide the operations and maintenance manual (see G.12.4 – “Operations and Maintenance Manual”).

G.13.2 Final SWM Facility Acceptance Requirements

Prior to Final Acceptance of the facility, the following conditions must be met in order:

a) Clean-out of the SWM facility at 95% buildout: At 95% build out of the catchment area, all cells of the facility must be cleaned out following best management practices and with all applicable permits obtained. A survey shall be provided to the City to confirm all accumulated sediment has been removed.

The survey shall consist of a bathymetric survey of all storage cells including the forebay and any main cells or wetland areas to obtain the accumulated sediment volumes. These surveys shall be submitted to the City for review with the formal request to commence the post-construction monitoring program. The sediment volume shall be compared to the actual designed/constructed permanent pool volume.

Where multiple Subdividers are responsible for the maintenance of the same pond, a Subdivider who has reached 95% build out can go through the pond acceptance process, or enter into an agreement with all other Subdividers to be released of their pond maintenance obligations. By entering into the agreement, the Subdividers agree to clean out the absolved Subdivider's sediment from the pond and pipes. Further, the remaining Subdividers must have a minimum 15% Letter of Credit for the entire SWM block posted with the City.

b) 2 years of post-construction monitoring: After 95% build-out has been reached and the clean-out completed, a formal request to commence the post-construction monitoring must be submitted to Development Engineering – Refer to Section G.11.7 for details. Any landscaping below the 5 year storm level that is required for water quality treatment should be installed prior to monitoring.

c) Bathymetric survey: When the 2 year post-construction monitoring is completed, a bathymetric survey of all cells must be conducted. If the sediment survey shows the required

permanent pool volume is met, and there are no areas with sediment accumulation greater than 0.2m, then no further clean out is required by the Developer.

After review and approval of the monitoring and sediment survey results, the Consultant may proceed to request final inspection.

d) Satisfactory inspections and sign-off: from Parks, SWM Utility, and Development Engineering. All items in the SWM Block (underground and surface works) are to be inspected and accepted as a whole after the 2 years of post-construction monitoring has been accepted and approved by the City.

e) Review and approval of final acceptance package: The package shall include the Monitoring Report, Operation and Maintenance Manual, As-built deliverables, and the SWM Pond Acceptance Checklist (found under General Forms)

G.13.3 Initial Front Yard Infiltration Gallery (FYIG) Acceptance Requirements (Upper Blair Creek)

LC reduced to 15% only if:

- 100% of galleries installed and completed (for the facility catchment area)
- Subdivider's Consulting Engineer certifies the "at source" infiltration facilities are functioning as designed and approved to the satisfaction of the City's Director of Engineering Services
- At 90% buildout of the facility catchment area, the Consulting Engineer sends in a request to start the post-construction monitoring period (min. 2 years), along with calculations to confirm 90% buildout and the Final "during" construction monitoring report
- City will issue letter of post-construction monitoring commencement date
- With their LC request, the Consulting Engineer is to include the following: City's formal acceptance letter, City's post-construction confirmation date letter, City's acceptance memo for the Development Asset Drawings and the approved "during" construction monitoring report

G.13.4 Final FYIG Acceptance Requirements (Upper Blair Creek)

Balance of LC reduced to Zero only after:

- The FYIG will be assumed by the City concurrently with the conveyance infiltration facilities (CIFs), contingency galleries, SWM facility and end of pipes infiltration facilities (EOPIFs)
- Post-construction monitoring report has been approved by the City (2 years after date in the post-construction monitoring letter of commencement)
- Subdivider's Consulting Engineer has certified the "at source" infiltration facilities continue to function as intended and approved to the satisfaction of the City's Director of Engineering Services
- Subdivider's Consulting Engineer submits standard package requirements:
 1. Operations and Maintenance Manual including FYIGs, CIFs and EOPIFs
 2. Inspection/deficiencies corrected
 3. Department signoffs
 4. GRCA signoff
 5. As-recorded PDF to GIS
 6. DADs submission complete

Subdivisions within the Doon South, Blair Creek and Rosenberg Communities may have SWM infrastructure and monitoring requirements in addition to what is outlined in this manual. The acceptance

of these SWM ponds and infiltration facilities (including infiltration facilities on City lands or within City easements on private property) will take place after satisfactory monitoring results are achieved, as described in their Subdivision Agreement, and in accordance with the relevant Sub-Watershed study.

H STREETLIGHTING

Within the City of Kitchener, streetlighting design is completed by Kitchener-Wilmot Hydro (KW Hydro), with the exception of Ornamental Streetlighting Design.

The specifications for standard streetlighting equipment for the City of Kitchener include:

- Cobra-head luminaire, Leotek Electronics, GreenCobra Junior Series part numbers: GCJ0-15H-MV-WW-2R-GY-700-PCR7-CR, GCJ1-20H-MV-WW-2R-GY-580-PCR7-CR or approved equivalent;
- Round, concrete pole 32.5' B, StressCrete part number: E32.5-BPR-G-MOO S/F 120, or approved equivalent.
- 7-pin control node (one per luminaire) compatible with Street Light Vision software on the Itron network, SELC or Acuity Brands, or approved equivalent.

The installation of the streetlighting system must be completed by KWHydro or an approved Contractor at the Subdivider's cost (including supply of all standard streetlighting equipment) and energized prior to occupancy. The City of Kitchener is responsible for installing the control nodes, and coordination required to upload control node to the adaptive mesh network.

H.1 ORNAMENTAL STREETLIGHTING

Within residential subdivision, Subdividers have the opportunity to request ornamental streetlighting as an alternative to the standard municipality approved streetlighting equipment. The Subdivider shall confirm whether ornamental lighting will be used for the subdivision prior to servicing. The City has established a standard for ornamental roadway streetlighting in new plans of subdivision regarding illumination levels and equipment.

The following conditions and responsibilities between the City, Kitchener-Wilmot Hydro Inc., and Subdividers shall apply.

H.1.1 Approval

Consent

- The Subdivider will obtain consent from the City for installation of the approved ornamental streetlighting equipment;
- The Subdivider will show proof of consent to Kitchener-Wilmot Hydro Inc., after which, street lighting design will proceed based on use of City approved ornamental streetlighting;
- A determination if ornamental lighting would be permitted will be the type of lighting that has been installed in adjacent plans of subdivision (if present). The intent being that on connecting streets, between plans of subdivision, the lighting style will be consistent. The use of standard or ornamental roadway lighting throughout the development will be as directed by the City having jurisdiction. Where possible, Subdividers are encouraged to work together and proposals for lighting for adjacent plans must be submitted to Kitchener-Wilmot Hydro Inc. for review; and
- Luminaries and control nodes must be interoperable with Streetlight Vision Central Management System software on the SilverSprings network.

H.1.2 Financial

Initial Capital Cost

The Subdivider will be responsible for 100% of the capital cost for ornamental street lighting equipment, luminaire control nodes, as well as, any additional engineering design costs, including extra poles for closer spacing.

Maintenance

- In view of the substantially higher capital cost of the upgraded ornamental street lighting equipment and increased maintenance costs over the normal City approved standard, Subdividers are required to contribute a one-time cash contribution towards future maintenance and replacement costs. The contribution will be equal to 10% of the capital equipment cost plus applicable taxes for such equipment or minimum of \$2,000.00, whichever is the greater, prior to Initial Acceptance of the subdivision stage underground services. The contribution will be paid directly to the City. The Subdivider will include, along with payment, copies of all invoicing from the streetlighting and control node suppliers. Proof of payment is to be submitted to KW Hydro before streetlighting system energization authorization will be given;
- The City will fund 100% of all maintenance costs for streetlighting within its jurisdiction after each subdivision development's streetlighting electrical system is energized;
- The Subdivider will fund 100% of all maintenance costs prior to electrical energization of the subdivision streetlight system. This includes costs due to theft, weather, vandalism, and damage caused by construction;
- In observance of item H.1.2. above, Kitchener-Wilmot Hydro Inc. will, if so requested by the Subdivider, perform any required ornamental streetlight maintenance. Costs relating to such maintenance will be charged on a time and material basis to the Subdivider. Replacement equipment for emergency maintenance purposes shall be billed to the Subdivider.

H.1.3 Design

Equipment Selection

Selection of ornamental streetlighting equipment will be limited to the City's approved equipment as described in Item H.1.5. Substitutions of equipment will not be accepted unless approved in writing by the City.

Subdivider Responsibilities

The Subdivider shall provide the streetlighting photometric design layout of the development, supply drawings and specifications and other information thereof to the City of Kitchener and Kitchener-Wilmot Hydro Inc., which detail:

- a. Luminaire mechanical and electrical details.
- b. Pole construction and installation details.
- c. Overall layout and dimensional locations of all poles and luminaries along roadway allowance. Locations are to be reviewed and approved by the Subdivider in regard to location conflicts with driveways, services and other street furniture.
- d. Light level calculations to confirm that the roadway and intersection lighting levels will meet the City's standard. See attached Tables 1 & 2 for recommended values from ANSI/IESNA RP-8-00.

Note that Kitchener-Wilmot Hydro Inc. will designate the road and pedestrian conflict area classification for each street within the development and indicate the light level to be achieved. It is the City's intent to illuminate the areas using the minimum lamp wattage that will achieve the desired level at a reasonable luminaire spacing of approximately 35.0 – 45.0 metres. Over-illumination of areas, in view of luminaire wattage standardization by the Subdivider, will not be permitted.

- e. The preferred layout of poles and luminaries is on both sides of the roadway in a staggered pattern. Exceptions shall be on divided median roadways and at intersections.

Table 1

Street Classification	Pedestrian Activity Classification*	Average Luminance L_{avg} (cd/m ²)	Average Uniformity Ratio L_{avg}/L_{min}	Maximum Uniformity Ratio L_{max}/L_{min}	Maximum Veiling Luminance Ratio $L_{v,max}/L_{avg}$
Major	High	1.2	3.0	5.0	0.3
	Medium	0.9	3.0	5.0	0.3
	Low	0.6	3.5	6.0	0.3
Collector	High	0.8	3.0	5.0	0.4
	Medium	0.6	3.5	6.0	0.4
	Low	0.4	4.0	8.0	0.4
Local	High	0.6	6.0	10.0	0.4
	Medium	0.5	6.0	10.0	0.4
	Low	0.3	6.0	10.0	0.4

Table 2

Illuminance for Intersections				
Functional Classification	Pedestrian Activity Level Classification			E_{avg}/E_{min}
	High	Medium	Low	
Major/Major	34/3.2	26/2.4	18/1.7	3.0
Major/Collector	29/2.7	22/2.0	15/1.4	3.0
Major/Local	26/2.4	20/1.9	13/1.2	3.0
Collector/Collector	24/2.2	18/1.7	12/1.1	4.0
Collector/Local	21/2.0	16/1.5	10/0.9	4.0
Local/Local	18/1.7	14/1.3	8/0.7	6.0

KW Hydro Responsibilities

Kitchener-Wilmot Hydro Inc. will be responsible for:

- Underground cable design and layout.
- Streetlighting control system design.
- Co-ordination of fixture or pole locations with the electrical distribution locations in consideration with item H.1.3. above.

City of Kitchener & Network Administrator Responsibilities

City of Kitchener and Network Administrator will be responsible for:

- a. Installing the control nodes, and coordination required to upload control node to the adaptive mesh network. Upload each control node to the Central Management System (Streetlight Vision). Use Streetlight Vision to test the installed nodes to ensure functionality.

H.1.4 Construction

Purchase, Shipping and Storage of Streetlighting Equipment

- a. Subdividers will be responsible for purchase and storage of ornamental streetlighting equipment and the control nodes (one per luminaire) associated with each stage of subdivision development.
- b. The Subdivider will confirm with the equipment supplier the information needed to purchase the required ornamental streetlighting equipment and control nodes for each development. Information will include manufacturer, model number, style and quantities.
- c. The Subdivider must confirm with the manufacturer of the control node interoperability with the Central Management System (Streetlight Vision) and the SilverSprings Network.
- d. The equipment referred to in item H.1.4.a. above shall include (but not necessarily be limited to) poles, luminaries, control nodes and support brackets.
- e. The Subdivider will store and make accessible, all equipment in a secure location on the subdivision development site. Kitchener-Wilmot Hydro Inc. will not transport any Subdivider purchased equipment from locations remote from the development site. Disposal of equipment packaging material shall be the responsibility of the Subdivider.
- f. Poles, fixtures and control nodes should not be shipped to Kitchener-Wilmot Hydro Inc. unless special arrangements are made in advance. In this case, a fee of 10% of the shipment invoice will be applied.

Installation

- a. Kitchener-Wilmot Hydro Inc. or its approved Contractor will make all necessary installations of equipment associated with streetlighting on the public right-of-way within the development.
- b. The Subdivider shall make all necessary installations of lighting as required in the following areas:
 - i) Public walkways;
 - ii) Parks, and
 - iii) Privately owned lands or developments.
- c. Kitchener-Wilmot Hydro Inc. will be responsible for:
 - i) Obtaining poles and fixtures from the secured onsite storage area;
 - ii) Installing poles and fixtures;
 - iii) Installing underground cable and controls, and
 - iv) Connecting and energizing fixtures and luminaire control nodes.
- d. City of Kitchener will be responsible for:
 - i) Installing the luminaire control nodes and uploading the mesh network;
- e. The Subdivider shall coordinate other construction activities of the development with installation of the streetlighting system.

H.1.5 Material Selection

The specifications below are the approved ornamental streetlighting equipment for the City of Kitchener. The Subdivider is to confirm all ordering information with the manufacturer before purchase.

LUMINAIRE :	
Manufacturers :	King Luminaire Inc., Holophane
Style:	Washington Full Cut Off
Optical System:	Flat Array
IES Lighting Classification:	Type II, Type III, Type IV, Type V
Wattage:	LED 40W to LED 140W (to suit road classification)
Colour Temperature:	3000 Kelvin
Dimming:	Control-ready wired for wireless node dimming
Input Voltage:	MVOLT, 120 Volts AC
Wiring Accessories:	Setscrew, Quick disconnect wiring harness
Globe Ring Assembly:	“Rotolock” tool free globe removal c/w globe hanger and globe hanger hook
Pole Adapters:	K5 / K9 Capital (for use on single pole top locations to accept a 7-inch OD tenon) K16 Capital (for use with poles having KA65 Lansing twin arms and single locations on Hydro poles (using K69S brackets with 3.5-inch OD tenons) Modern Style - Swing Open Design c/w TC-P7C/3T-BK – Transitional aluminum from 7” diameter post capital to 3” diameter tenon PTA-35R-30R to transition from 3.5” to 3” tenon
Ornamental Accessories:	Non
Paint Colour:	Black

POLE:	
Manufacturers:	King Luminaire Inc., Holophane
Type:	KT14 Talisman, KT13 Talisman (for twin arm), Victorian direct buried concrete pole with 3 HHB’s
Finish:	E10 Midnight Lace Etched Finish
Colour:	Midnight Lace E-10

BRACKET:	
Manufacturers:	King Luminaire Inc., Holophane
Twin Arms:	KA65-Lansing Arm, Northbrook NP28
Single Arm:	K69-S, Annapolis ACA/1 (for mounting on KW Hydro poles)

Luminaire Control Node

Each new luminaire will be compatible with a luminaire 7-pin control node that will be integrated with a real-time radio frequency controlled, adaptive control mesh network. The control nodes will provide real time control for each individual luminaire and collect data from the environment which is then communicated to the Cloud data collection server.

The Subdivider is responsible for the supply of one control node per fixture. The City of Kitchener is responsible for installing the control nodes, and coordination required to upload control node to the adaptive mesh network.

CONTROL NODE:	
Manufacturers:	SELC, Holophane
Network Compatibility:	Itron Network
CMS Compatibility:	Streetlight Vision

(a) Physical Features and Requirements:

1. Control nodes shall be capable of normal operation over an ambient temperature range of -40 degrees C to 50 degrees C;
2. Field cabinets requiring external power supply shall comply with the Canadian Electric Code, CSA C22.1 respecting disconnect means;
3. Control nodes shall have the capability of withstanding power surges and transient voltages. All controllers and gateways shall have a minimum of 10kA and 10kV surge protection;
4. Controllers shall be capable of actuating the status (ON state, OFF state) of the luminaires;
5. Controllers shall be capable of actuating a luminaire dimmed state by creating a control signal that complies with a specified 0-10V standard (e.g. IEC 60929) or complies with a specified DALI standard (e.g. IEC 62386);
6. Controllers shall be capable of measuring and monitoring over time the following power quality parameters:
 - i. RMS input voltage (Volts);
 - ii. RMS input current (Amps);
 - iii. Apparent power (VA);
 - iv. True input power (Watts); and
 - v. Power factor.
7. Controllers shall measure power quality parameters at each control point for the luminaire and the controller;
8. Controllers shall measure energy consumption with an accuracy and precision of $\pm 5\%$ or better, over the ambient temperature range -40C to 40C and a load range of 0.1% to 100% relative power;
9. Controllers shall be capable of integrally sensing (or otherwise determining) and monitoring over time the following environmental parameters:
 - i. Expected sunrise and sunset times (e.g. via an Astronomical Clock);
 - ii. GPS Location; and
 - iii. Luminaire temperature.
10. Control nodes shall be capable of logging:
 - i. Cumulative hours in the luminaire ON state for each control point; and
 - ii. Cumulative energy consumption of each control point.
11. Control nodes shall log cumulative energy consumption according to the following specifications:

- i. During offline operation, control nodes shall be capable of storing the following offline time-stamped control point parameters:
 - i. Controller status (Online, Offline, Warning or Error codes);
 - ii. Luminaire status (ON, OFF, Dimmed State, Warning or Error codes);
 - iii. Cumulative ON state time (minutes); and
 - iv. Cumulative energy consumption (kWh).
- ii. During offline operation control nodes shall be capable of storing measurements of all offline parameters at a storing frequency of less than once every 30 minutes; and
- iii. During offline operation control nodes shall be capable of storing measurements of all offline parameters at the specified storing frequency for a storing period of greater than 4 days.

(b) Logical Features and Requirements:

1. During online operation, control nodes shall be capable of reporting the following online control point parameters:
 - i. Controller status (Online time, Offline time, Warning or Error codes);
 - ii. Luminaire status (ON, OFF, Dimmed State, Warning or Error codes);
 - iii. Average RMS input voltage (Volts) in the ON state;
 - iv. Average RMS input current (Amps) in the ON state;
 - v. Average true input power (Watts) in the ON state;
 - vi. Average input power factor in the ON state;
 - vii. Cumulative ON state time (minutes);
 - viii. Cumulative energy consumption (kWh); and
 - ix. GPS location (via integral sensor).
2. During online operation, control nodes shall be capable of reporting all online control point parameters for all control points at a maximum reporting frequency of once every 30 minutes;
3. During online operation, control nodes shall be capable of reporting all control point parameters for a single control point at a maximum reporting frequency of once every 5 minutes;
4. Control nodes shall execute any single command received from the Backhaul Communication Network in less than 300 seconds;
5. Control nodes shall automatically report all data stored during offline operation once online operation is restored; and
6. Control nodes shall utilize a secure boot up scheme to verify the integrity of firmware images that are to be executed, thereby preventing unauthorized or maliciously modified software from running on the device.

(c) Functional Features and Requirements:

1. Control nodes shall be capable of controlling a single Luminaire or groups of luminaires;
2. Control nodes shall be capable of manual control, whereby the ON/OFF and dimmed state of a single luminaire or group of luminaires is modified in response to commands

from the central management system;

3. Control nodes shall be capable of scheduled control, whereby the ON/OFF and dimmed state of a single luminaire or a group of luminaires is modified according to a predefined schedule;
4. Control nodes shall be capable of scheduled control that is defined for a minimum of 10 times/events per day;
5. Control nodes shall be capable of time-based scheduled control that is defined on a daily recurring basis or on a weekday recurring basis or on a weekend recurring basis;
6. Control nodes shall be capable of adaptive control, whereby the ON/OFF and dimmed state of a single luminaire or a group of luminaires is modified in response to dynamic inputs from the Central Management System;
7. Field Devices shall be capable of prioritized control, whereby the scheduled control of individual luminaires or groups of luminaires is modified or overridden according to input from the Central Management System;
8. During offline operation control nodes shall be capable of maintaining luminaire control by continuing to operate according to the most recently programmed scheduled control or a default scheduled control if one has not yet been programmed;
9. Control nodes shall be capable of light output control, whereby the luminaire dimmed state is actuated to achieve a desired light output (percent relative lumens); and
10. Control nodes shall be capable of automatically maintaining constant Luminaire light output (lumens) over time by compensating for Luminaire lumen depreciation.

(d) Interchangeability and Interoperability

11. Control nodes shall be Interoperable with Streetlight Vision Central Management System software on the SilverSprings network;
12. Control nodes shall be Interoperable with the City of Kitchener's Backhaul Communication Network;
13. Control nodes shall be Interoperable with the luminaires specified in this document; and
14. The Contractor shall demonstrate to the City of Kitchener every combination of control node interoperability with each of the proposed luminaires prior to installation;

(e) Rated Life

1. The rated life of all Field Devices at an ambient temperature of 25 degrees Celsius shall be 10 years or more and hardware devices shall be warranted for 10 years.

(f) Luminaire Control Node Installation:

1. The City of Kitchener is responsible for installing the control nodes supplied by the Subdivider, and all coordination required to upload control node to the adaptive mesh network. For each node installed, the information identified in Table 1.0 (below) will be required;

2. Control nodes for luminaires will be integrated (mechanically and electrically connected) internal to the luminaires, using a NEMA C136.41 standard 5-terminal polarized twist- lock receptacle for both electrical and dimming control signal connectivity;
3. For each node installed, the City of Kitchener will obtain the information identified in Table 1.0;

TABLE 1.0

Control Node Install Date	Control Node Serial Number	Control Node Brand Type	Assigned City of Kitchener Unique Identifier	Lamp Install Date	Control Node Mac Address	Luminaire Brand	Luminaire Model	Power
dd/mm/yyyy	From Manu.	From Manu.	TBD	dd/mm/yyyy	TBD	From Manu.	From Manu.	Based on Model

4. For each development, or development phase, the City of Kitchener will provide a series of unique identifiers. One unique identifier will be assigned to each control node.

I NATURAL GAS

In the City of Kitchener, Kitchener Utilities is responsible for natural gas servicing, except for a portion of the Pioneer Tower east area, where Union Gas has jurisdiction.

I.1 NATURAL GAS SERVICING DESIGN

All design and installation shall be the responsibility of Kitchener Utilities. Aid-to-construction, if required, shall be determined in accordance with the Kitchener Utilities Conditions of Service document. The Subdivider is responsible to contact Kitchener Utilities to co-ordinate the design in advance of the first submission.

In no case shall a gas service or main be placed within 2.0 m of other parallel-aligned water and sewer mains or services in accordance with the Public Utilities Act unless prior approval is received from the Director of Engineering Services.

Kitchener Utilities is responsible for maintenance of gas services to the meter outlet.

I.2 EASEMENTS

The minimum easement width required for a single pipe shall be 4.0 m, regardless of construction method. For more than one (1) pipe, the width of the easement shall be determined by the Director of Engineering Services.

I.3 TIMING OF INSTALLATION

Kitchener Utilities is responsible for the installation of the gas main within the right of way. The Consultant shall contact Kitchener Utilities regarding timing of installation of gas main prior to commencement of building construction.

J LOT GRADING

J.1 PURPOSE

The purpose of Lot Grading is to ensure individual parcels or properties are designed to minimize the impact precipitation events have on that parcel or property and the surrounding area. The design is based on an overall stormwater management and grading plan and interpolated by the designer at an individual lot level.

The design shall:

- Follow the Drainage Act;
- Ensure surface drainage from or on adjacent lands is accommodated or not adversely affected;
- Grading, drainage and building construction should be such that unanticipated stormwater does not enter the sanitary sewer system;
- Grading and drainage on lands developed should be congenial with nature and thus preserve the natural terrain as much as possible, and
- Grading and drainage schemes shall include erosion and sediment control measures. Refer to Section K of the Development Manual.

J.2 GENERAL

Lots, including drainage ditches and swales, are to be completely top soiled and sodded with a minimum 150mm of approved growing medium. The soil depth for all tree planting areas will meet the requirements of the Tree Planting Plan and the requirements of Section M of the manual.

All surface drainage, including downspout discharge, shall be diverted away from the building(s), including adjacent existing or future buildings.

Grade areas to:

- Provide proper surface drainage and maximum usable land area;
- Preserve existing trees where possible; and
- Direct flows away from buildings.

Front yard grades shall be:

- Minimum yard slope of 2.0%;
- Optimum yard slope of 4.0%, and
- Maximum yard slope of 6.0%.

Rear yard grades shall be:

- A minimum of 6m of the rear lot area from the back of the house shall be graded between minimum 2% to maximum 6%.

From House to Side Lot Lines grades shall be:

- Minimum slope of 2.0% (always away from the house), and
- Optimum slope of 4.0%.

Driveway grades shall be:

- Minimum driveway slope of 2.0% and maximum driveway slope of 8.0%; and
- Optimum driveway slope of 4.0%.

Walkway grades shall be:

- Minimum cross slope of 2.0% (where gradient is less than 2.0%), and
- Maximum walkway gradient and cross slope of 5.0% (combined).

Paved Utility Areas are required for the placement of Hydro boxes, cable/telephone boxes and are located in the City Right of Way and shall be installed by the Utility. The Paved Utility Area grades shall be:

- Minimum paved utility area slope of 0.5%;
- Optimum paved utility area slope of 1.0%, and
- Maximum paved utility area slope of 6.0%.

Lot grading shall be designed in accordance with the following City of Kitchener Standard Drawings:

- Lot Drainage Type 'A' (Standard Drawing 400)
- Lot Drainage Type 'B' (Standard Drawing 401)
- Lot Drainage Type 'C' (Standard Drawing 402)
- Lot Drainage Type 'D' (Standard Drawing 403)

J.3 REAR YARD CATCHBASINS

Lot grading should be completed in such a manner as to avoid rear yard catchbasins whenever possible. Recognizing that this is not always achievable, the following standards apply to rear yard catchbasins in the City of Kitchener:

- The maximum distance from the swale high point to the rear yard catchbasin shall be the lesser of 50.0m or three (3) single family lots, unless otherwise approved by the Director of Engineering Services;
- Rear yard catchbasins shall not have sumps;
- The proposed lowest adjacent opening elevation (i.e. basement window sill) shall always be above the maximum ponding level above the catchbasin, at which point there would be overland relief;
- Maximum ponding level above a rear lot catchbasin is 0.3m;
- Rear yard catchbasins and outlet pipes shall be located entirely on one (1) lot;
- Rear yard catchbasin outlet pipes must connect to a structure on the storm sewer, blind connections are not allowed; and
- Easement requirements for rear yard catchbasins and leads shall be as per the table below.

Table 10: EASEMENT REQUIREMENTS	
Size of Pipe	Minimum Width of Easement
250mm to 375mm	5.0m
450mm to 1500mm	6.0m
1650mm and up	6.0m plus 3 times O.D. of Pipe

J.4 SWALES

The maximum runoff typically allowed in a swale between two (2) buildings and within rear lot swales is based on the following grading guidelines.

Any swale deemed “significant” by City staff, which may require future maintenance, may be acquired as a permanent easement (minimum of 5.0m in width) by the City and designated as an overland flow route. Swales conveying 0.7m³/s or more in the 100-year storm shall be considered significant by the City (based on a 1.0m wide grassed swale with 3:1 side slopes at a depth of 0.3m and a slope of 2.0%).

Swale grades shall be:

- Minimum longitudinal swale slope of 2.0%;
- Maximum longitudinal swale slope of 8.0%;
- Optimum side slope of 6:1;
- Maximum side slope of 3:1; and
- Maximum side slope of 10.0% when swale is in rear yard access easement.

Swale Length:

- The maximum length of a swale shall not exceed 50.0m.

Swale Depth:

- Minimum swale depth is 150mm.

A cross-section of a swale is provided on Standard Drawing 404.

J.5 ROOF LEADERS AND SUMP PUMPS

Roof leader connections to storm laterals are expressly prohibited. Roof drains should discharge to the front of the building to grade, with flows directed away from the building foundations and without erosion or inconvenience to others, except where infiltration facilities are connected. Unless otherwise approved by the City Engineer, run-off from roof leaders shall flow across pervious ground surfaces prior to entering the storm systems.

Foundation drainage must be directed to sump pumps and discharged to a storm lateral where municipal infrastructure (storm sewers) exists in the right-of-way. This includes all new development (subdivisions) and most infill developments. Instances where municipal infrastructure does not exist sump pump discharge can be per OBC.

J.6 GROUNDWATER

Minimum 0.6m separation is required between the underside of the footing to seasonally high groundwater elevation. On a site-by-site basis, for walkouts only, where the footings are extended for frost cover the 0.6m separation can be considered to the underside of the floor slab. Third pipe ground water collection systems are not allowed to be installed to lower existing groundwater elevations to achieve the required groundwater separation.

Subdivision applications are to demonstrate difference of elevation between seasonally high groundwater elevations to the underside of footing elevations. This is to be submitted at time of Draft Plan and updated during detailed design (minimum two year groundwater elevation monitoring at time of detailed design submission, however some sites may require additional monitoring requirements).

Where lots are proposed within an area of concern, the Geotechnical Consultant shall provide the minimum underside of footing elevation for those lots and is to be shown on the lot grading plan. A letter is required from the Geotechnical Consultant certifying the minimum elevations as correct.

K EROSION AND SEDIMENT CONTROL

K.1 EROSION AND SEDIMENT CONTROL

Erosion control is a preventative measure and is defined by keeping soil on the project site through reduced grading of areas, timely re-vegetation, cover and erosion protection. Sediment control is a mitigation measure which stops silt migration once it has commenced. A multi-barrier approach is preferred.

To this end, soil erosion and sediment movement must be minimized and controlled in accordance with the latest requirements of the GRCA and the City of Kitchener (Refer to “Erosion and Sediment Control Guideline for Urban Construction”, The Greater Golden Horseshoe Area Conservation Authorities, December 2006).

All activities on the site shall be conducted in a logical sequence to minimize the area of bare soil exposed at any one time.

All erosion and sediment controls are temporary applications constructed prior to any land grading or disruption activities on the site. They shall be inspected and maintained by the Subdivider’s Consultant for the duration of the construction period, including building construction or until the site is stabilized.

Based on the above, no silt can leave the site or impact any waterways, wetlands or environmentally significant lands that cross or are adjacent to the site. At a minimum, silt fence shall be erected along the property limits. The silt fence shall be maintained throughout the year and replaced on a need to basis. Mud mats will be required at construction access points to limit the amount of silt and dirt entering the roadway. Silt sacks will be required in all catchbasin structures adjacent to construction sites. Filter fabric tends to dump trapped sediment into the catchbasin or end up in the structure anyways affecting the sewer.

All disturbed ground left inactive shall be stabilized by seeding, sodding, mulching or covering, or other equivalent control measure. The period of time of inactivity shall not exceed 30 days, unless otherwise authorized by the Director of Development Engineering.

Winter grading may be permitted at the sole discretion of the Director of Development Engineering; however, a sediment and erosion control plan shall be submitted to the Director of Engineering Services.

All Erosion and Sediment Control Facilities are to be inspected by the Consultant once a week, after each rainfall in excess of 25 mm and after a significant snowmelt. Daily inspections are required during extended rainfall or snow melt periods. These inspections are to ensure that the facilities are in proper working condition and all damaged Erosion and Sediment Control facilities are to be repaired and/or replaced within 48 hours of the inspection. A permanent record of these inspections must be forwarded to the Development Engineering staff within five (5) days of the inspection. Please see City of Kitchener website for a sample Inspection and Monitoring Sheet.

Sediment basins are a permitted sediment control measure within the Grand River Conservation Authority watershed. Guidelines for use of sediment basins are contained within the “Erosion and Sediment Control Guideline for Urban Construction”, The Greater Golden Horseshoe Area Conservation Authorities, December 2006. All sediment basins are subject to review and approval by the Grand River Conservation Authority. Should the sediment barrier be breached, the Consultant shall contact the City and Grand River Conservation Authority immediately and a restoration plan shall be proposed within 24 hours.

K.2 TOPSOIL STOCKPILE PROTECTION

Topsoil stockpiles containing more than 100 m³ of material shall be located a minimum of 10.0 m away from the roadway, drainage channel or an occupied residential lot, and a minimum of 2.5 m from the property lines. The maximum side-slopes for topsoil stockpiles shall be 1.5 horizontal to 1.0 vertical. The stockpiles shall be protected by heavy duty silt fence (OPSD 219.130) for stockpiles as per the Grand River Conservation Authority ESC Guidelines.

Topsoil stockpiles can be located on blocks owned by the Developer. The topsoil has to be removed and block graded to approved grades prior to conveyance to the City. Topsoil stockpiles can also be located on private lands between houses and on rear yards.

Runoff from all topsoil stockpiles shall be controlled by a sediment control fence or other approved devices.

K.3 EROSION AND SEDIMENT CONTROL INSPECTION

During active servicing and/or grading construction, all Erosion and Sediment Control Devices are to be inspected by the Consulting Engineer once per week and after each rainfall of 25mm or greater or significant snow melt. Daily inspections are required during extended rainfall or snow melt periods. These inspections are to ensure that the facilities are in proper working condition and all damaged Erosion and Sediment Control Devices are to be repaired and/or replaced within 48 hours of the inspection. A permanent record of these inspections must be forwarded to the Director of Engineering Services with five (5) days of the inspection.

L PARKS, OPEN SPACE AND MULTI-USE PATHWAYS

L.1 INTRODUCTION

Parks, open space, multi-use pathways and trails are an essential component of the urban area. They provide opportunities for both residents and visitors to explore other aspects of daily life and to have social, educational, and recreational experiences in a designated outdoor setting.

The City will pursue high quality and innovative park design that balances functional use, urban form and aesthetic benefits, community safety, accessibility, integration with nature and operational requirements to ensure long term sustainability.

This section has been prepared as a companion component to the City's urban design objectives as set out in the following documents:

- i. City of Kitchener Official Plan,
- ii. Secondary Plans,
- iii. Kitchener Growth Management Plan,
- iv. Community Plans,
- v. Urban Design Manual,
- vi. Parks Strategic Plan,
- vii. Kitchener's Sustainable Urban Forest Strategy,
- viii. Cycling and Trails Master Plan,
- ix. Kitchener Natural Heritage System Technical Background Report,
- x. The City of Kitchener's 'Accessibility Standards for the Built Environment'
- xi. Various City Policies and By-laws as noted throughout the Development Manual and companion documents, and
- xii. City of Kitchener Engineering as well as Parks and Cemeteries standard design details and specifications.

Other federal and provincial departments and agencies may have authority over aspects related to park, trail and open space development, including the Department of Fisheries and Oceans, the Ontario Ministry of Natural Resources, the Ontario Ministry of Transportation. In addition, conservation authorities with jurisdiction within the City of Kitchener such as the Grand River Conservation Authority. All organizations having authority should be consulted to obtain guidance and approvals as necessary.

Parks, open space, multi-use pathways and trails shall be designed and developed to support the City's vision of building an innovative, vibrant, attractive, safe, complete and healthy community contributing to an exceptional quality of life. Parks, open space, multi-use pathways and trails will be designed in accordance with current City design principles and standards.

All users of the City of Kitchener Development Manual Section L Parks, Open Space and Multi-Use Pathways are required to use the most recent updates to the companion documents that support this document and various related studies. The City of Kitchener will update the City of Kitchener Parks, Open Space and Multi-Use Trail design and tender document requirements periodically, as required.

The Developer shall retain the services of a Landscape Architect (henceforth noted as the Developer's Landscape Architect), Grading/Servicing Engineer and a Lighting Engineer and other design Consultants (as required) for the preparation of parks, open space and multi-use trail design and tender documents. To further assist the Development Community and City staff in undertaking the development of City parks, open space, multi-use pathways and trails, the City of Kitchener, Parks and Cemeteries Division

has created resources pertinent to related planning and design information, City standard construction details, City standard construction specifications, drawing submission standards, City tender requirements and construction administration standards that are available for download from the City's website.

The Parks and Cemeteries Landscape Architect is henceforth noted as the Parks Project Manager and Urban Forestry staff are noted as Forestry.

L.2 PARK BLOCK SELECTION

Parks, open space and multi-use pathways and trails are strategically acquired and located based on a diversity of park and trail typologies to satisfy recreational needs, provide access to and enhance existing natural features where possible, while responding to the local context.

It is important that the location and design of parks meets the needs of communities, creates memorable experiences and provides valuable social, recreational and environmental benefits. Parkland block selection decisions are important and set the stage for parks to meet the aforementioned needs and benefits. To ensure adequate access and visibility into the park, **a minimum of 90 metres of street frontage** is required. For the greatest flexibility for the construction of sports facilities – a square or rectangular configuration of the park parcel is preferred.

Park block selection is guided by the above noted planning and policy documents and the City retains the right not to accept the conveyance of land as parkland that is considered unsuitable, including:

- .1 hazardous or flood prone lands;
- .2 wetlands and woodlots retained for conservation purposes;
- .3 steep or unstable slopes;
- .4 any land having unsuitable or unstable soil conditions;
- .5 hydro rights-of-way or easements;
- .6 any land containing an easement, encumbrance, or right-of-use that limits or restricts the City's use of the land, including but not limited to utilities infrastructure; and
- .7 any land to be conveyed for stormwater management facilities, for flood plain or conservation purposes, for roadways, walkways or any other non-parkland purpose.

In addition to the lands mentioned above, the City, at its discretion, reserves the right not to accept the conveyance of the following lands as parkland, including but not limited to:

- .8 valley lands;
- .9 watercourse corridors;
- .10 environmental constraint lands, setbacks, or conservation buffers;
- .11 transportation corridors; and
- .12 land that it considers unsuitable and/or land that does not meet the standards for parkland as set out in this section.

Through various planning processes, the City will give direction to preferred park, trail and open space locations, total area requirements, park block shape, classification(s), programming, access, street frontage and fencing.

L.3 PARK(S), TRAIL(S) AND OPEN SPACE DEVELOPMENT REQUIREMENTS

Parks may be designed and built under different scenarios, parkland dedicated to the City must satisfy basic requirements as outlined in the City of Kitchener's Conditions for Draft Approval of Subdivision (as amended from time to time). In all scenarios, the Developer shall not remove or disturb any of the existing vegetation or topsoil on dedicated parkland unless such removal or disturbance forms a part of the remedial work approved by the City.

The following summarizes the requirements that Developers must satisfy when providing a park block to the City. To the satisfaction of the Director of Operations, Parks and Cemeteries Division, the Developer is to complete the following:

- .1 Analysis of parkland soils to the criteria as outlined in Section M as part of the geotechnical report, including boreholes, as well as digital topographic data for the park block(s) – tied to a geodetic benchmark – and certain criteria for contaminant testing (including but not limited to the following: methane, cadmium, etc.);
- .2 **Temporary signage is to indicate:** *City-owned land, No Construction Equipment and/or Staging, Dumping, No Unauthorized Removal of Soil or Vegetation, and No Storage of Materials;*
- .3 **Fencing:** City-owned land boundaries are to be staked by a certified Ontario Land Surveyor (OLS) and construction fencing, with temporary signage, is to be installed immediately following OLS staking operations;
 - a. **Temporary metal construction fencing:** options include the City of Kitchener TMP fencing with paige wire and silt cloth – or – Moduloc or approved alternate – to the approval of the Director of Parks & Cemeteries. The temporary construction fencing may need to be secured with spikes (ie. Moduloc) and wind braces (as required) surrounding the park, trail and/or open space block, and is inspected regularly and maintained in good repair;
- .4 Grade areas of parkland where necessary to provide positive surface drainage, in accordance with the approved subdivision and park block Grading Plan;
- .5 All park blocks shall be provided with servicing appropriate to the size of the park and the type of use. At the time of servicing, the Developer is to provide sanitary, stormwater, water service and hydro in locations approved by the Parks Project Manager as follows. The minimum standards of servicing shall be as outlined in Section L.7.6.

Where natural areas and/or stands of trees are to be preserved in park blocks, the Developer is responsible for:

- .6 Removing any hazardous vegetation that create liabilities to adjacent land/lots or proposed park amenities identified in the Detailed Vegetation Plan as outlined in Section A.5 and through a park concept plan prior to site servicing or subdivision registration, whichever comes first, as directed by the City;
- .7 Removing any debris from the park block present until such time as the park is developed;
- .8 Providing a detailed Park Tree Preservation Plan,

The Developer is responsible for all trail connections to park blocks, and stormwater management blocks within the subdivision that link neighbourhoods and/or allow subdivisions to be connected by pedestrian routes as set out in the Cycling and Trails Master Plan current to the time of construction. These connections do not comprise part of parkland dedication.

Works to be completed by the Developer, at their costs, includes the following (but is not limited to):

- .9 **Grading: Rough and Fine Grading and Topsoil**
 - i. Materials and testing;
 - ii. Erosion/Sediment Control on Park Blocks, Trail corridors and Open Space areas;
 - iii. Vegetation protection and removals; and
 - iv. Rough Grading of Park Blocks and Trail corridors; and
 - v. Fine Grading and Topsoil of Park Blocks and Trail corridors, including materials testing and topsoil amendments; drainage and Sports Field soil mix and grading.

- .10 **Temporary Fencing of Park, Trail and Open Space Blocks**
 - i. Materials and regular maintenance;
 - ii. Fencing of natural areas prior to area grading; and
 - iii. Fencing of parks and trail blocks following area grading.

- .11 **Park Block Site Servicing**
 - i. Storm Drainage;
 - ii. Sanitary Sewer;
 - iii. Water Service, and
 - iv. Electrical Service.

- .12 **Excavation, sub-grade granular, grading and surfacing of Trails**
 - i. Materials and Testing,
 - ii. Granular materials, and
 - iii. Drainage
 - iv. Fine grading prep for asphalt;
 - v. Asphalt surfacing and
 - vi. Curb cuts, signage, gates, vehicle controls.

- .13 **Park Seeding and Sodding**
 - i. Materials and testing;
 - ii. Seed/sod topsoil and fine grading (formerly seed/sod bed prep);
 - iii. Watering;
 - iv. Maintenance, and

- .14 **Warranties.**

- .15 **Other Park Features and Fixtures**
 - i. Park, Trail and Open Space property demarcation; and
 - ii. As per approved park and trail plans.

- .16 **Heritage Conservation Requirements**

- .17 **Naturalization**
 - i. Woodland;
 - ii. Meadow, and
 - iii. Wetland.

Front-Ended, Developer-Build works to be completed by the Developer with a cost sharing agreement with the City, may include the following (but is not limited to):

- .18 **Excavation, sub grade granular, grading for Play Structure and Equipment Areas**
 - i. Materials and Testing,

- ii. Granular materials, and
- iii. Drainage.

.19 **Park Facility Development**

- i. Parking lots, grading, paving, curbs;
- ii. Park trails and walkways, grading and paving;
- iii. Play area surfacing and play structures;
- iv. Sports field structures;
- v. Washroom/Change facilities;
- vi. Walkway and Sports Field lighting;
- vii. Garbage and Recycling facilities;
- viii. Benches, gates, garbage and recycling containers, bike racks, signage,
- ix. Maintenance and replacements, and
- x. Warranties

.20 **Park Planting**

- i. Materials and Testing;
- ii. Planting bed/tree pit preparation;
- iii. Planting medium;
- iv. Planting;
- v. Watering;
- vi. Maintenance and replacements; and
- vii. Warranties

L.4 PARK, TRAIL AND OPEN SPACE DEVELOPMENT OPTIONS

In order to ensure timely delivery of parks, trails and open space, the City has two options for the design, development and delivery of parks, trails and open space lands which includes Option 1 the “City-built” and Option 2 the front-ended “Developer-built” processes.

L.4.1 Park Construction Capital Budgets

There is no difference in the total budget allocated by the City for park, trail and open space development in either scenario and the City retains oversight over the design and construction process through a series of formal submissions and inspections as detailed in Section L.

Individual parks, trails and open space will be assigned capital budgets for construction based on predicted programming for the amenity and the affordability of such programming in light of anticipated Development Charges revenues and City Capital Budget constraints. The City will provide the Developer with the assigned capital budget for park, trail and open space development within the subdivision following the pre-submission, visioning session. The Developer and City will determine the preferred development option and timing of construction, which will be outlined in a **Parks, Trails and Open Space Letter of Intent (PTOSLOI)** including the capital budget assigned by the City and provided on the Developer’s letterhead. Note that the City’s assigned capital budget is not intended to be applied towards the Developers’ Consultants Fees.

Further to the PTOSLOI, the amount and timing of reimbursement of the City’s portion of the total parks, trails and open space development costs to the Developer will be identified in the front-ending **Park, Trail and Open Space Development Financing Agreement (PTOSDFA)** and is required at the 100% detail design phase as noted in Table 11: Parks, Trails and Open Space Submittal Process Summary.

In order for the Developer to proceed with either Option 1: Base Level of Development, City-built or with Option 2: Front-Ended, Developer-built, process a **Park, Trail and Open Space Development Financing Agreement (PTOSDFA) with the City is required.**

Both templates are available on the City website for downloading.

Note that these templates are for reference purposes only and may be altered on a project-by-project basis to accommodate specific project requirements.

L.4.1.1 Option 1 – Base Development, City-built Process

The Developer completes the base level of parks, trails and open space development according to City standards current to the time of construction. The City of Kitchener would later “complete” the park with the addition of recreational amenities such as playground equipment, multi-purpose courts, sports fields, site furnishings and plantings for example. The city will fund and manage the development of parks directly.

Base Development - includes the following:

- .1 Detailed Vegetation Preservation and Removals and Protection;
- .2 Erosion and Sediment Control;
- .3 rough grading;
- .4 topsoil and fine grading;
- .5 service stubs (water, electrical, sewer and storm drainage systems);
- .6 trail development as determined in the Cycling and Trails MP: including excavation, base material and proposed surface treatment as well as required trail entry treatments to City standards current at the time of construction;
- .7 park and open space fencing;
- .8 site identification, boundary markers and regulatory signage;
- .9 seeding/sodding, with appropriate seed mix to provide regulatory maintained turf areas; and
- .10 other heritage, parks, trails, open space, naturalization, landscape features/amenities as determined through the subdivision agreement process.

L.4.1.2 Option 2 – Front-Ended, Developer-built Process

This will be funded, managed and constructed by development partners with the final approval resting with the City. The Developer is responsible for funding the design and construction of the park(s), trail(s) and open space. A letter-of-credit will be secured from the Developer to ensure timely completion to a level of quality and workmanship acceptable to the City. The Developer-build option the City will reimburse the Developer for the Development Charge related items for parks, trails and open space development as set out in the Letter of Intent and the **Park, Trail and Open Space Development Financing Agreement (PTOSDFA).**

- i. Development and/or Subdivision Agreements may require the Developer to construct parks, trails, etc. in response to timing or permissions with regard to construction of phases within a development.
- ii. The Developer on its own initiative and interests may wish to enter front-ending agreements with the City for the early delivery of parkland.
- iii. In cases where these requirements are not registered as a condition on a plan, the Developer has the option to develop the park on behalf of the City in advance of the city’s capital budget schedule. This option is to be negotiated with the City if it is deemed advantageous for the

subdivision Developer and does not impose undue additional administrative or operating costs on the municipality. In order for the Developer to proceed, a front-ending **Park, Trail and Open Space Development Financing Agreement (PTOSDFA) with the City is required.** Depending upon the staging/phasing for the park, trail and open space block development, a PTOSDFA is required for each stage/phase prior to registration of each phase as noted in Table 11 below.

- iv. The advantages of choosing Option 2 where the Developer designs and builds parks, trails and open space, are as follows:
 - a. The completed park, trail or open space should be available to the new community's residents closer to their time of moving into the community.
 - b. With the Developer building parks, trails and open space there is a potential to accelerate sales and potential cost efficiencies in early delivery of these resources; and
 - c. Option 2 requires both the Developer and the City being in agreement in order to proceed with this option. Therefore, both the development community and the City have the choice to proceed with Option 2.
- v. Front-ended park, trail and open space construction shall be treated as any other municipally approved subdivision construction. The Developer is required to develop parks, trails and open space to the approval of the City, completing the construction to a set of City-approved technical drawings, specifications and standards. The Developer and their Consultants shall coordinate with the City's Parks Project Manager for the development and submittal of concept plans, park and trails development costing, detail design, tender drawings, cost estimates and specifications required for the construction of the community parks, trails and open space. The City will undertake review of the design and provide approval for these submissions and has authority over the final acceptance.
- vi. The park, trail and open space construction tender and contract process shall be open, fully coordinated with, and to the approval of the City.
- vii. **Park Construction Timing:** Notwithstanding L4.1.2 Front-Ended Park Construction by Developer, parks will generally be constructed by the City upon 50% occupancy of a residential subdivision or as determined by capital budget availability. Where as a result of either the Developer's phasing, servicing availability or any other factor that may delay the achievement of 50% occupancy within the entire subdivision, the park may be constructed on an accelerated schedule to ensure service to the local community – as determined by the City.

L.4.2 Enhanced Level of Development – Entry Features, Additional Structures, Etc.

Should a Developer, for purposes of marketing or community design theme desire to enhance or expand on an agreed amenity programming with additional features, the costs associated with the additional features and related operational costs shall be the sole responsibility of the Developer and are not candidate for re-imburement under the Development Charges By-law and clearly identified within the agreement and letter of credit as outlined in Section L4.1.2.

The following requirements for the design and construction of the enhanced features shall apply:

- i. Prior to Subdivision Draft Plan Approval, the Developer's Consultants are to provide the City with the design, layout, materials, construction and associated cost estimate/LOC for the proposed subdivision entry features, sign walls, pillars and other special site features for installation and ongoing maintenance for review and approval by Staff, including but not limited to: Planning, Operations, Parks and Cemeteries (City Landscape Architect).

- ii. For the concept-design phase, to ensure these proposed features are properly designed, sited and constructed, the Developer is to provide detail design, shop drawings for all entry features, sign walls, pillars, their footings/foundations (designed to the recommendations of the geotechnical report) and other constructed site features or identifiers that are approved and stamped by the Developers Landscape Architect, Structural and Transportation Engineers (to verify siting, conformity to design docs, geometry, visibility and acknowledgement that they meet all ministry requirements). Submission and approval milestones along with required securities will be specified through the City of Kitchener’s Conditions for Draft Approval of Subdivision and/or the **Park, Trail and Open Space Development Financing Agreement (PTOSDFA)**.
- iii. Prior to request for initial acceptance, the site elements/built enhancement features design details and As-Recorded drawings are to be reviewed and signed off by the Developer’s Structural Engineer, Transportation Consultant and Landscape Architect ensuring the following:
 - a. the constructed elements conform to the detail design (noting any field changes);
 - b. inspections were conducted at the appropriate stages of construction (with photo documentation, site inspection reports – appended to the IA request) to ensure the design is properly implemented; and
 - c. the As-Recorded drawings, data submission requirements are met, details and built condition are reviewed and signed off on by the Developer’s Landscape Architect, Structural Engineer and Transportation Consultant is also to review, approve and sign off on the geometry, design and placement to ensure compliance with all requirements.

To further assist the Development community in the undertaking of either the Options noted above, the City has provided drawing submission standards and checklists, as well as standard construction details and specifications available for downloading from the City website.

L.5 PARK, TRAIL AND OPEN SPACE DEVELOPMENT PROCESS

All new subdivision park(s), trail(s) and open space facilities design and construction drawings shall be subject to the review and approval by the Parks Project Manager. For all tree planting requirements for parks refer to Section M – Urban Forest – Tree Planting & Establishment section of the manual.

Throughout the development process, all new subdivisions require consultation meetings where the design features for the park, trail and open space facilities shall be part of the discussion. The Parks Project Manager along with the Developer and their Landscape Architect are to be present at these meetings prior to developing any design and tender drawings for the above noted.

The Parks Trails and Open Space design and development process from the pre-submission “visioning” consultation, through the Engineering review process, to registration and construction is summarized below in Table 11: Parks, Trails and Open Space Submittal Process Summary. Table 11 identifies the drawing, budgeting, cost estimation and construction contract document submission requirements associated with the aligned planning and engineering processes.

Table 11: PARKS, TRAILS and OPEN SPACE SUBMITTAL PROCESS SUMMARY		
Drawing Submission	Cost Estimate /Budget	Planning/Engineering Process (Per Section A.5)
Design Process:		
Visioning/Classification	Not required	<i>Prior to Subdivision formal pre-submission (A.2)</i>

Table 11: PARKS, TRAILS and OPEN SPACE SUBMITTAL PROCESS SUMMARY		
Drawing Submission	Cost Estimate /Budget	Planning/Engineering Process (Per Section A.5)
Park, Trails & Open Space Letter of Intent	Parks Project Budget provided	<i>Prior to Concept</i>
Concept	N/A	<i>Pre-Submission Parks Consultation</i>
35% detail design	Class “C”	<i>Engineering: 1st Submission Area Grading</i>
60% detail design	Class “B”	<i>Engineering: 2nd Submission Servicing Overall and at various Staging</i>
90% detail design	Class “A”	<i>Engineering: 3^d/4th Submission Surface Works</i>
P&C Letter of Credit - 1st	Class “A”	<i>Engineering: 3^d/4th Submission (A.9)</i>
100% detail design	Class “A”	<i>Prior to Registration of Applicable Stage</i>
Park/Trail and Open Space Development Financing Agreement and P&C Letter of Credit	N/A	<i>Prior to commencement of construction</i>
Construction Process:		
Issued for Tender (IFT)	Bid Analysis	<i>Within 1 year of Registration or Servicing</i>
Issued for Construction (IFC)	Project Contract Cost	<i>N/A</i>
Initial Acceptance [IA]:	Project Cost Summary	<i>N/A</i>
IA As-Built Submission	N/A	<i>N/A</i>
IA As-Built Comparative Analysis	Determine and address deficiencies per approved plans	<i>Determine and address deficiencies per approved plans</i>
IA Constructed Asset Data	N/A	<i>N/A</i>
Final Acceptance [FA]:	N/A	<i>N/A</i>
FA As-Built Submission	N/A	<i>N/A</i>
FA Constructed Asset Data	N/A	<i>N/A</i>

L.5.1 Pre-Submission “Visioning” Consultation

As described in Section A.2, prior to the Subdivision formal pre-submission, the City requires the Developer and their Agents meet with City staff from various departments to conduct a site visit and visioning session. The Developer and the Developer’s Landscape Architect are required to meet with the Parks Project Manager to determine overall parkland, open space, trails and facilities for the proposed subdivision. The Parks Project Manager will review adjacent lands and context at a high level to provide direction and recommendations as to park(s) category and location as well as potential trail locations and connections to abutting trails for the proposed subdivision.

At this juncture the City will confirm park, trail, open space and walkway block sizes, distribution and locations conform to the Secondary/Neighbourhood Plan and meets the criteria as set out in Section L.2.

The requirements for park, trail and open space requirements are determined on a case-by-case basis. The City will also confirm park and trail classifications, facility fit, servicing and amenity requirements as well as the capital budget allocated for the City portion of site works.

L.5.2 The Park/Trail and Open Space Development Letter of Intent (PTOSLOI)

The front-ending agreement consists of the Park/Trail and Open Space Development Letter of Intent (PTOSLOI) and the Park/Trail and Open Space Development Financing Agreement (PDFA/PTOSDFA).

Note that these templates are for reference purposes only and may be altered on a project-by-project basis to accommodate specific project requirements.

- .1 **The Park/Trail and Open Space Development Letter of Intent (PTOSLOI):** is to be prepared on the Developer's letterhead and is to include the following:
 - i. Subdivision Name;
 - ii. 30T#;
 - iii. Park, trail and open space block numbers to be developed;
 - iv. Phasing, proposed timing;
 - v. The total City share to be reimbursed to the Developer for park, trail and open space development as provided by the City; and
 - vi. Identify if the PTOS development level provided by the Developer is to be the base level option or a front-ended, Developer-build option, with reference to the PDF/PTOSDFA.
- .2 **The Park/Trail and Open Space Development Financial Agreement (PDF/PTOSDFA):** is to be prepared and executed by legal services.

L.5.3 Prior to Draft Plan of Subdivision Application Submission

Consultation with Parks Project Manager, the Developer and the Developer's Landscape Architect to review park(s) size, trail(s) and open space facilities location, configuration, zoning, preliminary servicing (A.8.4) and grading (A.8.5) requirements, etc. The Parks Project Manager will provide the Developer with the City's budget for the provision of items over and above what the Developer is to provide. It is at this juncture that the preferred park, trail and open space development option would be determined, and **the Parks, Trails and Open Space front-ending Agreement developed and signed** – refer to L.4 above for a description of the options.

Preliminary park, trail and open space concept plans and park development cost estimates with the proposed cost-sharing items shall be submitted by the Developer's Landscape Architect, Grading/Servicing and Lighting Engineers/Consultants to the satisfaction of the City as part of a complete application.

L.5.4 Engineering Submission Process (A.9)

Following Draft Plan Approval: Park(s), trail(s) and open space design development drawings and cost estimates submitted throughout the Engineering Submission Process are to be developed as outlined in Table 11: Parks, Trails and Open Space Process Summary above.

Parks and Cemeteries Division allows for two (2) reviews of each submittal and/or site inspection to obtain approvals. If more than two (2) reviews or inspections must be carried out to obtain an approval and/or complete release of the security for site development works, it will be at cost of \$500.00 per review and/or inspection and paid prior to the third (3rd) review and/or site inspection.

Refer to the city website for the most recent version of the City of Kitchener Checklist for Parks, Trails and Open Space Design & Construction; Parks Standard Details and Parks Standard Specifications.

- .1 **Plan and Drawings requirements:** are to be provided as outlined in Section A.10 and A.11 with additional park(s), trail(s) and open space specific requirements as described throughout Section L.

- i. Park(s), trail(s) and open space grading plans must be stamped with the following wording prior to being reviewed by the City:

“The Developer’s Landscape and Engineering Consultants verify that the grading of the subject park(s), trail(s) and open space blocks are in conformity to the approved subdivision lot grading plans and City standards.”

L.5.5 Prior to or at Time of Registration of Applicable Stage of Subdivision

- .1 Finalization of park(s), trail(s) and open space 100% design development drawings and development budget by the Developer’s Landscape Architect, Grading/Servicing and Lighting Engineers/Consultants to the satisfaction of the City.
- .2 The Developer is to submit the total construction costs and a Letter of Credit (LOC) for the development of the park, trail, and open space blocks whether it be for either the provision of Option 1 the base development of the base park, trail and open space blocks or Option 2 a front-ended, Developer-build process with a cost-sharing agreement with the City. The LOC will be appended to the front-ending agreement and updated with the tender bid pricing for the site works.
- .3 **The Park, Trail and Open Space Development Financing Agreement (PDFA/PTOSDFA):** is to be prepared by legal services, executed and registered.
- .4 At the time of Subdivision Registration, the Developer will provide:
 - i. a Record of Site Condition for all park and open space lands and any lands being dedicated to or purchased by the City; and
 - ii. a Letter of Reliance from the Environmental Consultant.

For Option 2 the Front-Ended, Developer-built process, transfer of the parkland will not occur at the Registration Phase. The transfer will happen at the time of the City’s approval of Substantial Performance of the park.

- .5 The park(s), trail(s) and open space block(s) are conveyed to the City of Kitchener free and clear of encumbrances.

L.5.6 Within One (1) Year of Registration or Servicing – Whichever Occurs First OR as specified in the PDFA/PTOSDFA

- .1 Park(s), trail(s) and open space tender drawings, specifications, cost estimates and Letter of Credit (LOC) are to be submitted by the Developer’s Landscape Architect, Grading/Servicing and Lighting Engineers/Consultants, and other Engineering Consultants as required, to the City requirements and standards current at the time of construction and to the satisfaction of the City.
- .2 Construction of park(s), trail(s) and open space development is to be administered by the Developer’s Landscape Architect, with the appropriate project Engineers/Consultants, and coordinated with the Parks Project Manager, to the satisfaction of the City. Refer to the most recent version of the City of Kitchener Parks Checklist for Design & Construction for construction contract administration requirements (available for download from the City’s website).
- .3 Certification of the Work and preparation of associated reports are to be coordinated by the Developer’s Landscape Architect with the appropriate project Engineers/Consultants for project completion to the approved drawings and City of Kitchener design standards and submittal of equipment operational manuals, warranties, etc.

L.5.7 Construction Contract Administration (CCA)

During the construction contract administration phase, the Developer's Landscape Consultant is to coordinate with the Parks Project Manager throughout the entire process. Refer to Section L.7 Park, Trail and Open Space Construction Requirements description of the CCA process.

L.5.8 Initial Acceptance (IA)

Refer to individual KPSS for acceptance criteria for each specification - available for download from the City website.

- .1 Developers Landscape Architect and Engineers/Consultants (as required) to provide an initial inspection and to co-ordinate deficiencies corrections with Contractor(s) prior to requesting the initial acceptance inspection by the Parks Project Manager.
- .2 Submit to the City the park(s), trail(s) and open space "As-Built" drawings and constructed asset data and a written request for the IA inspection by the Developer's Landscape Architect.
- .3 Preparation of the As-Built Drawings (A.9.4) with a comparative analysis of the As-Built conditions versus the Approved Street Tree, Parks, Trails and Open Space plans and Letter of Credit. The Developer and their Consultants will discuss how to address the discrepancies between the approved and as-built conditions with and to the City's approval.
- .4 Upon completion of the deficiencies, the Developers Consultants are to inspect the deficiency work by the Contractor(s) and when deemed complete, the Developer's Consultants are to co-ordinate a follow-up inspection by the Parks Project Manager. If the works are completed to the satisfaction of the City, the Parks Project Manager will issue a formal letter of initial acceptance.
- .5 The Developer's Consultant will prepare and provide the Constructed Asset Data Submission as outlined on the City's Development Manual webpage current to the time of submittal.
- .6 Initial Acceptance of Developer Built park(s), trail(s) and open space development by City and start of Maintenance Guarantee Period by Developer (A.15).

L.5.9 During Warranty Period

Refer to individual KPSS for maintenance criteria for each specification - available for download from the City website.

- .1 Guarantee/Maintenance of all park(s), trail(s) and open space development works for a period of two years by Developer from the date of Certification of Project Completion by the Developer's Landscape Architect and Engineers/Consultants (as required).
- .2 Developer to submit invoice for substantial completion to the City of Kitchener for park(s), trail(s) and open space development.

L.5.10 Final Acceptance (FA)

Refer to individual KPSS for acceptance criteria for each specification - available for download from the City website.

- .1 Developer's Landscape Architect and Engineers/Consultants (as required) to provide an end of warranty inspection and to co-ordinate deficiencies corrections with Contractor(s) prior to requesting the final acceptance inspection by the Parks Project Manager;
- .2 Developer's Landscape Architect and Engineers/Consultants (as required) to provide Certificate of Warranty Clearance for City review and acceptance;

- .3 Submission of final park(s), trail(s) and open space “As-Built” drawings and constructed asset data by Developer’s Landscape Architect and Engineers/Consultants (as required); and
- .4 Final acceptance of Developer Built park(s), trail(s) and open space development by City (end of warranty/final payment).

L.6 **PARK(S), TRAIL(S) AND OPEN SPACE DESIGN REQUIREMENTS**

Refer to City of Kitchener companion documents noted in L.1 as well as the Parks Standard Details [KPSD] and Specifications [KPSS] as provided on the City website for subdivision design and tender documents. The City of Kitchener will update the City of Kitchener Engineering, Parks, Open Space and Trails design and tender document requirements, design details and specifications periodically. Note that these documents will be updated from time to time and it is the responsibility of the Developer to use the documents current at the time of registration.

L.6.1 **Park Design**

For park blocks that the Developer will be front-ending the design and construction on behalf of the City (Option 2 as described in L.4.1.2. above), the playground typology, equipment, features, accessibility requirements and complementary site amenities (i.e. benches, bike racks, garbage receptacles, etc.) shall be as scoped by the Parks Project Manager.

Generally, the following park design criteria are to be incorporated when designing park blocks:

- .1 City parks are to be inclusive, welcoming, rich in character and provide a variety of experiences for all abilities and ages from 0 to 103;
- .2 Connections to the park block(s) should integrate with the proposed public walkways and trails to create a walking and cycling friendly neighbourhood;
- .3 It is important that our parks, trails and open spaces continue to grow, protect and enhance our natural areas and wild spaces to ensure that they not only improve access to nature for us humans, but also provide diverse, healthy habitat and valuable corridors for local flora and fauna;
- .4 **Heritage (cultural and natural):** aspects of the subdivision development can inform the park design, play elements and landmark/interpretive elements;
- .5 **Nodes, paths and landmarks:** are identified as special places that reinforce placemaking. For this park, provide primary nodes, secondary nodes, moments and landmarks, these are identified as follows:
 - i. Primary nodes: may be places of considerable activity and animation that create the heart of the community. These places will accommodate a diverse group of people and numerous uses.
 - ii. Secondary nodes: are created by convergence of circulation and movement. They will accommodate varied uses and will assist in creating neighbourhood character.
 - iii. Moments: are for spaces for pause and are to be designed to be memorable places. They can be habitat islands, small groves, areas for natural play and observation of nature with interpretive and story telling signage, etc.;
 - iv. Landmarks/Wayfinding features: within the parks are predominantly to highlight heritage features – natural, cultural, historic, etc. and are to assist with wayfinding. The historic uses of this site can inform the landmark features and differentiate the park blocks to facilitate wayfinding;
- .6 **Play Areas:** Playgrounds must conform to the latest Canadian Standards Association (CSA) standards for play spaces and equipment.

The design and layout of the play equipment elements, layout and complementary site amenities shall be prepared by the Developer's Landscape Consultant and coordinated with the other required Consultants, and conveyed on the functional plan, concept, detail design, detailed budget estimate and/or play equipment programme document. All play equipment drawings shall illustrate the safety zones for each play component to ensure the layout meets CSA requirements.

Play contributes to the overall physical, cognitive and emotional development of children, can take many forms and does not necessarily require formal play structures. Play areas, formal and/or informal, should be provided in each park block.

Park design ideas to consider include active and passive play and recreation for children teens and adults; universal/multi-age spaces; rainwater collection and interactive storm event water features; areas that explore and highlight biodiversity; etc. Additional design considerations include, but are not limited to, the following:

- i. **Children:** traditional play structure(s) with shade may include: play/exercise structures with shade for children from 2 to 5 and 6 to 12; two-bay swing set with 2 belt swings and 2 tot swings/w accessible swing; sand play; a climbing structure; slides; musical play opportunities; Non-traditional play may include: small forest grove with low understory plantings; sand play with water pump(s) and enough depth of sand (1m) to permit deep digging.
 - ii. **Teens:** gathering and performance space; recreation – table tennis, basketball (full and half court), informal soccer, parkour elements, fitness equipment, cooperative play opportunities; zip lines; a study space with shelter and group gathering; opportunities to create art (message boards, mural walls); observation points of nature and within nature; etc.
 - iii. **Adults:** outdoor exercise stations with signage (w QR/website links for instructions) and equipment, i.e.informal: armourstone, benches, etc. and formal – monkey bars, outdoor functional training stations; etc.; and
- .7 Associated Play Area Site Amenities:** considerations may include: accessible seating with shade for caregivers, garbage/recycling containers, bike racks (w spacing consideration for stroller securement), shade structure/gazebo (with power source for events); monkey bars; ping pong; pick up sports; informal group seating; etc.

L.6.2 Accessibility

In keeping with the spirit of the Accessibility for Ontario with Disabilities Act, the City of Kitchener will be expecting parks, trails and facilities to be designed with the intent of providing Universal Accessibility to the widest possible group of potential users. Designs will be considered on a site-by-site basis in order to evaluate the need and application of “accessible designs”. The City may consider a special, dedicated facility within a park to accommodate a variety of users, of all ages and abilities.

- .1 Trails and Walkways:** Parkland, park facilities and trails shall be designated to provide barrier free access to wheelchair users and others with mobility limitations. Trails are to be designed as Exterior Paths of Travel as defined by the AODA Accessibility Standards – Design of Public Spaces (DOPS). Each park shall contain a continuous, primary pedestrian system of walkways, trails, bridges and ramps; with provision of a direct pedestrian access from the entry point at the street and internal parking lot(s) to the park facilities. The primary accessible route to the park facilities and trails shall be at a maximum grade of 5% and rest areas provided along the route as required.

- .2 Playground Equipment:** The design of play areas is to include consideration for accessible paths to the play area from the rest of the park, as well as accessible surfacing to access the play equipment.

As a minimum, playground equipment shall be selected to allow for children who are wheelchair users to have access to the play equipment by means of a ramp or transfer platform used with the assistance of a parent or caregiver. Specific play components shall take into consideration the needs of limited-mobility users, other special needs, and age groups.

- .3 Other Features and Fixtures:** The selection of site furnishings (e.g. picnic tables), hardware (e.g. door handles) and fixtures (e.g. drinking fountains) shall be based on ease of use for a wide range of capabilities and age groups.

L.6.3 Topsoil Testing and Amending

All topsoil to be obtained from stockpiles or other sources are to be tested by a certified soils testing facility for N, P, K, Mg, soluble salt content, organic matter, pH value, and agricultural herbicide residue for the healthy growth of ornamental plantings, trees and turf/sod. Topsoil is to be amended, as required, to achieve the specifications outlined in UF Table 20. Recommendations for topsoil amendments, to achieve the required specifications, are to be defined by volume (not by weight).

Inspection and testing of topsoil shall be carried out by a certified testing laboratory. Testing costs associated with conveyance of parkland are the Developer's responsibility.

Submit two (2) copies of soil report, analysis and recommendations for corrections to the Parks Project Manager prior to construction.

L.6.4 Park, Trail and Open Space Grading and Certification

The City requires that land conveyed for parkland is generally flat, well-drained developable land of a suitable shape with no constraints to active park use and the provision of park facilities. All park blocks identified as parkland dedication in the approved Draft Plan of Subdivision shall be graded in a manner which facilitates its intended use by the public for the play and recreation activities. This includes the requirement that all park blocks shall be graded at a minimum 1% slope and maximum 5% slope, **where the maximum 5% slopes do not exceed 10% of the total park block area.**

- .1 Steep Slopes:** Steeper slopes, up to a maximum of 20% (5:1), **may** be considered in limited areas provided that the total length of the slope does not exceed 3.0 m and that these steeper slopes do not compromise safety, access to and/or the intended use of the park block for the play and recreation activities as identified by the City.

Steeper slopes may also be considered where this is a requirement to achieve the appropriate landforms for a specific recreational activity proposed within the park (such as tobogganing, mountain biking etc.) provided safe and appropriate run-outs, buffer areas and adjacent uses are considered in the design.

Lands which include slopes in excess of the maximums identified above shall not be considered acceptable as parkland dedication within a Plan of Subdivision. The Subdivider is required to ensure that the park blocks identified in the Draft Plan of Subdivision are graded to meet these requirements. Park blocks received as parkland dedication, which are not intended to be graded,

such as woodlands, hedgerows or cultural heritage landscapes may not be subject to these grading requirements.

- .2 Drainage:** All drainage associated with park amenities and open space shall conform to City of Kitchener Lot Grading and Drainage standards. Grading of all park, trail and open space blocks shall meet with the approval of the City.
- i. Drainage swales or other storm water management requirements servicing the subdivision shall not be located on lands received as parkland dedication unless directly related to the park function. Overland flow routes identified in the plan of subdivision shall not be located on lands identified as park dedication.
 - ii. Active parkland is to be conveyed in a condition where no surface water can be left standing and in accordance with a Park & Trail Grading Plan and Storm Water Management Plan. The Developer shall be responsible for all costs associated with installing a drainage system to meet City approval.
 - iii. The preliminary park drainage system required for conveyance is to be designed with the overall subdivision drainage taking advantage of nearby street sewers where possible.
 - iv. Park and open space property are not to be used for draining private properties.
 - v. The Developer is required to install a storm service connection to all Parks. The connection shall be sized for the gross park drainage to the satisfaction of the City. All drainage is to be designed to encumber the site as little as possible recognizing that park amenities require excavation. Drainage from adjacent lands is not to be outlet into Park land unless adequate conveyance through the park is provided to the satisfaction of the City.
 - vi. The entrances to the park, trails, and open space blocks are to be clear of sewer appurtenances.
- .3 Site Servicing and Grading Report and Certifications:** Refer to Section L.7.8 for Grading and Servicing Report and Certification requirements.

L.6.5 Park Servicing

All park blocks shall be provided with servicing appropriate to the size of the park and the type of use. Services to site amenities and features are to be routed within landscaped areas and are not permitted under play equipment areas, large berms or any other structures that may impede or obstruct access for maintenance or replacement.

Minimum standards of servicing shall be:

- .1 Stormwater:** All park blocks shall have a storm sewer connection and catch basins (CB) (minimum of one) appropriate to the size and use of the park.

Note that play areas may require connections to the nearest CB to provide drainage for the playground areas. If the nearest CB connection is within the roadway, the Developer's Consultants are to ensure the required connections are coordinated with the associated engineering road work plans and construction to provide stub out/connection into the park block for future connection when the park block is to be developed.

- .2 Sanitary Service:** All parks of 5.0 ha or more shall have a sanitary sewer connection to an appropriate location within the park of a size and design which shall meet the intended public use of the park and its facilities

- .3 Water Service:** All parks of 0.5 ha or more require a minimum a 50mm minimum water service, complete with backflow device, shut-off valve or curb stop, as per OPSD 1104.020, located to two (2) meters beyond the property line at its primary street frontage and extend the water line to the parks services as per the approved park design drawings.
- i. **Large Parks:** City, District and Regional Parks require a 150 mm water service complete with backflow device, shut-off valve or curb stop, as per OPSD 1104.020, located the two (2) meters beyond property line. This shall facilitate the future addition of an irrigation system, drinking fountain, water play feature, or service building. Each water service pipe diameter shall be identified on the Park Servicing Plans. Water meter chambers to be provided, in order to accommodate water service equipment to meet the requirements of Kitchener Utilities.
- .4 Electrical Service:** Supply of electrical servicing to parks is dependent upon both KW Hydro capacity and the electrical need of the park (i.e. single phase, three phase, 240 or 600V) pending the park hierarchy and amenities.

At minimum, all parks of 2.5 ha or more shall have an electrical service of 200 amps provided to an appropriate location within the park, including rigid sceptre conduit at a minimum depth of 1000 mm for all conductors.

L.6.6 Circulation – Pedestrian and Vehicular

All parks shall include a pedestrian circulation system including a major paved, vehicular grade asphalt walkway at a minimum of 3.0 m in width, with 0.5 m width shoulders on either side sloped to a maximum of 2% that connects the main (pedestrian) entrances to the main features and /or facilities within the park. This main pathway may also serve as a multi-use trail and maintenance vehicle access route with curb cuts at the road and entry treatment to City standards current to the time of construction.

A minimum 8.0 m inside radii of the walkway, trail and internal park roadway is required to facilitate regular maintenance vehicular requirements. Larger turning radii may be required pending the need for larger service and maintenance vehicles as identified by the Parks Project Manager.

- .1 Maintenance Access:** A minimum of one vehicular access for maintenance is required for each park and with a curb cut, detection plates, removable bollards and other requirements as identified in the City's standard details. Where there is only one vehicular access, provide a looped pathway configuration that permits the vehicle to exit without having to reverse. These vehicles may use the major pathway.
- .2 Service Vehicle Access Requirements to Drainage Structures:** Where a drainage structure is required within a park or along a trail, the trail design must accommodate various service trucks for ongoing maintenance.

It is important to verify that the detailed design of the trail or roadway meets the vehicle's requirements for turning radii, transitional vertical alignments (from down slope to flat) accommodate the long wheelbase. The asphalt trail surface for the portion of the trail used by the service vehicle needs to be designed to accommodate the service vehicle, fully loaded weight (heavy-duty asphalt per engineering's standards).

Note that where turnarounds can't be accommodated, the vehicle frequently drives in reverse. Therefore, it is important to review the offsets of various adjacent site amenities to ensure there is adequate room for the vehicle to maneuver. These amenities may include but are not limited to the following: retaining walls, trees, benches, armourstone, overhead structures and other

nearby park or trail amenities. Additional clearance may be required along the curves of the trail or roadway.

The Parks Project Manager will confirm the requirements of the service vehicle and the associated design considerations. For example, a Vactor 2100Plus Tridem model vacuum truck the roadway design requirements include, but are not limited to, the following:

- i. Inside to inside of turning circle: 19.8 m
- ii. Outside to outside of circle: 27.8 m
- iii. Length 12.8 m (42 feet)
- iv. Width 2.55 m (100.5 inches)
- v. wheelbase dimensions along the vehicle length from front and rear
- vi. number of wheel axles
- vii. dimensions from centre of wheel across the vehicle to the other centre of wheel
- viii. Overall height is 3.683m (12'1") based on a 1.066m (42") chassis; and
- ix. Consider the Vactor truck vehicle length of 12.8m for sloped transitions to accommodate the truck without damaging the undercarriage.

L.6.7 Trails

The most current approved Cycling and Trails Master Plan and Multi-Use Pathways and Trails Master Plan (2012) shall guide the planning and development of a comprehensive Trail network in Kitchener. Trails connect parks and open space within subdivisions and provide connections to other neighbourhoods of the city. Trails are both a recreational facility and a non-vehicular traffic route providing city wide, off road transportation routes for walking and cycling. Trails shall be fully accessible and barrier free.

These trails shall be located throughout the City, including Parks, stormwater management lands or other lands which facilitate the development of the city-wide Trail system. Trails shall be identified for all new development, as approved by the City.

Trails may also serve as maintenance vehicle access routes through parkland or open space areas and are to be designed to vehicular standards as directed by the City.

The Developer shall ensure that all tree protection fencing and siltation control fencing is located in such a manner as will allow the grading, construction and surfacing of the Trails as an integral part of the subdivision grading process.

The Developer's Consultant should apply the appropriate turning templates laid over the proposed design for City staff's review and comment. The Developer is required to design, engineer and construct all trails included in the approved Draft Plan of Subdivision at the same time as grading and servicing of the associated stage of development or within one year of registration. Conditions of draft plan approval will be added in this regard.

Trails shall be graded and constructed for that stage of the subdivision by the Developer within one year of registration or servicing whichever occurs first, unless otherwise directed.

All detailed grading and construction details for trails shall be to City of Kitchener approved standards and details current to the time of construction. Developer's Consultant to confirm current City details and

specifications for this work with the Parks Project Manager. The Developer's Consultant is to coordinate with the Parks Project Manager to ensure this requirement is met.

The trails shall be designed in accordance with the following requirements:

.1 Grade

- i. 5% maximum;
- ii. 8% maximum, limited distances only in areas of steep slopes where 5% max. not possible, and
- iii. Primary accessible trail routes shall be 5% maximum.

.2 Cross Slope

- i. 2% preferred; and
- ii. 2% maximum where trail grade exceeds 4%.

.3 Width

- i. Rough grading – 4.0m wide;
- ii. Trail surface – 3.0m wide, and
- iii. 0.5m width min. shoulder on either side of trail surface graded at 2% to 4% max.

.4 Drainage

- i. Cross-flow drainage over trails from adjacent slopes is not permitted. Design to include directed surface drainage such as swales and other structures, etc.;
- ii. Ensure trail design accounts for the velocity, potential scouring, erosion and undercutting from adjacent slopes; and
- iii. At overland flow collection points provide appropriate drainage features such as culverts, spillways, rock drains, sumps, etc. to control and mitigate drainage.

L.6.8 Topsoil/Approved Growing Medium and Seeding/Sodding

The Developer shall be responsible for the placement of the approved growing medium (approved topsoil), in required areas as per the approved grading plan and shall ensure that the park and trail blocks are sodded and/or seeded and comply with the City's topsoil requirements and grading criteria.

- .1** All areas designated for parkland, which are not identified as tree habitat zones, are to have a minimum of 300 mm of topsoil. All tree habitat zones shall have the required soil volumes and depth identified on the Tree Planting Plan and meet all of the requirements in Section M of this manual.
- .2** All park blocks shall be inspected and certified by the Civil Engineering Consultant to the City following rough grading and prior to topsoil placement and fine grading. Refer to L.6.4 above.
- .3** Topsoil must be tested and must meet or exceed the minimum topsoil requirements of the City of Kitchener as outlined in the Parks & Cemeteries Detail UF.6.1 – Growing Medium Specification for Trees, Planting Beds and Lawns current to the time of installation. The Developer's Contractor shall arrange for testing of the topsoil source by an accredited laboratory, and the topsoil must conform to the parameters outlined in UF.6.1. Test results must be submitted to the City prior to topsoil placement.

- .4 Prior to the placement of seed and/or sod, there is to be a minimum of 300mm of screened, friable approved growing medium, free of stones, sticks and other debris. The approved topsoil is to be fine graded prior to placement of the seed or sod.
- .5 These specifications may vary for sportsfield areas and shall be confirmed prior to completing detailed park plans and specifications. Developer to confirm with the Parks Project Manager the required depths of topsoil.
- .6 Prior to placement of seed or sod, the approved growing medium shall be sampled in situ at a minimum of one representative sample, to the full 300mm approved topsoil depth, for every 4000m² for park/trail blocks. Depending upon the complexity of the grading, additional testing may be required as directed by the Parks Project Manager.
- .7 All park blocks shall be seeded and/or sodded in conformance with the City of Kitchener Parks Standard Specifications for seeding and sodding provided on the City website and to the satisfaction of the Director of Parks and Cemeteries.

L.6.9 Tree Planting

The minimum requirement for park blocks shall be for the Developer to provide a minimum overall mature tree canopy cover as set out in the City's tree canopy target. Tree selection is to be diverse in species, deciduous and coniferous, that are tolerant of urban conditions, with an emphasis on native species. Refer to Section M for all tree planting requirements and standards for park(s), trails(s) and open space placement of trees within parks.

- .1 During the park design process consider solar exposure and prevailing winds when siting trees to provide a comfortable environment for the park users, including: shading seating and play areas, to mitigate wind speed, turbulence and control snow deposition. Wind mitigation is especially important around play and sand areas to prevent migration of Engineered Wood Fibre (EWF) and sand onto nearby surfaces and to reduce wind interference during play in sportsfields. Trees can also be used to mitigate snow deposition on pathways.
- .2 Crime Prevention Through Environmental Design (CPTED) design principles are to be employed when developing the park design and landscape plan. Plant trees to buffer the street frontage, to organize and define use areas within the park and as a visual amenity to the park. Plant flowering trees at all park entries where possible and appropriate.
- .3 Trees with excessive fruit, branch or litter drop shall be avoided in parks. Avoid planting fruiting trees next to play structures, trails, picnic areas and high use areas. Trees are to be planted adjacent to trails and can be planted in naturalized groves to meet the required targets and to allow for more open areas to facilitate sports play. The Developer's Consultant is to coordinate tree species selection and layout with the Parks Project Manager for the most recent requirements, as updated from time to time.
- .4 When planted in naturalized groves, ensure the species selected provide a multi-layered canopy with forage opportunities and shelter for birds and local fauna. Groups of trees are to be planted within a no mow area with an understory layer of low height native shrubs and perennials. The Developer's Consultant is to coordinate tree species selection with the Parks Project Manager for the most recent requirements, as updated from time to time.

L.6.10 Parks Facilities

Park Facility Standards are currently in development through the Parks and Open Space Master Plan and will form part of the Development Manual upon adoption by the City.

L.6.11 Parking Areas

Any off-street parking is to be designed in accordance with current Zoning by-laws and Urban Design Manual.

- .1 Parking lots, located within the park, are required within District, City and Regional Parks.
- .2 Parking lots are to be paved and have continuous concrete curb and located conveniently adjacent to the active facilities.
- .3 Each parking lot is to be accessed by a driveway adequate for two-way traffic (min 7.6 m at the property line).
- .4 Each parking space is to be delineated by line paintings.
- .5 Parking areas shall be illuminated to the lighting standards set out in the Urban Design Manual.
- .6 The minimum required number of parking spaces to be provided per park is as follows:
 - i. 40 per sports field; and
 - ii. Parking for all other parks facilities shall be as per the zoning by-law or as directed by the City.
- .7 Where parkland abuts a school, the number of paved parking spaces to be provided for the park may be adjusted with approval of the City and school board.
- .8 Where possible, drainage for the parking areas is to be by means of overland flow using a vegetated swale as part of the storm water management plan for the Park. Erosion protection is required at the entrance to the swale at the edge of the parking lot.
- .9 Parking Layout and Drainage Requirements:
 - i. All parkland parking to be off-street, unless approved by the City;
 - ii. Minimum setback from street line 3.0m;
 - iii. 90 degree entrance drive with clear visibility;
 - iv. Provide a minimum of 1 barrier free space per 20 regular spaces;
 - v. Drive aisle width - 7.3 m for double loaded aisle and 6.7 m for single loaded aisle;
 - vi. Backup aisle at end of lot minimum, 1.5m depth;
 - vii. Minimum 3m clearance at end of parking lot for snow storage;
 - viii. Where parking abuts a walkway at a right angle, walkway is to be a minimum of 1.8 m wide, and
 - ix. Sheet drainage to adjacent parkland if feasible or a swale along edge of parking lot leading to a catch basin.

L.6.12 Barriers

Bollards and standard park gates are required where trail and entrances intersect with roadways or other vehicle routes to control traffic and promote user safety. Refer to Kitchener Parks standard details, available for download from the City's website.

L.6.13 Sportsfields, Informal Playing Fields and Ice Rinks

Sportsfields are to be designed to KPSD and KPSS standards. Where areas are designated for informal sports play and winter rink area, the Developer's Consultants are to ensure the grades conform with standard sports field requirements. The Developer's Consultants to coordinate and confirm desired field play areas and level of play with the Parks Project Manager.

- .1 **Sportsfield Irrigation Standards and Specifications:** Refer to the Landscape Ontario Irrigation Commodity Group standard specifications. All irrigation proposed within the Park should follow the Turf and Landscape Irrigation Best Management Practice and follow the practice guideline.
- .2 **Irrigation design, contracting and management:** Irrigation Consultants shall be required to have obtained the certification specific to their field, including the following:
 - i. Certified Irrigation Designer (CID);
 - ii. Certified Irrigation Contractor (CIC);
 - iii. Certified Landscape Irrigation Auditor (CLIA);
 - iv. Certified Landscape Irrigation Manager (CLIM), and
 - v. Certified Golf Irrigation Auditor (CGIA).

A listing of certified individuals can be found on The Irrigation Association's website.

L.6.14 Signage (Regulation and Wayfinding)

The Developer is required to provide signage for the following:

- .1 **Property Demarcation:** park, trail and SWM/open space block private/public property demarcation per City standard details and direction. Timing of the installation of the property demarcation bollards are to be concurrent with lot development, **prior to occupation**. Property demarcation bollards locations are to be staked by a certified Ontario Land Surveyor and installed immediately following staking operations;
- .2 **Tree Protection:** In accordance with the City's Tree Management Policy;
- .3 **Trails:** at community trail entrances, with wayfinding and interpretive trail signage as required and directed by the City;
- .4 **Parks:** at park entrances, with wayfinding as noted on the City Standard Details and at directional changes with interpretive park signage as required and directed by the City;
- .5 **Open Space/Natural Areas:** at entrances, with wayfinding and interpretive natural area signage as required and directed by the City and as noted below in L.6.15.5; and
- .6 **Regulatory:** parking, playground, etc. as required and directed by the City.

L.6.15 Naturalization of Parklands and Open Spaces

As a departure from conventional turf-dominated green space design and maintenance, urban naturalization is an ecologically-based approach to landscape management that seeks to restore environmental integrity to the urban landscape.

- .1 **Concept and Principles of Naturalization:** Urban naturalization, also known as natural landscaping or nature-scaping, creates environmentally sound, sustainable landscapes through the use of plant species native to the region.

In comparison to conventional landscaping, natural landscapes are inherently low maintenance; self-renewing and can help foster a new relationship of urban environmental stewardship.

Naturalization is a process of ecological restoration that involves returning an altered or degraded site to a more natural condition through the use of trees, shrubs and flowers that are native to the area. In North America, native plant species are defined as those that existed in an ecological area prior to European settlement.

- .2 **Naturalization Design:** Naturalization is not a technique that is appropriate in all locations and instances. Where it is determined to be appropriate, design and layout shall take into consideration light availability, aesthetics, safety and site location. Planting density may not have to be high, as natural succession of the plant communities will ultimately make up the vegetation. As well, the overall planting should be designed to minimize maintenance.

Additionally, the following should be considered:

- i. select plants native to Kitchener where possible,
 - ii. select plants that produce seeds, nuts and fruits for diverse food sources throughout the year;
 - iii. combine plants to provide horizontal and vertical density, with well-developed tree canopies, understory trees and shrubs and low groundcovers for refuge from predators and weather;
 - iv. encourage integrated pest management (IPM) practices to reduce pesticide, herbicide and chemical fertilizer use;
 - v. reflect human intention and direction, or “perceived care” in the design; and
 - vi. acceptable planting times depending on plant species, type of stock, climate and weather.
- .3 **Naturalization Maintenance Plan:** All planting shall include a full maintenance program to ensure success. The maintenance plan should include identified watering cycles, mulching, weed or invasive species removal, and tree stake removal. Additionally, if special maintenance requirements exist such as prescribed burns for prairie naturalization or mowing late in the season to accommodate monarch butterflies feeding on milkweed before their annual migration, then, they too will need to be identified.
- .4 **Naturalization Monitoring Plan:** Project monitoring is required to monitor the success of the project (plant mortality, volunteer labour, naturalization techniques) given the environmental stresses of the urban environment such as soil contamination, invasive non-native plants, road salt and auto exhaust. The reintroduction of native plant communities can be difficult and may require the careful choice and mixing of native and non-native species in order to be successful.

A minimum two-year guarantee period is required for all plantings from the date of installation / acceptance. Inspections shall be carried out at least once per month by the Developers Consultant during the growing season from June 1 to October 31, and a site inspection report, with photograph documentation, shall be submitted to the Park Project Manager.

- .5 **Naturalization Signage:** Interpretive signage is required to identify the naturalization area, inform the public about the benefits of naturalization and to let people know that the changes to the landscape are intentional and managed. The design of the sign, text and visual content is to be coordinated with the Park Project Manager.

L.7 **PARK, TRAIL AND OPEN SPACE CONSTRUCTION REQUIREMENTS**

Refer to Section A for required studies, testing, reports and design development review submittal requirements as well as the KPSS and KPSD for a fulsome description of the requirements described below. When these specifications/standards are referenced for construction; substitute “Developer” for “Contractor”. Alternatively, the following sections present the Developer’s responsibilities.

All parks, trails and open space work is to be constructed to City standards current to the time of construction. The Developer’s Landscape Consultant is to coordinate with the Developer’s Consultant team and the Park Project Manager to ensure this requirement is met.

Throughout the construction process, the Contract is between the Developer and Contractor.

L.7.1 **Construction Process for Park, Trail and Open Space Projects**

Proposed changes to the approved design, scope, costs and/or schedule is to be reviewed and approved by the Parks Project Manager throughout the bidding and construction processes.

- .1 **Contract Documents:** The Developers Landscape Consultant shall coordinate the preparation of the Issue for Tender (IFT) and Issue for Construction (IFC) documents with the Developer’s Consultants in consultation with, and for the written approval of, the City;
- .2 **Contract Award:** Following receipt of written City approval for the Issue for Tender (IFT) documents, notify the City upon award and provide the construction schedule, contact information for the successful bidder and sub-consultants. Submit copies of the bid documents to the City;
- .3 **Project Start-Up Meeting:** The Developers Landscape Consultant shall hold a start-up meeting with the Parks Project Manager at the start of construction.
- .4 **Communication and Documentation:** Throughout construction the Developer’s Landscape Consultant is to provide the Parks Project Manager with regular updates on construction progress; proposed changes to the project scope, materials, and/or layout for review and comment by the City and communicates any schedule delays.

The Parks Project Manager is responsible for external communication related to park design. The Developer and Consultants are to provide the Parks Project Manager with regular updates regarding construction status.

- .5 **Submittals:** Submittals as identified in the *KPSS and KPSD* as well as project meeting minutes; project documentation (Contemplated Change Notices, Change Notices/Orders, etc.)
- .6 **City inspection milestones:** The Developer’s Landscape Consultant must notify the Parks Project Manager at each of the following milestones to allow the Parks Project Manager to complete an inspection: immediately following implementation of tree/vegetation protection measures and prior to designated existing features, trees, vegetation and invasive species

removals; rough grading prior to fine grading; upon completion of fine grading prior to seeding/sodding; layout of park, trails and open space features and amenities; following excavation of sub-base and footings preparation prior to installing sub-base, drainage layers, and footings; initial acceptance and final acceptance.

L.7.2 Setting Out

The setting out of work shall rest solely with the Developer who shall be responsible for same.

- .1 Prior to commencement of work on site, it is the responsibility of the Developer to become directly acquainted with the site, to carefully examine the location of the proposed work, to verify existing grades, site conditions including vegetation, property limits and easement lines, levels, and dimensions as indicated on the drawings and report in writing immediately to the City and the Consultant, any errors discrepancies and conditions which are at variance with drawings and specifications. Failure to do so will imply acceptance by the Developer of surfaces and site conditions and no claim made thereafter for damages or extras resulting from such discrepancies will be accepted.
- .2 Prior to commencing any excavation work verify on the site all underground services, such as water lines, sewers, electrical cables, telephone, gas and other utility lines and have such services located/staked on the site by the appropriate authorities. The Developer is responsible for damage or relocation incurred during the execution of the project.
- .3 The Developer is responsible for damage caused to the surrounding facilities. Facilities damaged by the Developer shall be repaired to the approval of the Director of Parks and Cemeteries, at the Developer's expense.
- .4 Meet and blend smoothly with existing grades at the project boundaries where required.

L.7.3 Site Protection

The Developer is to be fully responsible to ensure that all erosion and sedimentation resulting from the proposed works, dewatering operations, etc., is controlled and contained within the work site to the satisfaction of the Director of Parks and Cemeteries and / or the Grand River Conservation Authority.

- .1 An Erosion and Sediment Control Plan is required for park, open space and trail blocks for approval by the Park Project Manager. They are to stipulate inspection frequency, clean-out and maintenance of all control measures throughout construction;
- .2 Any clean-up or damage costs resulting from the Developer's failure to control erosion or siltation shall be completely at the Developer's expense; and
- .3 Refer to Kitchener Parks standard specification for Erosion and Siltation Control available for download from the City's website.

L.7.4 Tree and Shrub Protection

Tree and Shrub Protection shall be designed in accordance with current KPSD as well as KPSS and submitted to the Parks Project Manager for review and approval.

- .1 Developer is responsible to remove tree and shrub protection upon final acceptance by the Parks Project Manager.
- .2 Refer to Kitchener Parks standard specification KPSS **32 01 90.33** Tree and Shrub Protection, available for download from the City's website.

L.7.5 Clearing and Grubbing

Shall be completed in accordance with the KPSD and KPSS current to the time of construction. In general, this work is to clear the site of all rubbish, rocks, boulders, tree stumps and other useless materials and debris, remove from site and dispose of unless instructed otherwise. Refer to KPSS **31 11 00** Clearing and Grubbing.

L.7.6 Soils Testing and Topsoil Stripping

Shall be completed in accordance with the KPSD and KPSS current to the time of construction. Refer to section M for soils testing requirements. Where possible and deemed appropriate after testing the park block and open space soils in situ, the City's preference is to conserve soil.

- .1 All areas designed for paving or the construction of structures shall be stripped of all topsoil and organic matter to its full depth taking care not to contaminate it with any sub-soil.
- .2 All stripped topsoil to be used for the park and shall be stockpiled in areas designated by the Parks Project Manager and Developers Grading Consultant and shall be for park purposes only.
- .3 Stockpile topsoil in loose layers, not exceeding 225mm in depth, total height of stockpile not to exceed 4500mm. The stockpiles shall be protected by heavy duty silt fence according to Section K guidelines.
- .4 Commence topsoil stripping only after designated areas have been cleared of scrub, weeds, brush stumps, rocks and other deleterious materials. Such materials shall be removed from the site and disposed of by the Contractor.
- .5 Topsoil shall be tested, amended as required per City standards current to the time of construction and re-used for landscape work, unless specified otherwise. Amended and approved topsoil is henceforth noted as "approved growing medium".
- .6 Approved growing medium is to be free of stones, debris and weeds and fine graded to grades indicated on plan prior to start of seeding and/or sodding operation.

L.7.7 Rough Grading

Shall be completed in accordance with the KPSD and KPSS current to the time of construction.

L.7.8 Topsoil and Fine Grading

Shall be completed in accordance with the KPSD and KPSS current to the time of construction.

- .1 All areas designated for parkland, which are not identified as tree habitat zones, are to have a minimum of 300 mm of topsoil. All tree habitat zones shall have the required soil volumes and

depth identified on the Tree Planting Plan and meet all the requirements in Section M of this manual; and

- .2 Topsoil stripped from the area surrounding the park shall not be stockpiled on the Park or Trail site. The Manager of Design and Development requires topsoil testing to the City's satisfaction at the expense of the Developer.

L.7.9 Site Servicing and Grading Report and Certifications

A grading report and certification of the grading activities shall be provided by the Developer's Landscape and Engineering Consultants. The Developer's Consultants shall complete two inspections to ensure the site servicing, grading and approved growing medium are in accordance with the City's standards and the contract documents, as follows:

- .1 upon completion of site servicing, confirming drainage connections from playgrounds and other required areas to nearest catch basin (CB), and/or other drainage structures on site;
- .2 rough grading, prior to the placement of topsoil;
- .3 upon the completion of fine grading and application of the approved growing medium to the required depths;
- .4 The Developer's Landscape and Engineering Consultants are to verify that the grading of the subject park(s), trail(s) and open space blocks are in conformity to the approved subdivision lot grading plans and City standards and shall not adversely affect any adjacent property;
- .5 The grading report shall include photo documentation from the inspection(s) and test results of the samples of the in-situ growing medium as well as letters of certification for the rough and fine grading with both the certifying Engineer's and Landscape Consultants stamps;
- .6 Deviations (50mm tolerance) from the approved park and trail block shall be certified by the Consulting Engineer and approved by the City. If the inspections reveal any deficiencies, the Developer's Consultants will notify the Developer and the Parks Project Manager what further work is required to ensure the work is completed in accordance with the approved plans; and
- .7 It is the Developer's responsibility to ensure the required work is completed in accordance with their Consultant's recommendations.

L.7.10 Seeding and Sodding

Shall be completed in accordance with the KPSD and KPSS current to the time of construction. The Developer's Landscape Consultant is to coordinate seeding and sodding requirements with the Parks Project Manager during the detail design stage.

Seeding and/or sod laying to coincide with approved growing medium operations. Do not begin to install seed and/or sod without submission and the City's written approval of the Servicing and Grading Report and Certification as outlined above.

L.7.11 Planting

Shall be completed in accordance with the KPSD and KPSS current to the time of construction. The Developer's Landscape Consultant is to notify the Parks Project Manager of any proposed changes and/or substitutions to the species, size and/or condition of the approved plant materials for review and written approval to proceed.

L.7.12 Playground Structures

Shall be completed in accordance with the KPSD and KPSS current to the time of construction. The Developer's Landscape Consultant is to notify the Parks Project Manager of any proposed changes and/or substitutions to the playground equipment type, colour and any other proposed changes to the approved plans for review and written approval to proceed.

The Developer's Consultant is to ensure playground area drainage and servicing connection requirements are coordinated with servicing operations for the development in a timely manner.

L.7.13 Asphalt and Concrete

Shall be completed in accordance with City standard details and specifications current to the time of construction.

L.8 PARK, TRAIL AND OPEN SPACE RELEASES

Release for Park and Trail requirements may only be applied for upon 100% completion as certified by the Grading/Servicing Engineer, Landscape Architect, and Lighting Engineer/Consultant.

Any request for release must be supported by the following documentation, which certifies that the park and community development works have been completed in accordance with the approved plans:

- a) A Park and Trail Grading/Surfacing and a Servicing Site Development Works Notification form from the Developer's Engineering Consultant who prepared the plan(s)
- b) A Park and Trail Facility Completion Notification form from the Developer's Landscape Architect who prepared the Park Development Landscape Plan.
- c) A Park and Trail Site Development Works Notification form from the Developer's Lighting Engineer/Consultant who prepared the Lighting Plan.

These forms must be sent to:
Director of Parks and Cemeteries
131 Goodrich Drive
Kitchener ON N2C 2E8

With a copy to:
Manager of Development Review, Planning Division
Development Services Department
200 King St. W.
Kitchener City Hall
6th Floor
Kitchener, Ontario N2G 4G7

Upon receipt of the three above noted forms, the City may make an inspection to verify that the Park and Trail Site Development Works are installed in accordance with the approved plans. Should the City find any discrepancies and/or deficiencies, an inspection report will be issued to the owner and the appropriate consultant(s). Any revisions to the approved park development plan, site and trail grading, planting and landscaping, park facility and servicing plans, tree management and/or lighting plans require approval from the City prior to installation of the works

Upon completion of the items outlined in the inspection report, the applicant shall notify the City for further inspection in order to obtain a final release.

If more than one (1) inspection must be carried out to obtain a complete release of the security for site development works, it shall be per inspection at the current fee rate and paid in advance.

All site development works are to be maintained and all plant material is to be in a healthy vigorous state for approval. A Landscape Contractor's plant material guarantee is not acceptable to receive release related to dead or poor condition plant material.

Substantial and final acceptance of the park and Trail site development works by the City may occur between May 1st and October 31st only. Due to environmental conditions, final inspection and/or acceptance of the installation of plant material, sodding and/or seeding may not be possible between November 1st and April 30th. Consequently, between these months, it may not be possible to make any releases to ensure satisfactory completion of the installation of plant material, sodding and/or seeding.

The City will not release any of the park and trail works until the City has received all required Park and Trail Site Development Works Notification forms from the designated professionals, to the Manager of Design and Development, giving complete certification of the site, and the City is in complete agreement with the certification.

With the final acceptance of the above noted notification forms As-Built drawings are to be prepared and sealed by the Developer's Grading/Servicing Engineer, Landscape Architect and the Lighting Engineer/Consultant and upon receipt of the Construction Asset Data Submissions. Two (2) hard copy sets (Mylar) and one digital file in dwg. format (not read only) is required by the Manager of Design and Development.

M URBAN FOREST – TREE PLANTING & ESTABLISHMENT

M.1 GENERAL

Trees on City lands (residential streets, active parkland, and natural areas) are recognized as one of Kitchener’s corporate assets. In contrast to other assets, trees increase in value as they grow, providing the maximum economic, social and environmental benefits at maturity. Recognizing this, these Best Management Practices place a priority on the planting of large (≥ 60 cm) and medium (≥ 40 cm) stature trees (Table M.1) and the required soil volume to maximize community benefits while minimizing long-term costs. For more information and additional tools refer to the City of Kitchener Urban Forest Website. This section (M), Urban Forest – Tree Planting & Establishment identifies the minimum requirements for tree planting and soil habitat zones for all City lands managed by Operations, Infrastructure Services Department. Where a discrepancy exists between these standards and another City document, the standards in this section will always be viewed as Operations’ minimum standards and requirements.

Table 12: MATURE TREE SIZE		
Tree Stature	Diameter at maturity	Standard spacing
Large Stature Trees (LST)	≥ 60 cm	10 m
Medium Stature Trees (MST)	≥ 40 cm	10 m
Small Stature Trees (SST)	≤ 20 cm	7 m

Note: Tree stature refers to the mature size of the tree, and not species of trees, recognizing that trees adapt to the site conditions they are growing in (e.g. dwarf cedar trees growing on Niagara escarpment). To maximize community benefits, these standards place a priority on the planting of large and medium stature trees with the required soil volume (Refer to Table M.2 – Minimum Soil Volumes for Mature Trees - Soil Habitat Zones).

M.2 URBAN FOREST REQUIREMENTS

Minimum Quantities, Tree Size, Soil Volumes, Cash-in-Lieu, Species Diversity

The City of Kitchener has set minimum requirements for all tree planting on City lands. Tree size, soil volumes, cash-in-lieu payments and species diversity requirements are the same for all developments. The number of trees required and their locations varies by the type of development and land use, refer to M.2.1 to M.2.5 for specific requirements.

M.2.1 New Residential (post 1980) - Street Tree Planting Minimum Requirements

The Developer will provide at least 1 tree and the required soil habitat zone for each residential unit built (single, semi-detached, townhouses). At least 30% of the trees will be large stature trees, and 50% will be medium stature trees, while no more than 20% will be small stature.

For new development, where the front and side lot setback is ≥ 4.5 m, the City will permit up to 25% of the required trees to be planted on active parkland to achieve a mature tree canopy of 40 to 60% (See M.2.3).

Where the front and side lot setbacks are < 4.5 m, the City will consider other planting options on public and private lands, with the first priorities being active parkland, school properties and other public lands. All tree planting on private lands must include a restrictive covenant or equivalent to protect the tree and soil habitat zone.

M.2.2 Old Residential (pre 1980) - Street Tree Planting Minimum Requirements

Refer to the City of Kitchener's Operations Tree Planting & Establishment Best Management Practices Manual for more information (available on the City of Kitchener website).

M.2.3 Multi-Residential and Lot-less Blocks - Street Tree Planting Minimum Requirements

The minimum requirement for multi-residential lots and lot-less blocks will be for the Developer/Builder to construct 1 medium stature street tree and the required soil volume (e.g. boulevard and front yard soil habitats) for every 10 lineal meters of road right-of-way frontage.

The Developer/Builder will be required to achieve optimal street tree plantings beyond the minimum requirement, where conditions exist and upon review of the detailed site plan proposed i.e. where soil habitats supporting large stature trees are achievable, the Developer/Builder will be required to construct large stature street tree plantings.

M.2.4 New Development – Active Parkland Minimum Requirements

The Developer will provide the required number of trees and soil habitat zone to achieve at least 40% mature tree canopy cover within the active parkland. Where all of the required residential trees cannot be planted within the road right-of-way, the City may consider plans that increase the mature tree canopy cover from 40% up to a maximum of 60%.

The tree planting plan for active parkland will ensure that at least 75% of the trees are large stature, that no more than 20% of the trees are medium stature and no more than 5% are small stature trees.

For staged developments, where the active parkland is in future stages, the Developer may carry forward deficient tree targets from the residential streets to future stages that contain active parkland.

M.2.5 Letter of Credit

As part of the Letter of Credit submitted to Engineering and required at the time of underground servicing, the Developer will identify the full estimated value of the required large, medium and small stature trees. The calculated value, shown at a per-tree rate, will include: Consultant fees, supply of approved soils, installation of soil habitat zones, 50 mm wire basket trees, root pathways, and two years of maintenance that produces a healthy and vigorously growing tree that no longer requires supplementary watering.

M.2.6 Cash-in-Lieu Payments

Where the Developer cannot meet the minimum targets for tree planting on residential streets and active parkland, the City will accept a cash-in-lieu payment for the value of the tree/s, required soil volume/s, installation and maintenance costs established through the Letter of Credit process for large, medium and small stature trees.

Where the cash-in-lieu payment is greater than 20% of the minimum target, the Developer will

demonstrate to the City that all planting options have been considered before the City will accept the cash-in-lieu payment. Cash-in-lieu payments to the City will be made at the time of Initial Acceptance of the street trees.

M.2.7 Minimum Soil Volumes

For trees to provide the maximum benefits to the community over their lifecycle (50+ years), the minimum required soil volume and quality must be provided. Large stature trees (LST) require 45m³ of viable soil to grow to maturity, while medium stature trees (MST) require 28m³. With the large scale earth moving that occurs today prior to residential development, the functional and physical characteristics of the soil that sustained growth prior to development must be re-established after development for healthy and vigorous tree growth to occur. Starting at the Draft Plan Review Stage, the Developer's Landscape Architect will identify the tree planting requirements and work with the project's planners, engineers and all utilities to achieve the minimum tree planting requirements and required soil volumes.

All proposed tree planting on lands managed by Operations will include the minimum soil volumes required. For trees planted in groups or continuous soil trenches, a percentage of the required soil volumes may be shared. The soil volumes required for individual trees and trees planted in groups are provided in Table M.2 below. Any tree planting requirements for City lands that are planted on other lands will require these minimum soil volumes.

Table 13: MINIMUM SOIL VOLUMES FOR MATURE TREES – SOIL HABITAT ZONES			
CHARACTERISTICS	LARGE STATURE TREES (LST)	MEDIUM STATURE TREES (MST)	SMALL STATURE TREES (SST)
Diameter at Maturity	≥ 60 cm (24")	≥ 40 cm (16")	≤ 20 cm (8")
Minimum Soil Volume Required for Single Trees	≥ 45m ³	≥ 28m ³	≥ 17m ³
Minimum Soil Volume Per Tree Where Soil Volumes are Shared	≥ 30 m ³	≥ 18.5 m ³	≥ 11 m ³
Allowable Shared Soil Volume	≥ 15 m ³	≥ 9.5 m ³	≥ 6 m ³

A soil volume calculator is available for download on the city website.

M.2.8 Soil and Topsoil Depth

For all boulevards where trees are planted, the minimal soil depth will be 450 mm, and all other soil habitat zones (public/private front lawn, cul-de-sac, active parkland) associated with tree planting will be 900 mm. Where soil habitats zones (e.g. boulevard and front lawn) must be connected to achieve the required soil volumes, root pathways or Silva Cells will be used to provide a functional connection between the two areas. Refer to section M4 and the following details UF.3.1/3.2/3.3 for more information.

The City's minimum standard for topsoil in the soil habitat zones is 450 mm. Topsoil is permitted to a maximum depth of 900mm within these zones. The soil habitat zones (public/private front lawn, cul-de-sac, active parkland) is required to have the subsoil to be mechanically scarified to a depth of 900mm prior to the placement of topsoil. If the subsoil material (B Horizon) is not suitable for use as soil habitat

the City may require topsoil be installed for the entire soil habitat zone. Prior to topsoil placement all soil habitat zones the subsoil must be free of construction material larger than 50mm diameter, debris, garbage, rocks and wood.

M.2.9 Urban Forest Soils Report

The Developer's Consultants will provide a soils report that describes the physical and functional characteristics of the lands to be developed prior to any area grading, using the standards set in the Field Manual for Describing Soils in Ontario. The field work and reporting will be carried out by a qualified Pedologist or equivalent. Where appropriate, the Soils of Waterloo County will be referenced providing the historical context of the characteristics of the soils. Using the mapping available (Scale 1:20,000) in the Soils of Waterloo County, **minimum of 2 soil samples of the surface soil (A Horizon) and subsurface (B Horizon)** will be taken per polygon based on the size of the polygon and experience of the qualified Pedologist. Each sample point will be geo-referenced in the field and a map of the soil points will be included in the report, along with a shapefile. For each sample point, the field sheet in the Field Manual for Describing Soils in Ontario will be used. Soil samples will be taken at each sample point and all of the required tests identified in Table 5 will be taken and sent to an accredited soil testing facility. The soils report will provide a description of the soils within the developable lands prior to development based on the sample plots and laboratory results.

Table 14: SOIL ASSESSMENT & SPECIFICATIONS			
Composition	Sandy Loam	Silt Loam	Loam
% Sand	- 80%	0 - 35%	30 - 55%
% Silt	Remainder of the mix	Remainder of the mix	Remainder of the mix
% Clay	8 - 20%	0 - 25%	8 - 25%
Screening	≥ 7.5 cm mesh		
% rocks & sticks	Maximum 10%		
pH	7.0 to 7.5		
% organic content	4-8% (determined by oven-dried weight)		
Phosphorus(P)	20 - 40 ppm		
Potassium (K)	100 - 200 ppm		
Calcium (Ca)	1,500 - 4,000 ppm		
Magnesium (Mg)	100 - 300 ppm		
Sulphur (S)	20 - 100 ppm		
Sodium (Na+)	< 200 ppm		
Total Salts E.C.	<0.25 mS/cm		
Herbicides	Testing will identify any growth inhibiting herbicides present in the soil.		
CEC (Cation Exchange Capacity)	8 - 15 centimoles/kilogram	10 - 20 centimoles/kilogram	15 - 25 centimoles/kilogram

The Urban Forest Soils Report respond includes at a minimum the following items:

- Characterization of the depths and types of A & B Horizon soils observed onsite;
- Identify deficiencies:
 - In A Horizon soil properties (compared against Table 19)
 - In A Horizon volume, as compared to the preliminary volumes found by the PTPP.
- Recommendations for A Horizon soil improvement (if required), which may include:
 - A Horizon soil quality amendments

- At stockpile
- At time of front yard soil habitat installation
 - A Horizon volume solutions e.g. acquire suitable soils off site
- Specific recommendations if any required, for the retrieval and storage of A Horizon soils, including recommendations if any required e.g. mixing operations at the storage pile that may be necessary to achieve A Horizon soils that are ready to be relocated to tree planting locations;
- Specific recommendations if any required related to the site's A Horizon soil material properties e.g. moisture content and texture, for the purpose of informing fill and compaction operations of A Horizon soils into the front yard and boulevard soil habitats, in order to achieve suitable conditions for root development.

Based on the characteristics of the existing soils the Urban Forest Soils Report will identify the depths of both Horizon A and Horizon B existing onsite, quality of material based on Table 19 and general recommendations for any future amendments to meet Table 19 requirements. The Developer's Consultants will identify the acceptable range and depth of topsoil that will be used in the soil habitat zones for trees. The Developer's Consultant will also identify how the Horizon A material will be stored and installed in the soil habitat zones to maintain the physical and chemical characteristics. The Urban Forest Soils Report shall be submitted with the Preliminary Tree Planting Plan, to the satisfaction of the City of Kitchener's Director of Operations.

M.2.10 Species Diversity & Selection

Species diversity and selection are key elements in the creation of a sustainable urban forest. Recognizing that cities are cultural creations, a sustainable urban forest that maximizes community benefits for the lowest cost, supports the planting of native and non-native species in the appropriate location. No one genus can exceed 20% of the total planted trees. Long-term social, environmental and economic benefits will be considered along with long-term costs, with a focus on the planting of large and medium stature trees. The mature size/stature of a tree is dependent on the species and the available soil habitat zone. The Landscape Architect will identify the total number of large, medium and small stature trees included within the subdivision. City of Kitchener Operations Urban Forest Staff will review and approve the species selection and the stature designation of the trees for each project. The City may request changes and substitutions through the design of the tree plans.

M.3 PRE CONSTRUCTION PROCESS

Submissions & Approvals

For additional information refer to the following details in Appendix C and the City of Kitchener's Operations Tree Planting & Establishment Best Management Practices Manual.

M.3.1 Draft Plan Review

At the time of Draft Plan Review, the Developer's Consultants will provide a Preliminary Tree Planting Plan showing how the minimum tree planting requirements, of 1 tree per residential unit (or other stated requirement), will be prepared for review and comment by Operations. The Urban Forest Soils Report shall be submitted with the Preliminary Tree Planting Plan.

This plan, drawn at a scale of 1:1000, will include road, lot, driveway and boulevard layout information. Using the standardized colour coding system, the plan will identify all of the potential large, medium and

small stature tree locations based on soil volume requirements and the proposed layout of the subdivision. From this information the Developer's Landscape Architect will identify the potential locations and quantities for large, medium and small stature trees on the plan and in the Minimum Requirements Table M.4. Where the proposed tree planting quantities are below the minimum standards or where it is being proposed that the required trees along the City road right-of-way will be planted in other locations, the Consultant will provide sufficient information to show how the required targets will be met.

Table 15: TREE PLANTING REQUIREMENT SUMMARY	
(Requirement to be included on all Tree Plans)	
Subdivision Name:	Kitchener Green (example)
Subdivision Number:	30T-XXXXX
Number of Stages:	1 or any number planned
Stages on Plan:	1 or more depending on...
Proposed Residential Lots:	1 or more
Total Number of Trees Required:	Based on City standards
Total Number of Trees Provided:	How many proposed
Total number of Street Trees	Sum of trees in boulevards
Total number of Park/Open Space Trees	Sum of trees in parks/trails
Total Number of Large Stature Trees (LST)	Sum of large trees
Total Number of Medium Stature Trees (MST)	Sum of medium trees
Total Number of Small Stature Trees (SST)	Sum of small trees

As the design evolves, the Conceptual Tree Planting Plan will be used to inform the design team and all utilities groups about the minimum tree planting requirements, while also ensuring that the identified large and medium stature tree planting locations and soil habitat zones are protected wherever possible.

M.3.2 Engineering & Utility Design

Street Tree Planting Plan – 1st Submission

At the time of the 1st submission of the detailed engineering drawings, the Consultant will provide the City with a Tree Planting Plan (TPP) for review and comment by Operations. Based on the Preliminary Tree Planting Plan and refinements of the design, the STPP will be drawn at a scale of 1:500 using the City standard template for the tree related infrastructure. The drawing will show all of the soil habitat zones for large, medium and small stature trees. The drawing will also show the proposed: road, lot, driveway, boulevard, proposed known utility locations (sanitary, water, storm, hydro, front yard infiltration facilities, telecommunications, and gas layout information) along with the all known proposed aboveground infrastructure (all street furniture including sidewalks, driveways, community mailbox locations, telecommunication pedestals, utility structure/buildings, streetlight poles, conduits, ductwork, hydro vaults, gas valves and all utility crossings). **As part of their 1st engineering submission, the Engineering Consultant will incorporate A and B Horizon soil management planning results into the standard Lot Grading cross-section and plan details, such that the relevant Section M changes including the new soil habitat horizon requirements are accommodated.**

"A Horizon" soil material will conform to Table 19: Soils Assessment & Specifications. The upper 450 mm of front yard and boulevard soil habitats will be constructed of A Horizon soil material as outlined in the Urban Forest Soils Report. The Developer's Consultant will calculate and identify on a street by

street basis the volume of A Horizon topsoil material required to construct the front yard and boulevard soil habitats.”

Street Tree Planting Plan - 2nd Submission

As part of the 2nd engineering submission, the Landscape Architectural Consultant will submit the Street Tree Planting Plan -2nd Submission. The Plan will identify the soil habitat zones for large, medium and small stature trees and identify species, quantities, condition and sizes of proposed plantings, as well as identifying large, medium and small stature quantities achieved overall. The Plan will also show proposed subdivision infrastructure layers that potentially affect street tree planting locations, including: roads, on-street parking, lotting, driveways, boulevards, sidewalks and front yard infiltration galleries if any; proposed servicing including sanitary and storm sewer, gas, hydro and water; and also show proposed above ground subdivision infrastructure, including community mailbox locations, bus/transportation stops, telecommunication pedestals, utility structures/buildings, streetlighting poles and hydro vaults.

Street Tree Planting Plan - 3rd Submission (if required)

As part of the 3rd engineering submission and if it is required, the Landscape Architectural Consultant will submit the Street Tree Planting Plan - 3rd Submission. The Plan will address review comments from the 2nd Submission Plan as well as adding any new information not available at the time of the 2nd Submission e.g. hydro infrastructure.

Approved Street Tree Planting Plan

The Landscape Architectural Consultant will continue to submit Street Tree Planting Plans to coincide with engineering submissions where these are revised and may affect the Street Tree Planting Plan, until the City's Development Engineering advises that the Plan has been accepted. At this point the approved plan will become the Approved Street Tree Planting Plan.

The Approved Street Tree Planting Plan will guide the construction of soil habitats, root pathways and street tree installations and will also guide inspections for Initial and Final Acceptance.

As-Recorded Street Tree Planting Plan

Street trees are considered one of the assets that the City of Kitchener is required to include in their reporting of municipal assets to the federal government. In addition, street trees are part of the urban infrastructure fabric compiled from Subdivider submission requirements and mapped by the City's GIS Division.

As-Recorded Street Tree Planting Plans will be a requirement for achieving Final Acceptance on a street-by-street basis. The Subdivider's Consultant team are required to submit these because a number of actions during the build-out of a stage of subdivision may cause acceptable deviations from the Approved Street Tree Planting Plan, including:

- Driveways not constructed according to plan at the decision of individual Builders, necessitate street tree relocations;
- Changes to the location of other municipal infrastructure and utilities approved after the Approved Street Tree Planting Plan is achieved;
- Subdivider's Contractor responds to homeowner requests for new tree plantings that were not approved;
- During the time between the Subdivider achieving the Approved Street Tree Planting Plan and the street tree planting within a given stage of subdivision, street trees may be planted in locations not previously approved, and existing boulevard trees forming a part of the Approved Street Tree Planting Plan may have previously been removed, and;
- Other changes which may occur during the planning and construction of stages, following approval of the street tree planting plan e.g. Modifications to the Approved Draft Plan, etc.

Prior to Final Acceptance of the Servicing, the Consultant will provide the City with the SMTPP for approval by Operations. Prior to approval the proposed tree species will be shown for all large, medium and small stature trees complete with the soil volumes to be provided for each tree. All underground infrastructures including installed utility crossings are to be shown in their design or as-recorded locations. This drawing must be signed and sealed by the Developer's Landscape Architect. Prior to issuance of building permits, the Developer will provide to the City evidence of having entered into contractual arrangement for the provision of water and all other requirements of the maintenance period for all trees planted on public and private property as part of the approved TPP (refer Section M.5.2).

Documentation	I Preliminary Tree Planting Plan	II Tree Planting Plan	III Approved Tree Planting Plan	As-Recorded Tree Planting Plan
Copies	2 rolled sets 1 pdf	5 rolled sets 1 pdf	2 rolled sets 1 pdf	2 rolled sets 1 pdf 1 digital CAD
Timing	Draft Plan Application	1 st Submission Engineering Drawings	Prior to Final Servicing Approval	After Initial Acceptance (prior to Final Acceptance)
Review \ Approval	Review	Review	Approval	Approval
Soil Habitat Zones (Large, Medium & Small Stature Trees)	✓	✓	✓	✓
Letter of Credit	N/A	✓	N/A	N/A
Urban Forest Soils Report	✓	N/A	N/A	N/A
Utilities	N/A	Proposed	Final	As-Recorded
Root Pathways	N/A	✓	✓	✓
Tree species	N/A	✓	✓	✓

M.4 CONSTRUCTION & MATERIALS

M.4.1 Creation of Soil Habitat Zones, Root Pathways, Soils, Tree Planting

During the construction stage the Developer's Engineer will ensure that all parties are aware of the requirements of the Approved Tree Planting Plan. Prior to installation of any sidewalks and landscape works, the Developer's Engineer will also ensure that all parties and subcontractors are aware of the tree locations, required root pathways, and soil habitat zones.

The Developer's Engineer and Landscape Architect will oversee and inspect all aspects of the work, including the removal of the parent material/construction debris from the soil habitat zones, and installation of the approved topsoil, root pathways, and tree planting. Through the Initial and Final Acceptance Certificates, the Developer's Landscape Architect will verify that all work and materials meet the required standards (Refer to M.5 for more information).

Root pathways will be installed prior to the construction of the sidewalk. For the standard root pathway detail using Big “O” drainage pipe, five sections of pipe extending 300 mm beyond the edge of the sidewalk will be spaced 900 mm apart from the centre of the proposed tree. Placed at the top surface of the parent material (C Horizon) below the sidewalk, the areas around the pipe will be backfilled with parent material. The required 150 mm of granular ‘A’ material for the sidewalk will be placed on top. Where construction debris or excess granular ‘A’ has contaminated the parent material, the contaminated material will be removed before the Big ‘O’ drainage pipe is installed. Refer to UF.3.2 in Appendix C for more information.

M.4.2 ‘A’ Horizon Soil Habitat – Boulevard

The excavation for the soil habitat zone in the boulevard will be to a depth of 450 mm, with 1:1 slopes at the edge of the roadway and sidewalk. The boulevard will be backfilled with 450 mm of approved topsoil (A horizon material) in maximum 300 mm lifts and compacted to maximum 85%, minimum 78% Standard Proctor Density (SPD). Refer to UF.3.4 in Appendix C for more information. Compaction testing of each 300 mm lift of soil shall be completed by the Developer under the supervision of the Developer’s Consultant, at their discretion and expense, to ensure that the methods and equipment employed are achieving the required compaction results. The City may require testing, at their discretion and expense, where it appears that compaction requirements are not being met. In cases where these compaction tests fail, all costs of excavation, replacement of soil and all testing shall be at the Developer’s expense. No B Horizon Soil Habitat is required for the boulevard areas. Stockpiled ‘A’ Horizon material is to be made available to Contractors and homebuilders for the construction of front yard and boulevard soil habitats.

M.4.3 ‘B’ Horizon Soil Habitat – Front Yard

Excavation/scarification of the front yard soil habitat zone will be to a minimum depth of 900mm and maintain a minimum of 1000mm from the edge of any building foundation. This soil habitat zone is separated into two distinct zones. The lower 450 mm is to the B Horizon soil (or B Horizon zone). The B Horizon zone can be prepared by excavating to a minimum depth of 450 mm and back filling with approved B Horizon material or by scarifying the existing material in the area to a minimum depth of 450 mm prior to backfilling the upper zone. Scarification must be completed mechanically to the full 450mm depth to remove/release the compaction as a result of the area grading and house construction. The approved subsoil (B Horizon) will be compacted to maximum 85%, minimum 78% Standard Proctor Density (SPD) with the final surface level and scarified to remove crusting. Refer to UF.3.4 in Appendix C for more information. Compaction testing of the B horizon soil shall be completed by the Developer under the supervision of the Developer’s Consultant, at their discretion and expense, to ensure that the methods and equipment employed are achieving the required compaction results. The City may require testing, at their discretion and expense, where it appears that compaction requirements are not being met. In cases where these compaction tests fail, all costs of excavation, replacement of soil and all testing shall be at the Developer’s expense. The upper zone will be a minimum depth of 450 mm and consist of all A Horizon material.

M.4.4 ‘A’ Horizon Soil Habitat – Front Yard

The ‘A’ Horizon front yard soil habitat zone will be to a minimum depth of 450 mm. Prior to backfilling this zone the lower 450mm B Horizon Soil Habitat Zone must be prepared and all construction debris and garbage removed. The approved topsoil (A Horizon) will be installed in maximum 300 mm lifts and compacted to maximum 85%, minimum 78% Standard Proctor Density (SPD). Refer to UF.3.4 in Appendix C for more information. Compaction testing of each 300 mm lift of soil shall be completed by the Developer under the supervision of the Developer’s Consultant, at their discretion and expense, to

ensure that the methods and equipment employed are achieving the required compaction results. The City may require testing, at their discretion and expense, where it appears that compaction requirements are not being met. In cases where these compaction tests fail, all costs of excavation, replacement of soil and all testing shall be at the Developer's expense.

The Developer's Landscape Architect will randomly sample 5% of the soil habitat zones once the topsoil has been placed. Samples of the topsoil will be taken and submitted to an accredited lab for testing. Refer to details in Appendix C for more information. Where the test results are not within the allowable parameters, the Developer's Landscape Architect will notify Operations in writing and propose remedial action to correct the deficiencies and ensure that all of the soil habitat zones meet the requirements.

The Developer's Landscape Architect will mark all approved tree planting locations prior to any planting. All trees planted will be 50 mm wire basket; the same species and cultivar identified on the Approved Tree Planting Plan and approved by the Developer's Landscape Architect prior to planting. Refer to UF.4.1/4.2 in Appendix C for more information.

M.5 POST CONSTRUCTION PROCESS

(Initial Acceptance, Maintenance & Warranty, Final Acceptance)

M.5.1 Initial Acceptance

The Developer's Landscape Architect will request an inspection for Initial Acceptance after all required tree works are completed, and during the active growing season (June 1st to September 30th). Initial Acceptance will be provided on a street by street basis.

Prior to the site meeting the Developer's Landscape Architect will provide the Initial Acceptance Certificate (UF.1.2) signed and dated stating that all required work regarding the urban forest asset has been completed to the Operations' approved standards and the approved drawings. Certification of front yard and boulevard soil habitats and root pathways by the Engineering Consultant is a requirement for Initial Acceptance of street trees.

With the submission of the Initial Acceptance Certificate the Developer's Landscape Architect will also identify in writing whether this part of the development meets the minimum tree planting requirements. Where the minimum requirements have not been met, the Developer's Landscape Architect will identify the required cash-in-lieu payment.

The Developer's Landscape Architect will set up a site inspection which will include the Developer's Landscape Architect and the City's Operations Representative and Engineering Representative.

The Site Inspection Form (UF.1.1) and checklist will direct the field inspection. Following the field inspection, the Operations Representative will indicate whether the Initial Acceptance will be: 1) *Accepted*, or 2) *Rejected*. Where the Initial Acceptance is rejected, the Developer's Landscape Architect will correct all of the required deficiencies prior to requesting another inspection.

When all issues have been addressed, the City will approve the Initial Acceptance Certificate (refer to UF.1.2) and the project will move to the warranty/maintenance period. The date of Initial Acceptance will be the date of a satisfactory inspection. With approval of Initial Acceptance, the Developer may request that the Letter of Credit value be reduced (see Section A.15) and will receive reimbursement for the value of soil habitat excavation and installation of the topsoil and the root pathways. The value to supply and install the tree and two years maintenance will be held until the Final Acceptance Certificate has been approved.

M.5.2 Maintenance & Warranty

The Developer will provide all required maintenance to ensure that after the two year establishment period, all trees are healthy, growing vigorously and have a fully established root system that no longer requires regular, supplementary watering. The Developer will be responsible for the maintenance and related costs until Final Acceptance of the trees. The City will be responsible for maintenance after Final Acceptance of the trees.

Through the development of a community stewardship watering program or scheduled maintenance the Developer will ensure all trees are watered on a weekly basis, and provided with 25 gallons (95 litres) of water per week. All planted trees will receive supplementary watering from the first day of May to the last day of September. Additional weekly watering and/or an increased watering may be required if drought conditions exist.

The Developer's Maintenance Contractor will also inspect and maintain all of the planted trees after the first growing season. This will include the inspection of the tree stakes, any corrective maintenance, removal of broken or dead branches, the maintenance of the mulched area including the correction of mulch deficiencies (removal of volcano mulching, topping up low mulch, etc.), and the approved educational material will be left with each resident. All maintenance work will be done to the City of Kitchener – Operations Standards.

Prior to Final Acceptance, the Developer's Maintenance Contractor will carry out all of the required work for the first growing season, and all tree stakes will be removed. After the completion of the first year of maintenance, and during the active growing season June 1st to September 30th, the Developers Landscape Architect will complete an inspection of all trees using the Site Inspection Report (UF 1.1), and provide a written report to Operations concerning the maintenance, health and vigour of the trees. The maintenance period will cover two full growing seasons.

M.5.3 As-Recorded Submission

The Subdivider is required to submit As-Recorded Plans to the City's Manager of Development Engineering prior to the Final Acceptance of the street trees. The As-Recorded Plan will be prepared in accordance with the City of Kitchener's Constructed Asset Data Submission template package, available for download on the City website. All plans will be submitted in digital format.

Point features are required for each street tree planted. The As-Recorded plan must provide the following information for each tree.

Table 17: STREET TREE CONSTRUCTED ASSET DATA REQUIREMENTS

ATTRIBUTE	DESCRIPTION
SPECIES_NAME	COMMON NAME
PLANTED_BY	CONTRACTOR WHO PLANTED THE TREE
MONTH_PLANTED	MONTH
YEAR_PLANTED	YEAR
STOCK_TYPE	WIRE BASKET, 30 GALLON POT, BARE ROOT ETC.
STOCK_SIZE	50MM, 45MM, 40MM, 250CM ETC.
DIAMETER_BREAST_HEIGHT (DBH)	MEASUREMENT 1.37M ABOVE GRADE IN CENTIMETERS
TREE_HEIGHT	TOTAL TREE HIEGHT MEASUREMENT IN METERS
CROWN_WIDTH1	WIDTH IN METERS NORTH-SOUTH AXIS

ATTRIBUTE	DESCRIPTION
CROWN_WIDTH2	WIDTH IN METERS EAST-WEST AXIS
BRANCH_HEIGHT	METERS ABOVE GRADE <1.2M, 1.2 TO 2.4M, 2.4 TO 3.6M OR >3.6M

M.5.4 Final Acceptance

After two full growing seasons from the Initial Acceptance the Developer's Landscape Architect will request an inspection for Final Acceptance during the active growing season (June 1st to September 30th).

Prior to the site meeting, the Developer's Landscape Architect will provide the Final Acceptance Certificate (UF.1.3) signed and dated stating that all of the trees as per the plan are established, healthy and growing vigorously, no longer require supplementary watering, and all other requirements during the warranty period have been carried out. Assessment of plant vigour will be based, in part, on evidence of regular watering throughout the warranty period and the extent of new growth which is consistent with this regular watering.

At Final Acceptance, all street trees must meet the following acceptance criteria:

- All staking materials to be removed.
- Organic mulch placed a minimum of 50 mm deep over the tree pit. No mulch is to be in contact with the trunk of the tree as per the City Standard Planting Details.
- Planting depth to be completed in accordance with the City Standard Planting Details and relative to finished grade and elevation of topmost structural root, in accordance with Canadian Nursery Trades Association standards.
- Trees to have proper form and branching for the species.
- All dead wood shall be pruned and removed prior to inspection.
- All suckering and adventitious growth to be removed prior to inspection.
- Trees must show evidence of continuous growth and establishment since the Initial Acceptance.
- Trees shall be in good general health, free of mechanical bark damage, no evidence of disease and overall structurally sound.

The Developer's Landscape Architect will set up a site inspection, which will include the Developer's Landscape Architect and Operations Representative and Engineering Representative.

The Site Inspection Form (UF.1.1) and checklist will direct the final field inspection. Following the field inspection the Operations Representative will indicate whether the Final Acceptance will be: 1) *Accepted*, or 2) *Rejected*. Where the Final Acceptance is rejected, the Developer's Landscape Architect will correct all of the required deficiencies prior to requesting another inspection.

When all issues have been addressed, the City will approve the Final Acceptance Certificate and the City will assume full responsibility for the trees on City lands and their maintenance. With the approval of Final Acceptance, the Developer may request to have the remaining amount (value of the supply and install of the trees and two years maintenance) of the Letter of Credit reduced (see Section A.15). Where trees have been planted on other public or private lands, the Developer's Consultant will inform the owners that the trees are now their responsibility.