Township of Stirling-Rawdon

2529 Stirling Marmora Road

Stirling, Ontario K0K 3E0

Subdivision Development Guidelines and Technical Standards

Issued: June 2023

FOREWORD

The Foreword is provided as a general overview of the procedures and steps involved in the development of a subdivision in the Township of Stirling-Rawdon (the Township). This is not written as a detailed, step by step process, but rather as an overview of the subdivision approval process.

Following this outline is critical to timely approval and assumption by the Township.

DRAFT PLAN PRE-CONSULTATION MEETING

As the Township of Stirling-Rawdon does not have a planning department, the County of Hastings (the County) acts as the Township's planning authority. For the purpose of this document, Hastings County and Hastings County Planning department are considered to be the same. The pre-consultation meeting must include the Township and the County. At the Draft Plan pre-consultation stage, the Developer has the opportunity to discuss the subdivision concept with County and Township Staff to identify key planning issues as well as any major technical items, including studies that will be required as part of the submission. This item is initiated at the request of the Developer and is strongly recommended by staff. It should be recognized that as the approval process proceeds, other items not noted at the pre-consultation meeting, may be requested as the design progresses and more information becomes available. The following is a bullet list of steps as well as items for discussion at this meeting.

- Developer requests a meeting with the County to discuss the proposal. The Developer should have, at a minimum, a concept plan showing the configuration of the lots, lot areas and frontages, road widths, open space etc. Concept plan to be submitted to the Hastings County Planning Department and the Township of Stirling-Rawdon prior to the meeting. If the Developer would like to discuss specific aspects of the development, a meeting Agenda should be provided to Planning in advance.
- The County will confirm the Official Plan designation and Zoning, identifying any Official Plan and Zoning amendments which may be required in addition to draft plan approval
- Review of preliminary design of proposal. The County may consult with other agencies if there are concerns/constraints which are immediately identified
- The application requirements will be reviewed including:
    - Application forms required
    - Application fees
    - Any supporting documents required for the Official Plan and Zoning By-Law amendments (if required)
    - Draft plan of subdivision (2 full sized, folded copies, one 8 ½" x 11")

DRAFT PLAN OF SUBDIVISION APPROVAL

- Requires completed application (to County of Hastings), fees, 2 full-sized copies of draft plan (folded), one reduced copy (11" x 17") of draft plan, pdf copy of the draft plan and any required studies
- Application sent to internal and external agencies for technical review
- Public hearing scheduled and report prepared for Planning Committee
- Hastings County Planning Department and the Township of Stirling-Rawdon work with applicant to address technical and public concerns. Comprehensive report prepared, with recommendations and draft conditions, for Planning Committee once issues resolved
- Recommendation of Planning staff forwarded to County Council for decision
- If approved, Notice of Decision with stamped plans circulated (Applicant to submit 5 copies of signed draft plan)
- Draft Plan approved upon lapsing of 20 day appeal period, if no appeals filed.

PRE-SUBMISSION MEETING

This meeting, between the Developer's Engineer and Township staff, is being recommended to ensure that the first design submission will meet the technical requirements of the Township at the outset and thereby assist in shortening the review time.

- Public works and other departments, as needed, will be present at this meeting.
- The Developer's Engineer will present draft design drawings
- Potential concerns will be identified by Township staff, solutions and opportunities will be discussed
- The parties will re-confirm requirements for first submission

1ST DESIGN SUBMISSION

At this stage the Developer's Engineer should be presenting confirmation to the Township of Stirling-Rawdon that the design is in accordance with the guidelines. If there are areas where the guidelines cannot be met, then a brief can be submitted explaining the solution that is presented. With this information, the review can be completed in a timely manner.

- Developer's Engineer submits *complete* submission
- Developer's Engineer provides letter stating compliance with the Township's Guidelines, explains in detail where the design does not meet the guidelines and why
- Township assesses drawings for possibility of immediate application to MECP

1ST SUBMISSION COMMENT REVIEW MEETING

This meeting is suggested as an opportunity to advance the process in a timely fashion. An opportunity for discussion of the comments prepared by the Township in response to the first submission will reduce the timeline as clear communication is integral to a successful process.

- Township comments are issued within four weeks of receipt of a complete submission and a meeting can be arranged within one week with the Developer's Engineer if requested
- Hastings County Planning and Stirling-Rawdon staff to attend and others as necessary

2ND (REVISED) SUBMISSION

Should a second submission be required, the review should be very timely if the Developer's Engineer takes the opportunity to have the First Submission Review Meeting.

- At this stage, if not already under review, the MECP submission is received
- Design drawings reviewed by Township and/or any outstanding minor issues will be addressed

MODEL HOME AGREEMENT

This agreement permits the developer to construct model homes on 2 lots in advance of the completion of the underground services.

- Agreement to be requested in writing to the Township by Developer
- 2 Model Homes permitted (per phase)
- Specific lots to be identified by Developer in advance
- Requires security
- Requires building permit and Fire & Rescue approval

SUBDIVISION AGREEMENT

Section 6.2 of the document outlines the Subdivision Agreement in more detail.

- Full security required for remaining works, plus maintenance holdbacks
- If a Preliminary Certificate of Approval of Underground Services (PCAUS) is issued by the time the Subdivision agreement is signed, then the Building Permit can be issued. Building Permit issuance when services are completed to the satisfaction of the Township
- Developer provides 1% Inspection Fee

SECURITY REDUCTIONS

- As works progress, security can be reduced as per the Security Reduction Guidelines outlined in Section 8 of this document and the Subdivision Agreement.

PCAW AND ASSUMPTION OF THE WORKS

- Upon completion of all works, Preliminary Certificate of Approval (PCAW) is issued and one year maintenance period begins
- Final Certificate of Approval is issued and remaining security is released.

Revisions & Amendments

Township of Stirling Rawdon

Subdivision Development Guidelines

& Technical Standards

Section Revised/Amended	Page	Date
Appendix 1P: Water Commissioning Package	137, 140, 141	October 20 2023
Appendix 1N: Standard Drawings Figure A2	102	November 15 2023

1.0 GENERAL

1.1 INTRODUCTION

This information is provided for prospective developers and Professional Engineers as a guide to the technical standards and procedures required to design, process and obtain approvals for the installation of public works associated with urban and rural subdivision development.

1.2 ENGINEER'S ROLE

The Owner, throughout the design and contract inspection phases, shall utilize the services of a professional engineer, licensed to practice in the Province of Ontario (the "owner's engineer"). Such engineering firms shall at all times carry professional liability insurance coverage that is acceptable to the Township, and shall provide sufficient proof that said policy is in force. The professional engineer, whose services are engaged by the developer, shall act in the role of designer, contract administrator and "payment certifier" with respect to the works. The owner's engineer, as contract administrator, shall structure each construction contract to ensure that the requirements for substantial performance on the part of the contractor are consistent with the owner's requirements as contained in the subdivision agreement.

The owner's engineer shall provide inspection services and oversee all testing to the level prescribed by the Township of Stirling-Rawdon in accordance with its adopted standards. (See 10.4 Inspection and Testing). Prior to construction the engineer shall deliver to the Township a company profile outlining the work history and expertise of the inspection personnel assigned to the project.

The Township of Stirling-Rawdon reserves the right to reject any engineer or inspector who, in the sole opinion of the Township, does not possess the expertise and experience necessary to oversee the quality control of the works on the Township's behalf.

The Township, or their designated agents, will attend the construction site at key inspection intervals and will provide periodic random inspections during the course of construction. Should it be discovered that the developer's chosen consultant is not upholding the Township's inspection standards, alternate inspection services will be provided by the Township of Stirling-Rawdon. All costs incurred by the Township of Stirling-Rawdon in connection with inspection of the work will be recovered from the owner in accordance with the provisions of the subdivision agreement.

1.3 DESIGN OF WORKS

A professional engineer registered with the Professional Engineers of Ontario shall design the works. The owner's engineer shall be responsible for securing all necessary approvals on behalf of the developer.

1.4 PRE-DESIGN MEETING

The owner's engineer is encouraged to schedule a pre-design meeting to establish the design parameters or to clarify the design requirements. Such a meeting shall be arranged through the office of the Development Engineer.

1.5 SERVICES

The following are the typical types of public services to be provided in the development of each new urban subdivision:

- Roads with Curb & Gutter
- Sidewalks and Walkways
- Signs and Traffic Control Devices
- Drainage and Grading
- Stormwater Management
- Sanitary Sewers
- Watermains
- Wire Utilities
- Streetlights
- Tree Planting
- Natural Gas
- Fencing
- Parkland Development
- Bridges / Culverts

The following are the typical types of public services to be provided in the development of each new rural subdivision:

- Roads with shoulders
- Walkways
- Signs and Traffic Control Devices
- Drainage and Grading
- Stormwater Management
- Septic Systems
- Wells
- Wire Utilities

- Streetlights
- Tree Planting
- Natural Gas
- Fencing
- Parkland Development
- Bridges / Culverts

The Township will establish the extent of servicing at the pre-design meeting and advise on the required services when the type of development is defined by the owner.

Services are to be provided to the boundaries of the plan of subdivision and as required for the development of neighbouring lands (See Sec. 1.9 Commitment of Public Funds).

1.6 PHASING OF DEVELOPMENT

Construction of a registered plan in phases shall be coordinated through the Hastings County Planning Department giving due consideration to traffic routing, pedestrian movement and emergency access. In addition, the logical extension of hard services including municipal underground works and utilities (Electric, Telephone, Cable TV, Gas, Fibre Optics) is also required to be considered.

When phasing of a development is proposed, the phase limits and the works within each phase shall be clearly identified on the plans.

1.7 BRIDGES & CULVERTS

Bridge and culvert designs for structures with spans greater than 3.0 metres shall be prepared by a professional engineer who specializes in bridge design and shall be approved by the Township of Stirling-Rawdon. The owner's engineer shall provide "General Arrangement Drawings" (3 copies) showing the general layout of the proposed structure together with a Design Criteria Sheet, a Hydrology Report, and a Foundation and Structural Design Report as part of the design "package". The design package shall also include related correspondence from other approval agencies (MNR, MECP, CRCA, etc.) as applicable.

Upon approval in principle of the General Arrangement Drawings the consultant may then proceed to complete the overall design of the structure. It is anticipated the full design will accompany the second submission of engineering plans. Bridges shall be designed in conformance with the Ontario Highway Bridge Design Code (OHBDC) & Ontario Provincial Standard Specifications (OPSS).

It should be noted that all bridge plans and supporting material shall undergo a peer review at the developer's expense by a consulting firm commissioned by the Township of Stirling-Rawdon. The final drawing review will include a check of:

- Adherence to the General Arrangement Drawing

- Adherence to the OHBDC
- Adherence to foundation report recommendations, random details; etc.

1.8 PARKLAND DEVELOPMENT

Under the Planning Act, the Township can take 5% of land in the subdivision as parkland conveyance, without any cost to the municipality. The Township of Stirling-Rawdon looks to acquire functional lands for active and passive recreational needs for the community. Ideally the developer and staff should agree on the requirement for cash-in-lieu or parkland prior to any plan submission. If a municipal park(s) or open space is identified, staff and the developer can work towards a draft plan that presents the best park parcel to the neighbourhood and community.

The developer and the Township must agree prior to draft plan approval whether the Township will accept the parkland in a clean state only and be responsible for the implementation/ construction of the park or whether the developer will be responsible for the implementation and construction of the parkland. This decision will be included as a condition of draft plan approval.

The park concept design will be developed by a consultative process between Township staff and a consultant Landscape Architect hired by the Developer). Once a concept plan is agreed to and a final drawing approved by staff, the park plan and working drawing can be included in the 1st submission for final approval. This timing will allow the consultant to work in the grading of the park in conjunction with the lot grading plans. This will result in common lot lines that work both for the parks function and the adjacent homeowner and a park that will not require major cutting or filling to provide a neighbourhood or community park. The intent of this process is that the parks be constructed at the same time as the houses.

1.9 GROWTH RELATED SERVICES

The Township may, at its sole discretion, direct that certain underground and above ground services be sized, located and constructed to accommodate future growth in general and future growth from other development lands. The Township will examine the costing for oversized or additional works and, subject to the availability of funds, apply (or defer) subsidy entitlement according to its local service policies and guidelines in effect at the time of approval.

Financial commitments pertaining to the contribution of the respective benefiting parties, including the reimbursement of any previous front-end contributions, will be addressed in each subdivision agreement.

Payment for subsidized works will be administered in accordance with current policy and upon certification of the works being substantially complete. Subsidized works shall be subject to all conditions imposed by the subdivision agreement as they relate to completion and warranty of the Works.

The engineer’s estimate is required to show:

- the full cost of the subsidized works;

- the agreed upon subsidized portion; and
- the net amount to be used for financial security purposes.

In regard to subsequent applications for security reduction the standard 5% maintenance and 10% construction lien holdbacks retained by the Township shall at all times be based on the full (unsubsidized) cost of Oversizing.

Commitment of Public Funds

Any item to be cost shared must be tendered publicly. Where cost sharing is approved, the Township of Stirling-Rawdon reserves the right to review and accept the contract documents prior to tendering and/or approve of any prices used in establishing public funding.

1.10 REPORTS

The following reports are to be commissioned in the design of the works as required. (It should be noted that this list is not necessarily complete as other types of reports may be required on a case by case basis).

GEOTECHNICAL REPORT

As part of the design of each new subdivision, the owner's engineer shall provide a Geotechnical Report. The report shall examine and confirm subsurface conditions and the impact on construction of public works and building construction within the plan of subdivision.

The report shall specifically examine subsurface conditions such as:

- soil type(s);
- groundwater levels;
- depth of refusal, bedrock, etc.;
- soil bearing capacity.

The report shall confirm the adequacy of the Township's minimum standard of flexible pavement design or recommend a higher standard of design if site conditions warrant. The report shall also examine and recommend a method of accommodating subgrade drainage.

The report shall address the suitability of native soils, excavated and /or imported materials for roadway construction, trench backfill and building foundation construction. In addition to the forgoing, the report shall identify proposed construction methods, including those related to backfilling and the placement of fill materials.

The report shall be accompanied by a scaled plan of the subdivision showing test pit or borehole locations, together with a log of test pit or bore hole findings tied to geodetic datum.

A Soils Management Plan shall be included as part of the report. The report shall include

chemical analyses of existing soil, potential options for beneficial reuse and alternatives for management as excess soil.

The report shall be signed and sealed by a licensed professional engineer.

TRAFFIC IMPACT STUDY (TIS)

(See Appendix 1L)

Unless waived in writing by the Hastings County Planning Department, all developments bordering arterial roads are to provide a traffic impact analysis based on projected traffic flows and the ultimate build out of the development. The report is expected to recommend, at a minimum, storage lane requirements and traffic control devices based on the peak flows generated. The Planning Department reserves the right to request a TIS for other road classifications based upon the nature of the proposed site use.

NOISE REPORT

(As Required – See Appendix 1B)

All developments adjacent to or within close proximity to major noise sources such as those generated by existing or future rail and road facility expansions or other noise generators, shall provide a noise analysis, and possibly a vibration analysis, to demonstrate compliance to MECP guidelines.

STORMWATER MANAGEMENT REPORT

Unless specifically waived in writing by the Hastings County Planning Department and the Township, all developments shall be required to provide a Stormwater Management Report.

ENVIRONMENTAL SITE ASSESSMENTS

A Phase I Environmental Site Assessment (Phase I ESA) shall be undertaken by each site proponent (owner) for all areas of the subdivided lands intended for residential occupancy or conveyance as parkland, roadway or storm water management infrastructure. In general, the Township will require that the proponent provide assurances that the environmental quality of the soils and groundwater within the lands intended for development are compatible with the intended land use as described within Ontario Regulation 153/04, as amended. The Phase I ESA shall be carried out in accordance with the regulation and shall be up to date.

If the results of the Phase I ESA indicate a need for further investigation the proponent shall be required to undertake any required follow-up studies (Phase II ESAs, Site Remediation Plans, etc.).

ENVIRONMENTAL IMPACT STUDIES

Proposed developments that may impact upon significant natural environmental features may be required to provide an Environmental Impact Study. Significant natural

environmental features may include wetlands, woodlots, significant habitats or threatened or endangered species.

The Environmental Impact Study is required to characterize the nature of the impact on the natural feature(s) of concern and make recommendations to mitigate those impacts.

ARCHAEOLOGICAL REPORT

In those areas of the Township where deemed necessary, the owner shall conduct an Archaeological Assessment of the lands within the plan and shall be required to perform mitigation measures as required to preserve significant historical features. If required, the mitigation plan is to be included in the set of Engineering Plans.

1.11 REPORTS - DISTRIBUTION

The Developer shall submit 3 hard copies and a pdf copy of all reports to be submitted.

1.12 REFERENCE DOCUMENTS TABLE 1

PUBLICATION	PUBLISHER
Geometric Design Standards for Canadian Roads	Transportation Association of Canada.
Geometric Design Standards for Ontario Highways	Ontario Ministry of Transportation
Guide for the Design of Roadway Lighting	Transportation Association of Canada
Manual of Uniform Traffic Control Devices	Ontario Ministry of Transportation
Municipal Works Design Manual	Municipal Engineers Association.
Guidelines for the Design of Sanitary Sewer Works, Storm Sewers, Water Distribution Systems, Water Storage Facilities, servicing in Areas subject to Adverse Conditions, Water Supply for Small Residential Developments, Seasonally Operated Water Supplies,	Ministry of Environment
Standard Subdivision Agreement	Township of Stirling-Rawdon
Development Charges By-law(s)	Township of Stirling-Rawdon
Site Plan Design Guidelines	Township of Stirling-Rawdon

1.13 DOCUMENT REVISION PROCESS

This section helps to define the process to continuous improvement to the Subdivision Development Guidelines and Technical Standards. There are three scenarios by which the

guidelines and technical standards could require revision:

- Changes to existing standards that are legislated by other authorities, (Electrical Safety Authority, Ontario Provincial Standards, Provincial Government, Federal Government, Ministry of Labour etc. In some situations the change will occur in the field and the update to the guideline may occur after the fact.);
- Current standards requiring revision because they are not working when put into practice; and,
- New standards being introduced into the guidelines at the request of either the municipality or the development community (stormwater management standards, traffic signal design and installation standards etc.)

1.13.1 LEGISLATED CHANGES

This is a change that neither the municipality, nor the developer has an opportunity to challenge as it is initiated by others.

In these cases the revision can be initiated be whichever party first hears of the change. It should be communicated to the Township Engineer who will then issue an addendum to the appropriate section of the guidelines document. A notice will be placed on the Township's website advising of the update and communication will be sent to those parties that voluntarily registered when downloading the document.

1.13.2 REVISION TO CURRENT DOCUMENT

This is a revision to the guidelines resulting from any of the following: typing error, work cannot be completed as described, alternative idea or opportunity being presented for an existing standard, etc.

Any party to the development guidelines can initiate this discussion. A written document should be prepared by the party requesting the change that:

- States the section of the Guidelines that are to be discussed,
- States the wording changes or drawing changes to be recommended, and
- Provide a written paragraph or more explaining the reasoning, technical or otherwise, supporting the request.

1.13.3 NEW STANDARD INTRODUCED

From time to time the municipality, other agencies or the development community will want to make changes or additions to the guidelines that are not housekeeping in nature and are of significance. For these proposals it is anticipated that there will be considerable discussion as both parties work to an improved document.

The foregoing processes should foster open discussion that will result in the evolution and improvement of the guidelines and technical standards. Having a process in place will also assist in streamlining updates to the document.

1.14 DESIGN SUBMISSION REQUIREMENTS

A complete submission consists of the following:

- An application for Subdivision Agreement /Final Approval
- All applicable subdivision review fees
- A covering letter or report identifying the developer, the project, the owner's engineer and any special features of the submitted design.
- 2 copies of the watermain design calculations.
- 2 copies of the sanitary and storm sewer design sheets.
- 2 copies of streetlight design calculations (if varying from standard).
- Copies of reports as set out herein and any other reports that are required to support the design of the works in accordance with the Conditions of Draft Plan Approval.
- Copies of plans as set out herein including first application under Land Titles.
- Specifications for non-standard items.
- A checklist is suggested for inclusion with submissions (See Appendix 1C).

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

2.0 PLAN APPROVAL PROCESS

2.1 INITIAL DESIGN SUBMISSION

The initial design review submission shall be delivered to the Hastings County Planning Department who will in turn distribute the design review submission to the Township. Hastings County Planning Department shall submit to outside agencies and branches of government with instructions to copy the Township on all correspondence.

2.2 DESIGN REVIEW

The review of public works is coordinated through the office of the Development Engineer. When the Development Engineer receives the submission from the Planning Department the file will be assigned to a Senior Development Technologist who will circulate the submission to all internal departments as set out in the following table. Comments will be provided back to the Senior Development Technologist with four (4) weeks.

2.3 1ST SUBMISSION DISTRIBUTION

Comments from the internal departments will be consolidated by the Senior Development Technologist (SDT) and communicated to the owner's engineer. All correspondence exchanged during the review process will be copied to the Planning Department as well as to the owner. The owner's engineer will amend, revise, or justify the design accordingly. Revised drawings are to be submitted directly to the SDT including a written response clarifying how each item has been addressed. Additional sets of drawings may be requested on a case by case basis subject to comments received on the review. The owner's engineer should note that upon completion of any review of revised drawings new and/or amended comments may be generated as a result of the revisions required by the Township or external agencies.

Meetings are encouraged at all stages of the review to promote the early resolution of any issues. This iterative process will continue until all items have been satisfactorily addressed.

3.0 DRAWING STANDARDS

3.1 GENERAL

A complete submission includes a complete set of engineering drawings. All plans submitted shall be prepared in ink (or equivalent), on standard size of 24”x 36” sheets or metric equivalent. All digital files required for submission throughout the development process shall be saved/photocopied in actual size to ensure legibility.

In general, all plans in the set must be complete, legible, and give clear instructions as to the materials, methods and details of construction. Each individual plan must also contain:

- The legal description of all individual parcels of land in accordance with the plan of survey.
- A north arrow (true and construction).
- The NAD 83 UTM grid at 100m intervals
- A title block depicting the date, date of recent revisions, and scale of the plan in metric units.
- All "approved" street names.
- The seal and signature of a professional engineer licensed with the Professional Engineers of Ontario (P.E.O.)

3.2 AUTOCAD DRAWING STANDARDS

- Drawing scale for plan/profile drawings shall be in metric and drawn in metres, using a scale of 1:500 in areas of sparse detail. A scale of 1:250 shall be used in congested areas.
- Drawings shall be oriented such that North points up and/or to the left (or right if required)
- Dimension and elevations shall be provided in metric units
- Drawings shall be prepared such that the final representation of reproductions and photocopies show the proposed work in darker and thicker lines than existing conditions
- All linework and text should be drawn using a bylayer colour and linetype to facilitate easy modifications.
- Existing conditions should appear faded in comparison to proposed work.
- The various utility lines should be identified and appear slightly darker than existing topography
- Proposed work should appear heavier than existing conditions.

Plans which are "Approved for Construction" shall also be submitted to the Development

Engineer in digital format in a current version of AutoCAD software (one disk copy).

4.0 ENGINEERING DRAWINGS

A complete set of engineering plans is comprised of the following:

- Cover Sheet

  A cover sheet bearing the name of the development, the subdivision owner's name, a key plan showing the site location relative to two nearby major highways and a table of plan contents.

- General Service Plan (maximum scale 1:1000)

  The General Plan will indicate the general overall scope of the project and the geographic relationship to surrounding lands. In addition to the requirements of Section 4.1, the General Plan will illustrate:

  - Existing utility services and roads within and around the development
  - Proposed storm, sanitary collection systems, water distribution systems (mains only), with details for:
  - Pipe diameters
  - Valve sizes and locations
  - Hydrants
  - Direction of flow in sewers
  - Standard service lateral connection symbols
  - Existing and proposed easements.
  - The location of test pits or boreholes from the soils report.
  - A legend of symbols (OPSS 100).
  - A list bearing the description, location and elevation of benchmarks to be used in establishing vertical control on the site. A minimum of two benchmarks to geodetic datum is to be to be provided with locations preferably within the project boundaries.
  - A reference index showing the coverage of all plan and profile drawings and their corresponding drawing numbers within the set.
  - Phase limits.
  - Standard Notes and specification references as contained herein.

4.1 LOT GRADING PLAN (MAXIMUM SCALE 1:500)

The Lot Grading Plan shall establish the final grade control for all lots and blocks within the development in accordance with the Township's lot grading requirements and objectives and in accordance with the Conservation Authorities stormwater management objectives. The plan must contain sufficient detail to accurately assess the impact of post development surface

drainage both within and adjacent to the owner's lands. The plan will contain the following:

- A key plan
- A legend using standard symbols.
- A list bearing the description, location and elevation of benchmarks to be used in establishing vertical control on the site. Benchmarks are to be to geodetic datum and a minimum of two (2) are required within the project boundaries.
- Existing ground contours or elevations in and adjacent to the development as established by field survey. Within and adjacent to the subdivision boundary, the Township will accept elevations established by recent/modern aerial photography with the exception of all intersecting lot lines (existing and proposed) at the subdivision boundary. The Owner's Engineer shall verify the accuracy of all aerial contours by appropriate spot checks. Where adjacent lands are currently under development the approved proposed grades shall be identified and used in determining the treatment at the common boundary.
- The limits of cut and fill required in pre-grading (see Appendix 1E)
- Existing vegetation limits, including that which is to be preserved.
- Existing ditches, swales and watercourses in and adjacent to the development.
- Existing buildings, foundations to be demolished.
- Proposed grades at each property corner and at the building platform plus any other grades required conveying the intent of the plan.
- Proposed gradients along side and rear lot lines (in %).
- The proposed direction of surface run-off using arrows.
- Road centreline elevations calculated at the projected lot line extension or at regular chainage intervals (20 metre min.) whichever is the lesser.
- Control point road grades BVC, EVC, sag, crest etc.
- Location and inlet elevation of all existing and proposed storm drainage inlets. All structures are to be numbered. (Roadside inlets may be shown in table form)
- Test pit or borehole locations as per the soils report.
- Miscellaneous lot grading types and drainage patterns.
- Proposed swales and ditches including typical cross sections.
- Slope limits resulting from cut or fill operations.
- Typical grading details and specifications.
- Existing and proposed easements.

- Culverts including invert, diameter, slope and length
- Details of all structures required for slope stability where maximum slopes cannot be achieved.
- Location and pertinent details of all sedimentation and erosion control measures.

4.2 PLAN AND PROFILE DRAWINGS

The Plan and Profile Drawings will provide the detailed information required for construction of roads and municipal services.

The drawings will illustrate:

- **Plan Portion**
  - Horizontal control data for the road centreline including
    - P.I. Station chainage
    - length of tangent
    - degree of curve
    - curve length
    - beginning of curve chainage
    - end of curve chainage
  - All existing services with original plan referenced (when available).
  - Cross reference numbers of adjoining plans and match lines.
  - All municipal services to be constructed including service laterals with nonstandard locations dimensioned to property lines.
  - Pipe diameters and pipe material. Symbols and notes may be used to depict size and type of standard building service laterals.
  - Utility Structures i.e. Storm and Sanitary Maintenance holes, valve chambers etc. with corresponding identifier i.e. number or letter symbol (matching design sheets)
  - Catch basin locations and connection details such as
    - slope, invert
    - top of grate elevations (May be shown in table form)
  - Any facilities to address public transit (bus lay-bys etc.)
  - Radii at intersections and turnarounds.
  - Street furniture locations, such as utility pedestals, community mailboxes, streetlights, and fire hydrants.

- **Profile Portion**
  - A profile of the existing grade and proposed road grade along the centreline of pavement projected directly below the plan view.
  - Existing and proposed centreline road elevations.
  - Vertical control data, including:
    - points of intersection
    - tangent gradients
    - K – factors
    - Curve length
    - High or low point station and elevation
  - super-elevation details as necessary.
  - A profile of the road subgrade elevation showing grade treatment, transition treatment, method of achieving subgrade drainage etc.
  - Rock soundings at sufficient intervals to determine road construction requirements and to determine estimated rock excavation quantities for the construction of underground services.
  - Test pit locations and critical bore hole results.
  - Station chainage along the centreline of the road - maximum spacing 20 metres plus those for establishing vertical control.
  - All proposed and existing pipes showing length, inside diameter, gradient, invert elevations at maintenance holes (san. storm), depth of cover, type of pipe material, and bedding requirements including specification numbers and reference to detail drawings.
  - Storm and Sanitary Maintenance holes, valve chambers etc., including:
    - type (i.e., OPSD Type)
    - size (barrel diameter or inside dimensions)
    - chainage and offset from centreline.
    - top of grate elevation
    - identifier i.e. number or letter symbol (matching design sheets)
    - details of drop structures, safety platforms, etc.
  - Basement elevations of existing houses to be serviced from proposed sewers.
  - Proposed and existing watermains with type of pipe material, bedding requirements and depth of cover.

- Cross reference to detail drawings elsewhere in the set for sewer maintenance holes or special watermain details.
- All pipe clearance details at crossing of pipes.

4.3 DETAIL PLAN (SCALE TO SUIT)

Detail Drawings will be required when there is not sufficient space on the Plan and Profile Drawings or other drawings to fully describe the necessary works. The Detail Drawings shall include:

- Road cross section, curb and sidewalk details (mandatory).
- Details of special chambers, such as metering chambers.
- Details of special structures, such as storm sewer inlets and outlets, or retaining walls.
- Details of special drainage features, including stormwater retention/detention ponds.
- Pumping station details.
- Walkway fencing details.
- Typical service trench cross sections for single and double service trench (mandatory)
- Other details as required

4.4 UTILITY PLAN (MAXIMUM SCALE 1:750)

The designer will compile the Utility Plan for utilities other than water and sewer from the requirements of the various public and private utility agencies (Electric, Telephone, Natural Gas, Cable TV, Canada Post) and layout details for streetlighting. The Utility Plan shall include:

- A legend using standard symbols.
- Typical utility trench details, duct locations.
- Streetlight electrical distribution system.
- The location of all existing and proposed streetlights in and adjacent to the development.
- The location of utility structures and street furniture such as Electric, Telephone, Cable TV, Gas and Canada Post in and adjacent to the development.
- Connection details for all proposed streetlights, including wiring location, duct requirements, electrical source and fuse/disconnect pedestal locations.
- Existing and proposed utilities (Electric, Telephone, Cable TV, Gas, Fibre Optics, and Streetlight circuitry) including those in common trench (in schematic form). See Technical Schedule “G” of Subdivision Agreement.

- Specific duct and trench cross-section details for road crossings.

4.5 STORM DRAINAGE / SANITARY DRAINAGE PLANS (SCALE TO SUIT)

A separate drainage area map for storm and sanitary drainage calculations shall be prepared. Each drainage area map will include a key plan and a legend.

Each drainage area map will show the street and lot layout of the subdivision, street names, property descriptions, existing and proposed sewers, maintenance holes with identifying numbers, sewer diameters, lengths, direction of flow, sub area boundaries with areas in hectares and pipe design calculations.

The storm drainage plan shall depict to scale the extent of drainage areas outside the development and be supported by existing ground contours, which shall also be shown.

Storm drainage sub-areas are to identify the runoff coefficient and sanitary sub-areas are to identify the use of the property, i.e. residential, commercial, etc., and the population density or equivalent.

4.6 PARK DEVELOPMENT PLANS

A completed set of plans to be included in the 1st design submission will include:

- Approved park plan as developed through draft plan stage in agreed upon detail. (Trees – existing, to be preserved and protected) and new trees, recreational elements and play features/equipment, pathways, lighting, amenities, fencing, signage)
- Grading plan for park including any catch basins, swales, ditches or drainage control features
- Servicing (on grading plan) including any infrastructure in the park and service laterals to the property line
- Tree preservation and protection plan
- Street Lighting/Illumination Plan

4.7 MISCELLANEOUS PLANS (AS REQUIRED)

- Noise attenuation / fencing, etc.
- Tree Preservation Plan (See Bylaw 1265-19 and Canopy Policy in Official Plan)
- Tree Planting Plans
- Bridge plans
- Traffic related
    - Electrical (i.e signalization)
    - Lane markings

5.0 APPROVED PLAN DISTRIBUTION

Upon addressing all conditions to the satisfaction of the County, Township and all outside agencies, the plans are to be signed and sealed by the Owner's Engineer. Two (2) hard copies of the approved plans shall be provided to the Township of Stirling-Rawdon. The plans shall then be stamped by the appropriate Township authority as being "Approved for Construction".

The Owner's Engineer shall be responsible for distributing approved plans to the owner, the contractors and outside agencies.

6.0 AGREEMENTS

6.1 MODEL HOME AGREEMENT

Those wishing to construct model homes within the plan and prior to the preparation of a subdivision agreement may enter into a “Model Home Agreement” with the Township. The owner shall make the request for the Agreement in writing to the Planning Department. A Model Home Agreement is subject to the following pre-requisites:

- Approval of location of the model home lot(s).
- Approval of means of access and servicing level.
- All other provisions, as identified in the Model Home Agreement, including financial security.
- A copy of the standard Model Home Agreement may be obtained from the Township’s Planning Department.

6.2 SUBDIVISION AGREEMENT

The developer will be required to enter into a subdivision agreement with the Township. A standardized form of agreement is used; a copy of which is available from the Township. The owner’s engineer is expected to obtain a copy of the agreement and be fully conversant with its terms as well as the standards contained herein. The owner’s engineer shall also be expected to provide and/or co-ordinate the following schedules for inclusion in the subdivision agreement.

Schedule "A" - Legal Description of Subdivision Lands

Schedule "B" - Plan of Subdivision

Schedule "C" - Approved Engineering Design Drawings

Schedule "D" - Easements to be conveyed

Schedule "E" - Lands to be conveyed or Cash in Lieu of Parkland

Schedule "J" - Works and Utilities Cost Estimate

Schedule "L" - Form of Letter of Credit

6.2.1 SCHEDULE “C” (APPROVED PLANS)

All approved plans for the Works to be constructed are to be reduced to legal size (8.5”x14”) for inclusion in the Agreement. The reduced versions are to be photographic reductions of the originals having black lines on a white background. Photocopy reductions are not permitted.

6.2.2 SCHEDULE “J” – ENGINEER’S ESTIMATE

The owner recognizes the Township’s need to maintain sufficient securities at all times to complete the Works should the development be deferred or default for any reason. In this regard, the Engineer’s Estimate of Cost to Complete the Works shall meet the following criteria:

1. The estimate is to cover 100% of the cost to complete the Works and must factor in any

other costs that are dictated by the subdivision agreement.

2. When unit prices are based on estimated costs only, the unit prices shall be suitably conservative to provide a reasonable level of confidence that the works could be completed by the Township. When unit prices are based on tendered unit prices, the tendered unit prices shall be used. In all cases, the estimated cost of the Works shall extend to a two (2) year horizon. Should construction be deferred beyond the two-year horizon, the Township will re-examine the engineer's estimate and will require the estimate/security to be updated based on current construction costs.
3. Estimates of the cost to complete the Works shall take into account, in addition to applicable taxes, increases in unit prices that occur over time, and any local price increases that are known.
4. The secured value of the works shall contain no deductions for external sources of funding for any portion of the works.
5. Format of estimate to be as per Township Subdivision Agreement format. The Engineer is to provide four (4) copies of the Engineer's Estimate, signed and dated for inclusion in the Subdivision Agreement.

6.3 SITE ACCESS AGREEMENT TO PARKLANDS

To permit Township staff access to any park and/or open space blocks for site and environmental analysis, tree preservation and pre- engineering works prior to the deeding of these parcels at the executed subdivision agreement stage of the process.

7.0 SECURITIES

7.1 SECURITY FOR MODEL HOMES

Security for Model Homes shall be 10% of the house value, based on the building permit and as calculated solely by the Building Department.

7.2 SUBDIVISION AGREEMENT (SA)

1. Consultant provides for review a complete Engineer's Estimate for all remaining works.
2. Security amount required for the SA will be calculated based on the approved cost estimate of remaining works, as follows:
    - 100% of the remaining works + 5% contingency + 7% Eng./Insp./Testing + HST + 5% maintenance holdback for completed works + 10% construction lien holdback.
3. No reductions in security, including the construction lien holdback, will be processed until after the SA is registered.
4. The PSA security will be released without delay once the SA security is in place.
5. Prior to the Township forwarding the SA to the owner for signing, the following is required from the developer:
    - Letter of Credit or Certified Cheque in the calculated amount for security
    - Proof of insurance (where PSA was not requested)

8.0 SECURITY RELEASE

In order to request a reduction in the securities, the Owner must provide the Township with an executed copy of the Contract between the Owner and the Contractor completing the servicing.

8.1 FREQUENCY

Notwithstanding the requirements of Section 7.2, the Owner can begin requesting security reductions after 30% of the value of the Works have been completed. As work continues, the Owner can request monthly reductions. The Township shall, at all times, retain security equal to, **the greater of**, the total of:

- the value of the outstanding Works plus 20% of the Engineer's Estimate

OR

- the value of the outstanding Works plus 20% of the total actual construction cost

The value of the outstanding Works will be based on the Contract between the Owner and the Contractor.

8.2 CRITERIA FOR ENGINEER'S ESTIMATE

Requests for reduction shall be made by the Owner's Engineer, and shall include:

1. A cover letter.
2. An estimate of the cost to complete the works signed, sealed and dated by a Professional Engineer.
3. The secured value of the works shall contain no deductions for external sources of funding for any portion of the works.

8.3 PROCESS

The Township recognizes the Owner's need to reduce the security once works are completed, and will therefore attempt to meet the following guideline:

Where there are no known issues affecting the release of securities, the Township shall issue instructions to carry-out the release within ten (10) working days, and shall provide the Owner's Engineer with a written calculation of the securities to be retained.

If monies owing the Township are outstanding, security will be held pending payment of the account. Unaccounted for costs will be reported to the Owner's Engineer without delay with instruction to amend the estimate accordingly.

If liens have been registered against the project, the Township will take steps necessary to discharge the lien in accordance with the Construction Act.

Securities shall not be released if the Subdivision Agreement is not yet registered and/or while the Pre-Servicing Agreement is in effect.

If an inspection is required due to a known or reasonably suspected issue, the Township shall,

through its best efforts, schedule the inspection, subject to suitable weather conditions. The results of the inspection shall be made known to the Owner's Engineer within ten (10) working days of the issue being identified, subject to the availability of staff. Security shall not be released until the inspection is complete and, if necessary, corrective action has been taken.

8.4 HOLDBACKS

Each reduction will be subject to a 5% maintenance holdback on all completed works and a 10% construction lien holdback pursuant to the Construction Lien Act (publication in a daily trade newspaper and 60 day lien period).

9.0 CERTIFICATES

9.1 GENERAL

The Owner is required to maintain the public works until such time as Township Council formally accepts the works. The Agreement provides for the approval of the Works at various stages of construction through the issuance of Certificates. The Certificates verify preliminary approval of the Works, at such points that the Township will issue building permits and undertake to provide certain basic levels of service. An explanation of the various Certificates and the requirements for preliminary approval is as follows:

9.1.1 Stage 1: Preliminary Certificate of Approval of Underground Services

This Certificate is issued upon completion of the underground infrastructure, roads to base asphalt level and the completion of preliminary grading. The application of base asphalt may be waived, in writing, by the Township due to extreme weather conditions. The requirements for issuance of the Certificate are as follows:

9.1.1.1 Underground Infrastructure

The municipal water, storm sewer and sanitary sewer infrastructure must be fully installed as per approved plans such as to perform their basic function. All testing of the underground works must be completed with satisfactory testing of the sanitary and waterworks systems being confirmed by Stirling-Rawdon Public Works on the Certificate application.

All joint trench utilities must be fully installed and backfilled. In all cases, Electric and Telephone services to dwelling units must be fully installed and operable prior to occupancy.

All required leakage testing satisfactorily completed.

Water system is to be disinfected, flushed and verified as per the Watermain Disinfection Procedure and acceptable by Stirling-Rawdon Public Works.

Flow ratings must be completed on all hydrants. Flows must meet at a minimum, Max Day + Fire Flow rates.

All valves including curb stops are to be set to final grade and be fully operable.

All maintenance holes are benched (sanitary), cleaned and adjusted to finish grade. The exception is those within the roadway, which are to be at base course level.

All maintenance hole steps and safety platforms must be in place.

Pumping facilities must be fully operative (if applicable).

All catch basin frames and grates are to be installed to base asphalt grade. All other storm inlets and outlets are to be installed to grade with grates and headwalls in place.

All Stormwater Management quality and quantity ponds must be in place and functional to the satisfaction of the Township and the Conservation Authority. Security fencing shall be in place if applicable.

The entire sanitary and storm systems, including roadside catch basins, must be free of dirt and debris.

9.1.1.2 Roads

Granular road base must be in place. Base asphalt must also be in place unless waived, in writing, by the Township due to extreme weather conditions.

All traffic and street name signs must be installed.

Boulevard areas must be rough graded to promote positive drainage.

All designated swales and receiving channels must be rough graded and at grade.

All erosion and sedimentation control measures must be in place.

9.1.1.3 Miscellaneous

Security fencing or other such requirements, which are a condition of occupancy, must be in place.

9.1.1.4 Interim Operations and Level of Service - Township of Stirling-Rawdon

Upon the issuance of this Certificate the Township will provide the following levels of service to the public.

- subject to the maintenance provisions as contained in the subdivision agreement, undertake the operation of the water distribution and sewer collection systems.
- attend to winter maintenance of the road system and the collection of household waste provided base course asphalt is present.

9.1.2 Stage 2: Preliminary Certificate of Approval of the Works

This certificate is issued by the Township after all remaining works are substantially complete. The certificate marks the commencement of the “maintenance period” whereby the Township will hold security in the amount of 2.5% of the cost of works completed. Not limiting the generality of the foregoing the following must be complete.

The CCTV (Closed Circuit Television) inspection of the underground sewer works.

A 2nd (final) flushing of all sewers, sanitary and storm, and cleaning of all catch basins and maintenance holes.

Surface asphalt applied.

Concrete curb and gutter and sidewalks.

Street light system in place and energized.

Asphalt walkways and related fencing.

Noise attenuation barriers and related fencing.

Park grading complete.

All valve boxes shall have received their final adjustment and all valve boxes shall be confirmed as clean and deemed operative.

All landscaped areas are to be sodded or seeded as specified.

All street tree planting is to be complete to the satisfaction of the Township.

All deficiencies identified by the Owner's Engineer and/or Township's final inspection must be rectified with the exception of minor deficiencies, which are to be scheduled for correction to the satisfaction of the Township. Minor deficiencies will be at the sole discretion of the Township.

As-built drawings complete and provided to the Township.

9.1.2.1 Interim Level of Service - Township of Stirling-Rawdon

The Township of Stirling-Rawdon will undertake general maintenance of the "works", save and except for remedial work that is deemed beyond normal wear and tear. More specifically:

- undertake normal maintenance of the underground distribution and collection systems including the related above ground infrastructure and including the street light system.
- provide normal summer and winter maintenance on the road system and continue to provide solid waste collection.
- attend to grass cutting and maintenance of parks, stormwater management facilities and trees on public lands.

9.1.3 Stage 3: Final Certificate of Approval of the Works

Issued one year after the Preliminary Certificate of Approval of the Works, this certificate marks the end of the maintenance period and the release of the maintenance security deposit. Prior to release of the security, all deficiencies identified during the maintenance period are required to be rectified including the rough grading of vacant lots to provide positive drainage (and having due regard for neighbourhood aesthetics) to the satisfaction of the Township. Also, in accordance with the subdivision agreement, a Surveyor's Certificate must be filed with the Township confirming the presence of all main survey bars establishing the location of roads, parks and public utility easements within the plan.

10.0 CONSTRUCTION APPROVAL / INSPECTION

10.1 GENERAL

The owner's engineer, having obtained design approval and wishing to proceed to construction, is advised of the following.

10.2 CONSTRUCTION PREREQUISITES

The following shall be considered pre-requisites to the commencement of construction.

- Engineering plan approval including approval from all outside agencies having jurisdiction.
- All construction related permits / approvals in place including MECP Environmental Compliance Approvals
- Acceptance of the owner's contract documents.
- Posting of the certificate of insurance and others as set forth in the Subdivision Agreement.
- Delivery of all forms of consent, securities and payments as provided for in the subdivision agreement.
- Execution and delivery by the Owner /Developer of the subdivision agreement and all deeds and easements for lands to be given to the Township and other public agencies.
- Site Access Agreement in favour of Township for park and open space blocks
- Delivery of all approved plans plus copies of reports

10.3 PRE-CONSTRUCTION MEETING

Having met the pre-requisites for the commencement of construction, the owner's engineer shall request a pre-construction meeting to be arranged through the Township office a minimum ten (10) working days prior to commencing construction. The Township will contact project stakeholders as deemed necessary. It is expected that the owner's engineer, the site inspector and contractor will attend, as well as the owner or his direct representative.

For the meeting the contractor will be required to provide an approximate schedule of construction, a list of subcontractors, and a list of materials, mix designs etc., to be used in the construction of the subdivision works (materials must have Municipal approval). Minutes of the meeting will be taken by the owner's engineer and circulated to all in attendance upon a draft being reviewed and approved by the Township.

At the Township's discretion, other sub-consultants may be required to attend the pre-construction meeting.

10.4 INSPECTION AND TESTING

All works to be constructed shall be inspected and tested under the direction of a professional

engineer as approved or designated by the Township. In new subdivisions, inspection services will be provided by the owner. The owner's engineer must be approved by the Township to provide full time inspection in the subdivision. The Township or a representative of the Township will provide periodic part time inspection at pertinent inspection intervals.

10.5 QUALIFICATIONS FOR CONSTRUCTION INSPECTOR

The owner's engineer is required to provide the following qualifications for those engaged in the inspection of the public works:

- Each construction inspector must be a graduate of a three-year Civil Engineering Technology Community College program or equivalent and have a minimum of 5 years of work experience in the construction of Municipal Public Works Projects or equivalent as approved by the Township. The owner's engineer is to provide the Township with a resume of each Construction Inspector that is to be used in the inspection of the public works.

10.6 DUTIES OF THE OWNER'S ENGINEER DURING CONSTRUCTION

The owner's engineer shall ensure that an approved construction inspector is present on site for the purposes of ensuring quality control during construction. The following functions, at a minimum, are considered mandatory on the part of the owner's engineer.

10.6.1 START UP

- Attend pre-construction meeting
- Check all benchmarks on the plan for accuracy
- Check elevations of any receiving sanitary or storm sewers to ensure conformance with plan elevations
- Check for adequate control for layout i.e. survey bars
- Obtain approved engineering drawings from the Township of Stirling-Rawdon
- Obtain asphalt curves, asphalt and concrete mix designs, sieve analysis, and aggregate sources; to be forwarded to the Township and the chosen Testing Company

10.6.2 UNDERGROUND WORKS

- Record top of rock shots
- Check horizontal and vertical alignment and grades of all works
- Verify acceptability of material on site
- Inspect bedding installation and confirm proper compaction
- Inspect coverage of sewer pipes and verify clearances
- Check to make sure sufficient cover on watermain

- Check maintenance hole and catch basin locations to ensure they meet plan dimensions
- Check tops of maintenance holes and catch basins to ensure they are low enough to accommodate frames and grates plus at least one lift of modular adjustment units and mortar bed for frame and grate
- Ensure all maintenance holes are properly benched and have sufficient rungs
- Complete all necessary testing for sanitary sewer system (air test, mandrel, leakage, etc.) as well as for watermains (continuity of tracer wire, chlorination, etc.) and record information.
- Supervise closed circuit TV inspection and remedial work.
- Record all “As-Built” information and complete lateral sheets for each lot
- Check final elevations for frame and grates of all maintenance holes, catch basins and ditch inlets, which are not in the pavement

10.6.3 ROADWORKS

- Check sub base to make sure it is to grade; complete compaction testing
- Complete compaction testing and testing of granular materials
- Check curb grades, location and layout.
- Ensure all storm inlets are in accordance with the approved design elevation.
- Take air tests, slump tests, and cylinders on all concrete pours (curb and sidewalk)
- Check final road base elevations prior to base course asphalt to ensure proper crown and proper depth between top of base and top of gutter
- Ensure Maintenance Hole frames and grates and gate valve boxes are constructed to the proper grade and crossfall at base course asphalt grade.
- Sample both surface and base course asphalt
- Prior to surface course asphalt, confirm and witness CCTV; CCTV reports and tapes to be reviewed and commented upon
- Prior to surface course paving, make sure all Maintenance Hole frames and grates, catch basin frames and all gate valve boxes are properly adjusted.
- Ensure all ditch inlet structure grates and storm outfall grates are properly secured
- Check sidewalk alignment and grades
- Check sidewalk base material and compaction, check sidewalk forms to ensure proper thickness

10.6.4 UTILITY TRENCHES, STREET LIGHTS, BOULEVARDS, AND STREET TREES

- Check locations and depth of utility trenches
- Check locations of ducts
- Check location and grade of transformer pads, pedestals, etc.
- Ensure road crossings and utility trenches are properly backfilled and compacted
- Check location of street lights
- Check sod and landscaping for compliance
- Confirm stakeout of street trees and confirm species planted

10.6.5 MISCELLANEOUS

- Complete weekly progress reports which are forwarded to the Township which details the work completed, identifies significant deficiencies, details progression of work versus the contractors schedule of work, appends all test results, etc.
- Certification from a Professional Engineer that the works have been installed in accordance with the approved engineering drawings; both at above and below ground stages of construction
- Complete deficiency inspections and reports
- Verify security reduction requests
- Check all rip rapped areas for dimensions, grade, size, and quality of rock and installation of filter cloth
- Check all storm water management facilities for grade and dimensions
- Check all major drainage swales and rear yard swales for grades and alignment
- Monitor construction of berms and noise attenuation fences
- Monitor construction in park areas
- Check construction of walkways and fencing
- At completion of all landscaping, check fire hydrant flange elevation to ensure the minimum 150mm clearance
- Check all gate valves and curb stops for visibility and operation, documenting the final position of all valves.
- Tie in all maintenance holes and gate valves that are not in the pavement

10.7 QUALITY CONTROL/ INSPECTION FREQUENCY (MINIMUM STANDARDS)

The owner's engineer shall ensure that quality control and inspection frequency is carried out in accordance with the following tables:

Table 2: Compaction

Area	Min. % Compaction	Minimum Frequency/Intervals*	Test Location/Identification
Mainline Sewer – Bedding, Cover and Trench Backfill	95	50 meters at random depths, 0.3 meters max. lift for first 150 m and every 100 m thereafter	Street, Distance from Downstream Maintenance Hole
Mainline Water Main –Bedding, Cover and Trench Backfill	95	50 meters at random depths, 0.3 meters max. lift for first 150 m and every 100 m thereafter	Street, Station, and Offset
Road Subgrade Utility Crossings	100	50 meters at random depths, 0.3 meters max. lift for first 150 m and every 100 m thereafter	Street, Station, and Offset
Service Trenches (Water, Sanitary, Storm)	95	First 2 trenches and every 20th trench thereafter	Lot Number
Curb & Gutter Sidewalk	100	50 meters at random depths, 0.15 meters max. lift	Street, Station, and Offset (left or right)
Granular Road Base	100	50 meters, 0.15 meters max. lift	Street, Station, and Offset (left or right)
Asphalt	100	50 meters, each lane	Street, Station, and Offset (left or right)
Existing Driveway Reinstatement	100	Random	Lot or House Number and distance

Testing shall be done at all changes of soil types and/or types of mechanical compaction.

Table 3: Level of Inspection

Type of Operation	Owner's Engineer	Township of Stirling-Rawdon
Pre- Construction Meeting	A	A
Clearing and Grubbing	P	A
Stripping topsoil	P	A
Check benchmarks & Control Bars	A	A
Check Trenching, Bedding, and Backfilling Operations	F	A
Verify Acceptability of Materials	P	A
Check Layout & Monitor installation of below ground works	F	A
Monitor Testing of Watermain (leakage)	F	A
Monitor Chlorination (Water)	F	A
Contact Public Works for hydrant flow testing	A	F

Type of Operation	Owner's Engineer	Township of Stirling-Rawdon
Monitor Testing of San. Sewer and maintenance holes	F	A
Utility trenching (Electric, Telephone, Cable, Gas)	P	A
Utility Trench Backfill	F	A
Compile Information and Prepare As-Built drawings	F	
Checking grade and layout of all above ground works	F	A
Monitor Road sub excavation and placement of Granulars	F	A
Check Rough grading of boulevards	P	A
Check pre grading of lots /Swales/Parkland/ Storm Ponds	P	A
Check base asphalt	F	A
Check streetlight installation and wiring	F	A
Check curb and gutter installation	F	A
Check Sidewalk installation	F	A
Walkways	F	A
Fencing (Noise, Berms, Misc.)	P	A
CCTV sewers	F	A
Check top course asphalt	F	A
Boulevard Landscaping, Street Trees		A
Park Landscaping	A	A
Prepare weekly progress reports	A	A
Security reduction requests	A	A
Administering deficiency inspections	A	A

F= Full time inspection**, P=** Part time inspection**, A=** As required to establish compliance

10.7.1 CONSISTENCY

The owner's engineer shall make every reasonable attempt to maintain consistency in regard to on-site inspection. If an alternate inspector is to be assigned to the project, the owner's engineer shall notify the Township and obtain approval. If unforeseen circumstances require the immediate substitution of the designated inspector, the Township shall be notified as soon

thereafter as possible.

10.7.2 INSPECTION BY TOWNSHIP OF STIRLING-RAWDON STAFF

Township of Stirling-Rawdon staff will attend the site at periodic and random intervals to ensure that the level of inspection is adequate. As per the terms of the Subdivision Agreement, all costs incurred by the Township in attending to the periodic and random inspections will be paid for from fees paid by the owner prior to the issuance of the Preliminary Certificate of the Underground Services (1% of Schedule “J” - Subdivision Agreement). Any and all information regarding the work in progress shall be made available on request to the Township’s inspection personnel. Without limiting the generality of the forgoing, the owners engineer shall notify the Township of Stirling-Rawdon at least 48 hours in advance of all key steps in the construction process.

10.7.3 ON-SITE FACILITIES

Unless waived in writing by the Township an on-site heated office trailer with desk, chair and telephone shall be provided for the general use of the on-site inspector and the Township’s inspection personnel.

10.7.4 SITE MEETINGS

Site meetings may be called by the Township as required to monitor the work in progress and to discuss and resolve matters of mutual interest or to resolve any on site difficulties.

10.7.5 PLAN REVISIONS

Engineering Drawing revisions are to be reviewed and approved by the Township prior to issuance. Requests for design alterations shall be coordinated by the owner’s engineer who shall submit copies of the proposed revision to the Township together with a covering letter outlining the nature of the change. The number of plan copies required for review will be determined by the Township. Upon approval by the Township and/or the Hastings County Planning Department, other affected agencies may be contacted. Upon all necessary approvals being granted, copies of the revised plan(s) shall be submitted to the Township for internal use and for distribution to inspection personnel on site.

10.7.6 "AS-BUILT" INFORMATION / DRAWINGS

As-built information will be recorded by the on-site inspector as the work progresses and in turn the information shall be provided to the owner’s engineer*.*

Prior to or in conjunction with the application for issuance of the Preliminary Certificate of Approval of the Underground Services the owner’s engineer shall submit to the Development Engineer all as-built lot servicing details in the form of the Subdivision Lot Servicing Sheet attached hereto (Appendix 1O - Standard Forms)

Prior to the Township’s inspection leading to the issuance of the Preliminary Certificate of Approval of the Works or within 12 months of the issuance of the Preliminary Certificate of Approval of the Underground Services, whichever occurs sooner, three (3) clear and legible

hard copy sets of plans on bond paper of “as-built” drawings depicting all as-built features shall be provided to the Township. Digital as-built information shall also be provided to the Township in a standard Esri GIS shapefile (*.shp). The Township’s inspection will not proceed until this information is delivered.

The as-built plans shall record at a minimum**:**

- Inverts of all gravity sewers at the maintenance holes
- Inverts of all gravity sewer laterals at the property line.
- Top of watermain elevation
- Pipe lengths and grade
- Pipe materials, connection details including all non- standard features
- Top of grate, inlet and maintenance hole elevations
- Tie-ins to all water valves including curb stops (at all non-standard locations), bends**,** etc. from the 2 nearest property corners or 2 permanent structures.
- Tie-ins to maintenance holes from the 2 nearest property corners or 2 permanent structures.
- Trench rock elevations
- Street addresses as provided by the Township of Stirling-Rawdon.

Individual Lot Servicing sheets shall be provided with the as-built drawings.

All drawings and data files become the property of the Township of Stirling-Rawdon, and the Township and its agents may use these drawings and data files as the Township sees fit, without compensating the owner or the owner’s engineer. (See general – As-built plans)

10.7.7 CLOSED CIRCUIT TELEVISION EXAMINATION OF SEWERS

A video examination shall be carried out throughout the entire length of sanitary and storm sewer systems in accordance with OPSS. The examination shall be carried out prior to the application of the final lift of asphalt but not within the first 10 months following the completion of base asphalt. The CCTV inspection shall be carried out in the presence of the Township's designated representative who shall assist in the co-ordination of the work.

10.7.8 PROGRESS REPORTS / INSPECTION RECORDS

The owner’s engineer shall prepare weekly reports indicating:

- Works completed
- Works in progress
- Any change orders and/or directions to the contractor involving issues of non-compliance

- Adherence to the construction schedule
- All records confirming satisfactory completion of the works. Records shall include;
- Lot servicing details as set forth using the Subdivision Lot Servicing Detail Sheet attached hereto (Appendix 1O- Standard Forms)
- Leakage test results of both water and sanitary sewer systems as set forth in the OPSS
- Mandrel test results of plastic sewer mains as set forth in the OPSS.
- Water main disinfection test results as set out in the OPSS as set out in OPSS and other applicable legislation.
- Compaction results
- CCTV reports and videos
- Portland cement concrete test results
- Asphaltic concrete test results (all lifts)

Upon completion, copies of the weekly report are to be furnished to the Township

TECHNICAL SCHEDULE

Appendix 1A - Standard Conditions of Draft Plan Approval

Appendix 1B - Development Application Pre-Consultation Form

Appendix 1C - Submission Checklist

Appendix 1D - Design Standards – Roads

Appendix 1E - Design Standards – Lot Grading

Appendix 1F - Design Standards – Stormwater Management

Appendix 1G - Design Standards – Storm Sewers

Appendix 1H - Design Standards – Sanitary Sewers

Appendix 1I - Design Standards – Watermain

Appendix 1J - Design Standards – Street Lighting

Appendix 1K - Design Standards – Trees

Appendix 1L - Design Standards – Traffic

Appendix 1M - Design Standards – Rural Estate Subdivisions

Appendix 1N - Standard Drawings

Appendix 1O - Standard Forms

Appendix 1P – Watermain Commissioning Package

Appendix 1A: Draft Approval

Draft Approval

Standard Conditions of Draft Approval

1. Road allowances as shown on the plan and required by the Township shall be conveyed to the Township of Stirling-Rawdon subject to a registered subdivision agreement. Roadways and cul-de-sacs shall be designed to have a minimum width of a 20-metre right-of-way, plus maintenance turn-around radii and day light triangles. Roadways shall be designed and constructed in accordance with Ontario Provincial Standards and Township of Stirling-Rawdon Development Standards, to the satisfaction and/or of the Township of Stirling-Rawdon;

2. The subdivision agreement should include provisions to ensure that the conclusions and recommendations of any geotechnical report are implemented. Accordingly, the subdivision agreement shall contain provisions for on-site inspection of geological conditions of areas known to feature springs or sink holes, prior and during the installation of roadways, servicing, and building foundations.

3. A stormwater management plan be prepared by a certified and qualified engineer to the satisfaction of the Township of Stirling-Rawdon and the County of Hastings, in consultation with the Lower Trent Conservation Authority, which outlines:

    a. the means whereby stormwater quantity and quality will be addressed, so that 'post-to-pre' water quantity control is provided for runoff generated from the subject lands and at a minimum Level 2 water quality controls will be implemented (per the Ministry of the Environment's Stormwater Management Planning and Design Manual (2003)). The plan will also indicate how stormwater will be conducted to a receiving body and the location and description of any and all outlets which may require permits under Ontario Regulation 163/06 (Lower Trent Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shoreline and Watercourses).

    b. that a lot grading and drainage plan, and a sediment and erosion control plan, be completed and approved to the satisfaction of the Township of Stirling-Rawdon, the County of Hastings, and Lower Trent Conservation.

4. The Subdivision Agreement between the Owner and the Township of Stirling-Rawdon contain provisions with wording acceptable to the County of Hastings and Lower Trent Conservation, whereby the Owner agrees to carry out or cause to be carried out, the works outlined in Condition 3.

5. The Clerk of the Township of Stirling-Rawdon shall provide written confirmation to the County of Hastings Planning and Development Department that appropriate zoning classifications have been established:

6. In consultation with the County of Hastings' Planning Department, a subdivision agreement is entered into with the Township of Stirling-Rawdon to establish the following:

    a. That the agreement between the Owner and the Township of Stirling-Rawdon shall apply to all phases, or select phases provided appropriate engineering/works are in place, of the draft approved plan.

    b. That the Owner agrees in writing to satisfy all the requirements, financial and otherwise, of the Township of Stirling-Rawdon concerning the provision of roads, installation of services and drainage.

    c. Stormwater management facilities and related fencing (if any), pumping stations, electrical sub-stations and other facilities and mechanical structures associated with servicing the draft approved plan shall be located and constructed to a high standard of visual aesthetics as specified by the Township of Stirling-Rawdon.

    d. If contaminants are discovered during the course of construction of on-site or authorized off-site works, the occurrence shall be reported to the Township of Stirling- Rawdon in a timely fashion. On-site contaminants, if found, shall be the responsibility of the landowner to remedy to an adequate standard as may be specified by the Ministry of the Environment.

    e. A letter of credit or other forms of security acceptable to the Township shall be deposited with the Township to cover the costs of outstanding works.

    f. Proof of insurance shall be demonstrated to the Township prior to the developer commencing of activities associated with the construction of the draft plan.

7. That the Owner satisfies the requirements of Hydro One with respect to the installation of electricity services.

8. That the Owner satisfies the requirements of Canada Post with respect to the installation of required infrastructure.

9. The Owner shall engage a qualified archaeologist who will determine whether archaeological potential is applicable to the subject lands or phase (Stage I). If potential is determined to be applicable, the archaeologist shall carry out an archaeological assessment of the subject property and mitigate, through preservation or resource removal and documentation, adverse impacts to any significant archaeological resources found. No grading or other soil disturbances shall take place on the subject property prior to the County of Hastings and the Ministry of Culture confirming that all archaeological resource concerns have met licensing and resource conservation requirements.

10. That prior to final approval, a copy of the fully executed subdivision development agreement between the Owner and the Township of Stirling-Rawdon is submitted to the County of Hastings Planning Department.
11. All proposed street names shall be shown on the finally approved plans as accepted by the Township of Stirling-Rawdon in consultation with the County of Hastings Planning Department. The assignment of new civic addresses for each dwelling unit and the appropriate posting of same shall be required to the satisfaction of the Township of Stirling- Rawdon and the County of Hastings.
12. That the Owner satisfies the requirements of Enbridge with respect to the installation of natural gas if this service is contemplated for the subdivision lands.
13. That the Owner shall be required to satisfy all requirements of Bell Canada, including a) all necessary easements; and b) the provision of one or more conduit(s) of sufficient size from each unit to the room(s) in which the telecommunication facilities are situated and one or more conduits from the room(s) in which the telecommunication facilities are located and the street line, all to the satisfaction of Bell Canada.
14. The Owner shall be responsible for the full cost of construction of off-site sanitary sewer works necessary to connect to the existing sanitary sewer system with all work to be done to the satisfaction of the Township of Stirling-Rawdon.
15. That the Owner shall enter into any servicing agreements as may be required with utility companies for the installation or upgrading of any utilities servicing the subdivision, including but not limited to, the provision of electrical, natural gas, telephone, or cable services to the site, to the satisfaction of the appropriate authority, the Township of Stirling-Rawdon, and the County.
16. That prior to final approval by the County of Hastings, the Owner shall submit to the Planning Department the following:
    a. a statement from the Township of Stirling-Rawdon showing all taxes paid; and,
    b. A tax certificate from the collector of school taxes.
17. All measurements in the final subdivision final plans must be presented in metric units.
18. The final plan approved by the County of Hastings must be registered within 30 days or the County of Hastings may withdraw approval under subsection 51(21) of The Planning Act, R.S.O. 1990.
19. A digital copy of the survey of the plan shall be submitted in a form satisfactory to the County of Hastings Planning Department.
20. If final approval is not given to this plan within three (3) years of the draft approval date, and no extension has been granted, draft approval shall lapse. If the owner wishes to request an extension to draft approval, a written explanation, together with a resolution from the Township of Stirling-Rawdon, must be received by the County of Hastings prior

to the lapsing date. Please note that an updated review of the plan, and revisions to the conditions of approval, may be necessary if an extension is to be granted.

Appendix 1B: Development Application Pre-Consultation Form

Pre-Consultation Meeting Date: _____

Owner:_____ Agent: _____

Site Address: _____

Site Area:_____ Designated or Listed Heritage Property? _____

Application Type (check applicable applications):

☐ Official Plan Amendment	☐ Zoning By-law Amendment or H Removal Amendment	☐ Plan of Subdivision	☐ Site Plan
Future Plan of Condominium:	☐ (i) Standard	☐ (ii) Common element	☐ (iii) Vacant Land

---

1. Brief description of proposed development:

_____

_____

_____

2. a) **Existing Official Plan Designation:**_____

Conformity with County Official Plan land use designation? YES ☐ NO ☐

If 'NO' what is the nature of the amendment needed? _____

b) **Existing Zoning:**_____ **By-Law No.** _____

Conformity with existing zoning? YES ☐ NO ☐

If 'NO' what is the proposed zoning:_____

3. Fees Required

APPLICATION	TOWNSHIP OF STIRLING-RAWDON	HASTINGS COUNTY	LOWER TRENT CONSERVATION	
Official Plan Amendment				
Rezoning/H Removal				
Plan of Subdivision				
Site Plan				
TOTAL				

Note: fees are payable based on the fee schedule in effect on the date the application is made

4. Additional Agencies to be contacted: _____

5. Required Information

Reports, Studies, Plans * *(See Appendix for additional details)*		Number of Copies	To be submitted with application	To be submitted during processing
5.1	Planning Justification Report / Cover Letter			
5.2	Conceptual Site Plan Layout			
5.3	Serviceability Report			
5.4	Traffic/Transportation Impact Study			
5.5	Phase I Environmental Site Assessment			
5.6	Phase II Environmental Site Assessment/ Record of Site Condition Report			
5.7	Land Use Compatibility Study			
5.8	Environmental Impact Statement			
5.9	Lake Capacity Study – Water Quality			

5.10	Site Evaluation Report			
5.11	Hydrogeological or Water Quality Assessment			
5.12	Stormwater Management Report			
5.13	Archaeological Report			
5.14	Heritage Impact Study			
5.15	Tree Inventory and Preservation Study			
5.16	Shadow Analysis Plan			
5.17	Height Survey of Adjacent Buildings			
5.19	Other (Specify)			

* **Notes:**

It may be determined during the review of the application that additional studies or information will be required as a result of issues arising during the processing of the application.

There may also be financial requirements arising from the application, including, but not limited to, park dedication, development charges and impost fees, payment of outstanding property taxes, deferred local improvement charges, road widening conveyance, legal preparation and registration of agreements.

6. COMMENTS:_____

_____

_____

_____

_____

_____

_____

Hastings County Staff *(print)*	Hastings County Staff *(signature)*	Date
Township of Stirling-Rawdon Staff *(print)*	Township of Stirling-Rawdon Staff *(signature)*	Date
Owner / Agent *(print)* (I have authority to bind the owner)	Owner / Agent *(signature)*	Date

NOTES:

1. The purpose of this pre-consultation form is to identify the information required to commence processing of a development application, as well as any information required during the processing of the application. Pre-consultation does not imply or suggest any decision whatsoever on behalf of Township staff or the Corporation of the Township of Stirling-Rawdon to either support or refuse the application.
2. An application submitted without the information identified in this Pre-consultation Form may be recommended for refusal based on insufficient information to properly evaluate the application, or will be considered incomplete and processing will be delayed until all required information is received.
3. Acknowledgement of Public Information:

   The applicant acknowledges that the Township considers the application forms and all supporting materials, including studies and drawings, filed with any application to be public information and to form part of the public record. With the filing of an application, the applicant consents to the Township photocopying and releasing the application and any supporting materials either for its own use in processing the application or at the request of a third party, without further notification to or permission from the applicant. The applicant also hereby states that it has authority to bind its consultants to the terms of this acknowledgement.
4. The applicant acknowledges that if there is a need for a peer review for any of the required supporting studies/reports, the peer review shall be at the Owner's cost.

REQUIREMENTS FOR REPORTS/STUDIES AND PLANS

Planning Rationale Report

Required for all Official Plan Amendments, as well as major rezoning applications at the discretion of the County's Planning Division. A qualified planner must submit a report providing planning justification for the proposed amendment in light of the principles and objectives of the County's Official Plan. A draft of the proposed Official Plan Amendment is required to be submitted as part of the Planning Rationale. A detailed description of the requirements for a Planning Rationale is available from the Hasting's County Official Plan.

Conceptual Site Plan Layout

General plan required showing proposed building envelopes, driveways, parking, loading and landscape areas.

Serviceability Report

Required for all draft plans of subdivision and site plan applications for multi-residential development, may be required for Official Plan Amendments and Zoning Amendments. Report is to identify how the proposed development will be serviced, including water, sanitary and storm, connections to existing municipal infrastructure, availability of capacity in the municipal system to accommodate additional capacity of the proposed development. The Serviceability report should also address effects on downstream infrastructure that could require system upgrades.

Traffic/Transportation Impact Study

The need for a traffic impact study will be identified through pre-consultation. Most commercial developments and subdivisions will require the submission of a traffic impact study. Contact Hastings County Planning Department for background information. A peer review may be required.

Phase I Environmental Site Assessment

Generally required for all applications where a land use change is proposed. The need for this report will be addressed through pre-consultation. Applicants should contact the Township's Environment Division for further information regarding the preparation of Environmental reports.

Phase II Environmental Site Assessment/Record of Site Condition Report

Required when the Phase I site assessment identifies the possibility of site contamination. Applicants should contact the Township's Environment Division further information regarding the preparation of Environmental reports. There may be a requirement to have these studies peer reviewed.

Land Use Compatibility Study

Some uses (i.e. residential) may be sensitive to the odour, noise, vibration or their emissions associated with facilities such as an airport, highways, arterial roads, railway corridors, pits and quarries, various types of industries and sewage treatment facilities. Where a land use change or the creation of a lot(s) is proposed that may result in introducing or contributing to land use incompatibility, a land use compatibility study may be required to be completed by a qualified person that assesses the impacts of odour, noise, vibration, particulate or other emissions may be required in accordance with provincial guidelines. Specific requirements may be found in Hasting's County Official Plan.

Environmental Impact Statement

Required for applications that affect significant or environmentally sensitive lands. The report shall be submitted as part of the development application. The report shall include a description of the environment that will be affected, description of the development proposal, an assessment of the expected effects on the environment, a list of assumptions used in the assessment and recommendations regarding the actions necessary to prevent, mitigate or remedy the effects on the environment of the development proposal. Specific requirements may be found in Hasting's County Official Plan. This study may be peer reviewed.

Lake Capacity Study – Water Quality

The requirement for a lake capacity study will be identified through pre-consultation and by the County in consultation with MNRF and MECP. A lake capacity study shall be completed by a qualified professional in the relevant environmental field of study. General requirements for lake capacity studies can be obtained from Hasting County's Official Plan.

Site Evaluation Report

A site evaluation report may be required by the County, Member Municipality or other agency through the development review process to confirm that a lot is suitable for the proposed development, whether development constraints can be addressed, and if so, the most appropriate manner in which the proposed development should occur. Specific requirements can be obtained from Hasting's County Official Plan.

Hydrogeology or Water Quality Assessment

Required for all applications in areas subject to private water and septic services, Applicants should contact the Environment Division for more details regarding site-specific studies, which must be approved by the Environment Division.

A peer review may be required.

Stormwater Management Report

The requirement for a Stormwater Management Report will be identified through pre-consultation. All storm water runoff is to be controlled to the specified run-off rate adopted for the original subdivision, or to the Township/Conservation Authority's current Design Criteria. Specific requirements for SWM reports can be obtained from Hastings County Official Plan.

Archaeological Report

Required for all applications in or near areas of archaeological potential, as determined by the criteria set out by the Ministry of Culture. Reports must be completed in accordance with Provincial requirements.

Heritage Impact Study

Required for development or redevelopment applications on lands adjacent to protected heritage property. The proposed development is required to be evaluated and the report is to demonstrate how the heritage attributes of the protected heritage property will be conserved, and what mitigative measures or alternative development approaches may be required to protect the resource. This report is required to be prepared by a qualified professional.

Tree Inventory and Preservation Study

Required when a property under application contains woodlots, tree stands or hedgerows. A tree survey must be prepared by a qualified professional, identifying all existing trees, their type,

size and condition, those trees proposed to be removed and retained, and the methods to be used to ensure preservation of those trees to be retained. In accordance with the Township's Tree Preservation By-law, a permit may be required prior to any tree removal.

Shadow Analysis Plan

Required for all applications where, in the opinion of the Planning Division, the proposal may result in impacts on adjacent properties from sun shadowing.

Height Survey of Adjacent Buildings

May be required for residential infill and intensification rezoning applications. A surveyor's report must identify the highest points of the existing adjoining roofs measured from the existing average grade of the shared property line.

Other

Any other studies as determined to be necessary to facilitate proper consideration of the application.

Appendix 1C: *Design Submission Checklist*

To Be Included with Each Submission

☐	An application for Subdivision Agreement /Final Approval
☐	All applicable subdivision review fees
☐	A covering letter or report identifying the developer, the project, the owner's engineer and any special features of the submitted design.
☐	2 copies of the watermain design calculations.
☐	2 copies of sanitary and storm sewer design sheets.
☐	2 copies of streetlight design calculations (if varying from standard).
☐	Copies of reports as set out in 1.10 and any other reports that are required to support the design of the works in accordance with the Conditions of Draft Plan Approval.
☐	Copies of plans as set out in section 4.0 including first application under Land Titles.
☐	Specifications for non-standard items.

Appendix 1D: Design Standards – Roads

1.0 GENERAL

Roads are to be designed, commencing at the draft plan stage, to geometric standards established by the Township of Stirling-Rawdon and contained within this document, the Transportation Association of Canada and the Ontario Ministry of Transportation. This document will be updated from time to time. In the interim, the Township of Stirling-Rawdon reserves the right to make revisions having due regard for applications already in the review process. The Township will notify individuals or groups affected accordingly, and revisions will become effective on the date of notification.

2.0 DESIGN CRITERIA

The Township of Stirling-Rawdon's standard road cross-sections and standard utility locations are as shown in Figures A1 and A2.

2.1 ROAD CLASSIFICATION

2.1.1 URBAN ROADS

Local Residential

Local residential streets are those which serve to permit “local” traffic to immediately access private property and to convey traffic to and from the arterial roads. Traffic volumes are minimal at less than 1000 vehicles per day based on the annual average daily traffic (AADT).

Sidewalks are required on one side of the street.

Arterial

The arterial road provides a direct link for residential, commercial and public transportation traffic between the local roads and the major arterial road network. Traffic volumes are generally above 1,000 vehicles per day based on the annual average daily traffic (AADT).

Sidewalks are required on one side of the street.

2.1.2 RURAL ROADS

Rural Local Residential

Local residential streets are those which serve to permit “local” traffic to immediately access private property and to convey traffic to and from the arterial roads. Traffic volumes are minimal at less than 1000 vehicles per day based on the annual average daily traffic (AADT).

Rural Arterials

The rural arterial road provides a direct link for residential, commercial and public transportation traffic between the collector and the arterial road network.

Traffic volumes are generally above 1,000 per day based on the annual average daily traffic (AADT).

2.2 VERTICAL AND HORIZONTAL ALIGNMENT

Table 1D-1 Classification /Design Speed/ Alignment Criteria.

Classification (AADT Range)	Grades (%)		Alignment		
	Minimum	Maximum	Min. Hor. Radius	Min. "K" Value	
				Crest	Sag
URBAN					
Local (< 1,000)	0.5	8.0	15m Normal Crown	7	13
Arterial (> 1,000)	0.5	5.0	200m **4% *max*** Superelevation	17	23
RURAL					
Local (< 1,000)	0.5	7.0	15m Normal Crown	11	18
Arterial (> 1,000)	0.5	5.0	340m **6% max** Superelevation	39	38

Note: Maximum allowable grades may not apply at street intersections

2.2.1 VERTICAL ALIGNMENT

- Vertical curves are required where longitudinal grades change by more than 2%.
- Road cross fall is to be adjusted at sag curves and detailed on the plans as necessary to maintain minimum 0.5% grade along gutter line to catch basins. In the case of semi-urban sections, roadside ditch grades shall be designed at 1% minimum slope.
- The design profiles shall be in conformance with Lower Trent Conservation Stormwater Management requirements while minimizing the number of sag curves where possible. The limiting depth of flow on the roadway shall be 300mm and major overland flow routes are to be directed to coincide with public lands (parks, walkways etc.).

2.2.2 HORIZONTAL ALIGNMENT

All roads must be aligned to produce safe traffic flow at the design speed. Designs should be based on a normal cross fall however superelevation will be permitted depending upon road classification.

2.2.3 CROSS SECTION, RIGHT-OF-WAY WIDTH, BASE COMPOSITION

TABLE 1D-2 - URBAN SECTION

Road Classification (AADT)	**No. of Lanes**	***Minimum* Right of Way Width (m)**	***Minimum* Pavement Width (m)**	***Minimum* Pavement Structure *(Note 1)***	***Minimum* Granular Base *(Note 1)***	
					In Earth	**In Rock**
Urban Section						
Local (< 1,000)	2	20.0	8.0	40mm – HL3 50mm – HL8	150mm - Gran."A" 300mm - Gran."B"	200mm - Gran. "A" 300mm - Shatter
Arterial (> 1,000)	2	20.0	8.0	40mm – HL3 50mm – HL8	150mm - Gran."A" 300mm - Gran."B"	200mm - Gran. "A" 300mm - Shatter

Note: Minimum pavement structure and minimum granular base shall be as noted above or as determined by the geotechnical report, whichever is greater.

TABLE 1D-3 – RURAL SECTION

Road Classification	**No. of Lanes**	***Minimum* Right of Way Width (m.)**	**Paved Lane/ Granular Shoulder/ Rounding**	***Minimum* Pavement Structure *(Note 1)***	***Minimum* Granular Base *(Note 1)***	
					In Earth	**In Rock**
Rural Section						
Local (< 1,000)	2	20.0	4.0/1.0/0.5	40mm – HL3 50mm – HL8	150mm - Gran."A" 300mm - Gran."B"	200mm - Gran. "A" 300mm - Shatter
Arterial (> 1,000)	2	20.0	4.0/1.0/0.5	40mm – HL3 50mm – HL8	150mm - Gran."A" 300mm - Gran."B"	200mm - Gran. "A" 300mm - Shatter

Note: Minimum pavement structure and minimum granular base shall be as noted above or as determined by the geotechnical report, whichever is greater.

3.0 CUL-DE-SACS

- Permanent turning basins are to have a minimum diameter of 22m for both urban and rural subdivisions.
- Minimum grade of 0.5% is to be maintained along gutter line. Gutter line grades to be detailed on drawings.
- Circular right of way radius is to be 20 meters for 20 meter wide right of way.

Turning circles shall be provided at the limits of each phase where a “temporary” dead-end section of roadway would otherwise result. Where feasible, the temporary turning circle should be accommodated on lands beyond the phase boundary. If this is not feasible, the turning circle should be offset to one side of the roadway, so as to impact on as few lots as possible.

Easements shall be provided to the Township of Stirling-Rawdon for the construction of temporary turnarounds outside of the public road system and will be disposed of when no longer required. Each easement shall be deeded in the form of lots or blocks, with the intent that the Township will relinquish its interest in the lands at such time as the lands are no longer required.

4.0 DRIVEWAY ENTRANCES

Access to the public street must comply with Township of Stirling-Rawdon regulations governing entrances.

Driveway slope shall fall within the range permitted by OPSD 351.010 for urban driveways, and 301.010, 301.020, 301.030 for rural driveways.

Driveway minimum width shall be 5.5m. Services shall not be permitted under driveways.

Driveway locations and depressions shall be shown on plan and will not be permitted to be changed or mirrored after approval.

5.0 INTERSECTIONS

Intersection spacing shall be established on the basis of providing safe stopping, turning and crossing sight distances in accordance with the stipulated design speed.

- An intersection angle of 90 degrees is preferred, 70 degrees is the minimum.
- Gradients on through streets are to have a continuous profile. Maximum and minimum grades at an intersection are 8.0% and 0.5% respectively.
- Minimum turning radii is 8.0m. Turning templates are to be used where conditions warrant.

6.0 EMERGENCY ACCESS

Local Residential Streets shall not terminate in dead ends longer than 150 meters, measured from the intersecting street line to the start of the turnaround right of way. Streets configured as “P-Loops” shall have an entrance leg that does not exceed 150 meters measured from the intersecting street line to the start of the return loop.

Temporary roadways exceeding these guidelines may be acceptable provided that a temporary secondary access road is provided to loop the street to an adjoining street while limiting the limited access length to 150 meters or less.

Rural residential streets, having a single point of access, shall be limited in length as described above. Where conditions do not permit a second access, alternative designs comprising

emergency access points, increased road widths, restrictive covenants requiring all dwellings to be provided with fire sprinklers or combinations of these measures may be considered.

7.0 CONCRETE

Concrete shall conform to the following:

Class of Concrete	32 MPA at 28 days
Coarse Aggregate	19mm nominal maximum size
Air Content	5.0% to 8.0%
Maximum Slump	240mm
Curing Compound	White Pigmented, OPSS 1315

QUALITY ASSURANCE

Concrete poured without the benefit of inspection by the designated site engineer or the engineer's inspector will be rejected automatically and unconditionally.

UNSATISFACTORY CONCRETE

Unsatisfactory concrete shall be any sampled concrete, which has a representative twenty-eight day test less than 90% of the required strength. If this result occurs the concrete structure will be removed and replaced.

In addition, should the average of any five consecutive representative twenty-eight day tests fall below the required strength, then the number of tests that must be deleted to raise the average to the required strength shall be considered representing unsatisfactory concrete.

If the tests fail, the Contractor may submit core samples for testing under test method

C.S.A. A23.2-14C. When the cores test out at 100% of the required strength at 50 days it will be deemed acceptable. If the cores fail to reach 100% of the required strength at 50 days, the concrete will be rejected or accepted according to the above noted "Unsatisfactory Concrete".

8.0 SIDEWALKS

Location within the right of way will be determined in consultation with the Township of Stirling-Rawdon giving due regard to the pedestrian traffic being generated and access for the physically disabled. Sidewalks shall be placed on north and east sides of roadway. Sidewalks are required to facilitate access to neighbourhood schools and at all Canada Post mailboxes. The location of pedestrian crossings at intersections will be governed by pedestrian movements and the need to avoid conflicts with turning vehicles. Generally, sidewalks will be required in accordance with the following criteria in urban areas only:

Urban Sidewalk Placement – One side of street only.

8.1 Concrete sidewalks are to be 1.5 meters wide in accordance with OPSD 310.010. Granular base thickness shall be 100mm granular “A’, compacted to 100% Standard proctor density. Slab thickness shall be 125mm.
8.2 In the case of commercial/industrial frontages where entrance locations are unknown the entrances shall be determined at the site plan approval stage in which case the proponent shall apply 150mm X 150mm steel mesh reinforcement within the width of each new entrance.
8.3 All sidewalks and walkways are to be continuous through driveway entrances.
8.4 The tool margins from finishing tools used for finishing joints are to be broomed out to eliminate the lip, of which requirement will be strictly enforced.
8.5 Dummy joints shall be constructed as per OPSS 351 at a spacing of 1.5m. All dummy tool margins are to be broomed out so only the 5mm joint remains. See Figure 1A10.
8.6 Contraction joints shall be constructed as per OPSS 351 at every third dummy joint. All dummy tool margins are to be broomed out so that only the 5mm joint remains. The contraction joint must be saw cut to a depth of 0.25% of the sidewalk thickness as per OPSS 351.
8.7 Expansion joints shall be constructed as per OPSS 351 and shall be constructed where the sidewalk abuts a rigid object or changes direction or where thickness of sidewalk changes. See OPSD 310.030.

9.0 CURB AND GUTTER TYPES

Concrete shall be barrier curb with standard gutter as per OPSD 600.040 and depressed at driveway entrances.

10.0 PEDESTRIAN WALKWAYS

Pedestrian walkways shall be located as required to facilitate pedestrian traffic in conjunction with the roadway sidewalk system. The walkway shall link the street system with adjacent streets, parks, schools and/or commercial areas. Minimum right of way width shall be 3.0 meters however greater widths may be required to facilitate vehicular access and/or the placement of underground utilities. Walkways shall be constructed with an asphalt surface and flanked on both sides with chain link fencing 6 feet tall having a diamond mesh not greater than 38mm. Chain link fence shall be installed outside of the right-of-way.

11.0 COMMUNITY MAIL BOXES

Community mail boxes are an integral part of each new development and as such the owner’s engineer shall incorporate into the design of the works the necessary pedestrian approaches to accommodate the mailboxes provided by Canada Post. At each permanent mailbox location a concrete pad shall be provided with a concrete walk connecting to both the existing road and sidewalk system. The pad and approaches shall be poured in conjunction with the sidewalk system and shall follow the sidewalk width and thickness dimensions. The Township shall also require barrier curbing at each location to prevent damage to the boulevard area.

12.0 BOULEVARD LANDSCAPING

Boulevards shall be 2m and are to be finished with 100mm of topsoil and nursery sod. The requirements for seeding or sodding of other public areas will be determined by the Development Engineer in consultation with other Township officials.

Boulevard slope shall be a minimum of 2% and a maximum of 8% within the public right of way.

13.0 SIGNS AND TRAFFIC CONTROL DEVICES

All traffic control devices are to conform to the Ontario Manual of Uniform Traffic Control Devices, including all newly incorporated Ontario Traffic Manuals and shall also meet the requirements of the Highway Traffic Act.

Traffic control sign blanks are to be 0.064” thickness for less than 600mm x 600mm and 0.081” thickness for those that are larger. A street name sign indicating the name of each intersecting street will be required at each intersection.

Local intersections (2-lane)

Signs are to be high intensity grade reflectorized sheeting (3M or equivalent) mounted on 200 mm extruded aluminum blanks (green - anodized). Lettering is to be 125mm series “C” Highway Gothic (white – upper case).

The Developer will be required to provide all traffic and street signs as required including no exit signs on all dead end streets.

All traffic and street name signs are to be erected prior to completion of the base course asphalt.

Warning signs indicating “ROAD NOT ASSUMED – USE AT YOUR OWN RISK” are to be placed at each entrance to the development at such time as the base course asphalt is applied. The sign shall be sized such that it is legible from the roadway however it shall not exceed 3.0 square meters in size.

Pavement markings shall include a one time application of painted stop bars at all subdivision street intersections that are designated as being signed for stop conditions. Paint shall be in accordance with either OPSS 1713 or OPSS 1714.

14.0 NOISE MITIGATION / PRIVACY FENCING

Noise mitigation and privacy fencing are installed for the benefit of the subsequent purchaser and as such are to be located on private property. Design life expectancy is to be a minimum of 20 years. Those fences designed using wood are to be treated and are to have ground contact components made of galvanized steel.

Privacy fencing is required to be installed between all Residential / Commercial or other non-residential zones with installation being on the non-residential site if within the plan of

subdivision. Privacy fencing is also required abutting private lanes without rear yard access with location decided based on who is last in developing and requiring the visual barrier.

Fences shall be installed on residential/commercial side of property line and not on municipal ROW.

15.0 CONSTRUCTION MATERIALS

The requirements of the following Ontario Provincial Specifications shall apply:

OPSS 1010 Aggregates - Granular A and B. (In addition, Granular A and B shall be crushed limestone).

OPSS 1150 Hot Mixed, Hot Laid Asphaltic Concrete.

Note: All asphalt mix designs for Hot Mix asphalt shall be as follows:

HL1, HL3, HL4 - PGAC 58-34, minimum 5.0% asphalt cement and 4.0% +/- 0.5 air voids.

HL8, MDBC - PGAC 58-34, minimum 4.7% asphalt cement and 4.0% +/- 0.5 air voids.

OPSS 1350 Concrete - Materials and Production. Materials (OPSS 350, 351, 352 and 353, 1301, 1302)

16.0 CONSTRUCTION

All construction shall be in accordance with Ontario Provincial Standard Specifications and Drawings, unless specifically modified by the Township of Stirling-Rawdon.

Surface course asphalt shall not be placed before the completion of a closed circuit T.V. inspection of both the storm and sanitary sewer systems.

All maintenance holes within the roadway are to be set to the base asphalt grade pending final adjustment just prior to the time the surface course is applied. Maintenance hole adjustment units are to be pre-manufactured precast concrete. Where the top lift of asphalt is deferred to a subsequent construction season the Township will permit the use of one manufactured polyethylene adjustment unit (Turner adjustment ring or equivalent) providing the depth does not exceed the design thickness of the top course. Metal adjustment units are not permitted.

The Township requires strict adherence to the temperature provisions of the Ontario Provincial Standard Specifications for all pavement applications.

Appendix 1E: Design Standards – Lot Grading

1.0 GENERAL

Lot grading shall be designed to conform in principle to the site Storm Water Management Plan. The plan shall show the existing and proposed final grades for each lot and block within the plan. In addition the design shall adequately provide for any necessary interim drainage in order to limit flood risk, having regard for the pre development overland flow patterns. The term "flood risk" is to be interpreted as a risk of personal liability and/or property damage as a result of flooding brought about by the alteration of pre-development flows and/or flow patterns. The design shall make provision for such interim measures, grading, culverts etc. as may be required to promote positive drainage and such works shall be incorporated into the designated "works" as defined in the engineer's estimate. This shall not be construed as a requirement for the owner to pre-grade the subdivision as a whole.

2.0 DESIGN CRITERIA

Lot grades shall be 1% minimum and 33% (3:1) maximum on all grassed surfaces. Adequate control measures shall be employed where necessary to control erosion.

Retaining walls are to be identified on the plan where the maximum lot slope is exceeded. Subject to height, the Township may require an engineer's seal to support the design.

Entrance slope shall meet the provisions of OPSD 351.010 within the lot boundary.

Individual lot grading shall be designed in accordance with Figures B1, B2 and B3.

Natural drainage patterns and channels must be respected. Landowners must accommodate runoff from upgradient properties. Surface runoff water shall not be discharged onto adjacent lands in a concentrated amount nor shall it exceed the pre-development flows.

Major system drainage is to be directed to public lands.

Rear yard catch basin leads shall be located in public easements. Easements between lots shall be on one property only (i.e shall not straddle the common lot line). Spacing between catch basins shall not exceed 90 meters.

Leads to rear yard catch basins shall not be less than 250mm and shall be spaced to coincide with maintenance holes such that access is obtainable from either end.

The maximum depth of ponding resulting from any storm event shall not exceed 300mm.

3.0 OVERLAND STORM FLOW ROUTES

All major swales and major system outlets are to be constructed and sodded by the Developer in conjunction with site servicing. While lot grading in general is the responsibility of the building permit applicant, common drainage facilities are the responsibility of the Developer.

Major swales and major system outlets shall be located in public easements. Easements between lots shall be on one property only (i.e shall not straddle the common lot line).

4.0 LOT GRADING

The following steps form the process for review and approval of lot grading within a subdivision.

A Lot Grading Plan (LGP) has been approved by the Township and is registered as a Schedule within the Subdivision Agreement.

The Developer, as the owner of the lands described in the subdivision agreement, will act as the monitor for the progress of the subdivision as each lot is sold and built on.

When the builder makes application for a building permit the LGP is to be used to establish the grades for the lot. The builder prepares the Plot Plan as per the appended Plot Plan Requirements. For those Plans that deviate from the approved LGP, the Plot Plan must be sealed by an Engineer (of the Developer's choosing) and the box on the Plot Plan checked indicating there is a deviation. Copies of the Plot Plan are to be provided to the Building Department as well as the Developer.

During construction the Builder's OLS is to provide to the Building Department before the drywall stage a Surveyor's Real Property Report to show the as-built foundation yard ties.

Once the building is complete and the lot is graded the Builder's OLS or P.Eng. will prepare the Lot Grading Certificate. The Lot Grading Certificate is to illustrate the proposed grades as well as the as-built grades for the lot. A Lot Grading Certificate to certify compliance is to be provided to the Developer and a copy provided to the Township.

As the lot grading is completed the Developer's Engineer can choose to submit a letter to the Township certifying the lot grading for each lot or group of lots.

It is suggested that the Developer's Engineer compile the certificates to create a consolidated as-built lot grading plan. (This could be in the form of red lining the approved Grading Plan). The as-built plan is to be within reasonable tolerances to demonstrate that the as-built grading achieves the designed drainage pattern that was intended for the subdivision and that there are no locations within the lots that would result in extended periods of standing water or wet areas on a property.

Prior to issuance of the Final Certificate of Approval of the Works (FCAW), the Developer's Engineer is required to submit an as-built Lot Grading Plan for the subdivision.

Appendix 1F: Design Standards – Stormwater Management

1.0 GENERAL

The Developer's Engineer shall prepare a stormwater management plan for submission to Lower Trent Conservation Authority or Crowe Valley Conservation Authority. The Developer must obtain written approval from the Conservation Authority prior to final approval of the Subdivision Agreement.

The Stormwater Management Plan must be prepared by a qualified Professional Engineer and must address stormwater quality and quantity. The plan shall ensure that adequate water quantity control is provided for the runoff generated from the Subdivision lands to achieve pre-development flows post-development.

A Sediment and Erosion Control Plan shall also be included as part of the Stormwater Management Plan. The plan shall demonstrate how the erosion and siltation and their effects will be contained and minimized on the Subdivision Lands both during and after construction. The Sediment and Erosion Control Plan shall form part of the Stormwater Management Plan and the developer shall also obtain written approval of this plan from Lower Trent Conservation.

Any permits required under Ontario Regulation 163/06 shall be obtained from the applicable conservation authority.

WATER QUANTITY CONTROL

For quantity control, the minimum requirement is that post-development flow is restricted to predevelopment peaks, unless identified otherwise. Further control may be required depending on the receiver for the stormwater runoff (i.e. municipal storm sewer system). There are some areas that have been identified with Allowable Release Rates (ARR) in an MDP or drainage strategy.

WATER QUALITY CONTROL

For water quality control, outflow from SWM facilities should attempt to achieve enhanced level requirements (80% removal of total suspended solids), unless identified otherwise. Many watercourses within the LTC jurisdiction are cold-water systems and/or have sensitive wetland systems. SWM facilities should therefore incorporate measures to provide enhanced water quality and reduce the temperature of water discharging to the sensitive receiving watercourses. In some cases, it will be recommended that Water Balance assessments be made and attempts to achieve pre-development water balance should be undertaken through Low Impact Development design and treatment train approaches.

EROSION CONTROL

For erosion control, the minimum requirement is that the runoff from a 25mm storm is detained for 24 hours, unless identified otherwise.

2.0 CONSERVATION AUTHORITY SUBMISSION AND DESIGN REQUIREMENTS

2.1 Preliminary Submission for Subdivision Draft Plan Approval

The preliminary stormwater management report is required for the Subdivision Draft Plan Approval. The purpose of this report is to show at a conceptual level:

- the subdivision road pattern will properly direct major flow
- the lots are not encroaching into floodplain or other environmentally sensitive areas
- the SWM block is large enough to contain the minimum size of facility necessary to provide the required level of treatment
- SWM facilities will be on lands dedicated to the municipality in addition to any lands required to be dedicated for park purposes under the Planning Act.

The technical requirements and criteria of the stormwater management preliminary report are governed by "*Lower Trent Region Conservation Authority Stormwater Management Technical Guidelines, December, 2020*". This document can be found on the Lower Trent Conservation website.

A professional engineer must stamp and sign the report as well as all engineering drawings.

2.2 Detailed Submission for Subdivision Approval

The purpose of this report is to provide detailed calculations, methodology, background criteria, and engineering drawings to support the preliminary concept. Typically, the report is an expansion of the report written for the draft plan stage. This is required to get clearance of draft plan conditions and is typically submitted with the detailed engineering drawing package.

The technical requirements and criteria of the stormwater management final report are governed by "*Lower Trent Region Conservation Authority Stormwater Management Technical Guidelines, December, 2020*". This document can be found on the Lower Trent Conservation website.

A professional engineer must stamp and sign the report as well as all engineering drawings.

Appendix 1G: Design Standards – Storm Sewers

1.0 RESPONSIBILITIES

The responsibilities for storm drainage design approval at the local level are as follows.

a) Overall concepts of storm flow management – Township of Stirling Rawdon and the Conservation Authority

b) Surface and subsurface drainage including storm frequency, catchbasin location, catchbasin inlet capacity and runoff coefficients – Township of Stirling Rawdon and the Conservation Authority

c) Completion and submission of CLI-ECA application to Township where applicable, and ECA application to MECP where CLI-ECA does not apply.

2.0 DESIGN CRITERIA

The Storm Sewers shall be designed to the following design criteria and approved by the Conservation Authority and the Township of Stirling Rawdon.

2.1 Design Flows

The runoff directed to each storm pipe should be computed on standard storm sewer design sheets according to the Rational formula

$$Q = 0.002778\ C\ I\ A$$

Where:

A = contributing drainage area in hectares

C = imperviousness, or runoff co-efficient dimensionless

I = rainfall intensity (mm/hr)

Q= volume of runoff in cubic metres per second

Runoff coefficients can be found in Tables 3 and 4 of this report which are based on the MTO Design Charts (1997).

2.2 Rainfall Intensity

For normal residential and industrial developments, the minor system should by sized for the 5-year flow unless otherwise specified by the Township. Rainfall intensities can be found on the Intensity-Duration-Frequency (IDF) Curves. The Township recommends the use of the MTO IDF Curves with a 50-year projection. This information can be found on the website: http://www.mto.gov.on.ca/IDF_Curves/terms.shtml

2.3 Runoff or Impervious Coefficients

It is recommended to use the MTO Runoff Coefficients from Design Chart 1.07.

To account for a decrease in the perviousness during major storms, the recommended factors as identified in MTO's Drainage Design Standards (2008) should be used. For storms having a

return period of more than 10 years, runoff coefficients should be increased by the following values, up to a maximum coefficient of 0.95.

- 25-year event – add 10%
- 50-year event – add 20%
- 100-year event – add 25%

2.4 Pipe Sizing

Pipe capacity should be determined on the basis of the pipe flowing full. The value of the roughness coefficient to be used are provided as follows or as defined in Design Chart 2.01 in the MTO Drainage Management Manual (1997):

- Concrete Pipe all sizes 0.013
- Concrete Box Culverts 0.013
- Corrugated Metal pipe 0.024
- PVC Pipe 0.013

All minor system flow must be intercepted at each catchbasin (CB) or catchbasin maintenance hole (CBMH) location. Calculations may be requested to show capture capability.

The following criteria shall apply for pipe sizing:

- The maximum velocity at design flow shall not exceed 6 m/s.
- The minimum velocity at design flow shall be not less than 0.75 m/s
- Surcharging is permitted subject to 50 year storms not backing into any connected building foundation drainage system so as to cause flooding.
- Minimum pipe sizes shall be as follows:
    - Storm Sewers: 300mm
    - Single catch basin lead (road): 300mm
    - Rear yard catch basin leads: 300mm *
    - Double catch basin lead: 300mm
    - Foundation and Building Drains: Ontario Building Code Applies

  *All rear yard catch basin leads shall be connected to a maintenance hole
- Maximum manhole spacing shall be as per MECP's "Design Guidelines for Sewage Works, 2008" and as noted below:
    - Sewers 250mm to 425mm diameter: 120m
    - Sewers 450mm to 750mm diameter: 150m
- Structures shall be used to connect pipe mains. Tees will not be permitted other than for storm laterals.
- The depth of storm mains shall be such to ensure that they can withstand soil dead load and traffic loading from an H-20 live load. The minimum depth of bury shall be 1.2 m measured finished grade to top of pipe.

- Design shall ensure that adjacent structures are not jeopardized by extra frost penetration from within a storm sewer, catch basin or culvert.

2.5 Overland Flow

The depths of flooding permitted on streets for the major system are as follows:

a) depth of flooding should be restricted to 0.3 metres,

b) on local roads, the flow may spread to the crown,

c) on collector roads, the flow spread must leave one lane free of water,

d) on arterial roads, the flow spread must leave one lane in each direction free of water.

Flow across intersections is discouraged.

The major flow should not be less than the difference between the 100-year design flow and the 5-year design flow, calculated as follows:

$$Q_{major} = Q_{100year} – Q_{5year}$$

2.6 Culvert and Bridge Hydraulic Capacity

Bridges and culverts at watercourse crossings are recommended to be designed following WC-1 of MTO Highway Drainage Design Standards (2008), as well as the Canadian Highway Bridge Design Code, as follows:

- Driveway - 10-year flow
- Local road, span less than 6.0m - 10-year flow
- Local road, span greater than 6.0m - 25-year flow
- Collector road, span less than 6.0m - 25-year flow
- Collector road, span greater than 6.0m - 50-year flow
- Arterial road, span less than 6.0m - 50-year flow
- Arterial road, span greater than 6.0m - 100-year flow

Relief flow passage must be incorporated into the design of the roadway in cases where the Regulatory flow exceeds the design flow. Under Regulatory conditions, the maximum depth of flow on the roadway should not exceed 0.3 m, and the product of velocity and depth should not exceed 0.8 m2/s.

Culverts shall be minimum 450mm.

2.7 Hydraulic Gradeline Calculations

Hydraulic gradeline calculations may be requested. The pipe system should be designed to provide at least 0.3 metre freeboard between the minimum basement floor elevation and the 25-year hydraulic gradeline (HGL). Spreadsheet calculations showing calculations should be included with the submission. The 25-year HGL and proposed basement floor elevations should be plotted on all plan/profile drawings.

2.8 Outlets

Outlet structures must be designed so that exit velocities minimize potential erosion or damage in the vicinity of the outfall. Where the discharge velocity is high or supercritical, energy-

dissipating structures (such as rip rap, headwalls, wingwalls, stilling basins) are required to prevent erosion of the natural channel bed or banks.

Outfalls to natural watercourses should discharge at or above the bankfull water elevation of the watercourse. Submergence of the outlet during times of high watercourse water levels must be assessed with hydraulic grade analysis and backwater conditions. The outlet invert should be above the 25-year flood elevation of the receiving channel.

2.9 Materials

The following criteria shall apply:

Pipe sewers:

- All sewers will be smooth walled conforming to OPSS. Corrugated steel pipe and high-density polyethylene (HDPE) pipe are not permitted.
- All pipe and fittings supplied must carry CSA certification to the appropriate CSA standard sewer grade. The following pipe shall be used for sewers:
    - Reinforced concrete pipe per OPSS 1820 according to CSA A257.2 Class 65-D with rubber gaskets or
    - Type PSM polyvinyl chloride (PVC) pipe with elastomeric gasket per OPSS 1841 and CSA B182.2 M1990.
        - Mains – DR 35 pipe
        - Storm Laterals – DR 35 pipe
    - Profile Polyvinyl Chloride (PVC) pipe with elastomeric gasketed bell and spigot type joints meeting CSA 182.4 and having a minimum stiffness of 320 kPa may be used for storm sewer applications.

Culverts:

- Culverts shall be concrete or corrugated steel pipe. High Density Polyethylene (HDPE) pipe is not permitted.
- All culverts supplied must carry CSA certification to the appropriate CSA standard sewer grade. The following pipe shall be used for culverts:
    - Reinforced concrete pipe per OPSS 1820 according to CSA A257.2 Class 65-D or
    - Corrugated steel pipe (CSP) per OPSS 1801 according to CSA G401 and Appendix A of the same standard. CSP shall be Aluminized Type 2 and shall be 2.0mm thick.

2.10 Storm Laterals

Where storm sewer mains have been provided for in the design of the public works each dwelling unit shall be provided with an individual storm drainage lateral extending from the main to the limit of the public right of way.

Building and lot storm drainage sewers including rain leaders may be subsequently connected to the storm sewer.

Foundation drainage shall be connected to the storm sewer by gravity unless otherwise waived in writing by the Township. Foundation drainage shall be protected from surcharging from the storm drainage main for design storms of up to 50 years.

Unconnected foundation drains shall be capped at the property line.

Capped services shall be appropriately marked with a “2X4” extending from the pipe invert to at least 1.0 meter above finished grade level.

All gravity foundation drains shall be white in colour.

A storm lateral cleanout shall be installed at the property line for all storm laterals.

3.0 EASEMENTS

Storm sewer infrastructure that is to be assumed by the Township of Stirling-Rawdon and servicing more than one property shall be situated in either a road allowance or on property deeded to the Township of Stirling-Rawdon by easement or ownership. Easement documents shall be in the standard format prescribed by the Township of Stirling-Rawdon.

All easements shall be of sufficient width as to permit access for routine maintenance, repair and replacement purposes. Widths shall allow for future excavation without the need for shoring and shall permit sufficient working clearance and side slopes as required by regulation. Easement width shall not be less than 5.0 meters. Where more than one utility main or line is to be contained in a single easement, the easement shall extend to 2.5m beyond the outside edge of the outside mains or lines. All measurements are to be construed as being perpendicular in relation to the works. Regardless, the separations as stated in the Public Utilities Act are not to be compromised.

Storm sewer infrastructure shall be situated between lots such that where an easement is required, the easement is on one property only and does not straddle the property line.

Where there is an easement in the rear yard, the rear-yard setback for that lot shall be increased by 5m to facilitate the easement.

Appendix 1H: Design Standards – Sanitary Sewers

1.0 MATERIAL

Pipe bedding shall be as set forth in OPSD 820 series. Bedding and cover shall conform to Granular "A" as set forth in OPSS 1010.

All pipe and fittings supplied shall carry CSA certification to the appropriate CSA standard sewer grade. The following pipe shall be used for sewers:

- Reinforced concrete pipe per OPSS 1820 according to CSA A257.2 minimum Class 65-D with rubber gaskets or;
- Type PSM polyvinyl chloride (PVC) pipe with elastomeric gasket per OPSS 1841 and CSA B182.2 M1990. Profile type pipe such as those meeting CSA 182.4 and CSA 182.6 shall not be used for sanitary sewer applications.
    - Sanitary Mains to be DR 35 pipe
    - Sanitary Laterals to be DR 28 pipe

2.0 Design Considerations

Sewer Mains

Sewer mains shall conform to the following:

- No decrease in pipe size downstream shall be allowed unless otherwise approved by the Township
- The minimum sanitary main size shall be 200mm.
- The maximum design velocity at peak design flow in the sanitary sewers shall be 3.0 m/s. The minimum design velocity at peak design flow shall normally be 0.6 m/s at design flow. Consideration will be given on a case-by-case basis for design flow velocity less than 0.6 m/s but in no case shall slopes be less than shown below and in no case shall pipe size be increased so as to reduce the minimum slope.
- Minimum Slopes:

Size/Condition	Minimum Slope
Top Reach (MH to MH)	1.0%
Top 25 Dwelling Units	1.0%
200mm	0.4%
250mm	0.3%
Greater than 250mm	MOE Guidelines

- The minimum cover for sanitary mains shall be 1.5 meters from the finished grade.
- The crown of the main at the point where the service is connected shall be a minimum of 1.0 m below the lowest floor grade of the buildings being serviced except where connection is by a pumped sewage connection with back flow prevention installed to protect the building being connected.
- The Manning's roughness coefficient for design purposes shall be 0.013 unless otherwise specified.
- Design flows shall be 350 L/d per person. Population design density based on gross population per ha will be provided by Hastings Planning Department. Contributing industrial, commercial and institutional design flows shall be considered on a case-by-case basis. Infiltration shall be 0.00014m^3 per second per hectare of contributing area.
- Peaking factors shall be 2.75 for maximum flow and 4.0 for minimum flow as derived from the Harmon formulae.
- Sewers shall be air tested with services extended to the lot line based upon OPSS 410, modified so that the pressure drop does not exceed 3.5 kPa over a time in minutes equal to the volume in cubic meters multiplied by 1.25.
- Sewers shall be tested for deflection as per OPSS 410.
- Design sheets shall be submitted in spreadsheet format in accordance with the attached standard, containing formulae used in arriving at the calculations. See standard format contained herein. Drainage Plan is also to contain pipe design data.
- Sewers shall be flushed immediately prior to the closed circuit TV inspection and again just prior to the issuance of the Preliminary Certificate of Approval of the Works.

Maintenance Holes

All sanitary maintenance holes (MH) shall be as follows:

- All MH shall conform to OPSD 700 standards.
- MH spacing shall be at a distance not greater than 120 m (400 ft) for sewers of 375 mm diameter or less and 150 m (500 ft) for sewers of 450 mm diameter to 750 mm diameter.
- Where pipes of different sizes are connected to a MH, the crown of the inlet pipe(s) shall not be lower than the crown of the outlet. The difference in invert elevations between inlets and outlets shall be as indicated in MOE Guidelines.
- MH shall be tested for leakage in accordance with OPSS sect 407.

Sanitary Service Laterals

All public sanitary service laterals shall be as follows:

- Separate services shall be provided to each building and each unit of a semi detached or row house residential building.
- Service laterals from the building line to the main shall be laid at a minimum of 2% from the building line to the main sewer. There shall be a minimum of 300mm of machine compacted bedding under the service and hunched to the centered line of the service.

- The building services connected to mains shall be set above the spring line of the sewer main with a saddle or tee connection and with long radius bends. Service connection size in AC mains shall not exceed greater than 50 percent of the diameter of the sewer main unless using a tee connection. The tee shall be rotated at least 45o above horizontal for sewers connected by a tee connection.
- Service laterals shall not be connected directly to maintenance holes unless authorized by the Township.
- Service laterals from adjacent properties shall not be connected to each other.
- Service laterals shall be sized to meet the Ontario Building Code as amended and shall be minimum of 100mm. If foundation drainage is provided such piping shall be connected to the storm sewer.
- The minimum cover for service laterals will normally be a minimum of 1.5m from the finished grade. Services with less than 1.5m cover may be permitted on a case-by-case basis. In such cases frost protection must be equivalent to 1.5m of cover. Services with less than 1.0m of cover are not permitted.
- Service laterals shall not be connected to a storm main.
- Sanitary services shall have a minimum of one clean-out located between the building line and the property line. Location(s) of clean-outs shall be only as approved by the Township. Clean-outs shall be capped with water-tight caps. The Township may direct that an inspection MH be placed at the property line of a site development.
- Unconnected sanitary and other drain services shall be brought to the property line, properly capped and clearly marked such that an installer will not cross connect services. Caps must withstand air testing of sewers including services to the lot line. Capped services shall be appropriately marked with a “2X4” extending from the pipe invert to at least 1.0 meter above finished grade level.

The developer shall be responsible for the completion and submission of CLI-ECA application to Township where applicable, and ECA application to MECP where CLI-ECA does not apply.

Appendix 1I: Design Standards – Watermain

1.0 GENERAL

a) Water model to be sent to J.L. Richards to be run with Township's model. The developer shall be responsible for the fee for J.L. Richards' services.

b) Water and sewer mains will normally be aligned in accordance with the approved drawing. Where the alignment is forced to deviate from those locations it shall maintain the horizontal separation as detailed below. All measurements between structures are the minimum permitted and measured near edge of water or sewer main trench to near edge of structure.

- Joint Utility Trench shall be 2.5m from water or sewer mains.
- Water Mains – 2.5m from sewer mains, 2.0m from all other buried utilities, 1.5m from curb edge, and 1.0m from sidewalk as measured from the trench edges.
- Sanitary and Storm Sewers – straddle road allowance centreline separated by 1.0m and 2.0m respectively from other buried utilities.
- Catch Basins – 1.0m from any main, or service and if necessary insulated to provide the equivalent of 2.0m of earth cover frost protection to water mains and services.
- Curb Stops – at or near property line (property owner side) or at the edge furthest from the road allowance where a utility easement abuts and runs parallel to the road allowance.
- Fire Hydrants – 1.0m from gas lines and joint utility trenches, 0.5m from sidewalks, 2.5m from curb edge and 0.9 meters from the limit of the public right of way. The fire hydrant obstruction free zone shall satisfy local bylaws.

c) Separation between water and sewer mains shall conform to Ministry of the Environment and Climate Change (MOECC) guidelines. Where due to construction in rock or Type 4 Soils it is proposed to use methods other than horizontal separation to protect the water main, all design of such works must be approved by the municipality prior to submitting an application for MOECC approval.

d) Water and sewer services and foundation drains may be laid in the same trench subject to the provisions of Ontario Building Code. In such cases the horizontal separation between each service shall be a minimum 0.5m plus the difference in depth between the services. All other utility services shall be separated 2.5m from water and sewer services measured from edge of structure. Sanitary and foundation/storm service drains that are terminated to facilitate future construction shall be capped and clearly marked at the property line with a wooden 2X4 projecting above ground a minimum of 1.0 meters.

e) All buried water and sewer mains and services shall have an appropriate warning tape laid on top of the cover material or no closer than 300mm of the top edge of the structure. The municipality shall approve such tape.

f) All water mains and sanitary sewer mains shall be designed and installed in accordance with accepted good engineering practices and with MOECC guidelines for water

distribution and sanitary sewage collection. They shall be constructed in accordance with applicable OPSS and Ontario Provincial Standard Drawings (OPSD) and the Municipalities Standard Contract Specifications, whichever is the most stringent.

g) Clearance between pipe or conduit crossings shall normally be a minimum of 300mm between the outside pipe barrels. Where a clearance of 300mm or less cannot be avoided, there shall be concrete encasement or non-shrink backfill of the crossing extending one meter in each direction on each pipe.

2.0 Mains

Watermains shall conform to the following:

a) Plastic Pipe and Fittings (preferred)
    i. Plastic pipe shall conform to;
        a. AWWA C900-Poly (Vinyl Chloride) (PVC) Specification, SDR 18, Pressure Class (PC) of 235 or
    ii. The pipe shall be homogeneous throughout, free from voids, cracks, inclusions, discolouration, and other defects.
    iii. All pipe and fittings shall be certified by CSA to meet CSA B137.3
    iv. Fittings shall be:
        a. Ductile iron according to AWWA C153/A21.53 or
        b. Injection moulded PVC plastic according to CSA B137.2 or
        c. Prefabricated PVC plastic for pipe diameters 300mm and larger according to CSA B137.3
    v. The colour for all PVC pipe and PVC fittings shall be blue

b) Concrete Pressure Pipe and Fittings
    i. Concrete Pressure Pipe shall only be allowed if so stated on the approved subdivision drawings.
    ii. Concrete pressure pipe shall be laid according to the specifications outlined in the A.W.W.A. M9 Concrete Pipe Installation Manual. The internal joint gap shall be checked to ensure the proper seating of the gasket. The interior joint gap shall then be pointed with cement mortar using a hand trowel. The joint exterior shall be protected with a diaper filled with grout installed to the manufacturer's instructions.

c) Mechanical joints required for valves 400mm and over, shall be a mechanical joint conforming to AWWA C111/A21.11-85.

d) The interior of all pipe, fittings and other accessories shall be kept clean and free from foreign material at all times.

e) All watermain material shall comply with OPSS 441.07.07. Cut pipes of length 1.5m or less, fittings and valves do not require end caps, but shall be field cleaned prior to installation. Pipes delivered on-site with damaged or missing caps shall be field cleaned by swabbing with a 1% chlorine solution to remove all undesirable material along the entire length of the interior of the pipe prior to installation.

3.0 Valves

3.1 General

Valves shall be as follows:

a) Three valves shall be placed on a tee intersection and four valves on a cross intersection. On straight runs isolation valve spacing shall be not more than 150m or such that 40 family dwellings units or equivalent can be isolated.

b) Valve boxes shall be adjusted to finish grade.

c) Main valves are to be located in line with the intersecting street lines, at all intersections.

d) Valves shall be turned clockwise to close.

3.2 Valve Material

a) Valve boxes shall be of cast iron as manufactured by Bibby Ste Croix or Star Pipe Products, 112mm and shall be of sliding type, complete with grommeted hole for tracer wire, which cannot carry any surface load down to the pipe. The covers shall be of a design which prevents unauthorized entry and marked “Water”, length to be 140mm to 240mm as manufactured by Bibby Ste Croix and Star Pipe Products. Special attention shall be paid to compaction adjacent to valve boxes.

b) Gate Valves for pipe shall be Clow or equal, cast iron body, resilient seated mechanical joint pattern conforming to ANSI/AWWA C509, designed for a working pressure of not less than 150 PSI. Valves shall open when turned in a counterclockwise direction, shall be fitted with a compound operating nut. All valves shall be manufacturer approved for direct bury applications.

The operation of all valves, curb stops and hydrants shall be restricted to employees of the Township of Stirling-Rawdon.

4.0 Fire Hydrants

Hydrants shall be installed as per OPSD and shall also conform to the following.

a) Hydrants shall be located such that the maximum road travel distance from hydrant to the center frontage of a lot shall not exceed 75m. Any deviation beyond the maximum allowable spacing shall require the approval of the Township’s Fire Chief.

b) Fire hydrants shall be AWWA C502-85 with mechanical joint. Hydrants shall be Canada Valve Century.

i.	Size	150-mm iron pipe connection
ii.	Depth of Trench	2.0 metres
iii.	Type of Boot	Mechanical Joint
iv.	Number of Connections	2 - 63mm hose connections
v.	Direction of Opening	Counter Clockwise
vi.	Port Threads	Connections to conform to ULC S513
vii.	Colour	Chrome Yellow

c) All hydrants shall have a breakaway flange, and a C.I. stem guide coupling at the ground line of the hydrant. Drain plugs shall be removed.

d) A 150mm valve and valve box shall be installed on each hydrant run.

e) Hydrants shall have a 1m x 1m x 150mm shock collar cast in Portland Cement Concrete (PCC), the top of which shall be 150mm below the flange.

f) Hydrants shall be set where and as directed by the Engineer. The base of each hydrant shall be packed around with at least one cubic yard of washed coarse gravel or crushed stone. A barrier approved by the Engineer shall separate the stone from other cover or backfill. Hydrants shall be installed absolutely vertical and kept vertical during backfilling operations. The hydrants shall be installed with the ground line of the hydrant at the level of the curb or the finished grade elevation on the road shoulders, whichever is the highest.

g) All hydrants shall be placed in an obstruction free zone such that neither their view nor their accessibility is obstructed. No object shall be permitted within a triangle bounded by a point commencing 1.0 meter behind the hydrant and extending at a 45º angle to the curb or roads edge. In addition, no object wider in any direction than 250mm is permitted within an area bounded by a triangle within an apex 1m behind the hydrant and sides intersecting the road edge or curb at a 10º angle. The Fire Chief shall have the final authority on the location of structures or other items which might interfere with the view or the accessibility of hydrants.

h) All hydrants shall be self-draining. Washed gravel of suitable size and quantity shall be placed around the drain holes to ensure drainage. Such material shall be topped with suitable geotextile to ensure fines do not migrate into the drainage rock.

i) Hydrants set in ditches or swales shall conform to OSPD 217.050.

j) Fire hydrants which are not in service shall be covered completely with an “out of service” bag. This covering will remain in place until the hydrant has been commissioned by Township of Stirling-Rawdon staff.

k) Prior to the issuance of the Preliminary Certificate of Approval of the Underground Services each hydrant shall be flow rated by Township personnel in accordance with *Installation, Field Testing, and Maintenance of Fire Hydrants* AWWA M17. Upon meeting the applicable standard, the flow ratings, will be forwarded to the owner’s engineer prior to issuance of the Preliminary Certificate of Approval of the Underground Services. The owner’s application for the Certificate shall have appended to it the hydrant ratings as per NFPA.

l) All hydrants to be painted Chrome Yellow, and the bonnet and nozzle caps painted as per NFPA 291.

5.0 Service Connections

5.1 General

Service connections shall be as follows:

a) Services shall be sized in accordance with The National Plumbing Code of Canada. The minimum shall be 19mm.

b) Service connections shall have a corporation main stop and be “goose-necked” near the

water main as per the appropriate OPSD. Main stops may be set at the spring line and the gooseneck may be horizontal.

c) A draining curb stop (unless otherwise specified by the municipality) and associated valve box to finish grade shall be provided on the service connection to each premises and be located on, or near the property line (property owner side). All such service connections shall be in accordance with relevant OPSD. A stainless steel extension rod shall be used. A pre-cast concrete pad of 150x150x30 shall be set under the curb stop.

d) New curb stop installations shall not be located in driveways or sidewalks unless approved by the municipality.

e) Separate services shall be provided to each building and each unit of a semi-detached or row house residential building.

f) Water services shall be “Type K” copper or polyethylene PC 160. The same material shall be used throughout the development. Non-conductive materials will require the use of tracer wire.

g) Services of 50mm or less shall have no joints between the main stop and the curb stop and no joints between the curb stop and the building interior.

h) Service connections to PVC mains shall be by stainless steel saddle or by factory supplied PVC service tees.

i) Water services shall not be used as an electrical ground.

5.2 Materials

a) Service Pipe shall be soft copper tube – Type K, meeting NSF 61

b) Service connections shall utilize AWWA thread and shall be;

   i. On PVC main either with;

      a. A manufactured molded fitting conforming to AWWA C907 and CSA B137.2, tapped coupling or

      b. A single band, double stud, type 304 stainless steel service saddle complete with stainless steel nuts and neoprene gasket.

   ii. On Ductile Iron main with;

      a. A Ductile Iron body, plated steel straps and nuts, services saddle complete with neoprene gasket, a single strap for services 25mm, a double strap for 38 and 50mm services.

      b. A single band, double stud, type 304 stainless steel service saddle complete with stainless steel nuts and neoprene gasket.

   Acceptable saddle manufacturers are Mueller Canada, Ford Meter, Smith/Blair or Robar.

c) All brass fittings shall be manufactured from Low Lead Alloy C89520 or C89833.

   i. Corporation main stops shall be copper compression joint type with AWWA thread as manufactured by Mueller Canada, Ford Meter, Cambridge Brass.

   ii. Couplings and adapters shall be compression fittings or compression X Male or

Female iron pipe as manufactured by Mueller, Ford Meter, Cambridge Brass.

iii. Curb valves (stops) shall be copper compression joints type with AWWA thread and shall be stop only (not stop and drain) as manufactured by Mueller Canada, Ford Meter, Cambridge Brass. For 38mm and 50mm services the curb valve shall be a Mueller Mark II Oriseal or approved equal.

d) Water service boxes shall be;

i. For < 38mm diameter service - Mueller Cat. No. A-726 or equal complete with cast iron lid (including centre brass nut), 900mm stainless steel rod and stainless steel cotter pins.

ii. For 38mm & 50mm diameter services– Mueller Cat. No. A-753 or equal complete with cast iron lid (including centre brass nut), 1200mm stainless steel rod and stainless steel cotter pins.

6.0 Tracer Wire and Marking of Mains and Services

a) All non-metallic water mains and services shall have a #12 solid tracer wire. Tracer wire shall be laid flat and affixed to the main at intervals not to exceed three (3) metres.

b) The main line tracer wire shall not be cut at connections to services or other points, and must be kept as continuous as possible. Connections to the main line shall be made by baring the insulation without severing the conductor. Any buried splices or connections on tracer wire shall be limited to the minimum possible. If buried splices or connections are required then they shall utilize a manufactured waterproof splicing device specifically designed for direct bury, and sized appropriately for the number of conductors. Approved splicing devices shall be;

i. 3M Splice Kit DBR or DBY, or

ii. DryConn Waterproof Direct Bury Lug by King Innovation, or

iii. Other approved equal.

c) Tracer wire shall be looped around all main valve boxes and curb stops and looped back to the main.

d) The tracer wire loop shall extend up the barrel of a fire hydrant terminating in a Locate Station (see section 7.0 Locate Stations) immediately above the flange.

e) All mains and services shall be marked with a 50mm wide detectable metallic tape blue in colour with the wording “Buried Water Line Below”. The tape shall be SETON PRODUCT #48302 or equivalent. The tape shall be laid 300 to 450mm above the main or service.

7.0 Locate Stations

a) All tracer wire terminated above grade shall do so with a locate station.

b) Locate stations shall be “Finklet” two terminal, blue in colour as manufactured by Cott manufacturing Model # 775-B2AC or equivalent. Each station shall include 1.5m of 18mm PE conduit, also blue in colour), open on the bottom and connected at the top to the “Finklet”.

c) For continuous PEX PE water services that require a “Finklet” Test Station, the tracer

wire shall extend up through the PE conduit, barred and terminated onto one of the terminal posts on the back of the face plate. A 5.5 kg zinc anode shall be connected to the second terminal post. A removable, solid nickel plated copper bonding strap, complete with two slotted holes, one open ended, shall be attached across the two connection points on the front of the Locate Station face plate complete with stainless steel nuts to secure it in place.

d) For fire hydrants, the tracer wire shall be looped up the conduit and each end of the looped wire terminated onto the terminal posts on the back of the face plate. A removable, solid nickel plated copper bonding strap, complete with two slotted holes, one open ended, shall be attached across the two connection points on the front of the Locate Station face plate complete with stainless steel nuts to secure it in place.

e) A locate station adjacent to a building foundation shall be held securely in place during backfill to insure that it remains plumb, with the bottom of the end fitting approximately 200mm above final grade, the back of the box square and tight to the wall and the cover plate easily accessible and facing front.

f) A locate station connected to a hydrant barrel shall be secured such that the bottom of the "Finklet" fitting is located approximately 25mm above the flange with cover plate easily accessible and facing front.

8.0 Cathodic Protection

a) Tracer wire on mains shall be protected with a 2.3 kg zinc anode, at each end a maximum spacing of which shall be 500 m.

b) Metallic services of 25mm or smaller and less than 20m in length shall be protected with a 2.3kg zinc anode.

c) Other metallic services of 50mm or smaller shall be protected with a 5.5kg zinc anode.

9.0 Pipe and Joint Restraint

Only mechanical joint restraint shall be used.

The number of joints requiring mechanical thrust restraint shall be set by the Engineer.

a) Eye Bolts and Rods

   i. Eye bolts shall be ANSI/ASME B1.1 19mm (¾ inch). Rods shall be ANSI/ASME B1.1 19mm (¾ inch) Grade 316 stainless steel. The number of rods required will be as set out below:

Number of 19 mm Rods for Eye Bolt Restraint				
Pipe Size	**Dead End, Tee, & Dead End Valve**	**Fitting 90^0 Elbow**	**Fitting 45^0 Elbow**	**Fitting 22.5^0 Elbow**
150 mm	2	2	2	2
200 mm	2	2	2	2
250 mm	3	3	2	2

300 mm	4	4	2	2
400 mm	Not permitted	Not permitted	3	2

b) Ductile Iron Pipe Restraint

i. Mechanical restraint for standardized mechanical joints shall be incorporated in the design of the follower gland and shall impart wedging action against the pipe, increasing its resistance as the pressure increases. The assembled joint shall maintain its flexibility after burial and shall maintain its integrity by controlled and limited expansion of each joint during the wedging action. Restraining glands shall be manufactured of ductile-iron conforming to the requirements of ASTM A 536, Grade 65-45-12. Wedging mechanisms shall be manufactured of Ductile-iron to hardness of 370 BHN minimum. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee head bolts conforming to the requirements of ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53 of latest version. Twist off nuts shall be incorporated in the design of the wedge activation screws to insure proper torque during installation.

ii. The mechanical joint restraining device shall have a working pressure of 1750 kPa with a safety factor of 2.1 against separation when tested in the dead-end situation.

iii. The Mechanical joint restraining device shall be Uni-Flange series 1400 or approved equal.

c) PVC Pipe Restraint

i. Mechanical joint restraint devices for PVC Pipe shall incorporate a series of machined serrations (cast serrations are not permitted) on the inside diameter to provide restraint, exact fit, and 360 degree contact and support of pipe wall. Restraint devices shall be manufactured of high strength ductile iron, ASTM A 536, Grade 65-45-12. Bolts and connecting hardware shall be of high strength low alloy material in accordance with ANSI/AWWA C111/A21.11.

ii. All joint restraint devices for PVC shall carry a water working pressure rating equivalent to the full rated pressure of the PVC pipe on which they will be installed, with a minimum factor of safety of 2:1 in any nominal pipe size. In addition, they shall meet or exceed the requirements of Uni-B-13-94, Recommended Performance Specification For Joint Restraint Devices For Use with Polyvinyl Chloride (PVC) Pipe.

iii. Restraint Devices shall be Uni-Flange Series 1300, 1350, 1360, 1390 or approved equal.

iv. Series 1300 – For restraint of PVC pipe with DI mechanical joint or DI Push-on fittings with “ear plugs”.

v. Series 1350 – For restraint of PVC pipe bell in spigot joints. (new installations)

vi. Series 1360 – For restraint of PVC pipe in PVC pressure fittings joint (AWWA C907 PVC Fittings or “fabricated PVC pressure fittings)

vii. Series 1390 - For restraint of PVC pipe bell and spigot joints. (new or existing

installations)7.5. Joints so restrained must have a clear and permanent visual indication on the outside of the Bell indicating that the joint is restrained.

10.0 Flushing/Swabbing and Disinfection of Watermains

a) All watermains shall be wet swabbed as follows;

   i. A minimum of 3 (Three) new foam swabs with a density of approximately 25 kg/m3 and a minimum diameter of 50mm larger than the watermain shall be used.

   ii. Swabs shall have a minimum length of 1.5 times the diameter

   iii. Swabs shall be propelled through the watermain using potable water and shall be spaced a minimum of 1.5m meter between swabs.

   iv. During the swabbing procedure the contractor is to install spool pieces in place of all butterfly valves. These shall be supplied, installed and removed by the contractor.

   v. Gate valves must be left in the open position

   vi. Swabbing shall continue until the discharge water runs clear within 10 seconds of the last swab exiting the discharge point.

   vii. All fitting, taps, valves etc. required for the introduction, propelling and recovery of the swabs, as well as the swabs are to be supplied by the contractor. The removal of all of the above at the completion of the swabbing works is the responsibility of the contractor.

b) All water discharged by the flushing/swabbing operations shall be at an approved outlet location. The contractor shall be responsible for collecting and/or disposing of all such water, ensuring that all erosion and sediment control and de- chlorination requirements of the MECP, Lower Trent Conservation and various other authorities having jurisdiction are met.

c) After flushing/swabbing is completed, water from the existing distribution system shall be allowed to flow at a controlled rate into the new pipeline. Liquid chlorine solution shall be introduced so that the chlorine is distributed throughout the section being disinfected. The chlorine shall be applied so that the chlorine concentration is 50 mg/L minimum and 200 mg/L maximum throughout the section. The system shall be left charged with the chlorine solution for 24 hours.

d) Sampling and testing for chlorine residual will be carried out by the Engineer's Inspector. The chlorine residual will be tested in the section after 24 hours. If tests indicate a chlorine residual of 25 mg/L minimum, the section shall be flushed completely and recharged with water normal to the operation of the system. If the test does not meet the requirements, the chlorination procedure shall be repeated until satisfactory results are obtained.

e) Immediately after the system has been recharged and then additionally twenty- four (24) hours following, samples shall be taken for micro bacteriological testing. Two consecutive acceptable samples taken a minimum of twenty-four (24) hours apart must be obtained. The system shall not be put into operation until clearance has been given by the Township of Stirling-Rawdon.

f) A Professional Engineer shall certify that testing and the disinfecting of mains was undertaken as per OPSS. All newly constructed watermains shall be isolated from the existing distribution system by physical separation or through the use of an appropriate backflow prevention device approved by the Township of Stirling Rawdon. This isolation shall remain in place until approval is granted for permanent interconnection.

g) Watermain commissioning shall be performed and recorded as per the Township's Watermain Commissioning Package in Appendix 1P.

11.0 Design Considerations

a) Design flows shall be as follows:

- Average day per capita – 350L per person / day.
- Maximum day 2.75 times the average day.
- Peak Hour Rate factor shall be 4.25 unless approved otherwise by the Township.
- Sizing shall be based on needed fire flow plus maximum day flow or peak hour flow alone, whichever is largest.

b) Design fire flows shall be in accordance with Water Supply for Public Fire Protection, A Guide to Recommended Practices 1977, by Insurance Bureau of Canada.

c) The maximum and minimum pressure under normal operating conditions shall be 700 kPa and 280 kPa respectively. The minimum system pressure under fire flow conditions shall not be less than 140 kPa.

d) The following Hazen-Williams "C" value shall be used for design:

Diameter (mm)	C
50-300	120
Over 300	130

e) The minimum pipe size for water mains shall be 200mm with exception that dead-end mains on cul-de-sacs of 20 or less dwelling units may be 150mm.

f) All mains shall be looped except those servicing cul-de-sacs with not more than 40 dwelling units.

g) A suitable means for flushing such as a hydrant or a blow off shall be provided on mains larger than 50mm. Such flushing devices shall not be connected to any sewer. Devices other than hydrants shall be approved on a case-by-case basis.

h) A Kupferle 88 Sampling station with pedestal (or approved equal) shall be placed at the phase limits of each new subdivision or as specified by the Township. Each sampling station shall fitted with one ¾ " NPT x 1" copper compression, brass fitting (or 45° bend as required).

i) Water mains shall be evenly graded and hydrants or air release valves shall be placed at high points.

j) The minimum depth of cover measured from the top of a main or a service connection gooseneck shall not be less than 1.8m.

k) Pipe bedding and cover shall conform to those requirements as set forth in OPSD 802 series for sewer mains. Bedding and cover shall be Granular “A”.

l) Water mains and water services shall not be used as an electrical ground in new buildings.

Appendix 1J: Design Standards – Street Lighting

1.0 GENERAL

Street lighting design in the Township of Stirling-Rawdon shall be generally based on ANSI/IESNA RP-8-00.

Street lighting design must provide uniform lighting at a level that is adequate and comfortable for vehicular and pedestrian movement on the Township's roads and sidewalks. All street lighting systems shall be designed by a qualified lighting designer using the illuminance method as described in RP-8-00 (unless noted otherwise), as well as incorporating the Township's standards and specifications. Street lighting design in the Township must meet all of the approved luminaires of a given type in order to allow interchangeability of luminaires during maintenance operations.

It is the responsibility of the street lighting designer to ensure they have the latest revisions of these street lighting standards and specifications prior to designing the street lighting system.

All street lighting design and construction is subject to Electrical Safety Authority (ESA) inspection and approval.

Only with the approval of the Township may any variance to the specifications or requirements included in these guidelines be permitted.

2.0 DESIGN REQUIREMENTS

The street lighting design shall be completed by a qualified lighting consultant, (e.g. P.Eng.), utilizing these design standards and guidelines. The design and supporting documentation shall be included in the design submission for subdivision approval. Submission requirements include:

- luminaire type and wattage;
- manufacturer name(s); specification sheets, catalogue numbers and supplier contacts for proposed equipment;
- photometric files used in calculations;
- light loss factor utilized;
- copy of design calculations and computer printout using one of the three (3) computer programs:
    a) Lithonia's Visual;
    b) Canlyte's Genesys;
    c) AGI32; or
    d) alternate program approved by the Township;
- pole types and heights;
- drawings indicating existing streetlight poles as well as new pole locations, as illustrated within the composite utility plan;
- proposed power supplies, circuiting, estimated demand load, conductor and duct sizes,

ground rod locations, and voltage drop calculations.

3.0 MATERIAL SPECIFICATIONS

All street lighting equipment must meet these street lighting standards and specifications and the appropriate CSA standards and specifications.

3.1 Street Light Poles

Standard Round Concrete Street Light Poles

Concrete street light pole shall be a direct buried Class B pre-stressed round concrete pole with provision for electrical ground, natural concrete finish and suitable for use with a 1.8m or 2.4m tapered aluminum bracket.

- 9.1 metre (25.0 ft.) Class B Centrifugally Cast Round Concrete Pole
- 9.9 metre (32.5 ft.) Class B Centrifugally Cast Round Concrete Pole

Base Mounted Octagonal Heavy Duty Steel Poles:

- 9.1 metre (25.0 ft.)
- 9.9 metre (32.5 ft.)
- 10.7 metre (35.0 ft.)

3.2 Luminaires

Cobra Head Luminaires

The following cobra head luminaires have been approved for use:

- 100W HPS Equivalent - 53W LED comes with a twist lock photo control receptacle and electronic photo control. Cree XSP Series PN: XSPA02GA-U R
- 150W HPS Equivalent - 65W LED (101W with dimmer set to position E) comes with a twist lock photo control receptacle and electronic photo control. Cree XSP Series PN: XSPA02HXE-U RQ
- 250W HPS Equivalent - 101W LED comes with a twist lock photo control receptacle and electronic photo control. Cree XSP Series PN: XSPA02HA-U R

3.3 Support Arms

Cobra Luminaire Support Arms

Tapered Elliptical Aluminum Brackets Standard street light brackets for use with "cobra- head" luminaires must be manufactured in accordance with "ANSI C136.1", latest revision.

The brackets shall be a 1.8 m (6 ft.) or 2.4 m (8 ft.) tapered elliptical aluminum bracket.

3.4 Load Centres

To meet ESA requirements, the Township requires a disconnect for any street lighting system. The disconnect is provided by means of a service entrance rated load centre (pedestal type for underground systems, and pole-mounted unit for overhead systems) with weather proof enclosure.

Pedestal (typically used in subdivisions)

- Pedestal supplied by Composite Power Group PN: 2SL702VE or approved equivalent

Type 1 Disconnect

Type 1 Disconnect is typically used at traffic intersections where the disconnect feeds the traffic signals and street lighting circuits. The street lighting circuits are contactor controlled with blockers installed in the connected luminaires. Type 1 Disconnects are also to be used on Collector and Arterial streets where the supply is only feeding street lighting. The Type 1 disconnect will meet all specifications of OPSD 2440.010.

Pole Mounted Disconnect

In some installations a simple disconnect can be used to feed a single circuit or double circuit using the following products installed to meet ESA requirements:

a) Square D Panel Q02L70RB NEMA E3R (Service Entrance) with:

- 70A Double Pole Breaker

b) Square D Panel Q02L70RB NEMA E3R (Distribution) with:

- 1 x 40 A Breaker and 1 x 30 A Breaker OR
- 2 x 30 A Breakers

3.5 Street Light Cable Conduit

Conduit will be rigid PVC raceway conforming to CSA C22.2 No. 211.2-06 suitable for direct burial, concrete encasement or surface mounting (above ground). No DB2 or Flex conduit will be accepted. All ducts must meet CSA specifications and are subject to ESA inspection and approval.

3.6 Street Light Wiring From Handhole To Luminaire

Street light wiring from the handhole to the luminaire shall be 2 -#12 copper NMWU with ground, CSA approved and will include a fuse holder and fuse. Fuses shall be 600 Volt rated, amperage to suit lamp size complete with insulated boot fuse holder with breakaway feature. Fuses to be Ferraz Shawmut type ATM while holder to be Ferraz Shawmut type FEB BA, or Amerace 65 fused connector kits.

3.7 Street Light Distribution Cable From Load Centre To Pole

Wiring shall be sized to suit load and voltage drop. Maximum voltage drop at the end of the circuit shall not exceed 5% of the supply voltage. As a minimum, the street light cable from load centre to luminaire and from luminaire to luminaire shall consist of 3 - #8 copper RWU triplexed 1000 volt conductors (black/white/green), CSA approved.

3.8 Street Light Distribution Cable From Transformer To Load Centre

The street light supply cable feed from transformer to the street light load centre shall be 3 - 1/0 aluminum secondary cable unless otherwise directed. The contractor shall obtain approval for the type of secondary cable before installation. Note that the 60 amp main breaker in the street light load centre accepts cable sizes from #12 to 2/0 al/cu.

3.9 Connections

All connections shall be made with CSA approved copper split bolts and taped with mastic sealing tape and black vinyl electrical tape or copper SX-4,6 compression connector taped with mastic sealing and black vinyl electrical tape .

3.10 Grounding Rods And Plates

Ground rods shall be solid steel, 19 mm diameter, 3 m long, copper clad for the full length and shall be according to CSA C22.2 No 41.

Ground plates shall present not less than 0.2 m of surface to exterior soil and be not less than 6 mm thick as per the Electrical Code. The plates shall be made of hot dip galvanized solid steel. Steel shall be according to CAN/CSA G40.20/G40.21, Grade 230G and shall be galvanized according to CAN/CSA G164.

3.11 Underground Servicing

All new street lighting shall be serviced with underground wiring placed in conduit between poles. Conduit shall be sized to suit wire sizes, with a minimum of 50 mm diameter. Road crossings shall be in conduit to Municipal standards. Underground wiring shall be a minimum #8 RWU for load and neutral conductors and #6 or #8 for ground conductors.

3.12 Frangible Bases

Frangible bases are only to be used on roads posted at 80km/h or greater or when directed by the Ministry of Transportation.

3.13 Alternating Circuits

Alternating circuits must be maintained from pole to pole to ensure 50% illumination upon loss of one circuit feeder for all arterial and collector areas of commercial and intermediate roadways.

4.0 INSTALLATION SPECIFICATIONS

4.1 General

Street lights shall be located on the boulevard in accordance with the Township's standard cross sections and as shown on the trenching plans and typical road sections while maintaining proper clearances from fire hydrants, driveways, transformers, switching units and trees or any other services. The street lighting power supply is to be supplied to each streetlight load centre in accordance with the Supply Authority distribution specifications.

The entire street light installation is subject to inspection and approval by the ESA. The contractor is responsible for applying for and obtaining ESA inspection.

4.2 Cable

The cable shall be installed in 50 mm (2") direct buried duct. As per the Electrical Code, a 6" wide red plastic warning tape is to be installed with black lettering stating "ELECTRIC LINE BURIED BELOW". This warning tape is required to be installed midway between the topmost conductor and final grade above all conductors within the trench.

Cables are to be inserted into the poles via the cable access ports and the ground wire shall be #6 connected to the internal ground lug at the hand hole by means of a 6 AWG compression

connector lug. All connections to ground and to the luminaire conductors are to be made at the hand hole and taped or otherwise insulated after installation.

4.3 Street Light Cable Conduit

In general, the street light duct shall be placed in the common trench on the same level as the secondary and/or communication cables, and on the road side of the trench, with a minimum of 600 mm cover.

When street light ducts are placed under driveways, the top 300 mm of the backfill shall be compacted to 100% Standard Proctor Density with granular “A”.

When street light ducts are placed under roadways or adjacent to roadways, ducts shall be placed with a minimum of 750mm cover.

A ¼” polypropylene fish rope is to be pulled into each duct.

4.4 Poles

Installation of street light poles is to be in accordance the manufacturer's requirements.

In general, poles are to be installed in augured or vactored (high pressure water evacuation method) holes; the bottom of the hole must be cleaned of loose material before placing the pole.

The Contractor shall take care to ensure that no damage occurs to the electrical or street lighting system or other utilities during the installation of street light poles.

4.5 Grounding

Two ground rods must be installed adjacent to the street light pedestal, at least 0.3 m below final grade and connected to the bonded neutral block of the service entrance and must be spaced no less than 3 m apart in accordance with the Electrical Code requirements.

Alternatively, a ground plate must be installed adjacent to the street light pedestal at least 0.6 m below final grade level and connected to the bonded neutral block of the service entrance.

Ground rods/plates to be provided at the end of each circuit feeder and every fifth pole in between.

5.0 Energization Process

The developer/contractor shall provide the following documentation to the Township of Stirling-Rawdon when they wish to have their street lights energized:

- Letter requesting energization;
- As-built drawings clearly showing street light wiring;
- As-built one-line-diagram;
- List of lights to be energized along with location, ESA certificate #, Transformer # and Wattage of light information;
- Up-to-date ESA certificates of inspection. ESA certificates are valid for 6 months. Any request to energize with out of date ESA certificates will not be accepted;

When the Township of Stirling-Rawdon has received and accepted all required documents and materials, the Township will perform an inspection of the installation. If required, a deficiency list will be provided back to the developer/contractor indicating the deficiencies. When the

installation passes the inspection, the Township will send a request to energize the lights to the Supply Authority.

Appendix 1K: Design Standards – Trees

1.0 GENERAL

Trees are required to be planted in conjunction with subdivisions by the developers according to approved plans reviewed by the Township of Stirling-Rawdon. The intent of the review is to provide for a diverse and healthy urban forest that is easy to maintain which will add to the quality of life in the Township.

One (1) tree per lot, rural and urban, shall be planted on private property, in the rear yard of the lot.

The developer shall submit a Street Tree Planting Plan prepared by a Landscape Architect to the satisfaction of the Township as part of the first engineering submission. The plan shall list in a table format, the selected species by common and cultivar name, size, planting state and include in the notes all required specifications as per the below including any additional ones that are specific to the site.

2.0 TREE AND PLANTING SPECIFICATIONS

1. Trees to be planted in accordance with the Township of Stirling-Rawdon Bylaw 1265-19 and the subdivision agreement. Trees shall be species on the Township's list of approved trees.
2. The location of trees shall include minimum separation as follows and is subject to on-site relocation as impacted by service locates.

Street lights	3.0 m
Sidewalks	0.5 m
Curbs	1.5 m to back of curb
Driveways	1.25 m
Other trees	8.0 m
Electric transformers	3.0 m from the access hatch side
Hydrants	1.5 m
Water/sewer lines	2.0 m
Hydro lines	1.0 m from line or as required by Hydro One

3. Appearance – All trees furnished shall be well branched according to species and well rooted with a uniform straight trunk. No double leaders will be accepted.
4. Caliper – The minimum caliper tree shall be 60mm as measured 150mm above the root ball.
5. Pruning – All trees shall show evidence of pruning and shall be free of mechanical injuries, disfiguration, sunscale, frost cracks, broken bark, broken and dead branches, or any other objectionable features.
6. Topsoil – Topsoil shall consist of loose friable loam, free of subsoil refuse or other deleterious material, and shall not contain less than 5% nor more than 20% organic

matter.

7. Tree Wound dressing – Paint for wounds or cuts shall be approved tree wound dressing compound, containing no ingredient harmful to the plant cambrium. Cuts or wounds measuring 25mm in diameter and greater, and all exposed wood or scars resulting from previous work or damage shall be painted with any approved tree wound dressing.
8. Anchoring Stakes – Stakes for anchoring tree guy wires shall be spruce, 50mm x 750 mm, pointed at one end and notched at the other to securely hold the guy wires.
9. Wrapper material – Wrapping material for trees shall be approved kraft, waterproof paper, type 30-30-30 in 100mm strips, pre-approved burlap in 150mm strips.
10. Wire – Wire used for bracing the tree shall be Number 12 galvanized steel wire. All wire shall be new and free from bends or kinks.
11. Hose – Hose to be used with the wire bracing shall be 17mm diameter (5/8 inch) rubber or plastic garden hose.
12. Tree Stakes – All trees are to be staked according to detail with 2 steel “t” bars not less than 2m long hammered into the ground free of the disturbed soil.
13. Root Pruning – Ensure that the ends of all broken or damaged roots of 6mm diameter or larger are pruned with a clean cut.
14. Pruning – Dead wood and broken or dead branches of 25mm in diameter and greater shall be removed.
15. Planting Balled and Burlapped Stock – All trees and evergreens shall be balled and burlapped (B & B) complete with wire basket and shall be dug in a manner that they may be lifted with the necessary roots in an earth ball. Tree balls shall be wrapped and burlapped using 5 oz burlap and shall be drum laced. Tree ball size shall be approximately 80cm in diameter.
16. Tree Holes – Tree holes shall be dug to a diameter greater in width and depth than the root ball. Surplus excavated material shall be removed from the site.

Appendix 1L: *Traffic*

1.0 TRAFFIC IMPACT STUDY GUIDELINES

The Township of Stirling-Rawdon/Hastings County may require a Traffic Impact Study (TIS) for any development regardless of its size and land use. All proposed developments are considered on an individual basis to assess the need for a TIS. A TIS may be required for any proposed development that is expected to generate a total of 100 vehicle trips or more (inbound and outbound), during the morning or afternoon peak period.

The TIS must be signed and sealed by a licensed professional engineer.

The TIS must identify the impacts of the proposed development for five horizon years after completion.

All numerical data (including raw traffic count data), results and findings must be tabulated in a report.

A functional sketch of the proposed road system modifications must be included (Scale 1:250) along with cost estimates for any required off-site improvements.

The design of all off-site modifications i.e., a left-turn bay, must adhere to the minimum standards outlined by the Transportation Association of Canada (TAC). Exceptions to the TAC standard will only be considered where there are serious design constraints. The Township retains the right to require left-turn bays for safety related reasons.

A minimum of (3) three copies of the Transportation Impact Study should be submitted for circulation and review.

Intersection analyses must be completed with Synchro software.

If a TIS is not needed for a particular development, the Township may still require the Owner to be responsible for any off-site modifications deemed necessary.

The Township requires that all Transportation Impact Studies adhere to the methodology outlined as follows:

- Project & Transportation System
    - Describe the project, study area and existing conditions
    - Describe existing and proposed land uses for the subject site
    - Identify and describe the study area
    - Identify anticipated adjacent developments
    - Describe the study area transportation system
    - Identify proposed roadway improvements in the area
    - Identify transit routes

  - Identify bicycle and pedestrian facilities

- Background Traffic
  - Assemble existing hourly background traffic volumes for the weekday AM and PM peak periods and identify the design hours for analysis. If the proposed development would generate high volumes of traffic on weekends, a peak weekend design hour must be included as well.
  - Estimate future hourly background traffic volumes on the study area road system for the selected design hours. The current growth rate being used for the Township of Stirling-Rawdon is 1.0% non- compounded.
- Traffic Impact
  - Estimate site generated traffic for the selected design hours.
  - Identify the net-auto trips for the proposed development.
  - Identify the trip distribution/assignment methodology and carry out a directional distribution of the net auto trips.
  - Assemble estimated traffic volumes for any nearby proposed development sites.
  - Determine total traffic conditions in the study area by adding the development traffic and the future background traffic volumes for the selected design hours.
  - Determine intersection and movement Level of Service (LOS) and Volume to Capacity ratios (V/C) at signalized intersections under existing, future background and future total traffic for the 5-year horizon period. The Township may be consulted regarding current traffic signal timing information.
  - The use of the current version of Synchro/SimTraffic is preferred for all capacity analysis calculations and simulations.
  - The saturation flow shall not exceed 1800 passenger cars per hour of green per lane.
  - Determine signalization warrants for unsignalized intersections.
  - Identify operational and geometric modifications required to maintain the system at Level of Service “D”. A V/C of 0.90 should not be exceeded for any vehicle movement if at all possible.
  - Identify potential safety implications.
  - Identify implications for pedestrian and bicycle movements.
- Other Considerations
  - Public safety
  - Turning restrictions for vehicles and crossing restrictions for pedestrians

- Upgrades to existing traffic signals for pedestrians i.e., pedestrian fixtures and crosswalk markings.
- Parking for all vehicles, including bicycles
- Pedestrian movements.
- On-site traffic circulation must demonstrate that vehicles queues would not extend out to adjacent public roads.
- Access locations must be checked for sightlines, the need for dedicated left-turn and right-turn bays and conflict with other driveway locations, bus stop locations.
- Left-turn storage lanes must be long enough to accommodate 1.5 times the average number of arrivals per cycle during the heaviest hour.
- Right-turn storage lanes should be long enough to permit right-turning traffic to clear the maximum queue of through vehicles in the queue during the red indication.
- The introduction of right-turn channelization is not acceptable unless deemed necessary by the Township for turning radius reasons.
- Vehicle storage between intersections must be adequate to accommodate 1.5 times the average number of vehicles arriving on each red indication during the heaviest hour.

2.0 TRAFFIC SIGNAL INSTALLATION

The Township generally follows the Ministry of Transportation Ontario's warrants to determine if a traffic signal could be installed. A detailed study of the traffic conditions and the physical characteristics are key components to assess whether or not a traffic signal is justified.

It is important to note that warrants are guidelines and as such, **there are occasions when a traffic signal may be installed that does not meet the MTO warrants.** For special circumstances, engineering judgement may be used to support the installation of a traffic signal. Similarly, there is no requirement to install a traffic signal at a location that meets the warrants.

"Justifications should be used as a guide to determining the need for traffic control signals rather than as absolute criteria. The fulfillment of a traffic signal justification or justifications shall not in itself ***require*** *the installation of a traffic control signal; the justifications must be used in combination with experience, professional judgment and economic analysis. The satisfaction of the signal installation justifications is only one criterion for determining the suitability of traffic control signals for any location."*

Source: Book 12, Ontario Traffic Manual, 2001

The Township will consider the installation of a traffic signal at a location that **does not meet the warrants**, under the following circumstances:

- Existing sight distance issue exists that could be improved with the installation of a traffic signal.
- Traffic signal is required for transit operations.
- A neighbourhood shortcutting issue could be mitigated.
- Traffic signal(s) is required to facilitate a development. *(Note: these traffic signals are typically wholly funded or cost-shared with the developer)*
- In conjunction with planned roadway construction; if the traffic signal is expected to meet the warrants in the near future.

The Township will **NOT** consider the installation of a traffic signal that meets the warrants, under the following circumstances:

- The proposed location is too close to an existing intersection that may or may not be controlled by a traffic signal.
- Existing sight distance issue that could be worsened with the installation of a traffic signal.
- The traffic signal would seriously disrupt traffic flow.
- There may not be enough space for an appropriate length of left-turn lane on major approach

When the requirement to assess the need for a new traffic signal arises, the Township will adhere to the “Guidelines for the Installation of New Traffic Signals” in order to determine if a traffic signal is warranted. The justifications will be used as a guide to determining the need for traffic control signals rather than as absolute criteria. The fulfillment of a traffic signal justification or justifications will not in itself **require** the installation of a traffic control signal. The justifications will be used in combination with experience and professional judgement. Traffic signals will only be installed after a thorough analysis and careful consideration.

Appendix 1M: *Design Standards – Rural Estate Subdivisions*

1.0 INTRODUCTION

This section is for special conditions that apply to Estate Residential Developments. The developer is encouraged to prepare a design that complements the vision of the development; however, the following criteria is to be considered.

The standards listed in this document will apply to the design of the subdivisions except where the following conditions are applicable.

2.0 ACCESS

The developer will be required to make improvements to existing roads that provide access to the subdivision or secondary subdivision entrances.

3.0 ROADS

Roads in rural subdivisions are to be designed using the standard road cross section for Rural Local Residential Right-of-Way. Figure A2 – Appendix 1N.

The following shall apply where applicable:

Rural residential streets, having a single point of access, shall be limited in length as described in Appendix 1D. Where conditions do not permit a second access, alternative designs comprising emergency access points, increased road widths, restrictive covenants requiring all dwellings to be provided with fire sprinklers or combinations of these measures may be considered.

Cul-de-sacs shall have a minimum diameter of 22m.

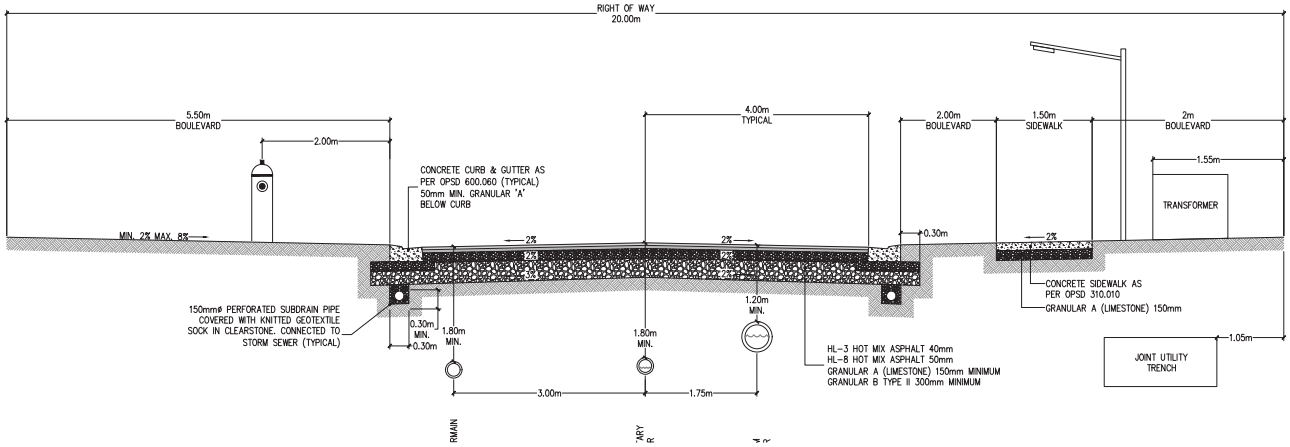
4.0 STREETLIGHTING

At a minimum, streetlighting is to be designed and submitted by the developer for review by Township staff.

- Streetlighting is required at all horizontal curves in the road where sight lines are a concern.
- Streetlighting is required at all vertical curves in the road where sight lines are a concern.
- Streetlighting is required at all intersections to be approved by the Township.
- Streetlighting is required at the end of all cul-de-sacs.

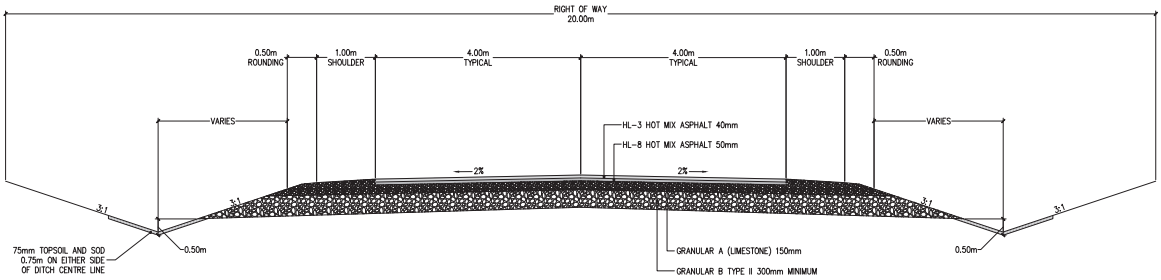
The developer shall adhere to the criteria for street lighting as described in Appendix 1J of this document.

Appendix 1N: Standard Drawings



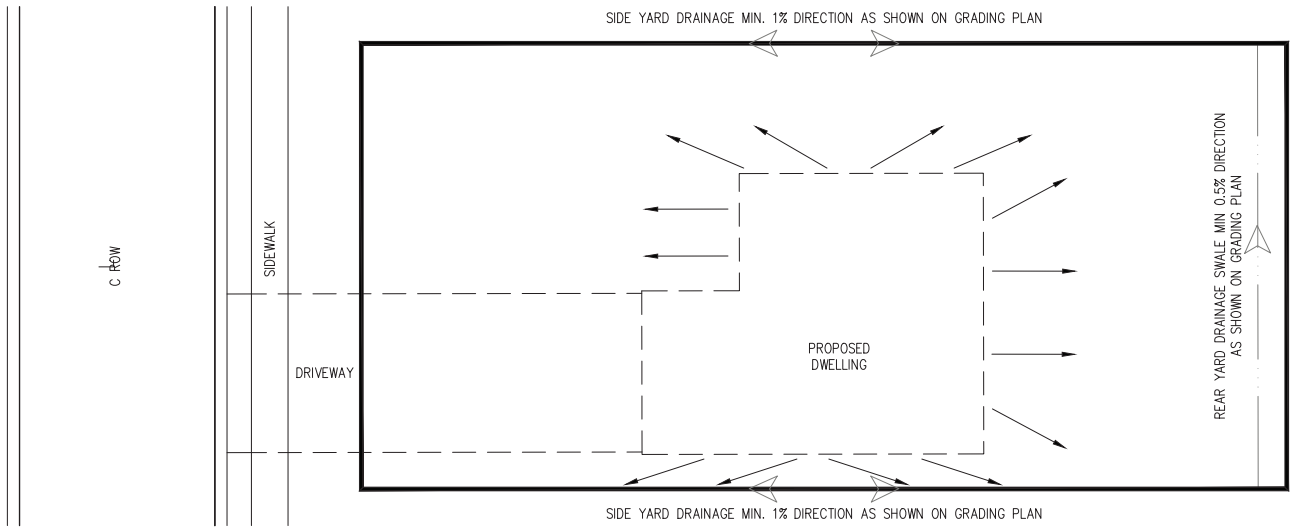
TOWNSHIP OF STIRLING–RAWDON

TYPICAL URBAN SECTION



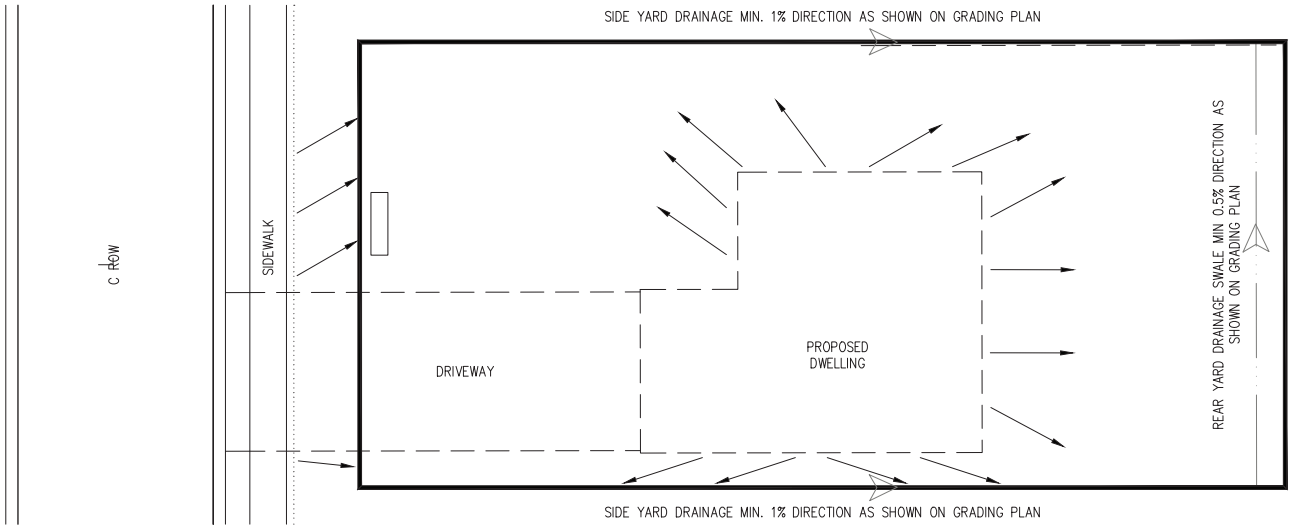
TOWNSHIP OF STIRLING–RAWDON

TYPICAL RURAL SECTION



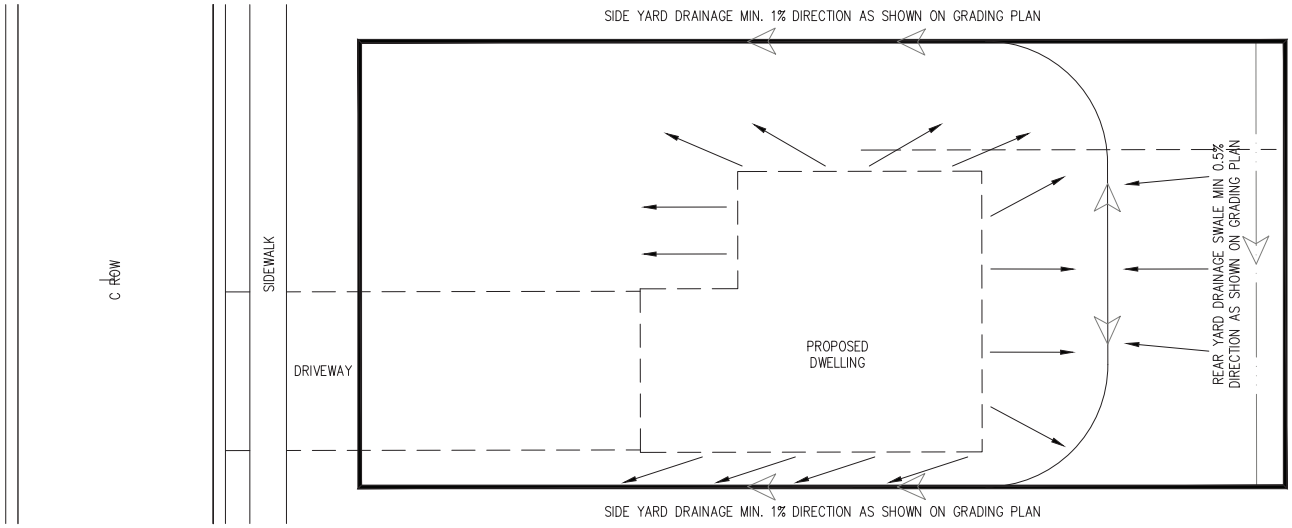
TOWNSHIP OF STIRLING–RAWDON

TYPICAL SPLIT LOT DRAINAGE



TOWNSHIP OF STIRLING–RAWDON

MODIFIED SPLIT LOT DRAINAGE



TOWNSHIP OF STIRLING–RAWDON

TYPICAL BACK TO FRONT DRAINAGE

Appendix 1O: *Standard Forms*

Subdivision Lot Servicing Detail Sheet

Sanitary Sewer Design Sheet

Water Valve Inspection Sheet

Form SW1 – Record of Future Alteration Authorized for Storm Sewers/Ditches/Culverts

Form SW2 – Record of Future Alteration Authorized for Stormwater Management Facilities

Form SW1 – Record of Future Alteration Authorized for Third Pipe Collection Systems

Form SS1 – Record of Future Alteration Authorized for Separate Sewers/Nominally Separate Sewers/Forcemains

Form SS2 – Record of Future Alteration Authorized for Components of the Municipal Sewage Collection System

Form SS1 – Record of Future Alteration Authorized for Combined Sewers/Partially Separated Sewers/Combined Sewage Storage Tanks and Storage Structures

SUBDIVISION LOT SERVICING DETAIL SHEET

Civic Address _____

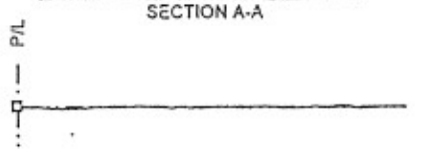
Subdivision _____

Lot # _____

PLAN VIEW

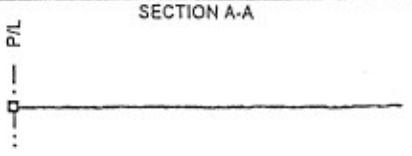
SHOW MAINS AND SERVICE LOCATIONS. INDICATE DISTANCE TO EACH SERVICE AT THE PROPERTY LINE TO A PROPERTY CORNER SURVEY MARKER.

SANITARY SERVICE PROFILE
SECTION A-A



INDICATE INVERTS, SLOPES, FITTINGS, AND HORIZONTAL DISTANCES.

FOUNDATION DRAIN SERVICE PROFILE
SECTION A-A



INDICATE INVERTS, SLOPES, FITTINGS, AND HORIZONTAL DISTANCES.

MATERIALS:

WATER SERVICE SIZE_____mm, MATERIAL_____, DEPTH @ P/L_____m

SANITARY SERVICE SIZE_____mm, MATERIAL_____, COLOR_____

FOUNDATION DRAIN SIZE_____mm, MATERIAL_____, COLOR_____

***GIS INFORMATION SHALL ALSO BE INCLUDED IN SUBMISSION**

STORM SEWER DESIGN SHEET

Peak Runoff Estimate by Rational Method

$$Q = \frac{1}{360} C\, i\, A$$

Where:

Q = Peak Flow in cms
C = Runoff Coefficient
i = Rainfall Intensity in mm/hr
A = Area in hectares

Intensity for: **Belleville** **Station:** 6150689

$$i = A * T_c^{\,B}$$

Where:

i = Rainfall Intensity in mm/hr
T_c : Time of Concentration in hours

5-Year Parameters
26.5
-0.677

Manning's Coef
CSP 0.024
RCP/PVC 0.013

Pipe Capacity by Manning's Equation

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

Where:

A = area of pipe in m^2
R = Hydraulic radius = A / P
P = Wetted perimeter
S = Slope (m/m)
n = Manning's friction coef.

Check
$q \leq Q$
$V \leq 6\ m/s$

LOCATION			PEAK FLOW CALCULATION									PROPOSED SEWER									
STREET / CATCHMENT AREA ID	FROM	TO	CATCHMENT AREAS / RUNOFF COEFFICIENT				R.C. x A	CUM. R.C x A	TIME OF CONCENTRATION	INTENSITY	PEAK FLOW	Pipe Size	Length	Type of Pipe	Grade *(use m/m)*	Capacity, n = 0.013	Full Flow Velocity	Time of Flow	Actual Velocity at Q_d	q/Q	Check Capacity
			0.35	0.45	0.6	0.9	ha	ha	min	mm/hr	m^3/s	(mm)	(m)		(%)	(m^3/s)	(m/s)	min	(m/s)		

Township of Stirling-Rawdon
2529 Stirling Marmora Road
Stirling, ON, K0K 3E0

Ph. 613-395-3380
Fx. 613-395-0864
www.stirling-rawdon.com

Designed:
Checked:
Date:

Project:

Water Valve Inspection Sheet

Subdivision Name and Phase:		Date:	
Water Valves (mainline)			
Total number of valves			
Total number of open valves			
Number of closed valves			

Reason for valves being closed and exact location

Valve	Location and Explanation

Additional Comments:

Contractor's signature		Township's signature
	Township of Stirling-Rawdon 2529 Stirling Marmora Road Stirling, ON, K0K 3E0	

Clear Form Print Form

Ontario

Ministry of the Environment, Conservation and Parks

Form SW1

Record of Future Alteration Authorized for Storm Sewers/Ditches/Culverts

RETAIN COMPLETED FORM - DO NOT SEND TO THE MINISTRY

Part 1 - Environmental Compliance Approval Number

(Insert the Environmental Compliance Approval number authorizing the alteration of Storm Sewers, Ditches or Culverts)

Part 2 - Description of storm sewer/ditch/culvert alteration (Use attachments if required)

The description shall include:

1) A brief description above of the undertaking (e.g. street name(s); subdivision name; project name); and
2) An attachment including plan and profile drawings identifying at a minimum:
   a) location(s) of the undertaking (e.g. showing street names, easements, discharge points, slope, etc.); and
   b) nominal diameter of the sewer/culvert(s), associated with the alteration.

Part 3 - Verification by Licensed Engineering Practitioner

I hereby verify that I am a Licensed Engineering Practitioner who is licensed to practice in the Province of Ontario and the design of the storm sewer/ditch/culvert alteration:

1) Has been prepared by a Licensed Engineering Practitioner who is licensed to practice in the Province of Ontario;
2) Has been documented in a design report and any other applicable design forms;
3) Has been designed only to collect and transit stormwater, and not designed to collect or treat any sanitary sewage, nor designed to collect, store, treat, control, or manage groundwater, unless for the purpose of foundation drains, road subdrains, or LIDs;
4) Satisfies the design criteria set out in the Ministry's publication "Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under Environmental Compliance Approval", as amended, and have documented the reasons for this opinion;
5) Satisfies the standards as set in Ontario Provincial Standard Specifications and Ontario Provincial Standard Drawings, as applicable to ditches and culverts;
6) Is consistent with, or otherwise addresses, the design objectives, as applicable, contained within the Ministry of the Environment, Conservation and Parks publication "Design Guidelines for Sewage Works, 2008", as amended;
7) Has been planned, designed and built to be consistent with the Ministry's publication "Stormwater Management Planning and Design Guidance Manual, 2003", as amended;
8) Does not increase stormwater flow of an existing storm sewer, unless the existing downstream municipal SWM system has sufficient residual conveyance and treatment capacity to accommodate the additional stormwater, and have documented the reasons for this opinion; and
9) Does not increase local hydraulic capacity of an existing storm sewer or ditch to accommodate new stormwater flows unless the existing downstream municipal SWM system has sufficient residual hydraulic capacity to accommodate the additional stormwater, and have documented the reasons for this opinion.

Name (Print)	PEO Licence Number

Signature	Date (yyyy/mm/dd)

Part 4 - Verification by Owner

I hereby verify that:

1) Alteration of the stormwater system's storm sewers/ditches/culverts, and/or appurtenances will not result in:
   a) Adverse effects; or
   b) A deterioration on the approved quantity of downstream stormwater management facilities which results in not being able to achieve the overall stormwater performance criteria per Appendix A of the ECA identified in Part 1 of this form.
2) The storm sewer, ditch or culvert alteration will not adversely affect the municipal stormwater management (SWM) system's ability to maintain a gravity flow without overflowing or increasing surcharging any maintenance holes as per design, or provide smooth flow transition to existing gravity storm sewers.
3) The alteration does not establish or alter any outlets that discharge to land not owned by the Owner without the expressed written consent of the owner(s) of such private land(s) that the works will discharge to;
4) An assessment of the proposed works has been completed to determine if the works pose a Significant Drinking Water Threat. The proposed works do not pose any threats to sources of drinking water or design includes features that mitigate the threat to sources of drinking water, such as those included in: Ministry's Standard Operating Policy for Sewage Works, as amended from time to time; and Source Protection Plan policies pertaining to the works;
5) The proposed works are wholly located within the municipal boundary over which the owner has jurisdiction except where there is an agreement existed between municipalities;
6) The owner consents to the storm sewer/ditch/culvert alteration;
7) The owner has consulted with the local Conservation Authority and obtained necessary clearance, as required;
8) Any works that establish new or increase discharges to a municipal drain have obtained written approval by the Owner and a signed engineer's drainage report, in accordance with the Drainage Act; and
9) I am an authorized representative of the owner to complete this verification.

Name of Owner (Print)	Name of Owner Representative (Print)
Signature	Date (yyyy/mm/dd)

Part 5 - Post Construction Verification by Owner for Inspection and Testing

I hereby verify that:

1) The storm sewer alteration has complied with inspection and testing requirements set out in the Ministry of the Environment, Conservation and Parks publication "Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under Environmental Compliance Approval", as amended, and have documentation of the inspection and testing results.

Name of Owner (Print)	Name of Owner Representative (Print)
Signature	Date (yyyy/mm/dd)

Note: Parts 1 to 4 above shall be completed before construction.
Part 5 is to be completed after the inspection and testing have been undertaken.

Print Form

Clear Form Print Form

Ontario

Ministry of the Environment, Conservation and Parks

Form SW2
Record of Future Alteration Authorized for Stormwater Management Facilities

RETAIN COMPLETED FORM - DO NOT SEND TO THE MINISTRY

Part 1 - Environmental Compliance Approval Number

(Insert the Environmental Compliance Approval number authorizing the alteration of Stormwater Management Facilities)

Part 2 - Description of stormwater management facility alteration (Use attachments if required)

The description shall include:

1) A brief description above of the undertaking (e.g. street name(s); subdivision name; project name); and
2) An attachment including plan and cross-section drawing identifying at a minimum:
   a) location(s) of the undertaking (e.g. showing street names, easements, discharge points, etc.); and
   b) components of the alteration of the stormwater management facility

Part 3 - Verification by Licensed Engineering Practitioner (as applicable to the undertaking)

I hereby verify that I am a Licensed Engineering Practitioner who is licensed to practice in the Province of Ontario and the design of the stormwater management facility alteration:

1) Has been prepared by a Licensed Engineering Practitioner who is licensed to practice in the Province of Ontario;
2) Has been documented in a design report and any other applicable design forms;
3) Has been designed to collect, receive, treat, or control only stormwater, and not designed to collect, receive, treat, or control sanitary sewage;
4) Has been planned, designed and built to be consistent with the Ministry of the Environment, Conservation and Parks publication “Stormwater Management Planning and Design Guidance Manual, 2003”, as amended;
5) Satisfies the design criteria set out in the Ministry’s publication “Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under Environmental Compliance Approval”, as amended, and have documented the reasons for this opinion;
6) Satisfies the requirements outlined in Appendix A of the ECA identified in Part 1 of this form, and have documented the reasons for this opinion;
7) Includes an outlet or an emergency overflow for the works, with the verification of the location, route, and capacity of the receiving major system to accommodate overflows; and
8) If adding new Manufactured Treatment Devices, has met the requirements of the conditions of the ECA identified in Part 1 of this form which authorizes the alteration.

Name (Print)	PEO Licence Number

Signature	Date (yyyy/mm/dd)

Part 4 - Verification by Owner

I hereby verify that:

1) Any alteration by adding, modifying, replacing, or extending stormwater management facilities will not result in:
   a) Adverse effects; or
   b) A deterioration on the approved quantity of downstream stormwater management facilities which results in not being able to achieve the overall stormwater performance criteria per Appendix A of the ECA identified in Part 1 of this form.
2) The alteration does not establish or alter any outlets that discharge to land not owned by the Owner without the expressed written consent of the owner(s) of such private land(s) that the works will discharge to;
3) If privately owned stormwater works have been used in the stormwater treatment train to achieve Appendix A criteria of the ECA identified in Part 1 of this form, then the Owner has met the requirements of the conditions of the ECA identified in Part 1 of this form which authorizes the use of privately owned stormwater works;
4) An assessment of the proposed works to determine if the works pose a significant drinking water threat has been completed and where applicable, mitigation measures are incorporated to protect water sources in accordance with the Ministry's Standard Operating Policy for Sewage Works, as amended; and Source Protection Plan policies pertaining to the works;
5) The proposed works are wholly located within the municipal boundary over which the owner has jurisdiction except where there is an agreement existed between municipalities;
6) The owner consents to the stormwater management facility alteration;
7) The owner has consulted with the local Conservation Authority and obtained necessary clearance, as required;
8) Any works that fall under the Drainage Act has obtained approval of a petition for the works under the Drainage Act;
9) Any works that establish new or increase discharges to a municipal drain have obtained written approval by the Owner and a signed engineer's drainage report, in accordance with the Drainage Act; and
10) I am an authorized representative of the owner to complete this verification.

Name of Owner (Print)	Name of Owner Representative (Print)
Signature	Date (yyyy/mm/dd)

Part 5 - Post Construction Verification by Owner for Inspection

I hereby verify that:

1) Any alterations to low impact development or end-of-pipe stormwater management facilities have been inspected before operation to ensure that the works as constructed will continue to conform to the Design Criteria and the ECA, and have documentation of the inspection results.

Name of Owner (Print)	Name of Owner Representative (Print)
Signature	Date (yyyy/mm/dd)

Note: Parts 1 to 4 above shall be completed before construction.
Part 5 is to be completed after the inspection and testing have been undertaken.

Print Form

Clear Form Print Form

Ontario

Ministry of the Environment, Conservation and Parks

Form SW3
Record of Future Alteration Authorized for Third Pipe Collection Systems

RETAIN COMPLETED FORM - DO NOT SEND TO THE MINISTRY

Part 1 - Environmental Compliance Approval Number

(Insert the Environmental Compliance Approval number authorizing the alteration of third pipe collection systems)

Part 2 - Description of third pipe collection system alteration (Use attachments if required)

The description shall include:

1) A brief description above of the undertaking (e.g. street name(s); subdivision name; project name); and
2) An attachment including a plan and profile drawing identifying at a minimum:
   a) location(s) of the undertaking (e.g. showing street names, easements, discharge points, etc.); and
   b) components of the third pipe collection system alteration.

Part 3 - Verification by Licensed Engineering Practitioner

I hereby verify that I am a Licensed Engineering Practitioner who is licensed to practice in the Province of Ontario and the design of the third pipe collection system alteration:

1) Has been prepared by a Licensed Engineering Practitioner who is licensed to practice in the Province of Ontario;
2) Has been documented in a design report and any other applicable design forms;
3) Has been designed only to collect, transmit, reuse and/or treat only foundation drainage and groundwater, and not designed to collect or treat sanitary sewage;
4) Satisfies the design criteria set out in the Ministry of the Environment, Conservation and Parks publication “Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under Environmental Compliance Approval”, as amended, and have documented the reasons for this opinion; and
5) Has been designed to primarily function for the non-potable reuse, as deemed acceptable by the Owner and/or local health unit, of foundation drainage and/or groundwater, and no discharge to a storm or sanitary sewer if there is excess volume that cannot be reused, unless providing wetland recharge.

Name (Print)	PEO Licence Number

Signature	Date (yyyy/mm/dd)

Part 4 - Verification by Owner

I hereby verify that:

1) The third pipe collection system alteration is not located on a contaminated site, or where natural occurring conditions result in contaminated discharge, or where the site receives contaminated groundwater or stormwater from another site, unless the discharge being received has been remediated or treated prior to acceptance by the third pipe system;
2) A site assessment has been undertaken for water quantity, water quality and hydrogeological site conditions regarding the third pipe collection system alteration;
3) Any alteration of the third pipe collection systems will not result in adverse effects;
4) The alteration does not establish or alter any outlets that discharge to land not owned by the Owner without the expressed written consent of the owner(s) of such private land(s) that the works will discharge to;
5) The proposed works are wholly located within the municipal boundary over which the owner has jurisdiction except where there is an agreement existed between municipalities;
6) The owner has consulted with the local Conservation Authority and obtained necessary clearance, if required;

7) The owner consents to the third pipe collection system alteration; and

8) I am an authorized representative of the owner to complete this verification.

Name of Owner (Print)	Name of Owner Representative (Print)
Signature	Date (yyyy/mm/dd)

Part 5 - Post Construction Verification by Owner for Inspection

I hereby verify that:

1) Any alterations the Third Pipe Collection System have been inspected before operation to ensure that the works as constructed will continue to conform to the Design Criteria and the ECA, and have documentation of the inspection results.

Name of Owner (Print)	Name of Owner Representative (Print)
Signature	Date (yyyy/mm/dd)

Note: Parts 1 to 4 above shall be completed before construction.
Part 5 is to be completed after the inspection and testing have been undertaken.

Print Form

Clear Form Print Form

Ontario

Ministry of the Environment, Conservation and Parks

Form SS1

Record of Future Alteration Authorized for Separate Sewers/Nominally Separate Sewers/Forcemains

RETAIN COMPLETED FORM - DO NOT SEND TO THE MINISTRY

Part 1 - Environmental Compliance Approval Number

(Insert the Environmental Compliance Approval number authorizing the alteration of Separate Sewers/Nominally Separate Sewers/Forcemains)

Part 2 - Description of separate sewer/nominally separate sewer/forcemain alteration (Use attachments if required)

The description shall include:

1) A brief description above of the undertaking (e.g. street name(s); subdivision name; project name); and
2) An attachment including plan and profile drawings identifying at a minimum:
   a) location(s) of the undertaking (e.g. showing street names, easements, discharge points, slope (separate sewer only), etc.); and
   b) nominal diameter of the sewers/forcemain(s), associated with the alteration.

Part 3 - Verification by Licensed Engineering Practitioner

I hereby verify that I am a Licensed Engineering Practitioner who is licensed to practice in the Province of Ontario and the design of the separate sewer/nominally separate sewer/forcemain alteration:

1) Has been prepared by a Licensed Engineering Practitioner who is licensed to practice in the Province of Ontario;
2) Has been documented in a design report and any other applicable design forms;
3) Has been designed only to collect and transmit sewage and has not been designed to treat sewage;
4) Satisfies the design criteria set out in the Ministry of the Environment, Conservation and Parks publication “Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under Environmental Compliance Approval”, as amended, and have documented the reasons for this opinion; and
5) Is consistent with, or otherwise addresses, the design objectives contained within the Ministry of the Environment, Conservation and Parks publication “Design Guidelines for Sewage Works”, as amended;

Name (Print)	PEO Licence Number

Signature	Date (yyyy/mm/dd)

Part 4 - Verification by Owner

I hereby verify that:

1) The maximum wastewater discharge by users who will be serviced by the addition, modification, replacement or extension of the separate sewer/nominally separate sewer/forcemain will not result in:
   a) An exceedance of the municipal sewage collection system hydraulic capacity, sewage treatment plant uncommitted reserve hydraulic capacity, or the downstream pumping station capacity;
   b) Adverse effects;
   c) Any increase in collection system overflows that is not offset by measures, and have documented any offset measures used; or,
   d) Any increase in the frequency and/or volume of Sewage Treatment Plan (STP) bypasses or STP overflows that is not offset by measures, and have documented any offset measures used. (Alternatively, if the wastewater flows to a STP not owned by the Owner, then the wastewater volume or flow rate is as agreed to with the Owner of the STP.)

2) The separate sewer, nominally separate sewer or forcemain alteration will:

   a) Not cause overflows or backups, nor increase surcharging at any maintenance holes or privately owned infrastructure (e.g. basements) within the municipal sewage collection system or any municipal sewage collection system connected to it; and
   b) Provide smooth flow transition to existing gravity sewers.

3) An assessment of the proposed works has been completed to determine if the works pose a significant drinking water threat. The proposed works do not pose any threats to sources of drinking water or design includes features that mitigate the threat to sources of drinking water, such as those included in: Ministry's Standard Operating Policy for Sewage Works, as amended from time to time; and Source Protection Plan policies pertaining to the works;

4) The separate sewer/nominally separate sewer/forcemain alteration is wholly located within the municipal boundary over which the owner has jurisdiction except where there is an agreement existed between municipalities;

5) The owner consents to the separate sewer/nominally separate sewer/forcemain alteration; and

6) I am an authorized representative of the owner to complete this verification.

Name of Owner (Print)	Name of Owner Representative (Print)
Signature	Date (yyyy/mm/dd)

Part 5 - Post Construction Verification by Owner for Inspection and Testing

I hereby verify that:

1) The separate sewer, nominally separate sewer or forcemain alteration has complied with inspection and testing requirements set out in the Ministry of the Environment, Conservation and Parks publication "Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under Environmental Compliance Approval", as amended, and have documentation of the inspection and testing results.

Name of Owner (Print)	Name of Owner Representative (Print)
Signature	Date (yyyy/mm/dd)

Note: Parts 1 to 4 above shall be completed before construction.
Part 5 is to be completed after the inspection and testing have been undertaken.

Print Form

Clear Form | Print Form

Ontario

Ministry of the Environment, Conservation and Parks

Form SS2

Record of Future Alteration Authorized for Components of the Municipal Sewage Collection System

RETAIN COMPLETED FORM - DO NOT SEND TO THE MINISTRY

Part 1 - Environmental Compliance Approval Number

(Insert the Environmental Compliance Approval number authorizing the future alteration of components of the municipal sewage collection system)

Part 2 - Description of alteration of components of the municipal sewage collection system (Use attachments if required)

The description shall include:

1) A brief description above of the undertaking (e.g. street name(s); subdivision name; project name);
2) An identification of the system component being altered;
3) The location of the works being altered: and
4) Any associated drawings, if applicable.

Part 3 - Verification by Licensed Engineering Practitioner (as applicable to the undertaking) or Technical Representative

I hereby verify that I am a Licensed Engineering Practitioner who is licensed to practice in the Province of Ontario (as applicable to the undertaking) or the technical representative and the design of the alteration of the components of the municipal sewage collection system:

1) Has been prepared by a Licensed Engineering Practitioner who is licensed to practice in the Province of Ontario, where the Alteration falls within the practice of professional engineering as defined in the Professional Engineers Act, R.S.O. 1990, OR has been prepared by a technical representative with the required qualifications.
2) Has been documented in a design report and any other applicable design forms;
3) Is consistent with, or otherwise addresses, the design objectives contained within the Ministry of the Environment, Conservation and Parks publication “Design Guidelines for Sewage Works”, as amended and as applicable;

Name (Print)	PEO Licence Number
Signature	Date (yyyy/mm/dd)

Part 4 - Verification by Owner

I hereby verify that:

1) The alteration of the municipal sewage collection system made shall not result in:
   a) Exceedance of hydraulic capacity (including uncommitted reserve hydraulic capacity, as applicable) of the downstream:
      i) Municipal sewage collection system; or
      ii) Receiving sewage treatment plants (STP).
   b) Exceedance of any downstream pumping station capacity, unless verified under Part 3 of this form;
   c) Any increase in collection system overflows, that is not offset by measures taken elsewhere in the municipal sewage collection system, and have documented any offset measures used;
   d) Any increase in the frequency and/or volume of STP bypasses or STP overflows that is not offset by measures, and have documented any offset measures used; (Alternatively, if the wastewater flows to a STP not owned by the Owner, then the wastewater volume or flow rate is as agreed to with the Owner of the STP.)
   e) Deterioration of the normal operation of municipal STPs (as applicable) and/or municipal sewage collection system;

f) A negative impact on the ability to undertake monitoring necessary for the operation of the municipal sewage collection system; and

g) Adverse effects.

2) The alteration will:

a) Not cause overflows or backups, nor increase surcharging at any maintenance holes or privately owned infrastructure (e.g. basements) within the municipal sewage collection system or any collection system connected to it; and

b) Provide smooth flow transition to existing gravity sewers.

3) An assessment of the proposed works has been completed to determine if the works pose a significant drinking water threat. The proposed works do not pose any threats to sources of drinking water or design includes features that mitigate the threat to sources of drinking water, such as those included in: Ministry's Standard Operating Policy for Sewage Works, as amended from time to time; and Source Protection Plan policies pertaining to the works;

4) The alteration is wholly located within the municipal boundary over which the owner has jurisdiction, except where there is an agreement existed between municipalities;

5) The owner consents to the alteration of components to the municipal sewage collection system; and

6) I am an authorized representative of the owner to complete this verification.

Name of Owner (Print)	Name of Owner Representative (Print)
Signature	Date (yyyy/mm/dd)

Part 5 - Post Construction Verification by Owner for Inspection

I hereby verify that:

1) Any alterations the Municipal Sewage Collection System have been inspected before operation to ensure that the works as constructed will continue to conform to the Design Criteria and the ECA, and have documentation of the inspection results.

Name of Owner (Print)	Name of Owner Representative (Print)
Signature	Date (yyyy/mm/dd)

Note: Parts 1 to 4 above shall be completed before construction.
Part 5 is to be completed after the inspection and testing have been undertaken.

Print Form

Clear Form Print Form

Ontario

Ministry of the Environment, Conservation and Parks

Form CS1

Record of Future Alteration Authorized for Combined Sewers/Partially Separated Sewers/Combined Sewage Storage Tanks and Storage Structures

RETAIN COMPLETED FORM - DO NOT SEND TO THE MINISTRY

Part 1 - Environmental Compliance Approval Number

(Insert the Environmental Compliance Approval number authorizing the alteration of combined sewers/partially separated sewers/combined sewage storage tanks and structures)

Part 2 - Description of combined sewer/partially separated sewer/combined sewage storage tanks and structures alteration (Use attachments if required)

The description shall include:

1) A brief description above of the undertaking (e.g. street name(s); subdivision name; project name); and
2) An attachment including plan and profile drawings identifying at a minimum:
   a) location(s) of the undertaking (e.g. showing street names, easements, discharge points, slope (sewer only) etc.);
   b) nominal diameter of the sewers/forcemain(s), associated with the alteration; and
   c) size of the storage tanks or structures, as applicable.

Part 3 - Verification by Licensed Engineering Practitioner

I hereby verify that I am a Licensed Engineering Practitioner who is licensed to practice in the Province of Ontario and the design of the combined sewer/partially separated sewer/combined sewage storage tanks and storage structures alteration:

1) Has been prepared by a Licensed Engineering Practitioner who is licensed to practice in the Province of Ontario;
2) Has been documented in a design report and any other applicable design forms;
3) Has been designed in accordance with a pollution prevention and control plan (PPCP) or, if a PPCP is not available, then an interim detailed plan;
4) Has been designed only to collect and transmit sewage and has not been designed to treat sewage;
5) Satisfies the design criteria set out in the Ministry of the Environment, Conservation and Parks publication “Design Criteria for Sanitary Sewers, Storm Sewers, and Forcemains for Alterations Authorized under Environmental Compliance Approval”, as amended, and have documented the reasons for this opinion; and
6) Is consistent with, or otherwise addresses, the design objectives contained within the Ministry of the Environment, Conservation and Parks publication “Design Guidelines for Sewage Works”, as amended.

Name (Print)	PEO Licence Number

Signature	Date (yyyy/mm/dd)

Part 4 - Verification by Owner

I hereby verify that:

1) The maximum wastewater discharge by customers who will be serviced by the modification, replacement or decommissioning of the combined sewer/partially separated sewer/combined sewage storage tank and structure will not result in:
   a) An exceedance of the municipal sewage collection system hydraulic capacity, sewage treatment plant uncommitted reserve hydraulic capacity, or the pumping station capacity;
   b) Adverse effects;
   c) Any increased collection system overflows that is not offset by measures elsewhere in the municipal sewage collection system, and have documented any offset measures used; or
   d) Any increase in the frequency and/or volume of Sewage Treatment Plant (STP) bypasses or STP overflows that is not offset by measures, and have documented any offset measures used. (Alternatively, if the wastewater flows to a STP not owned by the Owner, then the wastewater volume or flow rate is as agreed to with the Owner of the STP.)

2) Any alterations involving combined sewer separation have complied with the following:

   a) Stormwater quantity, quality and water balance control have been provided such that combined sewer separation will not result in an overall increase in pollutants discharged to the natural environment; and

   b) Any new storm sewers that result from the combined sewer separation will be constructed but not operated until the proposed stormwater management facilities designed to satisfy 2.1 above are in operation;

3) The alteration will:

   a) Not cause overflows or backups nor increase surcharging at any maintenance holes or privately owned infrastructure (e.g. basements) within the municipal sewage collection system or any municipal sewage collection system connected to it;
   b) Provide smooth flow transition to existing gravity sewers; and
   c) Not increase the generation of sulfides and other odourous compounds in the municipal sewage collection system.

4) An assessment of the proposed works has been completed to determine if the works pose a Significant Drinking Water Threat. The proposed works do not pose any threats to sources of drinking water or design includes features that mitigate the threat to sources of drinking water, such as those included in: Ministry's Standard Operating Policy for Sewage Works, as amended from time to time; and Source Protection Plan policies pertaining to the works;

5) The combined sewer/partially separated sewer/combined sewage storage tank and structure alteration is wholly located within the municipal boundary over which the owner has jurisdiction except where there is an agreement existed between municipalities;

6) The owner consents to the alteration of the combined sewer/partially separated sewer/combined sewage storage tank and structure; and

7) I am an authorized representative of the owner to complete this verification.

Name of Owner (Print)	Name of Owner Representative (Print)
Signature	Date (yyyy/mm/dd)

Part 5 - Post Construction Verification by Owner for Inspection and Testing

I hereby verify that:

1) The combined sewer/partially separated sewer/combined sewage storage tank and structure alteration has complied with inspection and testing requirements set out in the Ministry of the Environment, Conservation and Parks publication "Design Criteria for Sanitary Sewers, Storm Sewers, and Forcemains for Alterations Authorized under Environmental Compliance Approval", as amended, and have documentation of the inspection and testing results.

Name of Owner (Print)	Name of Owner Representative (Print)
Signature	Date (yyyy/mm/dd)

Note: Parts 1 to 4 above shall be completed before construction.
Part 5 is to be completed after the inspection and testing have been undertaken.

Print Form

Appendix 1P: *Watermain Commissioning Package*

PROCEDURE FOR THE CLEANING, TESTING, DISINFECTION, AND CONNECTION OF WATERMAINS

1.0 INTRODUCTION

1.1 Scope: Watermain Installation and Testing Procedures

This procedure covers the cleaning, testing, disinfection, and connection of watermains. Unless specified otherwise this procedure applies to all new watermains, above ground by-pass watermains and relined watermains.

1.2 Definitions

Township means The Corporation of the Township of Stirling Rawdon.

Municipal Field Representative means The Corporation of the Township of Stirling Rawdon, Public Works Department, and functions as the on-site representative for the Township.

Consultant means the Engineering Consulting company, who is retained by the Developer/Proponent and who is also identified as the Engineer of Record for the associated works.

Contractor means the person, partnership or corporation undertaking the physical installation of the Work.

Developer means the person, partnership or corporation undertaking the work.

ORO means the Municipality's Overall Responsible Operator within the Water and Wastewater Operations Department

Specialist means the person, partnership or corporation with expertise in works associated with swabbing, pressure and leakage testing, chlorination, dechlorination and sterilization of watermains. If the Contractor has appropriate expertise with this type of work, the Contractor may be considered as the Specialist for the purposes of this paragraph.

Backflow Prevention means the prevention of a reversal of normal flow that could introduce contamination to the potable water supply; accomplished by an air gap or CSA approved backflow preventer selected, installed and tested in accordance with CSA Standard B64.10: Selection and Installation of Backflow Preventers.

Disinfectants mean calcium or sodium hypochlorite that meets or exceeds AWWA 8300 or liquid chlorine that meets or exceeds AWWA 8301. All references to 'chlorine' or 'chlorination' in this document shall mean sodium hypochlorite.

LWO Number means the Environmental Laboratory Work Order Number.

Neutralizing Agent means Sodium Thiosulfate that meets or exceeds Appendix C of AWWA Standard C651.

SOWA means the Safe Drinking Water Act of Ontario.

NSF 61 means the National Sanitation Foundation, Standard 61.

1.3 References

These procedures are based on and shall be used in conjunction with, the Ontario Provincial Standard Specifications (OPSS), the American Waterworks Association Standards (the most current version of ANSI/AWWA C651 and Appendicies A, 8 and C), the Safe Drinking Water Act of Ontario, and CAN/CSA-864.10.

1.4 General Requirements For Watermain Installation and Commissioning

Prior to establishing timelines for the work to be undertaken, the Developer or Contractor shall complete and submit an Application for Connection to Municipal Infrastructure, currently referred to as an Encroachment/ROW Occupancy Permit. Staff will review the Application and communicate with the Applicant if clarification is required. The current form is attached to this document.

In preparation for the commissioning phase, during installation the Contractor shall keep pipes clean and dry and take precautions to protect the interiors of pipes, fittings and valves against contamination. End caps shall be installed when work is not in progress and removed only when connecting the next pipe or appurtenance or continuing work. Pipes shall not be laid directly in water. Existing watermains, which are dead ended during construction, shall have a minimum 25 mm bleeder installed at the dead end. New watermains which are temporarily dead ended shall have a minimum 50mm blow off installed with a temporary cap if there is no hydrant downstream of the last water service on the watermain. All dead ended watermains shall have a sampling hydrant permanently installed at a location approved by the Municipality.

1.5 Connection and Testing Procedures Plan and Meeting

The Contractor shall provide a Commissioning Plan to the Consultant detailing the connection locations, swabbing locations, hydrostatic testing, chlorination and dechlorination methods, disposal of water and final connection methods consistent with this document. If the project is being constructed in phases, this plan shall detail each of these items for each phase. The Consultant shall review, approve and recommend the plan to the Township. The Township shall review and provide approval once it has been deemed acceptable. No work is to proceed until the Township has given written approval of the plan.

A pre-watermain connection and testing meeting shall be held by the Consultant prior to any commissioning procedures and shall include representative(s) from the Contractor and Municipality.

1.6 Forms

The following forms are attached to this document:

a) Application for Encroachment/ROW Occupancy Permit
b) Watermain Commissioning Form 1- Field Record for Swabbing of New Watermain
c) Watermain Commissioning Form 2 - Field Record for Hydrostatic Testing of New Watermain
d) Watermain Commissioning Form 3 - Field Record for Disinfection
e) Watermain Commissioning Form 4- Field Record for De-Chlorination
f) Watermain Commissioning Form 5 - Field Record for Bacteriological Sampling
g) Watermain Commissioning Form 6 - Field Record for Tracer Wire Conductivity Test

h) Watermain Commissioning Form 7 - Temporary Backflow Prevention Device Report
i) Watermain Commissioning Form 8 - Certificate for Hydrostatic Pressure Test
j) Watermain Commissioning Form 9 - Certificate for Disinfection

1.7 Supervision, Testing and Records

The Consultant shall witness and document all cleaning, swabbing, hydrostatic testing, disinfection, sampling activities connection to existing system and charging. The Consultant shall also take and record measurements on the appropriate Watermain Commissioning Forms and provide certification for Hydrostatic Testing and Disinfection procedures. The certificates must be signed by the project Engineer of Record.

1.8 Valve Operation

Municipal ORO staff must perform the operation of all existing valves inclusive of hydrant secondary valves. In the event of an emergency, the ORO may direct the Contractor to operate valves.

The opening and closing of any valve should be coordinated with the Municipal Field Representative. The Specialist shall notify all known affected residences or businesses shall be notified a minimum of 48 hours prior to a planned disruption of water service.

2. WATERMAIN TESTING PROCEDURE

This document is to be read in conjunction with the forms at the end of this document. These procedures are to be used in conjunction with the Ontario Provincial Standard Specifications (OPSS), the American Waterworks Association Standards (AWWA) and the Safe Drinking Water Act of Ontario (SOWA). Where conflicts exist between this document and the specifications, standards, and acts referred to above, the more stringent requirement shall apply.

All required chlorine residual tests for the purposes of the Disinfection Phase (Super-Chlorination) shall be performed by the Consultant in the company of the Municipal Field Representative utilizing an electronic tester such as a Hach Pocket Colourimeter or equivalent.

All works associated with swabbing, pressure and leakage testing, chlorination, dechlorination and sterilization of the watermain are to be performed by a Specialist who is company with expertise in this type of work or a company approved by the Township. If the Contractor has appropriate expertise with this type of work, the Contractor may be considered as the Specialist for the purposes of this paragraph.

Temporary by-pass piping shall meet all procedures and requirements of new watermain with the exception of hydrostatic pressure testing. A visual check shall be performed at line pressure on a temporary by-pass to ensure that it is leak free.

2.1 Charging of Watermains

The watermain is to be charged via a temporary connection equipped with an approved backflow preventer as outlined below.

2.2 Temporary Connection and Backflow Preventer

This section is to be read in conjunction with Form 7, located at the end of this document.

The temporary connection is to be used for all water supplies to maintain continuous supply of water unless otherwise noted. The size of the temporary connection shall be 50mm diameter for watermains up to and including 200mm diameter and 100mm diameter for watermains 250mm diameter to 400mm diameter, inclusive. All materials for the temporary connections are to be approved by the Municipality. Watermains larger than 400mm in diameter shall be as per design standards.

For non-municipal projects, the hydrant adapter (inclusive of backflow preventer, valving, fittings and meter) shall be a reduced pressure zone type backflow preventer. The assembly is supplied, installed and certified by licensed professionals provided by the Contractor and/or Specialist.

For Municipal projects, the hydrant adapter (backflow preventer and meter) shall be supplied by the Municipality, upon request by the Contractor.

The adapter shall be installed on a prescribed hydrant and charged by the Municipality. Hydrant(s) utilized as the source water for temporary by pass will be determined by in consultation with the Municipal Field Representative and the Municipal ORO.

Once installed and certified, the backflow preventer shall be remain installed until the end of the watermain Commissioning Phase. The backflow preventer must be secured and protected against freezing, tampering, theft and vandalism. If for any reason the backflow preventer has become compromised and/or must be removed prior to the end of the watermain testing phase, the backflow preventer shall be re-certified prior to the Municipally re-charging with system pressure.

The existing distribution system and backflow preventer shall be physically disconnected from the test section during all hydrostatic testing.

2.3 Swabbing

The isolated section of the watermain shall be charged or pressurized prior to the commencement of swabbing. The swabs shall be numbered and carefully controlled by the Specialist to ensure that all swabs that are introduced into the watermain are retrieved and accounted for. The Consultant shall record the number of swabs inserted and retrieved. All swabs must be inspected prior to insertion and immediately after they exit the watermain to ensure that they have remained intact and that, pieces of the foam do not remain inside the watermain. New swabs shall be used for this procedure; under no circumstances will used swabs be allowed.

All watermain pipes must be swabbed with a minimum of THREE swabs. A minimum of one swab shall be passed through each hydrant lead, large diameter water service, stub or blow-off. Additional swabs shall be used as directed by the Consultant or Municipal Field Representative should discharge water not run clear within ten seconds of the swab exiting the discharge point. No additional payment/claims shall be made for subsequent swabbing.

Swabs shall be forced through the watermain using potable water at a minimum velocity of 0.6 to 1 meter per second. The Consultant and Municipal Field Representative must approve all methods of disposal of the discharged water. The Contractor shall take all necessary precautions to minimize soil erosion and shall reinstate any affected areas upon completion.

The swabs must be new open cell polyurethane foam, having a density of 1.5 pounds per cubic foot (24

kilograms per cubic meter) and are to be a minimum of 50mm larger than the nominal pipe diameter with a length at least one and a half times its diameter. Watermains 300mm or smaller may be swabbed through hydrants on approval by the Township. Procedures for swabbing watermains larger than 300mm must also be approved by the Township. Both the aforementioned approvals are to be considered during the Commissioning Plan review.

2.4 Hydrostatic and Leakage Testing

Hydrostatic and Leakage Testing is described as a two-step process. The Contractor, in coordination with the Specialist may, at his option, completely backfill the trench and only perform the two-hour test as described below in Step Two. The Contractor shall identify what process is to be used in the Commissioning Plan. In the event that the single step process is chosen, the Contractor and Specialist assumes all associated responsibility and there shall be no additional allowances or claims for re-excavation should repairs be required as a result of a failed test. Regardless of process chosen, the Municipality may direct the Contractor to completely backfill the trench if local traffic or safety conditions require. In such a circumstance, there shall not be any entitlement to claim for additional allowances.

Hydrostatic and Leakage tests shall be carried out on the test section of watermain after swabbing operations have been successfully completed. The Specialist shall ensure that no air pockets are present in the test section of watermain. The existing distribution systems and the backflow preventer shall be physically disconnected from the test section during all hydrostatic and leakage testing.

Step One: The test section shall not exceed 365m in length and shall be braced to prevent any movement when the test pressure is applied. The Specialist shall fill the test section with potable water under a pressure of 1035 kPa, {150 psi) for a period of one hour. The exposed parts shall be thoroughly examined and corrected for leakage, as necessary by replacing with new sound material. Repeat as necessary until all defects have been corrected.

Step Two: After backfilling, the Specialist shall fill the maximum test section length of 365m with potable water under a pressure of 1035 kPa {150 psi). Any make-up water utilized shall also be potable. The Consultant, in the company of the Municipal Field Representative shall observe the pressure in the test section during the two hour period. During the test period, no water is to be added - make up water shall only be added after the two hour period has ended. At the end of the two-hour test period, the Consultant shall document the water pressure in the test section and witness and record the amount of make-up water added to the test section to restore the initial pressure of 1035 kPa. The Specialist in coordination with the Consultant, shall accurately measure the quantity of make-up water added utilizing a calibrated container. The measured quantity shall not exceed the Allowable Leakage amount. If leakage exceeds the allowable loss, the leak points shall be located and repaired. All defective pipe, fittings, valves and other appurtenances discovered, shall be removed and replaced with sound material. The test section shall be re-tested until a satisfactory result is obtained.

Allowable Leakage for PVC pipe shall be calculated as follows:

$$L=ND\{p)^{112}/7,400$$

Where: L = allowable leakage {gal/hr)
N = number of joints in tested line
D = nominal diameter of pipe (in)
P = average test pressure (psi)

2.5 Disinfection of Watermains

Once the watermain has successfully passed hydrostatic testing, the disinfection phase may commence.

The Specialist shall completely fill the watermain with potable to remove air pockets and then flushed to remove any particulate. After flushing is completed, the main shall be re-filled with potable water.

The Specialist shall thoroughly mix the chlorine solution prior to pumping it into the system. The Chlorine solution shall be injected into the system using the continuous feed method through the access point on the temporary connection. The chlorine solution shall be applied so that the initial chlorine concentration is a minimum of 50mg/L throughout the system.

The chlorine solution shall flow through each fire hydrant, blow-off and sampling hydrant(s). The chlorine concentration levels shall be measured and recorded by the Consultant at each sampling location within the test section; this shall be performed in the company of the Municipal Field Representative. Once the minimum concentrations have been achieved throughout the system the recorded concentration levels become the Initial Chlorine Concentration.

The Initial Chlorine Concentration shall be left, isolated, in the system for a minimum of 24 hours. After the required contact time, the chlorine residual shall be measured and recorded at each sample location by the Consultant in conjunction with the Municipal Field Representative. This reading is referred to as the "24 Hour Chlorine Residual" on Form 3, attached to this document. Flow required to take the chlorine residuals shall be provided through the temporary connection. The maximum allowable decrease in Chlorine concentration shall be 40% of the initial chlorine concentration to a maximum decrease of 50 mg/L. In the event the decrease in chlorine concentration is greater than 40% of the initial chlorine concentration or the decrease is greater than 50 mg/L, the chlorine in the system is to be discharged in accordance with section 2.6 and the system shall be re-chlorinated. The Municipal Field Representative has the authority to require further swabbing if the residual is less than 25mg/L.

2.6 Removal/Disposal of Super Chlorinated Water

The Specialist shall de-chlorinate the discharge water to protect receiving streams and other bodies of water, via catch basins or other points of entry, as per the Ministry of Environment (MOE) regulations and ANSIIAWWA C651 as amended. Dechlorination is not required when discharging directly into a sanitary sewer. If the Specialist is proposing to dispose of chlorinated water via sanitary sewer, it must be identified in the Commissioning Plan and be given specific approval by the Municipality. The Specialist shall be required to supply all labour, equipment and materials to dechlorinate the water including, but not limited to, dechlorination mats, diffusers and dechlorination chemicals. There shall be no separate payment and or claim for de-chlorination.

2.7 Bacteriological Sampling

Before the watermain, or temporary above ground by-pass system can be approved for connection to the existing water distribution system, two (2) consecutive rounds of water samples, taken 24 hours apart, shall pass the appropriate chlorine residual and bacteriological testing requirements. Prior to chlorine residual and bacteriological testing, all other testing and disinfection shall be completed and any super chlorinated water removed from all portions of the watermain system under consideration including hydrant leads, stubs, branches, services, etc.

The Specialist is to provide a minimum of 3 work days notice to the Municipal Field Representative who will coordinate with the Municipal Overall Responsible Operator (ORO). The Specialist shall utilize the temporary connection to obtain the flow necessary for sampling. The ORO's office will take bacteriological samples at each

sample location and prepare the chain of custody documentation for the Municipality's contract Environmental Laboratory. The Specialist shall deliver the samples to the Municipality's contract Environmental Labortory along with the completed chain of custody documents. The watermain test section shall be immediately shut down, isolated and must not be disturbed or flushed for the period between this sample round and the next bacteriological sample round 24 hours later. The watermain must remain continually pressurized from the start of the bacteriological testing until the connection to the existing system is undertaken.

Samples shall be taken from the end of every dead end and from every 360 metres or less of new watermain pipe. No hose or fire hydrant shall be used in the collection of bacteriological samples.

2.8 Sample Results

Laboratory staff will process and log in the bottle{s). Each chain of custody form will be assigned LWO Number. In addition to the LWO, each sample bottle will be assigned a unique record number. Samples delivered after 3:30pm on working days will be set up the same day but may not be logged in until the next day. Samples delivered after 4:00pm on working days may not be set up for analysis or logged in until the next day.

Laboratory staff will communicate with the ORO's office to advise of the results. Once the ORO's office has reviewed and confirmed the records, they will communicate with the Townships office who will in turn communicate with the Consultant and/or Specialist and Contractor.

It may be possible for special arrangements to be made to collect and deliver sample bottles to the laboratory on a weekend, which may incur additional costs to the Contractor. The Consultant shall advise the Municipal Field Representative of such special requests as soon as possible.

If sample results are successful, connection to the existing water distribution system can proceed as outlined, below. A single failed bacteriological parameter will constitute a failure of the entire sampling round. If sample results do not meet requirements, the failed section must be flushed or re-disinfected as directed by the Municipal Field Representative and re-sampled at the sample locations. Sampling will continue until two {2) consecutive sets of water samples, taken 24 hours apart, pass both the appropriate chlorine residual and bacteriological requirements.

Note: The Backflow Preventer is to remain installed on the temporary connection until the bacteriological tests have passed.

3. CONNECTION TO EXISTING WATER DISTRIBUTION SYSTEM

All connections to the existing water distribution system shall be via Live Tap. In instances where a Live Tap cannot be performed, cutting into the system may be permitted by the Municipality. In such cases, it must be identified in the Commissioning Plan along with the specific reasons for the cut-in connection. The Municipality will outline additional requirements of the Contractor should a cut-in connection be approved.

Once the bacteriological tests have passed, the connection to the existing watermain shall be performed. A sump, minimum 300mm depth, shall be excavated in the trench bottom and filled with clear stone to provide a location to collect and pump water.

Watermains shall be cut back to remove any temporary taps. The Contractor shall disinfect the connection watermain pipe as outlined in Section 3.1 and shall dewater the watermain and trench in a controlled manner as to not allow backflow of water into the watermain.

If trench water, dirt, or debris has entered the watermain during the final connection, the watermain shall be aggressively flushed and additional bacteriological samples shall be taken as directed by the Municipal Field

Representative.

3.1 Connections

The Contractor shall ensure that the final connection is not longer than one pipe length.

The new pipe, fittings and valves required for the connection shall be spray-disinfected and swabbed with a minimum 1 % to maximum 12% solution of chlorine immediately prior to being installed. The existing watermain being connected to, shall also be cleaned in the immediate area of the connection and spray-disinfected with the same solution.

Where existing watermains are tapped, the pipe surface at the location of the tap shall be cleaned and disinfected using a minimum 1% sodium hypochlorite solution. Where applicable, the drill/cutting/tapping bits and all surfaces of mainstops, service saddles, tapping sleeves and valves which will come into contact with drinking water shall likewise be cleaned and disinfected using a minimum 1% sodium hypochlorite solution immediately prior to installation. If any of the disinfected surfaces come into contact with the soil and/or water in the excavation prior to use, the cleaning and disinfection procedure shall be repeated.

3.2 Tracer Wire

During the final connection of the new watermain to the existing distribution system, the Contractor shall ensure that the new tracer wire is connected to the existing tracer wire.

After the final grading, the Contractor shall demonstrate the integrity of the underground tracer wire by applying a conductivity signal and confirming the signal on all watermains and services. The Consultant shall witness the conductivity test(s) and provide written confirmation on the attached form, Form 6.

A continuity signal shall be applied to the tracer wire and the signal confirmed over the entire length of all tracer wire installed. The signal shall be detectable for a distance of at least 300m from either side of the signal connection point. At no point shall there be a break in the continuity of the tracer wire.

It shall be demonstrated that the tracer wire on the services is connected to the watermain tracer wire and that the service tracer wire is intact for the length of the service.

The Contractor shall demonstrate that the tracer wire in chambers can be accessed from finished grade and that the signal is detectable on the watermain outside of the chamber.

3.3 Valve Positioning

During final connection of the new watermain, the Contractor shall demonstrate that all valves, main and service, are in the final positioning as outlined in the commissioning plan or as directed by the Municipal Field Representative.

4. WATER SERVICES

Services 100mm in diameter and larger shall be considered mainline and shall meet all mainline procedures and testing requirements.

Service connections shall be tapped and connected under pressure. All connections shall be inspected to ensure they are drip tight prior to backfilling. The pipe shall be left exposed where directed by the Municipal Field Representative, after which backfilling shall be completed. All new water service pipe 38mm in diameter up to but not including 100mm diameter, as well as all sized of temporary by-pass service hose, shall be disinfected.

The chlorine solution shall be applied so that the chlorine concentration is a minimum of 25mg/L and does not exceed 100mg/L. Pre-disinfected pipe shall be sealed immediately following disinfection until immediately prior to connection.

All new services shall be thoroughly flushed prior to connecting to the existing service. Required fittings and valves shall be cleaned and spray-disinfected with a minimum 1 % to maximum 12% solution of chlorine immediately prior to the connection.

All by-pass services hoses to be used will be of potable water grade and shall meet the requirements of NSF 61 Standard. Service hoses shall be capped on both ends with brass caps until installed. Service hoses shall not be installed on by-pass piping until the day of the change over from the distribution watermain to the above ground by-pass watermain.

5. PRIVATE WATERMAIN

Private Watermains shall follow the same commissioning procedure at outlined in this document, except that, at the discretion of the Municipality, the Municipal Field Representative may not be present at the same frequency.

All Private Watermain connections to Municipal watermain shall be separated by a Backflow Prevention Device and water meter as specified by the Municipality. Where connections are already in existence and Backflow Prevention and Metering is not currently installed, the Municipality may elect to install such appurtenances at its own costs at any time, or may require the installation of the appurtenances by the Developer should a substantial expansion to the Private Watermain be requested by the Developer. In such a case, the Developer would be advised during the development approvals stage of the expansion.

Right of Way or Temporary Road Occupancy Permit

Please note: payment and proof of insurance must accompany application

Applicant's Name: _____

Address: .....

Phone: ..... Fax: .....

Email: .....

Date: .....

Type of Permit:

Right of Way - work on Municipal Property including boring, road cuts, paving, ditching, grading, etc.

Road Occupancy - placement of dumpsters, moving trucks, window cleaning, etc.

Location of Work: .....

Estimated Date of Work: .....

Scope of Work (specify): _____

_____

Reason for Work: .....

The Constructor must have $2,000,000 (Two Million Dollars) liability insurance to work on The Township right-of-way. Proof of insurance coverage to accompany application.

Agreement:

I/We hereby agree to assume liability for all damages incurred as a result of the above work or occupancy and to indemnify and save harmless The Township of Stirling Rawdon from any actions, claims, suits or demands made against The Township by any person arising out of the issuance of this application. 48 hours notice is required for all involved. Deposit (if applicable) will be refunded once work has been completed to the satisfaction of Stirling Rawdon Public Works Department.

_____ _____

Signature of Applicant Date

_____ _____

Approved by The Township of Stirling Rawdon Date

Right of Way - Or - Occupancy Permit
Sketch of Municipal Address Location and Scope of Work

WATERMAIN COMMISSIONING FORM 1
Field Record for Swabbing of New Watermain

PROJECT INFORMATION

PROJECT NAME: _____

LOCATION: _____

CONSULTANT: _____

CONTRACTOR: _____

SPECIALIST: _____

MUNICIPAL FIELD REPRESENTATIVE: _____

TEST/ PROCEDURE INFORMATION

TEST LOCATION: _____

DATE: _____

TEST LOCATION: _____

PERFORMED BY {PRINT): _____

WITNESSED BY {PRINT): _____

SECTION ID	No.SWABS INSERTED	No. SWABS RETRIEVED

RESULTS: Satisfactory Unsatisfactory

Remarks:

SIGNATURES

SPECIALIST: _____ **CONSULTANT:** _____

MUNICIPAL FIELD REPRESENTATIVE: _____

WATERMAIN COMMISSIONING FORM 2

Field Record for Hydrostatic and Leakage Testing of New Watermain

To be performed only after Swabbing has achieved satisfactory results

PROJECT INFORMATION

PROJECT NAME:. _____

LOCATION: _____

CONSULTANT: .....

CONTRACTOR: _____

SPECIALIST: _____

MUNICIPAL FIELD REPRESENTATIVE: _____

TEST INFORMATION

TEST LOCATION: _____

DATE: _____

TEST LOCATION: .....

CONDUCTED BY (PRINT): _____

WITNESSED BY (PRINT): _____

SECTION ID	LENGTH	MATERIAL	DIAMETER	PRESSURE		TIME		VOLUME LOSS {LITRES)	
				START	END	START	END	ALLOWABLE*	MEASURED

**Attach Allowable Leakage Calculations to this form*

RESULTS: Satisfactory Unsatisfactory

Remarks:

SIGNATURES

SPECIALIST: _____ **CONSULTANT:** _____

MUNICIPAL FIELD REPRESENTATIVE: _____

WATERMAIN COMMISSIONING FORM 3

Field Record for Disinfection - (Super-Chlorination and Residual Sampling)

To be performed only after Hydrostatic Testing has achieved satisfactory results

PROJECT INFORMATION

PROJECT NAME: _____

LOCATION: _____

CONSULTANT: _____

CONTRACTOR: _____

SPECIALIST: _____

MUNICIPAL FIELD REPRESENTATIVE: _____

PROCEDURE/TEST INFORMATION

WATERMAIN SECTION ID: _____

DATE: _____

DISINFECTANT UTILIZED: _____

METHOD OF INFUSION: _____

CONDUCTED BY (PRINT): _____

WITNESSED BY (PRINT): _____

SAMPLING INFORMATION

DATE	SAMPLE LOCATION	INITIAL CHLORINE RESIDUAL		24 HOUR CHLORINE RESIDUAL	
		TIME	(mg/L)	TIME	(mg/L)

METHOD OF RESIDUAL MEASUREMENT: _____

SAMPLED BY: _____ **WITNESSED BY:** _____

(Consultant's Office Representative)

WATERMAIN COMMISSIONING FORM 4

Field Record for De-Chlorination

To be performed during flushing of Super Chlorinated Water

PROJECT INFORMATION

PROJECT NAME: _____

LOCATION: _____

CONSULTANT: _____

CONTRACTOR: _____

SPECIALIST: _____

MUNICIPAL FIELD REPRESENTATIVE: _____

PROCEDURE/TEST INFORMATION

WATERMAIN SECTION ID: _____

DATE: _____

DECHLORINATION CATALYST UTILIZED: _____

METHOD OF INFUSION: _____

CONDUCTED BY (PRINT): _____

WITNESSED BY (PRINT): _____

SAMPLING INFORMATION

DATE	SAMPLE LOCATION	CHLORINE RESIDUAL	
		TIME	(mg/L)

METHOD OF RESIDUAL MEASUREMENT: _____

SAMPLED BY: _____ (Consultant's Office Representative)

WITNESSED BY: _____

WATERMAIN COMMISSIONING FORM 5

Field Record for Bacteriological Sampling

To be performed only after Disinfection has achieved satisfactory results

PROJECT INFORMATION

PROJECT NAME: .....

LOCAT1ON: _____

CONSULTANT: _____

CONTRACTOR: _____

SPECIALIST: .....

MUNICIPAL FIELD REPRESENTATIVE: .....

PROCEDURE INFORMATION

WATERMAIN SECTION ID: _____

DATE: _____

CONDUCTED BY (PRINT): _____

WITNESSED BY (PRINT): _____

SAMPLING INFORMATION

DATE	LWO No.	SAMPLE LOCATION	CHLORINE RESIDUAL		
			TOTAL (mg/L)	FREE (mg/L)	COMBINED (mg/L)

METHOD OF MEASUREMENT: .....

SIGNATURES

SAMPLED BY: _____ **WITNESSED BY:** _____

(ORO'S Office Representative)

WATERMAIN COMMISSIONING FORM 6
Field Record for Tracer Wire Conductivity Test

PROJECT INFORMATION

PROJECT NAME: _____

LOCATION: _____

CONSULTANT: .....

CONTRACTOR: .....

SPECIALIST: _____

MUNICIPAL FIELD REPRESENTATIVE: _____

PROCEDURE INFORMATION

DATE: _____

TEST LOCATION:

Street to Street: .....

Station to Station : .....

DESCRIPTION ON TRACER WIRE CONNECTION TO EXISTING WATERMAIN:

_____

_____

GAUGE AND TYPE OF EQUIPMENT USED:

_____

_____

PARAMETER	SATISFACTORY	UNSATISFACTORY
Continuity Signal applied to Tracer Wire and the signal confirmed over the entire length of all Tracer Wire installed		
Tracing Wire on services is connected to watermain Tracer Wire and wire is intact for the length of the service		
Tracing Wire in chambers is detectable on the watermain outside of the chamber		

TEST RESULTS: Satisfactory Unsatisfactory

Remarks:

SIGNATURES

SPECIALIST: _____ **CONSULTANT:** _____

MUNICIPAL FIELD REPRESENTATIVE: _____

DRINKING WATER SYSTEMS
CROSS CONNECTION CONTROL
WATERMAIN COMMISSIONING FORM 7
BACKFLOW PREVENTION DEVICE REPORT

TEMPORARY BFP DEVICE INSTALLATION FOR THE PURPOSES OF WATERMAIN COMMISSIONING

To be submitted by the consultant to the Municipal Field Representative. This test report form and the tests must be completed by a certified tester and as required by CSA B64 Standard.

PROJECT AND SITE INFORMATION

Developer		**Project**	
General Contractor		**Site Address**	
Consultant		**City**	
Site Supervisor/Owner		**Postal Code**	
Telephone		**Municipal Field Rep**	
Email		**City**	
		Postal Code	

LOCATION DETAILS AND HAZARD LEVEL

New Watermain size

Temporary connection size

BFP Device has been secured and protected how?

Water Meter #

Water meter reading

Is the by-pass value sealed in the off position? YES ☐ NO ☐

HAZARD LEVEL OF INSTALLATION

☐ SEVERE ☐ MODERATE ☐ MINOR

BACKFLOW PREVENTION DEVICE DETAILS

Serial # Manufacturer Model

Type of BFP Device Device Orientation ☐ Horizontal ☐ Vertical

Pipe Size Location of Assembly (i.e., Room #)

Installation Date (YY/MM/DD) Tagged with a Stirling Rawdon tag? ☐ Tag # NO ☐

GENERAL TEST INFORMATION

Successful Test Date Type of Test ☐ Replace Old Serial #

Tester Name Certification #

Company Name. Telephone

Address Postal Code

Test Kit Serial # Manufacturer

Model Calibration Date

Any false information or misleading statements made on this report will render any approval granted by The Corporation of the Township of Stirling Rawdon null and void and may result in removal of the certified tester and/or testing company from the Utilities Cross Connection Control database of approved testers for a predetermined length of time.

DRINKING WATER SYSTEMS- CROSS CONNECTION CONTROL- BACKFLOW PREVENTION DEVICE REPORT-WATER COMMISSIONING FORM 7

TEST DETAILS

RP/RPF Assembly Serial # _____

Pressure Differential Across Check Valve (no flow) — **Check Valve 1** _____ **Check Valve 2** _____

Relief Valve	Check **Valve** 1	**Check Valve 2**
Failed to Open ☐ Opened ☐	Leaked ☐ Closed Tight ☐	Leaked ☐ Closed Tight ☐

Opened, Opening Point of Relief Valve (2psi or greater) _____

Buffer (3psi or greater) _____

DCVA; DCVF; SCVAF Serial# _____

PVB / SRPVB Assembly Serial # _____

Check Valve 1	**Check Valve 2**	**Air Inlet Valve**	**Check Valve**
Leaked ☐ Closed Tight ☐ Pressure Differential Across Check ☐	Leaked ☐ Closed Tight ☐ Pressure Differential Across Check ☐	Failed to Open ☐ Opened ☐ Opened at (Pressure) ☐	Leaked ☐ Closed Tight ☐ Pressure Differential Across Check ☐

Shut Off Valves — **Valve 1** Leaked ☐ Closed ☐ — **Valve 2** Leaked ☐ Closed ☐

Static Inlet **Pressure at Time of Test (Required for Pass)** _____

Test Date _____ **TEST RESULTS** **PASSED** ☐ **FAILED** ☐

REPAIR – If the device fails the initial test for any reason complete repair and retesting

Check Applicable Valve(s) Relief Valve ☐ Check Valve 1 ☐ Check Valve 2 ☐ Air Inlet Valve ☐ Shut Off ☐

Check Applicable Repair: General Inspection, Cleaning, Servicing ☐ Parts Replaced (Check applicable below) ☐

Parts Replaced: Disc ☐ Spring ☐ Diaphragm ☐ Seat ☐ Guide ☐ O-Rings ☐ Poppet ☐ Repair Kit ☐

RETEST DETAILS

RP/RPF Assembly Serial # _____

Pressure Differential Across Check Valve (no flow) — **Check Valve 1** _____ **Check Valve 2** _____

Relief Valve	**Check Valve 1**	**Check Valve 2**
Failed to Open ☐ Opened ☐	Leaked ☐ Closed Tight ☐	Leaked ☐ Closed Tight ☐

Opened, Opening Point of Relief Valve (2psi or greater) _____

Buffer (3psi or greater) _____

DCVA; DCVF; SCVAF Serial# _____

PVB / SRPVB Assembly Serial# _____

Check Valve 1	**Check Valve 2**	**Air Inlet Valve**	**Check Valve**
Leaked ☐ Closed Tight ☐ Pressure Differential Across Check ☐	Leaked ☐ Closed Tight ☐ Pressure Differential Across Check ☐	Failed to Open ☐ Opened ☐ Opened at (Pressure) ☐	Leaked ☐ Closed Tight ☐ Pressure Differential Across Check ☐

Shut Off Valves — **Valve 1** Leaked ☐ Closed ☐ — **Valve 2** Leaked ☐ Closed ☐

Static Inlet Pressure at Time of Test (Required for Pass) _____

Test Date _____ **TEST RESULTS** **PASSED** ☐ **FAILED** ☐

CERTIFICATION OF TEST RESULTS

I certify that I have tested the device identified on this report in accordance with The Corporation of the Township of Stirling Rawdon and as specified by the CSA 864 standard and that the information provided is true and accurate

Certified Tester Name _____ Certified Tester Signature _____ Date _____

Owner/Owner Representative/Occupant _____ Owner/Owner Representative/Occupant _____ Date _____

INSPECTOR'S COMMENTS

Any false information or misleading statements made on this report will render any approval granted by The Corporation of the Township of Stirling Rawdon null and void and may result in removal of the certified tester and/or testing company from the Utilities Cross Connection Control database of approved testers for a pre-determined length of time.

WATERMAIN COMMISSIONING FORM 8

CERTIFICATE

of

HYDROSTATIC PRESSURE TEST

GENERAL INFORMATION	
Project:	
Project Location:	
Testing Completed by:	
Date:	

TEST RESULTS	
Date of Test:	
Time Test Initiated:	
Time Test Completed:	
Elapsed Time:	
Initial Pressure:	
Pressure at Completion:	
Total Pressure Loss:	
Allowable Loss (L):	
Measured Loss (L):	
Comments:	

CERTIFICATION OF TEST RESULTS		
I certify that the Hydrostatic Testing of the potable water service connection was successfully completed and meets the requirements of OPSS 441 and AWWA C651-14.		
Name:	**Signature:**	**Date:**

WATERMAIN COMMISSIONING FORM 9

CERTIFICATE

of

DISINFECTION

GENERAL INFORMATION	
Project:	
Project Location:	
Testing Completed by:	
Date:	

TEST RESULTS	
Date & Time Test Initiated:	
Date & Time Test Completed:	
Duration (Minimum 24 hours):	

DATE	SAMPLE LOCATION	INITIAL CHLORINE RESIDUAL {mg/L)	24 HOUR CHLORINE RESIDUAL {mg/L)

Comments:

CERTIFICATION OF TEST RESULTS		
I certify that Disinfection of the potable water service connection was successfully completed and meets the requirements of OPSS 441 and AWWA C651-14.		
Name:	**Signature:**	**Date:**