Town of Aurora

Design Criteria Manual for Engineering Plans

August 2023

Planning and Development Services

Engineering and Capital Delivery Division

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Record of Revisions

Revision	Date	Description
1	January 2000	Overall Updates and Revisions
2	September 2009	Format Update and Revisions
3	February 2013	Overall Updates and Revisions
4	April 2013	Addition of Parking Lot LED Lighting Criteria
5	August 2013	Revisions to Standards for Maintenance Holes, Service Connections, and Hydrants
6	December 2013	Revisions to Sanitary Section
7	March 2014	Overall Updates and Revisions
8	August 2019	Overall Updates and Revisions to Drawings
9	March 2020	Format Update and Overall Revisions
10	November 2020	Format Update, Revisions to Criteria, Drawings and Appendices
11	January 2022	Overall Updates and Revisions
12	November 2022	Revisions to Standards for Sidewalks Overall Updates and Revisions
13	April 2023	Addition of Appendix I – Watermain Disinfection Procedure
14	August 2023	Overall Updates and Revisions

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Section A General Information

Section A General Information

A1.00 General

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

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

The design and construction of roads and services is to be completed in full accordance with any and all By-laws as may exist within the Town. It is incumbent upon the Applicants and the Applicant's Consultants to be aware of all By-laws and other regulations which may otherwise affect the works as described within this manual.

A1.01 Glossary

The following abbreviations and terms are used in this document:

A.O.D.A. – Accessibility for Ontarians with Disabilities Act

Consultant – Applicant's representative

Applicant or Owner – property owner making application or obtained approval for construction related to changes in land use

D.C.B.S. – Development Charges Background Study

D.F.O. – Department of Fisheries and Oceans Canada

Director – the Town's Director of Development Services or his/her designate

E.C.A – Environmental Compliance Approval, as issued by the M.E.C.P.

F.S.S. – Functional Servicing Study

L.I.D. – Low Impact Development measures

L.S.R.C.A. – Lake Simcoe Region Conservation Authority

M.E.C.P. – Ministry of the Environment, Conservation and Parks

M.N.R.F. – Ministry of Natural Resources and Forestry

M.S.C.C. – Manual of Sewer Condition Classification

M.T.O. – Ministry of Transportation

F.S.R. – Functional Servicing Report

N.A.S.S.C.O. – National Association of Sewer Service Companies

O.B.C. – Ontario Building Code

P.T.T.W. – Permit to Take Water

Region – Regional Municipality of York

S.P.P. – Source (Water) Protection Plan

Town – Town of Aurora

Town Approval – written and signed approval from the Director

Town Engineer – An identified Town of Aurora staff member or other person as assigned by the Town

T.R.C.A. – Toronto and Region Conservation Authority

W.H.P.A.-Q2 – Well Head Protection Area identified in the Source Water Protection Plan as an area where activities which reduce recharge may be a threat to water drinking water quantity

W.Q.M.P. – Water Quality Management Plan for potable water systems

W.R.c – Water Research Center

A1.02 Familiarization

Prior to commencement of the engineering design, the Consulting Engineer shall obtain current copies of the Town of Aurora “Design Criteria Manual for Engineering Plans” to become familiarized with the requirements of design in the Town of Aurora. The subject design guidelines and standard drawings will apply to all developments in the Town of Aurora regardless of type (i.e., subdivisions, plan of condominium, site plans, severances, consents, individual lots, improvements, etc.).

Pre-consultation Meetings may be held with the Town's Engineering and Planning staff to discuss areas of preliminary concern and other issues prior to commencement of the both the preliminary and detailed engineering designs (see Sections A3.00 and A4.00).

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

A1.03 Regional Municipality of York

The Regional Municipality of York is generally responsible for all trunk sanitary sewers, forcemains, and trunk watermains that are constructed within the Region of York. Within the Town of Aurora, the Region is responsible for trunk watermains between supply and storage facilities and from storage facilities to the local distribution system. In addition, the Region is responsible for the York Durham Sanitary Sewer system and the Town is responsible for the sub-trunk and local sanitary sewers. The Town is fully responsible for the storm sewer system and stormwater management facilities.

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

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

A1.04 Conservation Authorities

The Town of Aurora falls within the jurisdiction of both the Toronto Region Conservation Authority (T.R.C.A.) and the Lake Simcoe Region Conservation Authority (L.S.R.C.A.). The Authorities are responsible for the regulation of development, interference with wetlands and alterations to shorelines and watercourses. The Consulting Engineer shall contact the Planning Department at the appropriate Conservation Authority at the beginning of Draft Plan preparation and prior to detailed design to obtain information on all design and submission requirements.

Within the T.R.C.A.'s jurisdiction, the Region also reviews E.C.A. applications for stormwater management approvals. Within the L.S.R.C.A.'s jurisdiction, the L.S.R.C.A. has undertaken the M.E.C.P.'s review role for stormwater management services through the Transfer of Review program. Following review and endorsement by the Town, applicants are to direct submissions to the Region and L.S.R.C.A. respectively.

A1.05 Ministry of the Environment, Conservation and Parks

The M.E.C.P. is responsible for the approval of works associated with development and land use changes through the Ontario Water Resources Act. Approvals are issued in the form of Environmental Compliance Approvals for various activities such as water and wastewater servicing and noise and vibration assessments and mitigation. Through the Transfer of Review

program, the Ministry has delegated the authority for technical review of selected E.C.A. applications to the Town of Aurora, the Region of York and Conservation Authorities.

A1.06 Ministry of Natural Resources and Forestry

The M.N.R.F. is responsible for enforcing Ontario's Endangered Species Act which protects specific threatened and endangered plants and animal species in the province. The Act requires that applications for development, land use changes and servicing-related activities which may have an impact on these species, be made to and approvals obtained from the M.N.R.F. Applicants are to involve the M.N.R.F. early in the Draft Plan review process and copies of all correspondence with the Ministry are to be provided to the Town as part of the development review process.

A1.07 Ministry of Transportation

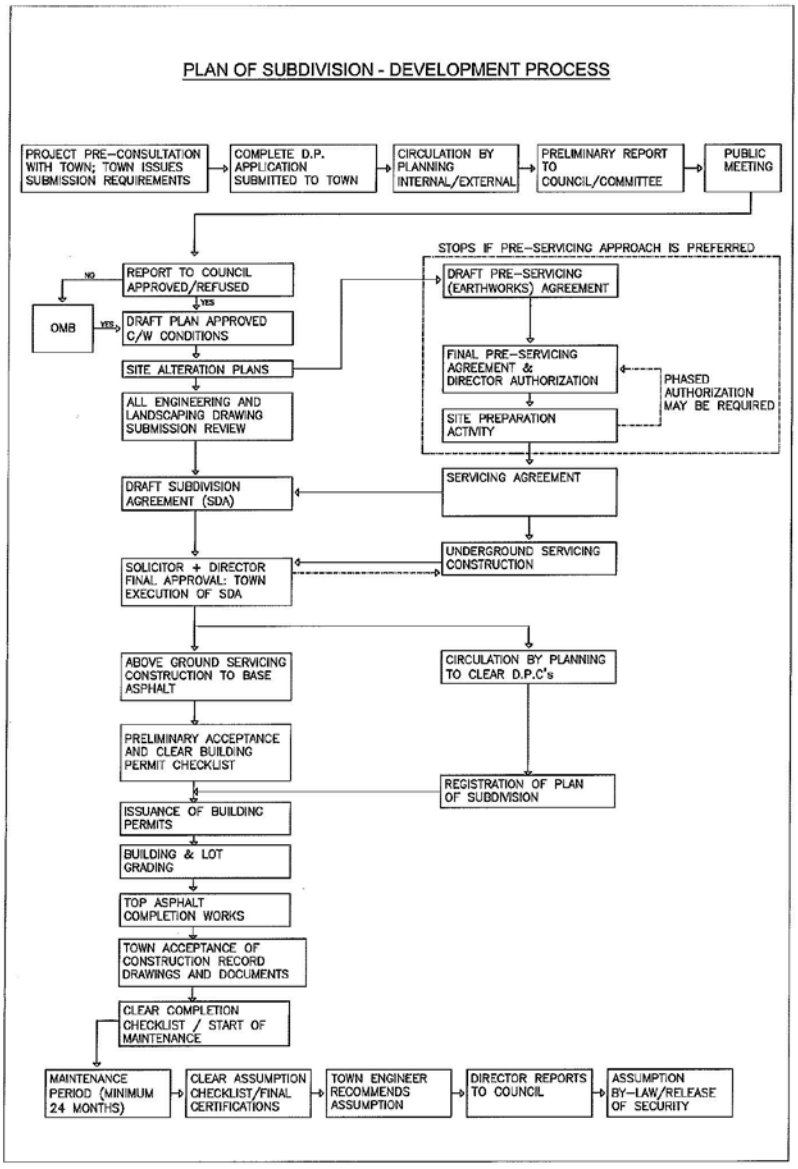
Provincial Highway Nos. 11 and 404 are within the jurisdiction of the M.T.O. All applications which fall within the corridor control criteria of the M.T.O. are subject to the Ministry's review and approval.

A2.00 Development Process

A2.01 Introduction

The usual development process is outlined in Figure A-1. The issuance of a Pre-servicing and/or Pre-servicing Agreement Amendment will be at the discretion of Council. Any specific requirements in these agreements and the Subdivision Agreement are in addition to or override specific requirements of this section.

Figure A-1: Plan of Subdivision - Development Process



A2.02 Pre-construction Requirements and Pre-servicing (Earthworks) Agreement

Pre-construction activities include creating a construction access and possibly a site office (if required), installing approved erosion and sedimentation controls, clearing and grubbing, topsoil stripping and earthmoving. No underground or above ground services may be constructed.

Prior to any pre-construction activity, a Pre-Servicing Agreement shall be executed by both the Applicant and the Town. The Pre-Servicing Agreement requires the following conditions to be met:

a) An Erosion and Sediment Control plan(s) shall be reviewed and approved by the Town and the Conservation Authority. The Erosion and Sediment Control plan(s) shall include written Dust Control Plan describing the proposed dust control and mitigation measures to be implemented.

b) All applicable approvals shall be obtained from other Agencies and are in place as per the Draft Plan conditions.

c) Tree Preservation Plan(s) shall be reviewed and approved by the Town.

d) Site Alteration plan(s) or subdivision Grading Plan(s) shall be reviewed and approved by the Town.

Following approval of a Pre-Servicing Agreement by the Director of Planning and Development Services, the Agreement may be subject to implementation in stages. The Applicant shall not begin site work without written authorization from the Director and shall undertake the works only in phases or stages, if so, approved in writing by the Director.

The Applicant or their Consultant shall also submit all required documentation, including but not limited to engineering servicing plan(s), payment of securities, provision of proof of insurance, approvals from required agencies, and any other specific requirements as deemed necessary by the Director. All submitted documents shall be in accordance with Town Policy No. 55 – "Requirements for Pre-Servicing New Subdivisions".

A2.03 Servicing Agreement

The Servicing Agreement will typically allow construction of underground works before execution of a Subdivision Agreement. Construction of underground works shall not proceed without a Servicing Agreement being signed by both the Applicant and the Town. Servicing engineering drawings must be acceptable to the Town and will be so indicated by the Town's signature on the plans prior to the start of construction. Underground works are undertaken solely at the Applicant's risk if servicing proceeds prior to the Town signing all engineering plans and preparation and execution of a Subdivision and Site Plan Agreements.

M.E.C.P. Environmental Compliance Approvals (E.C.A.s) shall be in place prior to the start of municipal infrastructure construction.

M.E.C.P. Permits to Take Water shall be in place prior to the start of dewatering requiring permits. Copies of permits shall be available on-site where dewatering is underway. Prior to the start of dewatering, the Town shall approve the dewatering plan including surrounding

resident/business notifications and public relations, equipment type, locations, operational plan and noise attenuation measures that will employed.

The Town will assume operation of the water system, once the watermain system has been fully constructed and commissioned and the following has been completed:

a) M.E.C.P. and Town requirements and the related documentation has been submitted to the Town.

b) All hydrants within the construction area have been fitted with anti-tampering devices. Banding or hydrant locking nuts where directed shall be provided acceptable to the Town Fire and Emergency Services and Infrastructure Operations Departments to prevent unauthorized use.

c) All main line valves will have been reviewed on site with Infrastructure Operations staff and checked for operation.

d) The system shall have adequate flushing and sampling points so that Infrastructure Operations staff can manage the system.

e) All relevant fees have been paid and securities posted.

All costs associated with maintaining the water system until Assumption (Final Acceptance) will be back charged to the Applicant.

A2.04 Subdivision and Site Plan Agreement

The execution of a Subdivision Agreements by the Applicant and the Town allows for construction of roads, aboveground services and utilities. The construction of these services shall not proceed without a Subdivision Agreement being signed by both the Applicant and the Town. The preparation of a Subdivision Agreement is to follow the requirements set out in Section A3.08.

A2.05 Building Permits and Preliminary Acceptance

Building permits will not be issued until Registration of the Plan of Subdivision has taken place and the following items have been completed to the satisfaction of Development Services. These include but are not limited to:

a) All municipal works completed up to and including base course asphalt.

b) Permanent street name signs and traffic control signs and temporary lot number identification signs have been installed.

c) All facilities are operational.

All sewers are to be inspected by CCTV and the reports and videos submitted to the Town. The inspections, testing, repairs and re inspections required noted in the Checklist are to be conducted under the direction of the Development Engineer and if appropriate other specialist engineers such as the Development Geotechnical engineer. At its discretion, the Town may spot check that the work has been done appropriately. The results of these tests will be compiled by the Development Engineer and submitted to the Town. The Town will undertake verification inspections only once assurance has been provided by the Development Engineer the site is suitable for inspection. The Development Engineer will provide certification to the Town that the water, sanitary and storm systems have been constructed and are operational in accordance with the approved design. Once Preliminary Acceptance has been granted, the Applicant is responsible for maintenance of the installed services and the site in general.

A2.06 Registration of Plan of Subdivision

The Applicant shall request in writing to the Town that the Town undertake a review for registration of the Plan of Subdivision. To facilitate the request, the Applicant shall provide a written summary, with copies of relevant correspondence as necessary, how the conditions of Draft Plan approval have been addressed. The final legal Plan of Subdivision prepared by an Ontario Land Surveyor, including any supporting Reference plans showing easements, etc., are to be provided to the Town. Through review of the Draft Plan conditions, Town staff may request further documentation or information to support a recommendation to the Town's Director. Following the Town's endorsement of subdivision design(s) and technical report(s) complete with the execution of the Subdivision Agreement, receipt of clearance letters from the required parties and/or government agencies, and all issues being addressed, Town staff (Development Services) will prepare a memorandum to the Director of Development Services for endorsement of the plan. The Director will sign the Plan of Subdivision prior to deposition at the Land Registry Office (L.R.O.) in sufficient reproductions and type/format as per the L.R.O. requirements. The plan will be delivered to the L.R.O. by the Town with confirmation being provided to inform the Applicant of the same. The Applicant's legal team will be required to make appointments with the L.R.O. and the Town's Legal Department to register the plan.

The following construction-related requirements are also to be met prior to registration of the Plan of Subdivision:

a) Streetlights have been energized.

b) For permanent facilities such as pumping stations and pressure reducing stations, operating manuals and instruction have been given to the Town.

c) Maintenance agreements acceptable to the Town are in place for facilities that will be the responsibility of the Applicant until Final Acceptance.

A2.07 Occupancy Certificate

In addition to provision of all hydro, gas and telephone connections, Occupancy Certificates shall not be requested by the Applicant until:

a) Grading certificates in a form acceptable to the Town have been provided by the Development Engineer.

b) All unoccupied adjacent areas shall be stabilized within six months.

c) Occupied lots have been sodded.

d) Occupied lots shall have top course paved driveways by the fall of preceding year following occupancy.

e) Municipal house numbers have been installed.

f) Water meter and remote reader has been installed.

g) Hard surface to the principal entrance has been constructed (e.g., paving stones or slabs).

A2.08 Completion Certificate and Start of Maintenance Period

Typically, a completion certificate will not be issued until:

a) A specified percentage (typically 65% for rural areas and 90% for urban areas) of the final occupancy permits have been issued.

b) Items outlined in Checklist Appendix H1 have been completed to the satisfaction of Development Services.

c) Base course asphalt has been in place for two full winters.

d) Surface course asphalt has been laid (and if applicable Stage 2 curbs completed).

e) Construction Record drawings all related post-construction design sheets and tables as noted in the Completion Checklist have been submitted and found to be acceptable by the Town.

Prior to the construction of the Stage 2 curb (if two stage curb is specified), base curbs shall be cleaned and inspected. Any damaged concrete work or stirrups shall be replaced.

Generally, all work within the subdivision will have been completed. The Development Engineer shall supply a certificate in a form acceptable to the Town that all works have been completed and are operational. The Town will reply with correspondence accepting Completion of the

subdivision and acknowledge the date of Completion. The Applicant will continue to be responsible for maintenance of the site servicing and general site conditions as noted in Section A2.05.

A2.09 Assumption (Final Acceptance)

The Town, the construction company responsible for the works and the Development Engineer and/or Development Landscape Architect, shall carry out final inspections prior to development assumption.

Typically, assumption will not be issued until:

a) Items outlined in Checklist H2 have been completed to the satisfaction of Development Services.

b) All sewers and selected sewer service laterals have been inspected by CCTV and related documents have been submitted to the Town for review.

c) All structures have been visually inspected on the inside for any deficiencies. Any deficiencies have been rectified prior to Final Acceptance.

d) All pavement markings are in good condition.

e) All signs are in place including trail signs.

f) Final inspection of the water system shall include check (turn on and off) every hydrant, valve and curb stop to verify proper functioning.

A2.10 Project Documentation and Meeting Minutes

The Applicant shall assign responsibility for preparing and circulating project correspondence and meeting minutes to the Town by a lead consultant or planner on the consulting team. Each meeting held is to be documented by preparation of meeting minutes. Submissions are to include a covering letter describing the comments made by all review agencies and responses to each comment describing how they have been addressed in the current submission.

A3.00 Submission Requirements for Engineering Design

A3.01 Pre-Design Consultation and Submission Coordination

Upon request from the Town, prior to commencement of the detailed design, the Applicant's Consultant shall meet with the Town to discuss the Town's design requirements. The Consultant is to advise during this meeting how the conditions of Draft Plan approval will be addressed and describe the proposed approach to the detailed design.

The Applicant is to identify a lead consultant who will be responsible for coordination and submission of all necessary documents and drawings. The consultant is to ensure that the submission materials as noted herein are provided at the appropriate time in the design review and approval process. The Town may reject any submission which is deemed to be incomplete or not meeting the required minimum standards for a full and complete submission.

The Applicant shall assign the responsibility to prepare and circulate to the Town, records and minutes of discussions and meetings held with the Town, its peer review consultant (if required), agencies, the Region or approval Ministries. Each meeting held is to be documented by preparation of meeting minutes. To expedite the Town's review, submissions are to include covering letters and comprehensive responses to Town and agency comments in one document, outlining how previous comments have been addressed in the current submission.

During the pre-design meeting, the Town will confirm the timing of Development Charge projects normally undertaken by the Town.

A3.02 First Engineering Design Submission to the Town

Engineering drawings shall be submitted simultaneously to York Region, the Conservation Authority, the M.N.R.F. and to the Town of Aurora. The Consulting Engineer is advised to review York Region's design criteria to determine the requirements for submission of engineering drawings to the Region. The initial submission of engineering drawings to the Town of Aurora shall contain the following information:

- Two copies of the approved Draft Plan.
- Two copies of the proposed plan for registration showing all lot and block numbering and dimensioning.
- Two copies of all "R" Plans showing proposed easements.
- A declaration from the Consulting Engineer indication that he has been retained to design and supervise the construction of the work in the subdivision according to the terms of the Subdivision Agreement.
- A cover letter summarizing all comments (including Ministries, Region and agencies) and responses identifying how comments have been addressed, for ease of review and clearance.

Two copies of the complete set of engineering drawings, including:

a) The Town's standard "General Notes" page (see Appendix C), modified with project specific notes if necessary. Any modified notes are to be indicated by striking out and retaining the standard note text and inserting the proposed revision.

b) General Plan of Services.

c) Lot Grading Plan.

d) Area Rough Grading Plan.

e) Internal and External Storm Drainage Plan(s).

f) Internal and External Sanitary Drainage Plan(s).

g) All Plan and Profile Drawings.

h) Utility Coordination Plan.

i) Pavement Marking and Signage Plan.

j) All detail drawings other than the Town of Aurora Standard Detail Drawings.

k) All drawings pertinent to the design including floodplain modifications and structural drawings.

l) A final Functional Report and plan, approved by the Town, is required following Draft Plan approval and prior to commencement of the detailed engineering design. The FSR is to have regard for all reports and previous submissions and comments received during the Draft Plan approval process. Further revisions of previous studies may be required as part of the design process.

The final FSR shall provide all details, calculations, costs, alternatives and recommendations necessary to evaluate the proposed development. In addition, the FSR shall reflect the conditions of Draft Plan approval and become the basis describing how they have been addressed as part of the first engineering submission. The final FSR and plan shall be signed and stamped by a Professional Engineer.

The report is to identify how the engineering design supports any proposed internal phasing, through the use of temporary measures or services if required. Phasing of a Draft Plan of Subdivision is to be carried out through individual legal Plans of Subdivision (i.e., M-Plans).

The final FSR shall confirm that the servicing design does not limit or isolate future developments. The report shall describe and quantify servicing under interim and ultimate conditions relative to external areas or future developments.

m) Two copies of the Town's completed storm and sanitary sewer design sheet templates (see Appendix A) and the Engineering Consultant's hydraulic gradeline sheets, stamped and signed by a Professional Engineer (including digital copies in Excel format).

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

o) Two copies of a Functional Internal Traffic Study prepared by a qualified Traffic Engineer. The study is to support the detailed design of the transportation system and shall be based on FITS submitted and approved with the Draft Plan of Subdivision. Refer to the study guidelines provided in Appendix G.

p) Two copies of an updated Geotechnical report prepared by a qualified Soils Consulting Engineer. The report is to document the recommendations made to support the complete design and construction of the project based on further site investigations if necessary and review of the first submission engineering drawings.

q) Hydrogeological Study and Water Budget Report prepared by a qualified hydrogeologist (updated as necessary following Draft Plan approval).

r) Water System Hydraulic Analysis report confirming the water system design criteria, providing water demand calculations and verifying that the proposed expansion or modification of the water distribution system meets the Town's and M.E.C.P. requirements.

s) A Stormwater Management and L.I.D.s Design Report.

t) Street Lighting designs and photometric calculations.

u) Noise Attenuation and Vibration (if required) reports.

v) All submission materials are to be signed and stamped by a Professional Engineer and accompanied by digital copies of the materials (PDF and Word/Excel formats where applicable for Town templates and design sheets) on a portable USB flash drive device. All plans and digital files are to be geo referenced to UTM coordinates as defined by the Region of York and/or the Town of Aurora.

The above information will be reviewed, and one set of drawings and calculations will be returned to the Consulting Engineer with the required revisions noted. This information may be provided in digital form.

A3.03 PSAB and GIS Data

Road, watermain, and sewer location and description information will be added to the Town's PSAB database as part of the subdivision process, and the water system design shall be verified by the Town's consultant on a peer-review basis.

All electronic GIS/CAD files (ESRI shapefile, Geodatabase or AutoCAD-dwg) drawings shall conform to the following projection:

Universal Transverse Mercator (UTM)

North American Datum (NAD) 83

Zone 17N

Spheroid – GRS1980

These GIS spatial files must be tied and geo-referenced to the horizontal and vertical control monuments within the local area. The location and description with respect to the monuments shall be indicated on the drawings. This information is to be provided in the specified digital format (including horizontal and vertical location in UTM coordinates for all infrastructure items) at the following times:

- With first Submission: All information necessary to verify the water system design.
- Prior to issuance of the Certificate of Completion: All information on underground infrastructure (sewers and watermain).
- Prior to issuance of Certificate of Acceptance: All information on roads and other specified above-ground infrastructure.

A3.04 Subsequent Design Submissions

Subsequent submissions of drawings, calculations and reports shall be made until the engineering drawings and design is acceptable to the Town of Aurora Engineer. Streetscape and landscaping/street tree plan as wells as any Open Space restoration plans are to be included. The design of the underground electrical distribution system shall be completed by Alectra Utilities. This design shall be submitted to the Town and shall be approved prior to the final approval of the engineering drawings. The design of the telephone system, cable TV system and gas mains shall follow the same format as the Ontario Hydro requirements. All utility information including Canada Post boxes are to be shown on a utility coordination plan, prepared by the Consulting Engineer.

A detailed cost estimate of all municipal servicing, roads, street lighting and landscaping is also required on second submission or as directed by the Town.

A3.05 Ministry of the Environment, Conservation and Parks (M.E.C.P.) Applications

The approvals for storm and sanitary sewers are provided by the Town of Aurora under the M.E.C.P. Transfer of Review program. The Transfer of Review program allows the technical

review of Environmental Compliance Approvals (E.C.A.s). The Transfer of Review Program covers a number of works that are of a non-complex or less environmentally sensitive nature. Storm water management facilities designs are subject to the Town's review and approval prior to being submitted by the applicant to the L.S.R.C.A. under the M.E.C.P. Transfer of Review program to obtain an E.C.A.

When the Town has determined that the design has advanced to a satisfactory level of detail, the Applicant is to submit three copies of the completed Application for Environmental Compliance Approval and all required documents, to the Town for review. Applications shall be completed electronically online, with all of the required sections completed fully and the Application Status shown on Page 5 reads "Form Complete" and to be submitted in colour. Incomplete applications will be returned to the Applicant's Engineer. If the Town has comments related to the approval process, they will be sent to the Applicant's Engineer and the Town will not recommend approval until all comments are addressed. Once the Town is satisfied with the application, the application will be processed by the Town.

Municipal residential drinking water systems approvals are subject to the Municipal Drinking Water Licensing (M.D.W.L.) Program. The Applicant is to confirm the eligibility of new waterworks to qualify under the M.D.W.L. as a pre-authorized installation under the guidelines. Should the project not meet the preauthorization requirements, an E.C.A. application directly to the M.E.C.P. is to be made for approval. Where the project meets the pre-authorization requirements, the Applicant is required to submit Form 1 – Record of Watermains Authorized as a Future Alteration and all related documents to the Town for review and comment. Upon acceptance, the submission will be recommended to the Director of Operations for approval.

A3.06 Other Approvals

The Consulting Engineer shall be required to make all submissions and representations necessary to obtain approval from all other authorities affected (Ministry of Culture, Sport and Tourism, Ministry of Natural Resources, Ministry of Transportation of Ontario, Conservation Authorities, Canada Post Corporation, Transport Canada, etc.). The Applicant is to ensure that the Town of Aurora receives copies of submission packages provided to other review authorities and shall keep the Town informed of the progress of these submissions by circulating copies of all correspondence.

A3.07 Original Drawings

After all approvals have been received from all affected parties and the Applicant has entered into a Subdivision Agreement with the Town of Aurora, the original drawings printed on vellum shall be submitted to the Town Engineer for signing. These drawings will be signed and dated and then returned to the Applicant's Consultant for further printing. The prints of drawings for all disciplines (i.e., civil, structural, street lighting, electrical, landscaping, etc.) for the Town's use shall be bound together into sets prior to delivery to the Town. Changes or revisions to the drawings after the signature of the Town Engineer has been affixed, must be formally submitted

to the Town for approval prior to construction, and shall be detailed in an appropriate revision item.

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

A3.08 Preparation of Subdivision Agreement

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

The Town must be in a position to clear all Draft Plan Conditions of Approval prior to the preparation of the draft Subdivision Agreement.

Prior to commencement of preparation of the Subdivision Agreement, the Applicant's Consultant shall provide the Town with the following:

1. M.E.C.P. E.C.A.s and completed and signed Form 1 or Schedule C amendments as required for Town services to be constructed for the proposed subdivision.

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

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

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

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

6. Two copies of the legal description of the subdivision prepared by an Ontario Land Surveyor, based on the Reference Plan.

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

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

9. Two copies of the engineering drawings and landscaping plans acceptable to the Town (including digital files).

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

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

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

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

    a) Detailed cost of services.

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

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

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

Table A-1: Contingencies and Engineering Cost Estimate Allowances

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

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

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

- Alectra Utilities.
- HydroOne Networks.

- Bell Canada.
- Consumer's Gas (Enbridge).
- Appropriate cable company.
- Any other authority where required.

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

15. Proposed timetable for construction of services.

16. Proposed staging plans.

A4.00 Engineering Design Requirements

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

2. All engineering drawings shall be prepared in metric and in a neat and legible fashion.

3. All information shown on the engineering drawings shall be prepared in accordance with the Region of York requirements for transfer of digital design and as-constructed record drawings to the Town through the Region of York. The design and all drawings are to be prepared using ACAD Version 14, or as may be updated from time to time. All drawings are to be geo referenced to the UTM NAD83 coordinate system.

4. The title block shall be located in the bottom right hand corner of all drawings and shall include the following:

   a) All plans submitted for approval of municipal servicing, grading and roadworks within new subdivisions are to be provided on the Town of Aurora title block (C.A.D. file is available from Planning and development Services) on A1 drawing size.

   b) Name of Development.

   c) Subdivision File No. (i.e., No. assigned at time of application for Draft Plan approval).

   d) Drawing title, consultant's drawing number and Town drawing ID number.

   e) Town of Aurora.

   f) Date, initials of draftsperson and checker, scale(s).

g) Development Engineer's stamp signed and dated.

h) Development Engineer's name, address, e-mail and telephone number where applicable, Development Landscape Architect's name, address, e mail and stamp.

i) Revision block with spaces for revision number, description, date and initials.

j) A space in the title block shall be reserved for signing by the Town Engineer.

k) A title sheet is required for the engineering drawings.

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

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

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

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

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

10. The reference drawing numbers for all intersecting streets and match lines shall be shown on all plan and profile drawings.

11. A north arrow shall be referenced on all drawings.

12. All engineering drawings shall be stamped by a Professional Engineer.

A5.00 General Plan of Services

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

2. When more than one "General Plan of Services" drawing is required for any development, then the division of drawings shall reflect the limits of the Registered Plans as closely as possible. Where more than one plan is prepared, a supplementary

"General Plan of Services" at a small scale shall be prepared to show the entire plan of subdivision on one drawing.

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

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

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

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

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

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

9. All watermain, sanitary sewers, storm sewers, foundation drain sewers, roof leader collectors and clean water systems and related appurtenances are to be shown. It is not necessary to show the grade and the sewer material on the "General Plan of Services"; however, the length, sizing, direction of flow, and type of the sewer must be shown.

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

11. All catchbasins are to be shown.

12. All curbs and sidewalks are to be shown.

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

14. Dimensioning of utilities and roadways is not required on the "General Plan of Services".

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

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

17. The proposed locations of Community Mailboxes and the associated number of units shall be shown on the "General Plan of Services".

A6.00 Plan and Profile Drawings

1. All plan and profile drawings shall be prepared at a scale of 1:500 horizontally, and 1:100 vertically. A complete legend shall be provided on all Plan and Profile Drawings.

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

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

4. All road allowances, lots, blocks, easements and reserves are to be shown and are to be identified in the same manner as the Registered Plan. The dimensions of lot and block frontages as well as road allowance curve radii are to be shown on the plan and profile drawings.

5. All curb and gutter and sidewalks shall be shown and dimensioned on the plan portion of the drawing. The location, soil profile and groundwater elevations of borehole and test pit logs are to be shown on the plan and profile. Groundwater elevation readings are to be represented by including the dates the measurements were taken. It is not necessary that boreholes and test pits be located within the road allowance to be represented on the plan/profile drawings.

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

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

8. All catchbasins and catchbasin connections shall be shown.

9. All storm sewer maintenance holes which have safety platforms are to be noted.

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

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

12. Manhole benching details are to be shown at a scale of 1:25 whenever the Town of Aurora Standard Detail Drawings are not applicable.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

A7.00 Other Drawings

A7.01 General Notes Sheet

The Town standard General Notes sheet (see Appendix C), is available from the Town in CAD and Word format, shall be used in the drawing set. Any approved revisions to the standard notes are to be shown by striking through the standard text and entering new text, as opposed to erasing and replacing standard notes.

A7.02 Lot Grading Plans and Area Rough Grading Plans

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

A7.03 Storm and Sanitary Drainage Plans

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

A7.04 Storm and Sanitary Design Sheets

Storm and sanitary sewer design sheets shall be prepared in accordance with the criteria given in the appropriate sections of this document and included in the drawing set.

A7.05 Stormwater Management and LIDs Plans

The design of end of pipe stormwater management and at-source or conveyance L.I.D.s infrastructure shall be shown on dedicated drawings. Plan views shall be prepared following the requirements for Lot Grading plans noted in Section G. Cross sections, sufficient in quantity and location to illustrate the design, shall also be prepared meeting the requirements of roadway Plan and Profile drawings. The location and geotechnical information (i.e., soils profile and groundwater levels) from boreholes and test pits shall also be shown in plan and cross section. Details and specifications of flow control devices, structures, erosion and sedimentation controls, maintenance and safety measures based on the S.W.M. and L.I.D. design report are to be included.

A7.06 Composite Utility Plans

Composite Utility Plans shall be prepared at a scale of 1:500 and shall clearly show all existing and proposed utility plants. Special note to be made that hydro switch gear infrastructure and communications Outside Plant Interface pedestals are to be located outside of the road allowance and not on private residential lots. A municipal access easement is to be provided for such utility infrastructure. Specific information related to telephone, hydro, streetlights, gas and cable TV and community mailboxes are to be shown. A joint use utility trench detail and all applicable Town standard cross sections are required on all plans. Street trees and the locations of sewer and water services to the lots and blocks are also to be shown.

Prior to the Director of Planning and Development Services approving the Composite Utility Plan, it must be signed by all of the utility companies.

A7.07 Street Lighting Plans

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

A7.08 Erosion and Sedimentation Control Plans

Erosion and sedimentation control plans shall be prepared for each stage of site conditions which change as grading and servicing take place. The typical stages of construction to be reflected on separate erosion and sedimentation control plans are topsoil stripping, post earthworks construction and post servicing construction however, each site shall be assessed individually.

All the plans for erosion and sediment controls shall be prepared at 1:1000 scale (or per the General Plan). They shall provide for all controls as typical for such purposes and to the satisfaction of the Town and/or Conservation Authority. Associated plans shall include details for all controls and appurtenances related to same.

A7.09 Tree Inventory, Preservation and Relocation Plans

Tree inventory, relocation and removal plans shall be prepared for all phases of the development and construction. Plans will be reviewed by the Town in conjunction with the Town's Tree Preservation By-law.

A7.10 Streetscaping and Landscaping Plans

Streetscaping and Landscaping plans shall be prepared for all phases of the development and construction.

A7.11 Pavement Markings and Signage Plan

Pavement marking and signage drawings shall be prepared at a scale of 1:500 horizontally and shall depict all required pavement markings and signage based on the recommendations of the TIS and FITS studies. The plans shall take into account all surface features such as utilities and driveways to avoid conflicts. The plan is to be based on York Region design standards for pavement marking and signage.

A7.12 Town of Aurora Detail Drawings

The Town of Aurora Standard Detail Drawings noted in Appendix D shall be used whenever applicable. The use of the latest revision of the Ontario Provincial Standard Drawings may be used when approved by the Town. These drawings shall be reproduced as part of the engineering drawings for the development and must be referred to by number on the affected plan and profile drawings. The Consulting Engineer shall be responsible to check the suitability of the details provided on these Standard Drawings for the application proposed. Individual details shall be provided by the Consulting Engineer for all special features not covered by the Town of Aurora Standard Drawings. These special details shall be drawn on standard sized sheets and shall be included as part of the engineering drawings. The minimum scale to be used for any special manhole or sewer detail shall be 1:25.

A7.13 Other Drawings

Other drawings that may be requested to be included at the discretion of the Town include but are not limited to the following.

- Removals and restorations.
- Limit of grading and disturbance.
- Construction management
- Traffic management.

A8.00 Construction

A8.01 Requirements Prior to Commencement of Construction

Prior to commencement of construction, the Applicant's Consulting Engineer shall convene a Pre-Construction meeting with all relevant parties in attendance. The Applicant and Consultant shall submit the following information to the Town for approval (allowing a minimum of two weeks for approval):

a) Engineering drawings which reflect the proposed works and will be included in an Agreement with the Town have been submitted to the Town. The Town Engineer will sign the drawings prior to final signature of the Agreement by the Town.

b) A Pre-servicing, Servicing or Subdivision Agreement is to have been signed by the Applicant and the Town at the time of convening a Pre-construction meeting.

c) Three sets of all approved construction drawings specifications.

d) The names of proposed contractors and sub-contractors.

e) The contractor's list of suppliers.

f) One copy of the signed Contract Documents, complete with all prices.

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

h) Conservation Authority permits and MNRF permits for grading, erosion and sedimentation control measures, in-stream works, or stream crossing works as applicable.

i) Provide a copy to the Town of Pre-Construction condition surveys completed by the Applicant on any adjacent or surrounding properties, structures, fencing, vegetation, landscaping or other features which may be susceptible to damage by construction activity including excavation, dewatering, backfill, vibration, grading, drainage, etc. The Applicant will be responsible to settle any claims for damages by landowners or residents related to the project.

j) Preparation of a draft Notice of Commencement of Construction for Town review, which is to be delivered by the Consultant a minimum of one week prior to the start of construction to adjacent and area residents, business and other potentially affected parties.

A8.02 Construction Quality and Workmanship

All constructed works related to development projects shall be of high quality and workmanship. Materials used are to be of high quality as outlined in these guidelines and generally in the Ontario Provincial Standard Drawings and Specifications. During inspections prior to assumption, the Town shall make a determination of the suitability of the quality and workmanship of the constructed services for final acceptance.

A9.00 Issuance of Building Permits, Certificate of Completion and Final Acceptance

A9.01 Issuance of Building Permits

Upon construction of all services up to and including base asphalt, the Development Engineer shall notify the Town that all services have been inspected and all deficiencies have been repaired. The Development Engineer shall provide to the Town a redline marked-up General Plan of Services and a Water Systems Plan indicating any change in the location of services installed to date prior to the preparation of construction Record Drawings.

The Town will undertake its own inspection and review of inspection reports to determine if the servicing and documentation is acceptable and allows for commencement of the building program. Any deficiencies noted by the Town are to be rectified and re-inspected prior to the start of building construction. The Development Engineer and any other specialist engineers such as structural or geotechnical engineers will provide certification to the Town that the water, sanitary and storm sewers and stormwater management facilities are constructed according to the design and specifications and are operational. Consultants shall also ensure that the existing downstream sanitary sewer system is isolated from the new construction area by means of a removable mechanical plug. The plug is to remain in place until such time as the Town authorizes the first building occupancy within the new development.

The Applicant is also to provide to the Town a copy of the executed Hydro One streetlight energization contract. The contract is required by the Town prior to the Town issuing building permits for the development.

A9.02 Certificate of Completion

The term “Certificate of Completion” shall be used to describe the date when the services are complete and acceptable to the Town of Aurora, subject to the maintenance requirements pursuant to the Subdivision Agreement. The date for Certificate of Completion of the services in the development shall be established by the Town of Aurora.

When the services are completed, cleaned and repaired with no outstanding deficiencies to the satisfaction of the Consulting Engineer, written notice shall be provided by the Consulting Engineer to the Town that the work is completed and shall request an inspection by the Town of

Aurora. The Town shall carry out inspections and shall advise the Consulting Engineer of any items of work requiring further rectification. If in the sole opinion of the Town that an unacceptable amount of time has passed since the Town inspections were completed with no notification from the Consulting Engineer repairs have been satisfactorily made, the Town reserves the right to conduct subsequent re-inspections of the services. When all deficiencies have been corrected to the satisfaction of the Town, a Certificate of Completion will be issued by the Director, which will establish the date for commencement of the maintenance period.

The Town will not issue a Certificate of Completion for any works between October 15 and May 15 of any given year. When the services are completed and cleaned to the satisfaction of the Consulting Engineer, he shall advise the Town in writing that the work is completed and shall request an inspection by the Town. The Town shall carry out their inspections and shall advise the Consulting Engineer of any items of work requiring further rectification. If in the sole opinion of the Town that an unacceptable amount of time has passed since the Town inspections were completed with no notification from the Consulting Engineer repairs have been satisfactorily made, the Town reserves the right to conduct subsequent re-inspections of the services.

When all deficiencies have been corrected to the satisfaction of the Town, the Director shall issue a letter to the Applicant being the Certificate of Completion which confirms the date for the commencement of the maintenance period.

A9.03 Final Acceptance

“Final Acceptance” shall be the terminology used to describe the date on which the Council of the Town of Aurora agrees by By-law that all the conditions of the Subdivision Agreement have been fulfilled, and all maintenance requirements have been completed.

Near the end of the maintenance period, the services shall be re-inspected by the Consulting Engineer and all deficiencies found shall be corrected. When the Consulting Engineer is satisfied that the work is complete and acceptable, the Consulting Engineer shall so advise the Town in writing and shall request a final inspection by the Director of Planning and Development Services. The Town shall carry out inspections and shall advise the Consulting Engineer of any items of work requiring further rectification. If in the sole opinion of the Town that an unacceptable amount of time has passed since the Town inspections were completed with no notification from the Consulting Engineer repairs have been satisfactorily made, the Town reserves the right to conduct subsequent re-inspections of the services.

When all work is completed to the satisfaction of the Director of Development Services, a report shall be forwarded to the Council recommending “Final Acceptance” of the works.

A10.00 Records of Construction

A10.01 General

The Applicant shall retain the design Consultant to be responsible for verifying in detail the actual conditions of the completed project for the preparation of signed and stamped "Record Drawings" as defined by Professional Engineers Ontario (P.E.O.). The Record Drawings constitute the original engineering drawings which have been amended to reflect the construction changes and variances in the design of the services being transferred to the Town with the granting of Final Acceptance. Further the Consultant shall prepare and submit additional documentation described herein which contains the attributes of constructed infrastructure.

All AutoCAD drawing files are to be prepared in accordance with Region of York requirements for processing digital files into GIS data, using ACAD Version 14, or as may be updated from time to time. All such plans are to be geo referenced to UTM-NAD83 coordinates and shall not include x-refs within the files. These files are to be accompanied by Adobe PDF (Vector image) files which include only the Town's drawing ID number as the file name.

A10.02 Interim Construction Record

Following construction of services and prior to the issuance of the first Building Permit, the Consulting Engineer shall provide to the Town a copy of the General Plan of Services marked in red with changes or revisions if any, which took place during construction. These plans will be used by the Town for recording changes in the GIS database and locating pipes and appurtenances prior to issuance of a Completion certificate for the subdivision. These drawings are to be replaced with final Record Drawings at the time of requesting a Certificate of Completion.

A10.03 Record of Field Survey

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

- Location of all sewer maintenance holes and elevation of the finished top of maintenance holes.
- Invert elevations of all sewers and drop structures.
- Location of all sewers including sewers with curvilinear alignment distances between all sewer maintenance holes.
- Location of all roadway catchbasins.

- Location, rim and invert elevations for all rear yard and lot catchbasins.
- Location of all sidewalks and curbs.
- Location of all valve boxes and valve chambers.
- Location of all hydrants.
- Location of all special watermain appurtenances.
- Road centreline elevations.
- Stormwater management ponds and lids facilities including topographic survey, bathometric survey, all related maintenance holes, pipes, weirs and structures or devices including confirmation of the sizes and control elevations of the devices.
- Site benchmarks.
- Location of all service connections to all lots and blocks and location of connection from nearest downstream manhole (i.e., +023).
- Sewer pipe sizes.
- Location of all fencing constructed as part of the subdivision services.
- Location of completed tree planting.
- Location of constructed trails and walkways.
- Location of completed pavement markings and installed signage.

A10.04 Construction Record Drawings

The original drawings shall be revised to incorporate all changes and variances found during the field survey. All drawings are to be updated as noted below:

a) The Registered Plan number and Certificate of Approval or E.C.A. (M.E.C.P.) number for the subdivision must be clearly showing the bottom right corner of the title block.

b) All drawings except erosion and sediment control drawings, phasing plans, and composite utility plans shall be revised and submitted as Record drawings.

c) All streetlight related above and underground infrastructure shall be included.

d) The Town Reviewed section within the title block shall be re-signed and dated by the Director of Planning and Development Services.

e) The Development Engineer will add his seal with signature and date to the Record drawings.

f) The revision block shall retain all previous entries records and the final entry shall indicate “Record Drawing”, with the date of the drawing approved by the Town Engineer. All wording that indicates proposed and linework and hatching that represents pre-development conditions which have been modified by construction shall be removed.

g) At the discretion of the Town, any proposed works which were not constructed but may remain relevant to the constructed works or original design shall be shown in ghosted/shaded line type and identified appropriately in the legend. Drawings shall typically have only Record information related to completed construction with revised line work for major changes.

h) All road centreline profile elevations are to be shown every 20 m.

i) All sewer and road grades are to be recalculated to two decimal places.

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

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

l) The Contract, the date of commencement of construction, and the date of completion, shall be noted on the “General Plan of Services” drawings only.

m) The title sheet of the Engineering Drawings shall be clearly marked with “Record Drawing”.

A10.05 Tolerances

Sewers

a) As-constructed invert elevations and pipe slopes (%) on plan and profile sheets are to be shown by striking-out "proposed" figures and indicating "existing" figures above or below, as permitted. If the elevation difference is greater than or equal to 0.50 m or, the pipe slope changes by 0.5% (minimum), then the profile of sewer must be redrawn.

b) Any changes to length, size, type, class, etc. must be shown on plans by striking-out the proposed information and placing the as-constructed information above or below.

c) Any maintenance hole location which differs by more than 3.0 m shall be redrawn.

d) Any changes to type of maintenance hole (i.e., poured instead of precast) shall be noted on the profile drawing.

Watermain

a) If the depth of the watermain varies by more than 0.50 m, the profile must be redrawn.

b) Any change to size, class, type, bedding, etc. must be shown on the plans by striking-out the proposed and showing the as-constructed information above or below.

c) Any changes to length, size, type, class, etc. must be shown on plans by striking-out the proposed information and placing the as-constructed information above or below.

d) Show a minimum of two ties to all mainline valves and chambers from permanent surface features (i.e., maintenance holes, catchbasins, buildings).

e) Show a minimum of two ties to all stub ends required for future connection.

f) Show ties to service boxes for all those which are located in any but standard location (in accordance with Standard Drawing M-409).

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

A10.06 Permanent Benchmark Installation

The Applicant shall construct a permanent geodetic benchmark within each phase of a subdivision at the Town’s discretion. The benchmark shall be a Second Order monument for horizontal and vertical control. The construction and documentation of new benchmarks shall meet the Ministry of Natural Resources and Forestry requirements for registration in the COSINE database of benchmarks. In the case of the use of digital leveling, following the most current “M.N.R.F. Provisional Digital Levelling Specifications” guideline is required.

The Ontario Land Surveyor (O.L.S.) retained by the Applicant is to contact M.N.R.F. staff prior to starting field work to obtain assigned benchmark identification numbers and confirm requirements to ensure acceptance of the work in the COSINE database. The O.L.S. is to supply and arrange for stamping of brass caps which should be completed before installation of the caps on the foundation.

The Town’s preference is to register new benchmarks in COSINE based on the Canadian Geodetic Vertical Datum of 1928, 1978 re adjustment (i.e., CGVD28:78) to be consistent with historical benchmarks. Should M.N.R.F. standards change requiring new benchmarks to be installed based on the CGVD2013 datum, consultations with the Town are to take place prior to installation of the new monuments.

A10.07 Infrastructure Attribute Data, Inventory Sheets and Maintenance Manuals

As part of the submission of Construction Record data, it is necessary to supply all attribute data and construction-related information and costs to the Town in a format as may be described from time to time. The data must also include geo referenced to coordinates for the development site and all items contained therein. The data will be provided to the Town in printed copies and digital formats (i.e., AutoCAD, Excel, etc.) which will allow importation to the G.I.S. records and the Public Sector Accounting Board (P.S.A.B.) reporting system.

A10.08 Submissions

Upon completion of all construction work and the approved Record information, two full size drawing print sets, plus the original signed drawings all on vellum stock shall be submitted to the Town of Aurora as the permanent record. At the Towns discretion these drawings may be submitted digitally in a format satisfactory to the Town.

The submission of the accepted Record drawings to the Town of Aurora must be made before the “Completion Certificate” for the subdivision will be given.

The Consulting Engineer shall provide a written declaration to the Town of Aurora stating that all subdivision works have been constructed in accordance with the terms of the Subdivision Agreement, approved Engineering Drawings, and the Town’s Design Criteria, prior to issuance of the “Completion Certificate”.

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Section B Roadways

Section B Roadways

B1.00 Design Guidelines and References

The design of roadways within the Town of Aurora is to be in accordance with the guidelines provided in this manual. In the absence of specific guidelines in this manual, the following sources of documentation can provide further information and may be adopted as a guideline by the Town at its sole discretion:

- Regional Municipality of York.
- Ontario Traffic Manuals.
- Transportation Association of Canada.
- Ontario Ministry of Transportation.
- U.S. Federal Highway Administration.

B2.00 Roadway Classification

Roadway classification is established through the Draft Plan approval process, Municipal Class Environmental Assessment process and transportation studies. A Transportation Study and Traffic Function Design Study shall be required by the Town in order to determine roadway requirements. All new roadways within the Town shall be fully urbanized.

Table B-1: Road Classifications

Category	Dwg. No.	R.O.W. (m)	Pavement (m)	Boulevards (m)	Type
Residential Local	R-209	18.0	8.0	4.5 and 5.5	Sidewalk on one side
	R-210	20.0	8.5	5.75	Sidewalk on one side
	R-211	23.0	11.0	6.0	Sidewalk on both sides
	R-212	26.0	11.0	7.5	Sidewalk on both sides
Industrial	R-213	20	10.5	4.75	Sidewalk on one side
	R-214	23	11.0	6.0	Sidewalk on both sides

All roadways in new developments shall be classified in accordance with the Town's current Official Plan Section 14.2.3 and Schedule I, which includes the following:

- Regional Roads with Right-of-Way widths of 20 m to 45 m.
- Municipal Collector Roads with Right-of-Way widths of 20 m to 24 m.
- Local Roads with Right-of-Way widths of 18 m to 22 m.
- Lanes which are generally only permitted as a private lane, having a minimum Right-of-Way width of 6 m.

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

B2.01 Supporting Traffic Studies

Prior to or at the time of draft plan approval, the Town will require the proponent to prepare and submit supporting traffic studies, for the Town's approval. The first portion of the study consists of a broad based Transportation Impact Study (T.I.S.), which will examine the property boundary conditions and interconnections with adjacent properties (including signalization issues), assessed under existing and future conditions, Transportation Demand Management (T.D.M.) requirements, and active transportation. The study must recommend the phasing of traffic signals and road widenings to match development. The transportation study must conform to the Region of York's Transportation Mobility Plan Guideline for Development Applications.

The second portion of the analysis consists of a Functional Internal Traffic Study (F.I.T.S.), which balances appropriate urban design guidelines with a detailed assessment of internal transportation and traffic geometric design, on-street parking restrictions, off-street or driveway parking issues, signalization warrants, stop sign warrants, a Transportation Management Plan, roadway capacity and classification, lane configurations, boulevard requirements (i.e., snow storage and utility corridors), transit and pedestrian requirements, vehicle decision making criteria and intersection vehicle sight lines. Where a roundabout is proposed, a preliminary design is required based upon the recommendations of the T.I.S., to confirm right-of-way requirements.

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

noted above are subject to the Town's approval prior to acceptance of the proposed draft plan. (See Appendix G.)

B3.00 Geometric Design Elements

Table B-2: Geometric Design Elements

Geometric Detail	Local	Collector*	Arterial*	Industrial
Typical AADT	<1,500	1,500 – 6,000	5,000+	<1,500
Design Speed (km/hr)	60	70	80	60
Posted Speed (km/hr)	50	60	70	50
Pavement Width (m) (edge to edge of asphalt)	Refer to Table B-1			
Minimum Grade (%)**	0.5	0.5	0.5	0.5
Maximum Grade (%)	6	6	6	6
Minimum Centerline Horizontal Radius (m)	90	115	300	115
Minimum Sag Curves (K Values)	7	11	30	20
Minimum Crest Curves (K Values)	5	10	35	20
Minimum Tangent Length between Reverse Curves (m)	45	75	75	75
Intersection Angle (degrees)	80 – 90	80 – 90	85 – 90	80 – 90
Minimum Tangent Length required at stop-controlled intersections (m) from intersecting road center line	30	50	60	50

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

*Arterial and Collector Roads – York Region or the Town of Aurora may require greater road allowance requirements for the implementation of their policies (i.e., minor vs. major road classification, turn lanes, H.O.V. lanes, bicycle lanes, or rapid transit). Input is required for such matters. Posted and design speeds are to be confirmed by the Town.

** Urban standard road designs (i.e., curb and gutter) are to provide a minimum 1.0% gutter grades on all curb radii. If the slope of less than 1.0% is required due to grading constraints, it shall be subject to Town Approval.

Typical road cross sections for Rural, Minor Local, Major Local, Minor Collector and Major Collector roads are included in Town of Aurora Standard Drawings.

B4.00 Design Elements

B4.01 Typical Road Cross Sections and Sidewalk Locations

The typical road cross section to be used shall comply with the Urban Design Guidelines for the subdivision, as established at the time of Draft Plan approval. Sidewalks and walkways shall be implemented based on the approved Functional Internal Traffic Study, which is reviewed with the Draft Plan submission. Where sidewalks are specified, they shall be continuous through all driveways.

B4.02 Horizontal

Horizontal alignment is to conform to the requirements as outlined in Table B-1. In general, “right angle bends” on local roads servicing “courts” or “crescents” must not have a deflection angle less than 80 degrees or greater than 110 degrees in accordance with the Standard Drawings.

B4.03 Vertical Curves

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

B4.04 Backfall at Intersecting Streets

At all street intersections, the normal crossfall of the major street shall not be interrupted by the crown line of the minor street. A minimum 0.5% but preferable 1% backfall shall be provided on the minor street at all street intersections. This backfall shall continue to the end of the curb return radii to facilitate proper drainage of the intersection. The overland flow route of storm drainage through the intersection must be maintained.

B4.05 Intersecting Road and Right-of-Way Characteristics

The curb return radii and daylighting triangle requirements at street intersections shall conform to the dimensions noted in Table B-3. Daylighting at all intersection quadrants shall be included in the road allowances and noted on the proposed plan for registration (M-Plan) and on all engineering drawings.

Table B-3: Intersecting Road and Right-of-Way Characteristics

Road Classification	Intersecting Road	Road Curb Radius	Daylighting Triangle
Local	Local, Minor and Major Collector	9.0 m	5.0 m
Minor and Major Collectors	Minor and Major Collectors	12.0 m	10.0 m
Major Collector	Major Collector	14.0 m	15.0 m

Note: The Region's requirements take precedence over the Town's requirements at Regional intersections.

B4.06 Cul-de-sacs

Permanent cul-de-sacs shall be constructed in accordance with the details provided in the Standard Drawings. Minimum gutter grades of 1% shall be maintained along the flow line of all gutters around the feature. The maximum permissible down gradient into a cul-de-sac is 4%. The maximum length of a cul-de-sac shall generally be 150 m or servicing 25 units.

B4.07 Roundabouts

Traffic circles or roundabouts are to be provided in plans of subdivision where directed by the Town, located at collector/collector road intersections or collector/local road intersections. Only in special cases would "mini" roundabouts be directed by the Town at local/local road intersections. The application of a traffic circle primarily as a traffic calming measure versus a roundabout for capacity purposes is to be confirmed by the Town during the Draft Plan review and approval process.

A traffic consultant specializing in the design of roundabouts is to prepare a functional design and road allowance configuration. The design is to be based on the Canadian Roundabout Design Guide taking into consideration traffic volumes, design and operating speeds, all specified vehicle turning movements, pedestrian movements, sidewalks and crosswalks, adjacent driveway access design and servicing and utility requirements. The following elements are to be considered in the functional design:

- Use of a raised center median in combination with a mountable apron for truck passage.

- Swept path movements for a City Bus and a WB 20 vehicle.
- Standard road allowance widths shall be increased as necessary on the approaches to the roundabout to accommodate splitter islands, crosswalks, etc.

A preliminary design of the roundabout and the siting of proposed houses on adjacent corner lots including driveway locations will be required prior to Draft Plan approval. Reserve blocks shall be provided on lots adjacent to roundabouts where required by the Town. Any necessary site-specific zoning requirements for the adjacent lots and housing units are to be identified prior to Draft Plan approval.

B4.08 Traffic Calming

Any proposed traffic calming devices or methodology are to meet the requirements of the Town's Traffic Policy No. 62 – Traffic Calming Policy (latest revision April 8, 2015).

B4.09 Temporary Turning Circles

Temporary turning circles will be required whenever a road is to be continued in the future. Details for the requirements of temporary turning circles are provided in Town of Aurora Standard Detail Drawing R-221. The street line and curb radius requirements for temporary cul-de-sacs are the same as for permanent cul-de-sacs. When temporary turning circles are required within the subdivision limits, the land within the temporary right-of-way limit must be conveyed to the Town or easements must be provided in favour of the Town. The temporary turning circle is to have complete services to the street line. Signage is to be erected at the terminus of the cul-de-sac indicating that the road will be extended in the future and a "dead end" barricade and sign shall be erected in accordance with O.P.S.D. 912.532.

B5.00 Pavement Design

The pavement design for all roads shall be as recommended by a qualified Geotechnical Consultant. The design is to consider analysis of the subgrade material, frost susceptibility, drainage characteristics, (future predicted) traffic volumes and impacts on pavement structure during the building program prior to placement of top course asphalt. The Geotechnical report shall be submitted as part of the Engineering Drawing Submission Package. The minimum pavement design for all streets in new subdivisions shall be as follows:

Table B-4: Minimum Pavement Design

Local Road	Collector Road and Industrial Road
40 mm HL3	50 mm HL3
50 mm HL8	75 mm HL8

Local Road	Collector Road and Industrial Road
150 mm – 19 mm crusher-run limestone	150 mm – 19 mm crusher-run limestone
300 mm – 50 mm crusher-run limestone	450 mm – 50 mm crusher-run limestone

Compaction requirements shall be reviewed and confirmed by a qualified Geotechnical Consultant. The following minimum standards are to be met.

Table B-5: Minimum Compaction Requirements

Item	Compaction Required (% of Standard Proctor Density)
HL3 Asphalt	Minimum 96%
HL8 Asphalt	Minimum 96%
Granular “A”	Minimum 100%
Crusher-run limestone	Minimum 100%
Subgrade	Minimum 98%
Trench backfill	Minimum 95%

Note: Granular and stone materials are to be spread and compacted in layers with a maximum depth of 150 mm.

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

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

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

B6.00 Driveway Designs

B6.01 Driveway Grades

The maximum permissible design grade for any driveway on private lands shall be 6%. The minimum grade for all driveways shall be 1%. The use of negative grade driveways is not permitted in urban areas. Negative sloping driveways will only be considered in estate residential developments under special circumstances. Where negative sloping driveways are

used, a positive slope of at least 2.5% must be maintained from the garage over a minimum distance of 10.0 m. Any variations from these limits must be approved.

B6.02 Driveway Dimensions and Curb Depressions

Single Family Detached and Townhouse Residential Driveways

The width of the private property portion of a driveway shall be in conformance with By-law 6000-17 Section 5.6.1. Industrial, Commercial and Multi-Residential Driveways

A Traffic Study is to be prepared for each non-residential Site Plan and shall confirm on-site traffic volumes, turning movements and entrance driveway requirements. The geometry of non-residential driveway entrances in the road allowance shall be in accordance with or based on O.P.S.D. 350.010 and modified as required based on the approved Site Plan Traffic Study and the current Town Zoning By-law.

B6.03 Driveway Locations and Clearances

Driveway and driveway apron locations and clearances to property lines and aboveground services shall be in accordance with the current Town Zoning By-law and as follows:

Table B-6: Driveway and Driveway Apron Clearance and Location Requirements

Driveway and Driveway Apron Clearance and Location Requirements	Minimum Clearance Distance
From driveway edge to daylight triangle or point of curvature of curb radius at intersection	6 m
From driveway edge to side lot lines and the projection of side lot lines to the curb (subject to full Zoning By-law requirements)	No closer than the main building setback and not less than 0.5 m
From driveway edge to outside edge of other services (adjacent driveways, streetlight poles, catchbasins, fire hydrants, water valves, water service boxes, grade-level vaults, maintenance holes, chambers, CATV or telephone or fiber optic junction boxes)	1.2 m
From driveway edge to edge of boulevard trees – residential driveway	1.5 m
From driveway edge to edge of boulevard trees – commercial and industrial driveway	5.0 m
From driveway edge to edge of community mailboxes and the open side of hydro transformers	3.0 m
Length of full height curb required between adjacent driveway curb cuts	1.0 m

Further details related to clearances required for siting boulevard trees are noted in the Street Tree Planting section of these Guidelines.

Driveways for lots located adjacent to roundabouts are subject to a review of house siting and driveway layouts in coordination with the roundabout geometric design review prior to Draft Plan approval. The approved plans will be the basis for Zoning By-law amendments if necessary, for these lots. The preliminary and detailed design will require the submission of vehicle turning templates to demonstrate full moves access to the driveways has been provided.

B7.00 Construction Requirements

B7.01 Clearing and Grubbing and Area Rough Grading

The road allowance shall be cleared of all trees and shrubs which are not included in the final landscaping, and of all other obstructions for such widths as are required for the proper installation of roads, services, and other works. Rough grading shall be done to bring the travelled portion of the road to the necessary grade and in conformity with the cross-section shown on the drawings. Stripped areas must be stabilized within six months and must be

graded to within a maximum of 0.6 m of finished grade with regard to eliminate ponding. The sub grade for all roads shall be properly shaped and compacted to minimum 95% Standard Proctor Density, prior to any application of granular base course materials. In all cases, topsoil shall be stripped for the complete width of the road allowance and stockpiled at locations approved by the Town. All topsoil stripped shall remain on site to be used within the limits of the subdivision. Topsoil shall not be sold and removed from the site without the approval of the Town.

In order for fill to be removed from the construction site to a disposal site within the Town of Aurora, a current and valid Fill Permit must be in place, and in accordance with Fill By law as may be amended from time to time.

B7.02 Road and Sub-Drains

In general, 100 mm diameter perforated, filter cloth wrapped plastic corrugated sub-drains, will be required to run continuous along both sides of all roads with curb and gutter. The sub-drains shall be trenched and have Granular A surround. The Town reserves the right to require video inspection of sub-drains.

B7.03 Curb and Gutter

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

Driveway depressions shall be formed in the curb according to the details and locations shown on the engineering drawings or approved site plans and as detailed per O.P.S.D. 351.010. A mechanical curb cutting machine is not permitted to saw-cut driveway depressions, unless specifically approved by the Town.

If the driveway depression has not been created in full-stage curb or has been improperly located, then that section of full-stage or depressed curb which is improperly located shall be broken out and shall be replaced with a normal curb and gutter section. The concrete capping of a depressed curb shall not be permitted. The new driveway depression at this location can be formed by cutting the back of the curb with a curb cutting machine, provided the existing section is free from cracks and other defects, and that the entrance is to a single-family residence. For multiple-family, commercial, industrial, apartment and other entrances, the existing curb and gutter shall be completely removed and replaced with a steel reinforced depressed curb section in accordance with the detail on the Standard Drawing.

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

B7.04 Temporary Roadway Barricade

Following placement of base asphalt and during the building construction program the Applicant shall install and maintain temporary roadway barricades at subdivision entrance locations specified by the Town. The barricade is to discourage construction and regular vehicular traffic however will allow passage by emergency service vehicles. The barricade shall be installed per Standard R-220 consisting of two concrete “jersey barriers” placed on the pavement separated by distance of 4 m, a connecting steel chain across the opening and a construction roadway delineator centered under the chain. The barricade is to be removed when directed by the Town.

B7.05 Sidewalks and Trails

Sidewalks are required on both sides of all arterial and collector roadways, and at least one side of all local streets or as noted on Detail Drawings R-209 to R-213. For local roadways, the locations of schools, parks, churches, commercial establishments, etc., the length of street, traffic volume expected, and the number of dwelling units serviced will be used as criteria in determining whether sidewalks are required on one or two sides of the street. Sidewalks are not required on cul-de-sac with less than 30 units, unless there is a walkway or path leading from the cul-de-sac to: another walkway or path; street; park; school; or plaza.

The sidewalk shall conform in details and dimensions to the current Town of Aurora Standard Detail Drawings R-200 and R-204 and shall be installed at locations as shown on the typical road cross sections. Special treatment related to urbanization of urban roads is to be considered per existing Town designs.

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

Sidewalks shall be installed at locations as shown on the Typical Road Cross Sections. The standard width of sidewalks for all streets shall be 1.5 m and the depth shall be a minimum thickness of 125 mm. Where adjacent to curbs or crossing residential driveways, the thickness shall be increased to 150 mm and in the case of crossing commercial, institutional or multiple-residential block driveways, the thickness shall be increased to 200 mm. Construction shall comply with O.P.S.D. drawings and shall be constructed on a 100 mm deep compacted layer of 19 mm crusher run limestone bedding. Sidewalks are to be specified as 32 MPa, C2 (per CSA A23.1).

Sidewalks must not be “dipped” at driveways. When a sidewalk is constructed adjacent to a curb and gutter, a keyway shall be provided along the back of the curb to support the sidewalk, all in accordance with the details shown on the Town of Aurora Standard Detail Drawing. This type of construction is to be minimized wherever possible.

All sidewalk dummy and contraction joints shall be constructed by saw cutting once initial curing is complete, without the use of troweled edges. Expansion joints shall be constructed without troweled edges on the sidewalk surface. The design of all sidewalks, trails and walkways is to be in accordance with the initiatives outlined in the documents and Regulations related to the Accessibility for Ontarians with Disabilities Act (A.O.D.A.), including width of sidewalks, trails and walkways, maximum slopes, landings, railings, etc. The treatment of sidewalks ramps at intersections is to be in accordance with standards as implemented by the Region of York including the use of iron tactile plates at pedestrian crossings (see Appendix D).

Off-Road Multi-Use Trails and Off-Road Hiking Trails shall be included in plans of subdivision based on the current “Trails System and Parks Concept Plan” and the “Active Transportation Servicing Plan” as directed by the Town and in accordance with the Standard Drawings.

For sidewalk design for capital construction the following guidelines apply.

a) Site conditions may dictate the locations and design of sidewalks. Proper engineering design and safety constraints shall be paramount when locating and designing sidewalks. Also, new and replacement sidewalks including curb cuts must be designed to ensure pedestrian accessibility as per A.O.D.A. Design of Public Spaces Standard Guidelines.

b) Sidewalks shall be typically located on the side of the street dictated by, but not limited to factors such as: cost, street lights, utility locations, connectivity of the sidewalk system, topographical constraints (ground elevations), and physical constraints (road allowance and driveway slopes).

B7.06 Driveway Construction

The Applicant is responsible for the grading, gravelling and paving of all driveways from the curb to the garage floor slab. For estate lots, only the apron section of the driveway (from the curb or edge of the road to the property line) is required to be constructed in accordance with this specification. The minimum consolidated depth requirements for the granular base and asphalt in driveways shall be as follows and or as is recommended by the Geotechnical Consultant.

a) Single Family Residential

- Asphalt 50 mm of HL3A
- Granular 150 mm of 19 mm crusher run limestone

b) Commercial, Light Industrial and Apartments

- Asphalt 40 mm HL3 surface course

  50 mm HL8 base course

- Granular 150 mm of 19 mm crusher run limestone

  300 mm of 50 mm crusher run limestone

c) Heavy Industrial Driveways

- Asphalt 40 mm HL3 surface course

  75 mm HL8 base course

- Granular 150 mm of 19 mm crusher run limestone

  400 mm of 50 mm crusher run limestone

At the discretion of the Town, commercial, industrial or multi-unit residential driveway aprons in the road allowance may be required to be constructed with crusher-run limestone subbase and base material in substitution of Granular materials. Alternate types of driveways (i.e., paving stones, concrete pads, etc.) will be subject to approval by the Town.

B7.07 Boulevards

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

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

Clean, weed free topsoil shall be placed on all boulevard areas that are to be sodded. In urban areas, the minimum depth of topsoil shall be 300 mm. No. 1 Nursery Sod shall be used for all areas that are to be sodded.

On all rural roads, the side slopes and the ditch bottoms are to be graded in accordance with the typical road sections and approved drawings. Slopes and ditches are to be completed with a minimum depth of topsoil of 300 mm and No. 1 Nursery Sod which shall be staked as required.

B7.08 Placing of Final Surface Course Asphalt

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

1. A minimum period of one year has expired from the completion date for the placement of the base course asphalt.

2. 90% of the units have been granted occupancy in an urban area development or 65% of the units have been granted occupancy in the case of a rural area development.

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

4. All services to lots and blocks within the plan of subdivision are installed.

5. All deficiencies and settlements have been repaired.

6. Favourable weather conditions are present, as defined by the O.P.S. specifications.

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

B8.00 Service Crossing and Service Connections on Existing Town Roads Requirements

Whenever it is necessary to install underground services under an existing Town road, the Applicant's Contractor is required to obtain a Road Excavation Permit from the Town Operations Department. Excavation permits will not be issued for works undertaken within a subdivision prior to assumption of services. In this situation it is assumed that all work is still under the controlled responsibility of the Owner/Developer. The Town assumes no responsibility for any works completed by a Contractor or Utility in this regard. Excavation permits will be issued by the Operations Section and signed by the Operations Manager or designate. A copy of the permit will be forwarded to the Infrastructure Operations Supervisor for follow up inspections, notices and final approval of works. All requirements with respect to charges and approvals regarding permits are detailed in the Roadway Excavation Control By-law.

The Contractor will be required to use trenchless methods to cross the road. The plans, details and specifications of the road crossing work are to be approved well in advance of the commencement of the work.

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

Before making detours, permission is required from the Town. Where the road is not part of the Town road system, approval from the appropriate road authority will also be necessary. In all cases, fire, police, and ambulance services, and school bus companies, must be notified in writing 72 hours prior to work by the Applicant or his Contractor. All work will be done in accordance with ordinances and By-laws of the Town of Aurora.

B8.01 Snow Clearing

Snow clearing operations prior to Final Assumption will be carried out by the Town with cost recovery being provided by the Applicant to the Town.

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Section C Sanitary Sewers and Appurtenances

Section C Sanitary Sewers and Appurtenances

C1.00 Jurisdiction

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

The Town of Aurora is responsible for the local sewage collection works in the Aurora urban area to the point of connection to the York Durham Sanitary Sewer system.

The Town of Aurora is responsible for allocation of municipal wastewater collection and treatment capacity as assigned by the Region of York. Prior to the commencement of any design for any sanitary sewage works within the Town, the applicant shall obtain confirmation from the Town and the Region that adequate treatment plant capacity and sewer allocation has been approved for the development by the Council of the Town of Aurora.

The sewage collection system is to provide flow capacity by gravity. Every effort shall be taken during the planning and preliminary design stages of secondary plan and subdivision draft plans to prevent the need for local (i.e., Town owned) sanitary pumping stations. Sanitary pumping stations will only be approved where in the opinion of the Town, gravity solutions are not feasible or preferable from a long-term operations and maintenance perspective.

C2.00 Hydraulic Design

C2.01 Sanitary Drainage Plan and Sanitary Sewer Design Sheet

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

Sanitary drainage areas external to a development are to be represented on engineering drawings at a suitable scale showing the location, drainage boundaries and area take-offs, land uses and densities of existing and/or future development.

The design flow and sewer sizing shall be computed on the Town's standard sanitary sewer design sheets (i.e., Appendix A – Sanitary Design Sheet), as stipulated by the Town. For each area entered on the design sheet, the maintenance hole numbers, invert elevations, size and grade of the sewers shall also be shown.

C2.02 Residential Sewage Flows

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

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

Where,

Q (d) = Peak domestic flow plus extraneous flows, in L/s

P = Design population, in thousands

q = Average daily per capita flow, in L/cap/d

M = Peaking factor

I = Unit of peak extraneous flow, in L/s/ha

A = Gross tributary area, in hectares

An average daily per capita flow of 400 L/c/d shall be used.

The unit of peak extraneous flow shall be 0.26 L/s/ha.

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

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

Where,

P = population, in thousands

Maximum M – 4.0

Minimum M – 2.0

The Harmon peaking factor is only applicable for residential developments. For Industrial Development the peaking factor peaking factor shall be calculated as follows:

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

Where,

Mi = industrial peaking factor

A = gross lot area (ha)

The design population shall be derived from the drainage area and expected maximum population over a minimum design period of 20 years, or as directed by the Town. Future land use and population shall be based on the approved Official Plan and Secondary Plans of the area.

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

Table C-1: Population Density per Hectare

Development Type		Persons/Hectare
Single Family Dwelling		80
Semi-detached and Duplex		100
Townhouse		125
Apartment	Low Density (62 units/ha)	140
	Medium-Low Density (86 units/ha)	190
	Medium Density (124 units/ha)	280
	High Density (274 units/ha)	600
Industrial		95
Commercial		75
Institutional		50
Parks and Recreation		50
School		0.30 persons/student
Hospital / LTC		4.0 persons/bed
Hotel/Motel		0.50 persons/bed
Office Commercial		115/persons/ha of floor (4 L/day/m^2)
Shopping Centre		115/persons/ha of floor (4 L/day/m^2)
Restaurant		60 L/day/m^2

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

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

Table C-2: Population Density per Residential Unit

Type of Housing	Persons/Unit
Single Family Detached and Semi-Detached	3.8
Townhouse	3.5
Apartment	2.5

C2.03 Commercial Sewage Flows

A design flow of 30,000 L/ha/day (75 persons/ha of gross land area population equivalent) plus allowances for infiltration and peaking effort shall be used for the design of all local sewers.

The area shall be based on the gross lot area.

C2.04 Industrial Sewage Flows

A design flow of a minimum of 38,000 L/ha/day (95 persons/ha of gross land area population equivalent) plus allowances for infiltration and peaking effort for industrial uses shall be used.

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

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

C2.05 Institutional and Schools Sewage Flows

A design flow of 20,000 L/ha/day (50 persons/ha of gross land area population equivalent) plus allowances for infiltration and peaking effort shall be used for the design of all local sewers.

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

C2.06 Extraneous Flows

The design allowance for extraneous flows in the sanitary sewer system is 0.26 L/s.ha.

Measures are to be implemented to mitigate all extraneous flows into the sanitary sewer system. Reference should be made to the “Sanitary Sewer System Inspection, Testing and Acceptance Guideline” (Oct. 2011 or as amended from time to time) as prepared by the Region of York. Specific measures are noted within these guidelines related to sanitary sewers, service laterals and appurtenances.

Flow monitoring will be required at the direction of the Town if deemed necessary to verify infiltration flows are within acceptable levels.

C3.00 Sanitary Sewer Design

C3.01 Location

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

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

C3.02 Sanitary Sewers and Fittings

Main line sewers will be PVC D.R35 sewer pipe and shall be in conformance with ASTM D3034 or ASTM F1760 and certified to CSA B182.2. PVC pipe shall have gasketed watertight joints. All sanitary sewer fittings shall be PVC D.R35 injection-molded or fabricated fittings gasketed fittings in conformance with D3034, F1336, CSA B182.1 or CSA B182.2. For sanitary sewers proposed to be installed at depth and/or in high groundwater conditions, a higher class of PVC pipe material may be required by the Town. Concrete pressure pipe (C.P.P.) is required for all sanitary sewers 600mm diameter and greater. Reinforced Concrete Pipe shall conform to CSA Specification A275.2 or latest revision thereof. The type and classification of all sanitary sewer pipes and the sewer bedding type shall be clearly indicated on all profile drawings for each sewer length.

C3.03 Pipe Capacities

Table C-3 provides the allowable sanitary sewer capacities and gradients. This table shall be used to determine the maximum and minimum slopes for sanitary sewers. Sewers should be sized to convey the peak design flow in accordance with Manning's equation, whereby the friction slope is assumed to the same as the bed slope of the pipe. The sizing of sewers at slopes greater than the critical slope is limited by inlet capacity and not friction slope. Although the Manning's Formula is to be used as a basis for sewer design, the values listed in Table C-3 will supersede the results of Manning's calculations, where applicable. These factors have been accounted for in the programming of the Town's Appendix A – Sanitary Sewer Design Sheet. In the case of partial pipe flow, the actual velocity is to be checked against the minimum allowable velocity at the design flow rate.

Manning's formula is as follows:

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

Where,

Q is in litres/second
V is in metres/second
R is in metres
S is in metres/metre
A is in square metres

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

Table C-3: Allowable Sanitary Sewer Capacities and Gradients

Diameter (mm)	Q Max (m^3/s)	Slope Min (%)	Slope Critical (%)	Slope Max (%)
200	0.042	0.33	1.54	8.2
250	0.074	0.30	1.43	6.1
300	0.12	0.30	1.34	4.8
375	0.20	0.30	1.25	3.5
450	0.32	0.30	1.17	2.8
525	0.47	0.30	1.12	2.3
600	0.66	0.30	1.07	1.9
675	0.88	0.30	1.03	1.6
750	1.1	0.30	0.99	1.4

C3.04 Flow Velocities

Minimum acceptable velocity = 0.6 m/s. Maximum acceptable velocity = 3.0 m/s.

All sewers should be designed with such slopes that they will have a minimum sewage flow velocity, when flowing full, of at least 0.6 m/s. In cases where the flow depth in the sewer, under peak flow, will not be 0.3 of the pipe diameter or greater, the actual flow velocity at peak flow should be calculated using a hydraulic elements chart and the sloped increased to achieve adequate flushing velocities

C3.05 Pipe Size

The minimum allowable size for a sanitary sewer under the control of the Municipality (within right-of-way or easement) shall be 200 mm in diameter.

Sanitary sewers 600 mm in diameter and greater are to be concrete pressure pipe (C.P.P.). The Town may consider the use of H.D.P.E. pipe for use in trenchless installation locations on a case by case basis.

C3.06 Minimum and Maximum Grades

The absolute minimum and maximum grades for sanitary sewers shall be in accordance with Table C-3 subject to achieving minimum acceptable velocity at the actual flow. The minimum grade for the first upstream leg shall not be less than 1.0%. The maximum grade for the first upstream leg shall not be greater than 2.0% unless the sewer is to be extended in the future.

C3.07 Minimum and Maximum Depths

The depth of the sewer shall be measured from the final centreline finished road elevation to the top of the sanitary sewer. The minimum depths of sewers for residential, commercial and institutional areas shall be 2.8 m. For industrial areas, the minimum depth shall be 2.2 m. Where sanitary sewers are located within an easement, a minimum frost covers of 1.5 m may be used provided that such sewers cross below watermains.

The maximum depth of sewers with direct lateral connections shall be 6.0 m (measured from finished centerline of road elevation to invert of sewer). In cases where deeper sewers are required, no direct lateral connections will be permitted. Separate local sewers constructed above the sewer at depth will be required for connection of laterals. Maintenance holes are to be common wherever possible with drop structures and discussions are to be held with Town staff prior to advancing such a design.

In all instances, the proposed sanitary sewer shall be installed at a depth sufficient to also service lands external to the site as determined by the Town Engineer.

C3.08 Curved Sewers

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

C3.09 Termination Points

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

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

C3.10 Sewer and Watermain Crossings

Al crossings are to be completed in accordance with M.E.C.P. guidelines. (See Section C3.01 above.)

C3.11 Service Connections to Deep Sewers

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

Service connection risers where the sewer main is greater than 4.5 m deep, are to connect to the main sewer tee by means of a vertical bend fitting. The bend shall be offset from the main sewer and it shall support the riser portion on the sewer bedding. An approved equivalent is to be considered with the riser portion of the service lateral to the satisfaction of the Town. Refer to O.P.S.D. 1006.010.

C3.12 Changes in Pipe Size

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

C3.13 Pipe Bedding and Groundwater Control

The class of pipe and the type of bedding shall be selected to suit loading and proposed construction conditions. Details and types of bedding and backfill are illustrated in O.P.S.D. 802.010 and O.P.S.D. 802.030. In general, the Type “2” bedding (19 mm crusher run limestone) shall be used for sanitary sewers in new developments, and the class of pipe will be selected to suit this bedding detail. Alternate granular materials for pipe bedding may be specified, subject to the approval of the Town, however, clear stone bedding will not be permitted. The width of the trench at the top of the pipe must be carefully controlled to ensure that the maximum trench width is not exceeded unless a higher class of bedding or higher strength pipe is used. The recommendations of a Geotechnical Engineer will be required in determining strength of pipe required, the recommended bedding standard and construction methods to be used. Where specified and shown on the engineering drawings to control groundwater migration, anti-seepage collars shall be installed in the bedding and keyed-in to native soils. The geotechnical engineer is to specify the design and location of the anti-seepage collars.

C3.14 Maintenance Hole Location

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

C3.15 Maximum Spacing

The maximum allowable spacing between maintenance holes shall be as follows:

Table C-4: Maximum Sanitary Maintenance Hole Spacing

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

C3.16 Maintenance Hole Types

Maintenance holes shall be constructed of precast concrete. The Ontario Provincial Standard (O.P.S.) maintenance hole details shall be used for maintenance hole design, where applicable. In all cases where the standard drawings are not applicable, the maintenance holes shall be individually designed and detailed.

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

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

C3.17 Head Losses

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

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

Table C-5: Minimum Maintenance Hole Drop Requirements

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

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

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

C3.18 Maintenance Hole Design

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

b) The maintenance hole shall be centered on the sanitary sewer main.

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

d) A maximum drop of 0.6 m will be allowed only if the design of the sewer cannot be modified to reduce the drop or modified to accommodate a drop structure. If the design of the sewer system is such that the difference in elevation between the maintenance hole inlet and outlet will exceed 0.6 m, then a drop structure, as detailed on O.P.S.D. 1003.010 or O.P.S.D. 1003.020 based on the height of the drop will be required.

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

f) For all junction and transition maintenance holes, the drop required shall be calculated using the standard calculation sheet, “Hydraulic Calculations for Manholes” found in the M.E.C.P. Design guidelines.

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

h) All maintenance holes shall be benched as detailed on the Standard Drawings. When any dimension of a maintenance hole exceeds those on the Standard Drawings, the maintenance hole must be individually designed and detailed.

i) Safety gratings shall be required in all maintenance holes greater than 5.0 m in depth. Safety gratings shall not be more than 4.5 m apart and shall be constructed in accordance with the Standard Drawings. Whenever practical, a safety grating shall be located 0.5 m above the drop structure inlet pipe.

j) A rubber gasketted fitting (Kor n Seal or equivalent) is to be used to connect the sewer to the maintenance hole.

k) Maintenance holes to be gasketed as per O.P.S.S. 1351 and CSA 257.3 and shall be watertight.

l) All sanitary maintenance hole joints, between base of maintenance hole up to the precast concrete adjustment units, shall be sealed with an external rubber sleeve (i.e., Gator wrap or equivalent). The width of the rubber sleeve shall be 225 mm (9") or greater. The seal shall be made of a stretchable, self-shrinking, intra-curing halogenated based rubber with a minimum thickness of 30 mils. The backside of each unit shall be coated with a cross--inked re-enforced butyl adhesive. The butyl adhesive shall be non-hardening sealant with a minimum thickness of 30 mils. The seal shall be designed to stretch around the joint and then overlapped creating a cross-linked and fused bond between the rubber and butyl adhesive.

C3.19 Maintenance Hole Frame and Cover

Sanitary maintenance holes shall have Bibby Auto Stable adjustable frames and covers as per O.P.S.D. 401.010, Type “A” and shall be made watertight by installing a 2 mm rubber gasket between the frame and grate and by installing rubber plugs within the grate's pick holes. Maintenance holes located outside of the road allowance (i.e., within an easement, walkway, or open space, etc.) shall be equipped with a security type cover per O.P.S.D. 401.060 and shall also be made watertight as described above. All manhole adjustment rings shall be sealed to become waterproof between all rings and from the outside of the structure prior backfilling with an asphalt mastic or approved equivalent.

All maintenance holes located within the travelled portion of the roadway shall have the rim elevation initially set flush with the base course asphalt. A maximum of 300 mm height of modular rings shall be permitted on all maintenance holes in new subdivisions. No concrete shall extend over the edge of the manhole.

Prior to the placement of the final course asphalt, the maintenance hole frame shall be adjusted to suit the final surface asphalt elevation.

C4.00 Sanitary Service Connection

C4.01 General

All sanitary sewer connections for single, semi-detached and townhouse lots shall be made with a single service pipe from the main sewer to each building or unit of semi-detached homes or townhouse blocks in accordance with Town standard drawing M-404, M-405 or M-406 and O.P.S.D. 1006.020 and shall conform to Ontario Provincial Specifications. All connections are to have a watertight PVC test fitting installed at the property line. The sewer connection shall

extend 1.5 m inside of the property line and terminate with a plug. The pipe is to be green in colour and marked with a 50 mm x 100 mm x 2.4 m stake painted black. No connections are to be made to a trunk sewer main without written approval from the Town and Region.

For re-development applications the following requirements are to be met.

a) In re-development applications, existing service connections may be reused subject to a condition assessment including, but not necessarily limited to, CCTV inspection to the satisfaction of the Town. Any obvious occurrences of root intrusion, displaced joints or other physical defects will require replacement with a new connection.

b) For low-rise residential re-development, existing service connections may only be reused on a 1-for-1 basis with respect to the number of units serviced (i.e., number of units draining to service connection under redevelopment scenario cannot exceed the number of units previously draining thereto), subject to satisfactory condition assessment.

c) Where existing service connections are to be reused, the hydraulic capacity of the connection to convey the design flow for the proposed development shall be verified by a Professional Engineer.

d) Any re-development applications servicing more than one (1) unit on a single property must have a control maintenance hole.

C4.02 Materials

For single family, semi-detached and townhouse units, the service connections shall be PVC bell and spigot pipe with the same DR rating as the main line sewer conforming to CSA Specification B182.1. Sanitary service connections to multiple residential blocks, or non-residential land uses which require service sizes greater than 125 mm diameter shall be PVC (DR35) bell and spigot pipe conforming to CSA Specification B182.2.

C4.03 Size

Residential service connections to single family, semi-detached and townhouse units shall be 125 mm diameter single services from the sewer main to the property line and 100 mm diameter from the test fitting for a distance 1.5 m inside the lot.

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

C4.04 Location

Residential sanitary sewer service connections shall be located per Town Standard Details M-409, M-410 or M-411.

C4.05 Depth

The depth of the service connections for single family units and semi-detached units at the property line, measured from the final centreline road elevation, shall be:

- Minimum: 2.5 m
- Maximum: 3.0 m

Risers shall be used when the depth to obvert of the sewer main exceeds 4.5 m. The riser section shall be used to bring the service to a maximum depth of 3.0 m. Risers shall conform to O.P.S.D. 1006.010.

C4.06 Grade

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

Table C-6: Sanitary Sewer Service Connection Grades

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

C4.07 Test Fittings

All residential connections shall have test fittings and plugs according to Standard Drawings S-301 and S-303.

C4.08 Connection to Main Sewer

The connection to the main sewer shall be made with an approved manufactured tee only. Town approved saddles shall only be used for connection to pre-existing sewer mains. Connections to maintenance holes will not be allowed unless specifically approved by the Town.

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

No service connection of a size greater than one-half the diameter of the main sewer shall be cut into the main sewer; however, a 125 mm or a 150 mm service connection will be permitted to connect to a 200 mm or 250 mm main sewer (provided an approved manufactured tee is installed and provided the invert of the service connection is above the spring line of the main sewer).

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

C4.09 Connection to Multiple Family and Other Blocks

Sanitary service connections to multiple residential blocks, or non-residential land uses which require service sizes greater than 150 mm diameter shall be PVC (DR35) bell and spigot pipe conforming to CSA Specification B182.2. An inspection manhole shall be required on private property (1.5 m from property line to centre of rim) on all connections to multiple family, industrial, commercial, institutional and other blocks.

C5.00 Construction, Inspection and Testing

C5.01 General

Construction of all sewers, service connections and appurtenances shall be in accordance with the Specifications and Standard Detail Drawings of the Town of Aurora or in their absence any OPS drawings and specifications.

All pipe testing should be per the Region's "Sanitary Sewer System Inspection, Testing and Acceptance Guidelines" (October 2011 or latest amendment thereto; See Appendix E).

C5.02 Sanitary Sewers and Maintenance Holes

Inspections of all sanitary sewers and maintenance holes are to take place prior to the release of Building Permits and prior to Final Acceptance, as noted in the Town's checklists (refer to Appendix H). Applicants may elect to undertake additional inspections at their own discretion at the completion of the building program and prior to the placement of top course asphalt.

The inspection process shall consist of sewer flushing, visual inspection of appurtenances, deflection testing of thermoplastic pipe, air exfiltration and/or water exfiltration testing and CCTV inspections of sewers and service connections in accordance with the Town's and the Region's requirements. Should thermoplastic pipes not pass the mandrel deflection testing, repairs shall be undertaken without using re-rounding methods in accordance with the Region's Guidelines. Refer to Section C5.04 regarding sewer performance criteria and repairs.

C5.03 Sanitary Service Connections

Completed sanitary service connections are to be inspected in the public road allowance and the private lot area, from the sewer main to the building foundation wall. The inspections shall be carried out prior to occupancy of the structure.

Sanitary service connections shall be inspected using CCTV technology as based on the following requirements:

- 25% of the total number of service connections, as selected by the Town, will be inspected immediately after placement of base asphalt and prior to the release of Building Permits.

- 100% of the total number of service connections prior to the placement of top course asphalt.

- CCTV inspection conducted on specific selected services prior to assumption as determined solely by the Town.

Refer to Section C6.04 regarding sewer services performance criteria and repairs. Any deficiencies shall be corrected, re-inspected, certified by the consultant and accepted by the Town prior to occupancy of the structure.

C5.04 CCTV Inspections, Evaluations and Video Records

Newly constructed sewers and service connections shall be inspected with digital CCTV equipment upon satisfactory completion of all other testing, prior to the Town's issuance of Building Permits and prior to Final Acceptance. The Town is to be advised prior to the commencement of any CCTV work.

A permanent digital record on a Flash Drive device shall be supplied, illustrating a continuous record of the sewer installations, service connections, maintenance holes, etc. A report identifying any unusual or substandard conditions shall also be submitted. Protruding laterals that prevent complete inspection of a sewer line without reversals are not acceptable.

An information screen on the CCTV record shall describe the sewer location and provide the Town manhole ID numbers prior to starting the inspection.

The following associated with CCTV inspections shall be provided:

1. A separate digital report book (including summary and video) will be provided for each Flash Drive device submitted. Each report will be numbered, and each sewer inspection will have a unique number identification. A space shall be left for the Town to enter a Town Report number.

2. The reports and digital video files shall have identification showing the inspection company and names of staff completing the inspection, the report number, date and identification of the sewer location.

3. An assessment of any sewer defects shall be prepared for each sewer based on standard codes and protocol described in the latest edition of the Manual of Sewer

Condition Classification (M.S.C.C.) produced by the Water Research Center (W.R.C.). The assessment is to be completed by NASSCO certified persons.

4. Further inspections required following repairs of deficiencies are to be documented along with the original assessment.

The digital record and pipeline evaluation shall be prepared by a pipeline inspection firm with staff experienced and qualified by N.A.S.S.C.O. in this field. The staff shall undertake the sewer defect assessment noted above and record the rating in the report and provide recommendations for acceptance or rectifications.

The CCTV digital inspection files and summary report shall be reviewed by the Consulting Engineer and upon being satisfied the results meet the Town's criteria submit the documents with a recommendation to the Town for acceptance. The Town will verify the inspection results prior to recommending issuance of Building Permits.

All digital CCTV files and reports provided from inspections are to become the property of the Town of Aurora.

The following table provides the sewer and service connection performance requirements, repair requirements or action to be taken. The Design Consultant shall review all information and prepare and submit recommendations to the Town based on these requirements prior to undertaking repairs.

Table C-7: Sewer and Service Connection Performance and Repair Requirements

Sewer or Service Connection Deficiency	Repair/Action Required
Gasket exposed	Remove exposed portion of gasket by cutting and seal the pipe joint.
Debris	Flush and re-inspect with CCTV If debris cannot be removed, reaming and/or excavate to remove and repair is required.
Ponding	Excavate and repair.
Cracking – minor and isolated	The Town may retain a third-party consultant to review and provide a recommendation. Pressure crack sealing may be required as directed by the Town. An extended monitoring period may be required.
Cracking – significant	Repair required by means of structural repair (excavate and repair, trenchless liner installation subject to an accepted hydraulic analysis) or pressure crack sealing.

Sewer or Service Connection Deficiency	Repair/Action Required
Structural Defect (based on assessment per N.A.S.S.C.O. methods)	Repair required. Consulting Engineer's recommendation required. Sewer liner alternative is subject to a hydraulic capacity analysis acceptable to the Town.
Flexible pipe out of round (greater than 5%)	Re-rounding process is not acceptable. Excavate and repair required.
CCTV results not clear	If the video becomes submerged, dirty, obscured, partially or fully out of focus or panning is not adequate or conclusive, the sewer or service connection shall be re-inspected.

Section D Forcemains and Sanitary Sewer Pumping Stations

Section D Forcemains and Sanitary Sewer Pumping Stations

D1.00 General

Sanitary sewer pumping stations and wastewater forcemains will only be allowed when the Director of Infrastructure Operations is satisfied that the conditions (such as topography) prevent the use of a gravity sewage system and that it is in the best interest of the Town to permit this type of system.

Sanitary sewer pumping stations shall be designed to incorporate the most modern equipment available in order to reduce maintenance and operational costs. Pumps, standby generating units, and any other equipment subject to ware shall have a minimum design lifespan of 15 years.

Sanitary sewer pumping stations shall be located such that the length of forcemain required is kept to a minimum.

D2.00 Forcemains

Wastewater forcemain shall be generally designed in accordance with the following considerations:

1. Cleansing velocity of at least 0.60 m/s shall be maintained.

2. Maximum velocity of 4.0 m/s.

3. Minimum diameter shall not be less than100 mm.

4. Friction losses should be based on Hazen-Williams formula with a “C” factor of 100; or other acceptable methods using a generally equivalent friction factor.

5. Air relief valves – An automatic release valve shall be placed at high points in the force main to prevent air pockets.

6. The design of the profile and size of the force main shall minimize the excessive negative head to the system.

7. Configuration and head conditions should be evaluated as to the need for and placement of vacuum relief valves. Fittings and isolation valves shall be stainless steel.

8. Forcemains should enter the gravity sewer system at a point not more than 200 mm above the flow line of the receiving maintenance hole.

9. To be located in the boulevard opposite the watermain, subject to M.E.C.P. clearance guidelines.

10. Minimum cover of 1.8 m.

11. Cathodic protection of all metallic pipes, mechanical joints/fittings/restraints, etc. Sizing to be determined by a geotechnical engineer subject to a minimum of 5.5 g each.

12. Pipe materials may include:

    a) Polyvinyl Chloride (PVC), DR26 minimum, conforming to CSA B137.3 and ASTM D3139. Must be green in colour. Alternatively, if the proposed size does not available on market, a tape marked “Sanitary” shall be used to wrap along the entire section of the sanitary sewer. Tracer wire with 8 gauge shall be installed.

    b) Polyethylene (P.E.) conforming to CSA B137.0, B137.1, ASTM D3035, D3350 or CG 5 Spec 41-FP-25M. PE3408/3608. To be installed with 14 A.W.G. tracer wire or, if in horizontal directional drilling (H.D.D.) applications, 4 × 8 gauge tracer wire.

13. Pipe and joints shall be equal to water main strength materials suitable for design conditions. The forcemain, reaction blocking, and station piping shall be designed to withstand water hammer pressures and associated cyclic reversal of stresses that are expected with the cycling of wastewater lift stations. The need for surge protection chambers shall be evaluated. Forcemain pipe materials shall be approved by the Town Engineer. Pressure rating (class) to be as per design.

14. Hydraulic transient (i.e., surge) analysis required to confirm pressure rating of pipe, surge protection devices, the provision of water hammer relief and identify potential vacuum and other conditions to be mitigated. Pump cycle times should be designed to minimize pump starts and stops to the extent practical.

15. The hydraulic grade lines for the range of potential pumping rates (i.e., minimum, average, maximum) shall be provided along the entire profile of the forcemain.

16. Detailed calculations for the system curve shall be provided.

17. Bedding material to be mortar sand conforming to O.P.S.S. 1004 Granular D and placed in accordance with applicable O.P.S. Drawings.

18. Thrust blocks to be in accordance with all applicable O.P.S.D. details.

19. Clean-outs – The need for clean-outs on the force main shall be determined during plan review by the Town of Aurora. As a general guideline, clean-outs will not be required on force mains under 600 m in length.

20. Additional requirements may be identified at the time of detailed design based on site-specific conditions, at the discretion of the Town.

D3.00 Testing & Inspection

D3.01 General

1. Forcemain Pressure Test – Contractor shall fill and pressure test the forcemain. The minimum required test pressure shall be the maximum force main operating pressure plus 50 psi.

2. Tracer wire inspections and conductivity tests shall be conducted prior to acceptance of forcemains. Inspections are to ensure that tracer wire is visible in maintenance holes, at pumping stations, etc. Conductivity tests are to ensure that the tracer wire is appropriately connected and continuous over its entire length.

3. A representative of the Town is required to be present during any testing of services. Depending on pipe material and installation condition, the following O.P.S. Drawings may apply: O.P.S.D. 802.010, 802.013, 802.014, 802.030, 802.031, 802.032, 802.033, 802.034, 802.050, 802.051, 802.052, 802.053 or 802.54. http://www.raqsb.mto.gov.on.ca/techpubs/ops.nsf/OPSHomepage

D4.00 Decommissioning

The following is required when decommissioning forcemains:

1. Saw-cutting of existing pipe.

2. Removal and disposal off-site of existing pipes, fittings, thrust restraints and thrust blocks, as required.

3. Filling of abandoned main with grout.

4. Supply and placement of 15 MPa concrete plug in the ends of the existing forcemains that are to be abandoned in place. Minimum length of the concrete plug shall be 300 mm.

5. Supply and placement of mechanical plug on existing forcemain to remain in service, where required.

D5.00 Sanitary Sewer Pumping Station

D5.01 General

The following are the standard specifications for sanitary pumping stations to be installed and connected to the Town of Aurora sanitary sewer collection system. The purpose of these specifications is to provide a minimum standard for pump stations that complies with the guidelines set out by the Planning and Development Services Department the most cost

effective and reliable design for maintenance and operation. Sewage pump stations shall consist of a wet well, sewage pumps, control systems, electrical systems (normal and emergency), superstructures, site security, grading and access. The developer shall be responsible for extending all necessary utilities to the pump station site (water, electrical, gas, phone etc.).

Sanitary sewer pump stations will only be considered when the thorough study of all alternatives clearly indicates the impracticability of gravity collection and disposal. The wet well for pump stations shall be equipped with a minimum of 3-hour storage capacity at peak pumping rate and an emergency generator. The generator and all controls shall be in a building as approved by the Planning and Development Services Department.

Sanitary sewer pumping stations:

1. Shall generally be designed in accordance with Ministry of the Environment Conservation and Parks (M.E.C.P.), N.F.P.A. 820 and Region of York standards and guidelines.

2. To be provided with permanent standby power facilities.

3. Shall preserve the architectural nature of the community where they are situated and, where applicable, conform to architectural control plans. Landscaping is required and subject to the approval of the Town.

4. Permanent and high accuracy flow meters on influent sewer and discharge header, well level and discharge header pressure sensors to have S.C.A.D.A. capability. Additional requirements may be determined by the Town.

5. Pumping functionality is to be maintained in a flooded condition. All electrical and control equipment shall be located above the Regional floodline.

6. For all stations a yard hydrant with high hazard backflow preventer and 38 mm dia. water service be provided for wet well and valve chamber washdown purposes.

D5.02 Safety

1. The design of a pumping station requires a review of the components of the system to assure that the system is safe to operate. Access ladders for the wet well and valve vault, a hoist for lifting out the pump, lighting, ventilation to remove dangerous gases and security for the electrical system are the major safety items that need to be considered.

D5.03 Engineering Report

All pump station plans shall be accompanied by an engineering report. The following information shall be included in the report:

1. Title Page

Title page should include the project (subdivision) name, Legal Description and/or Municipal Address, date, developer/owner's name and engineering firm preparing plans.

2. Sewer System Information

   a) Introduction

      i. Type, location and size of development.

      ii. Number of and range in size of lots or buildings to be serviced.

   b) Existing Sewer System

      i. Location and type of gravity system the force main will discharge into.

      ii. Future of sanitary sewer service.

      iii. State whether the entire development will be serviced by the proposed phase or if several phases will be involved.

      iv. State the number of lots this phase will encompass initially and finally if future phases are to be constructed.

3. Listing of results from the design calculations to be presented in the following order:

   a) Number of Lots or Buildings.

   b) Population Equivalent.

   c) Average Daily Flow in L/Sec.

   d) Peak Daily Flow in L/Sec.

   e) The Volume of the Retention Chamber (8-hour minimum, may require 24-hours in some cases).

   f) Static Head.

   g) Total Dynamic Head.

h) The Pump Selected (including type manufacturer, model number, size, Hp, R.P.M., phase and L/Sec).

i) Total Cycle Time for Average Daily Flow.

i. Number of Minutes ON (Pumping Time).

ii. Number of Minutes OFF (Fill Time).

j) Total Cycle Time for Peak Daily Flow.

i. Number of Minutes ON (Pumping Time).

ii. Number of Minutes OFF (Fill Time).

k) Size and Length of Forcemain.

l) Velocity Maintained in Forcemain.

m) Forcemain Retention Time (at initial flows and at design flows).

n) Air Release Valve Sizing Calculations (if applicable).

o) Maximum Forcemain Operating Pressure.

4. Consultant shall perform a cost-effective analysis for all proposed pump stations and expansions of existing Town of Aurora-owned pump stations. Cost analysis shall compare the construction, operation, maintenance, life cycle costs and any applicable salvage values over a 50-year period between proposed pump station and a reasonable gravity sewer alternative. Operation and maintenance costs that must be considered including the following, but not limit to, labor, electrical, equipment replacement, building, operation and routine maintenance. Pump stations will only be considered a viable option if the cost analysis clearly shows that the gravity sewers are not economically feasible.

a) Pump Information

Pump performance curves, make and model shall be included with the engineering report.

b) Leakage Testing

Leakage tests should be specified, including testing methods and leakage limits.

D5.04 Pump Requirements

At least two pumps shall be provided. If only two units are provided, they should be of the same size, to provide a firm capacity with one unit out of service and at least capable of handling the 10-year design peak hourly flow (L/Sec). Where more than two pumps are provided, each unit shall be designed to handle maximum flow conditions and must be of such capacity that with any one unit out of service the remaining units will have capacity to handle maximum sewage flows.

The designer should ensure that all pumps will be subjected to hydrostatic and operating tests performed by the manufacturer.

D5.05 Pump Selection Considerations

1. Submersible pumps are preferred for all situations. Pumps are to be removable and replaceable without dewatering the wet well or requiring personnel to enter the wet well. All pumps in a lift station shall be identical and interchangeable.

2. Pump impellers shall be of a non-clog design and be capable of passing spherical solids of up to 75 mm in diameter.

3. Pumps are to be selected which provide optimum efficiencies at actual operating points. The power rating of the motor should not be exceeded by the pump at any operating condition on the characteristic curve for the pump selected.

4. Service pumps will generally not be operating at their fully intended capacity due to mechanical wear and the subsequent loss of efficiency and increases in forcemain friction loss due to the deposition of solids and grit. Pump design capacity shall be in accordance with the manufacturer specification. Any pump capacity exceeding the manufacturer rated capacity shall not be permitted.

5. Flush valves, recirculation pipes or mixers shall be provided for aeration and suspension of grit and solids in the wet well.

6. Pump selection shall also take into account the availability of local repair service. Pumps selected shall also take into account the manufacture’s experience and history in the design and selection of pumps for raw sewage use.

7. Lift Station shall be designed with Xylem Pumps equipped with flush valves. Alternate pump selection would require that a present-worth analysis be undertaken and approved by the Town.

8. Pump motors shall operate at 3-phase power.

9. Minimum pump discharge piping diameter shall be 100 mm.

10. The pump discharge piping diameter and material shall be uniform from the pump discharge base to the common header tee.

D5.06 Pumping Station Electrical Requirements

1. Inlet (if possible) and outlet flow meter (flow rate and totalizer).

2. Soft starter and across the line starter option with pilot lights (run, fault) hour meters, amp meter and H.O.A. switch

3. Primary control – Level transmitter with back up level switches backup option (Low Level, Stop, Lead Start, Lag Start and High Level) such as E.N.M. level switches. Note: Transducer and level switches cables shall have quick connectors located in a non-classified area.

4. Pumps shall have plug and receptacle on cable.

5. Backup generator shall be natural gas, radiator controlled with louver controls (fresh air, outside vent and re-circulate) and automatic transfer switch.

D5.07 Piping and Valves

The piping from the individual pump discharge bases, through the valving assembly and out to the force main, shall be in accordance with the following (100 mm Diameter Piping and Larger):

1. Piping – The discharge piping shall be ductile iron Class 53 or greater A.N.S.I. A-21.51 (AWWA C151) with rigid radius grooves for end preparation in accordance with AWWA C606.

2. Fittings – Fittings shall be ductile iron, ASTM A-536, Grade 65-45-12, or cast iron, ASTM A-48, conforming to the requirements of AWWA C110 for center to end dimensions, AWWA C153 or AWWA 21.10/AWWA C110 for wall thickness, and AWWA C606 rigid radius grooving dimensions for end preparation. Fittings shall be cement lined and have a universal primer coating.

3. Mechanical Couplings – Mechanical couplings shall be ductile iron conforming to ASTM A536, Grade 65-45-12 with a universal primer coating as manufactured by Victaulic (style 31, style 75 or style 307), or approved equal. Couplings shall incorporate gaskets that are specially made to conform to ductile iron pipe surfaces and 304 stainless steel nuts and bolts.

4. Transition Fittings

    a) Grooved to Flanged – The connection of grooved pipe and fittings to flanged pipe and fittings shall be facilitated with flange adapters as manufactured by Victaulic

(style 341 Vic-Flange) or approved equal. The flange adapters shall be ductile iron conforming to ASTM A-536, Grade 65-45-12, with a universal primer coating. Gaskets shall have properties as designated by ASTM D-2000 and shall be suitable for the required service. Use 304 stainless steel bolts and nuts on all flange adapters and flanged components.

b) Forcemain Connection – The ductile iron pipe shall be extended at least 1.2 metre from the outside of the valve vault. The force main shall the connected to the ductile iron pipe with a mechanical coupling. The coupling shall be a MEGALUG Mechanical Joint Restraint or approved equal.

5. Discharge Risers

a) PVC – When plastic pipe is utilized for the pump discharge riser and the riser exceeds 2 meter in length, stainless steel support braces must be installed between the riser and wet well wall. The braces shall be placed at a maximum spacing of 2 meters.

b) DIP – When ductile iron pipe is utilized for the pump discharge riser and the riser exceeds 2.4 meters in length, stainless steel support braces must be installed between the riser and wet well wall. The braces shall be placed at a maximum spacing of 2.4 meters.

6. Maintenance Considerations

a) Isolation valves should be considered where forcemains connect into a common forcemain. Cleanouts at low points and chambers for pig launching and catching should be considered for any forcemain to facilitate maintenance.

7. Valves and meters shall be located in a concrete chamber separate from the wet well or dry pit. This dry pit shall be considered a Class 1, Zone 2 hazardous environment.

D5.08 Wet Well Size and Detail

1. Size Considerations

a) Wet wells are to be of adequate size to suit equipment space, operator access requirements and active volume considerations.

b) To minimize dead storage volume, the depth from the “pump off” level to the floor of the wet well shall be kept to an acceptable minimum. The required depth will be dictated by suction pipe inlet conditions, pump manufacturer’s requirements for submergence or cooling, net positive suction head, priming requirements and vortex control.

c) Wet wells must be sized small enough to minimize the total retention time, the time sewage is held in the wet well and any rising forcemain, and yet be large enough to control the frequency of pump starts. The maximum retention time in the wet well should not exceed thirty (30) minutes for the design minimum flow rate anticipated when the contributing area is fully developed. Total retention time in the wet well and forcemain shall be kept to a minimum (generally less than four (4) hours) to avoid anaerobic fermentation and the resultant production of odorous, hazardous and corrosive gases. Otherwise, provisions must be made to control anaerobic conditions. It is desirable to have a wet well with sufficient active volume so that all sewage within the discharge forcemain will be replaced during one pumping cycle, especially if sags exist in the forcemain profile.

d) Wet wells shall be sized large enough to maximize pump life by decreasing the frequency of pump starts. However, in the interest of limiting excessive detention time, wastewater pumping stations will inherently be subject to relatively high frequencies of switching cycles. Exceeding a frequency of 12 starts per hour for motors above 30 kw increases the cost of switch gear and motor maintenance and the reliability and life of the machinery and electrical components will decrease. Accordingly, sufficient storage between switching levels should be provided to limit the number of pump starts, normally to 6 per hour with pump alternation and 12 per hour with the standby pump inoperative. The manufacturer's recommendations with regard to the allowable frequency of pump starts for the specific size and type of motor are to be satisfied.

2. Shaping and Benching

a) Wet wells shall be arranged and benched to limit dead spaces were solids can accumulate and to provide smooth, uniform, unobstructed flow to the pump suction influence zones. Wet well floors should have a minimum slope of 1:1 to a hopper type bottom. The horizontal area of the hopper type bottom should be no larger than necessary for the proper installation of the pump or suction pipe.

b) The cross-sectional area and shape of the wet well above the benching is to be constant or increasing from the bottom towards the top.

c) The critical flood line shall be permanently marked on the walls of the wet well.

3. Vent

a) The wet well structure shall be vented with a 100 mm Sch. 40 stainless steel or aluminum vent pipe. Wet well ventilation system shall consist of the gooseneck vent installed on the opposite side of the wet well from the fresh air in-take (c/w a bird/insect screen).

b) Wet well ventilation fan, if require, must be rated for the area and force fresh air in above the operating level of pump start.

4. Vortex Prevention

a) Suction elbows, baffle plates, vortex breakers or drop tubes are to be provided as required.

5. Corrosion Considerations

a) All bolts, nuts, other fasteners and piping used in the wet well areas, including platform chain and pump lifting chain, shall be stainless steel. All supports, brackets, gratings, ladders and other structures shall be of corrosion resistant materials.

b) All-aluminum doors or hatches are required for access to the wet wells. Installation of electrical equipment and wiring within the wet well is to be avoided unless it is essential that it be located in the wet well.

6. Electrical

a) All electrical equipment and wiring located within the wet well shall be Class 1 Zone 1 as per the Canadian electrical Code.

7. Pump Removal Equipment

a) Pumps shall be removed through dedicated hatches of suitable size. Provide portable lifting davits and equipment for removal of pumping equipment. The hatches shall be of aluminum construction, hinged, complete with hold open arm and lockable padlock hasp. All hatches shall include a secondary hinged safety grate located immediately beneath the cover hatch for operator safety.

8. Wet Well and Valve Chamber Access

a) Operator access into the wet well and valve chamber shall be made through access hatches with minimum dimensions of 915 mm by 762 mm. The access hatches shall be of aluminum construction, hinged complete with hold open arm and lockable padlock hasp. All hatches shall include a secondary hinged safety grate located immediately beneath the cover hatch for operator safety. Ladders for access shall be of aluminum or stainless-steel construction and centred beneath the access hatch. Ladders shall be equipped with “ladder ups” that can extend above the hatch for safe entry and can be lowered when not in use.

D5.09 Commissioning

Commissioning testing of wastewater pumping stations is required and shall be certified by a Professional Engineer. Testing generally includes the following, although additional testing may be required by the Town:

1. Testing of station performance over full range of flows, including transitions between pumps.

2. Perform a performance pump test to demonstrate the pumping efficiency, capacity and function in accordance with the pumping station design report.

3. Continuous high-frequency (min 1 Hz) pressure monitoring during testing procedure and for 24 h period under normal operations using portable equipment.

4. Reporting to include the following:

    a) Plots of pressure and flow during testing procedure.

    b) Reports to include all relevant interpretation and explanations, including discussion of impact to operations and life cycle costs.

D5.10 Assumption

The Owner shall maintain the facility and provide maintenance reports on an annual basis (based on monthly inspections) until assumption of the facility by the Town. The Town will not assume the facility and forcemain until a minimum of 75% of the dwelling units are occupied.

Prior to the pumping station assumption by the Town, the following shall be required:

1. Engineer certification in relation to the overall pumping station construction and performance in writing, signed and stamped by a Professional Engineer.

2. Provide as-constructed drawings; including three copies of operation and maintenance manuals as well as the original design report and approved shop drawings for all equipment to the Town prior to final inspection.

3. A copy of the closed-out Permit from ESA.

4. An installation test reports of feeders, pumps etc.

5. I/O point to point check lists.

6. Manuals including PLC Logic and Panelview Logic if so equipped and all schematic drawings.

7. Pumping stations shall have PLC's and SCADA ready.

8. Supply an ALLEN BRADLEY PLC with Ethernet connectivity complete with a hub/switch (8 port) and panel door port. (PLC password and IP address to be provided to the Town's Operation Manager).

9. Provide documentation for load bank testing of genset, including oil sample testing report.

10. Confirm that "Normal" and" Emergency" power is in phase and demonstration of the genset operation from Normal to Emergency and back to Normal mode proving louver operation.

11. Engineering certification of ensuring the pumps rotation are correct.

12. All electrical enclosures are operational and clean.

13. Confirm capacitor sizing verse pump motor sizing. (If equipped) Perform Power Factor testing with and without load. Record same for evaluation.

14. Demonstrates alarm functions get annunciated local and remote.

15. Demonstration of a complete pump cycle, including alternation of lead pump as well as initiating a lead pump failure to prove lag pump backup operation.

16. Provide Pump servicing reports.

17. Provide spare parts and information package for all warranties.

18. Provide one (1) spare streetlight per subdivision (complete with luminaire assembly, arm, pole, and control device) for the Town's inventory in case of emergency streetlight replacement.

19. Provide a plastic laminate fact sheet on the pumping station, including lowest basement elevation, location of forcemain outlet to gravity system and bypass invert elevation. The fact sheet shall be a minimum size of 11" x 17" and mounted adjacent to the control panel.

20. Provide a plastic laminate with process flow diagram indicating valves and key interlocks.

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Section E Storm Drainage and Stormwater Management

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E1.00 Drainage Policies

The Town has prepared a detailed set of design criteria and applicable parameters for the design of minor and major storm drainage systems, LIDs and stormwater management (SWM) facilities. These policies are to be adhered to in the planning, design and construction of these services.

The objectives of the Town's drainage policies are provided as follows:

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

b) Minimize disturbances from occasional and extended surface ponding.

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

d) Minimize downstream flooding and erosion.

e) Minimize pollution discharges to watercourses.

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

g) Minimize impact on aquatic life and habitat.

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

E2.00 Attainment of Drainage Objectives

E2.01 Stormwater Management (S.W.M.) Planning and Design Principals

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

The most current version of the following documents applies to the planning and design of stormwater-related facilities in the Town in addition to the Town's Design Guidelines:

- Ontario Greenbelt Plan (2017) and the Oak Ridges Moraine Conservation Plan (2017).

- Region of York, Source Water Protection Plan and related Risk Management Plan preparation and permitting provided for under the Clean Water Act (2006).
- M.E.C.P., Stormwater Management Planning and Design Manual (March 2003).
- T.R.C.A., Planning and Development Procedural Manual (last updated 2012).
- T.R.C.A./C.V.C., Low Impact Development Stormwater Management Planning and Design Guide (ver. 1.0, 2010).
- L.S.R.C.A. Technical Guidelines for Stormwater Management Submissions (September 1, 2016).
- L.S.R.C.A. Phosphorous Offsetting Policy (dated September 2017).
- M.N.R.F. and D.F.O., most current policies with respect to the protection of threatened or endangered species, including vegetation, wildlife, fisheries and fish habitat.
- Town of Aurora, Comprehensive Stormwater Management Master Plan (November 2014).

The following S.W.M. planning and design principles are to be followed:

a) Consultation with the Town, Conservation Authority and agencies is to take place early in the planning process. The number of S.W.M. facilities should minimized and site selection is to be based on a sub-watershed planning approach.

b) L.I.D. measures may replace stormwater quantity and quality control measures in Town-owned municipal blocks. Redundancy to protect for blockage or plugging of L.I.Ds and sequential runoff events is to be provided. Credit for LIDs facilities toward reducing downstream municipal SWM facilities will not be given.

c) In the case of infill or redevelopment proposals, on site L.I.Ds and S.W.M. concepts may be considered by the Town in conjunction with potential off-site storm drainage improvements.

d) S.W.M. facilities are to be created as public amenity features and are to be sited adjacent to public road allowances and they are to be significantly visible and accessible to the public and adhere to safety criteria. Opportunities for linkages by means of trails to other open space, floodplain areas or S.W.M. facilities are to be maximized.

e) The S.W.M. design is to respect the riparian rights of upstream and downstream landowners. Impacts resulting from changes in flow rates or water levels, drainage areas and/or in-stream works to neighbouring private properties must be adequately addressed.

E2.02 Water Budget Report

The consulting hydrogeologist will prepare a Water Budget Report in conjunction with a Hydrogeological Study and obtain the local Conservation Authority's and the Town's approval of the report prior to acceptance of the Draft Plan. The report is to reference the completed hydrogeological site investigations and the Preliminary Geotechnical Report also completed for the project. The local Conservation Authority staff are to be consulted when determining pre-development water budget values to make use of available tools and expertise (e.g., T.R.C.A. Water Balance Tool) for comparison to M.E.C.P. calculation methods.

The water budget analysis is to quantify expected changes in evapotranspiration, infiltration and runoff resulting from development, that may impact natural environmental features or the sources of drinking water and will require mitigation. The report is to conclude if the necessary mitigation measures can be incorporated into the Draft Plan or if off-site mitigation measures are necessary. Also refer to Section D2.03.

Upon approval of the Draft Plan and the project advancing to design and construction, a revised Water Budget Report will be necessary should site conditions change or are determined to be different from the original report.

E2.03 L.I.D. Planning and Design

L.I.D. measures may be appropriate based on the results of the accepted Water Budget Report. The planning and preliminary design of L.I.D. measures is to be documented in the Preliminary F.S..R and accepted by the Town and the local Conservation Authority prior to approval of the Draft Plan. The Region has confirmed to the T.R.C.A. that the REC 1 Part 2(b) policy of the S.P.P. allows the municipality the option to require the applicant to locate compensating recharge on another site within the W.H.P.A. Q2 where it is not possible to protect pre-development recharge within the development site. The corresponding policy for L.S.R.C.A. is the Lake Simcoe Protection Plan Water Budget Offsetting Policy for LSPP 4.8-DP and 6.40-DP.

The final design and details of the L.I.D. system is to be documented in the Stormwater Management and L.I.D. Design Report.

The Town limits L.I.D. preferences on private residential lots in urban areas due to existing hydrogeological conditions, the increasing density and coverage on residential lots and the expected use and enjoyment by homeowners of private residential lots. The following approach to screening and proposing L.I.D. measures applies to development in urban areas:

- Where engineered fills are required to suit required development grading and servicing, the use of more pervious fill materials shall be provided resulting in opportunities infiltration.

- Structural LID measures such as reduced lot grading, soak away pits, infiltration galleries and bio-swales may be acceptable on private urban residential lots as part of new developments at the discretion of the Town.

- Structural L.I.D.s. including soak away pits, infiltration galleries, or bio-swales as noted above may be planned in municipal blocks or Open Spaces subject to Conservation Authority approval. The use of dedicated Clean Water Collector or Rooftop Leader Collector sewers within road allowances or municipal blocks in combination with the structural L.I.D.s. is acceptable. Limitations such as avoiding placing infrastructure within Open Space buffer areas, maintenance and access requirements are to be considered.

- Structural LIDs as noted above may be to be sited within road allowances or Park blocks at the discretion of the Town.

- Topsoil depths shall be a minimum of 150 mm and a maximum of 250 mm. Topsoil amended with other materials (as approved) designed to increase stormwater retention is acceptable.

- Rain barrels proposed on private residential lots are acceptable and shall be accompanied by educational and operational information provided to homeowners by Applicants.

- Municipally owned L.I.D.s. facilities are to include overflow or by-pass piping to downstream quality and quantity control facilities.

Residential development in rural estate settings may provide opportunities to incorporate some structural L.I.D.s. measures on private lots, subject to considering development density and soils and groundwater conditions. These are to be discussed on a site-specific basis with the Town during the pre-consultation meeting.

Non-residential developments are to investigate the suitability of private L.I.D. measures within each development block, subject to discussions with the Town and the Conservation Authority at the time of the pre-consultation meeting and submission of supporting documentation.

E2.04 Levels of Service

The design level of service to be provided by the storm drainage infrastructure is listed in the following table, unless stipulated otherwise. The planning of access routes for emergency services (i.e., police, fire, ambulance) may result in higher design levels of service as determined by the Town.

Table E-1: Design Levels of Service for Major and Minor Systems

Item	Design Level of Service	Comments
Eavestroughs and roof water downspouts	Required as per O.B.C. and By-law 2018-056-WS (or most current version)	Downspouts are to discharge to grassed or vegetated areas or to rain barrels where specified, with outlets directing drainage away from building foundations. Downspouts are not to be directed toward or across paved or concrete surfaces.
Storm Sewers	1:5 year design storm (typical) 1:10 year level of service may be required for some commercial areas	N/A
Foundation Drainage – service connections	Gravity service only	Sump pumps shall not be used in new development areas to provide continuous service during power outages.
Hydraulic Grade Line	1:100 year design storm	Subject to pre-design confirmation with Town staff, no less than 0.5 m between 1:100 year storm hydraulic grade line and finished basement floor elevations.
Major System	1:100 year design storm	Drainage areas may require classification as a floodplain using Regulatory storm criteria (T.R.C.A. and L.S.R.C.A.). Overland flow cannot exceed the flow capacity of a block or right-of-way as noted in Figure D-2 to a maximum depth of 0.30 m.
	Regional storm level of control	Consultant to confirm the maximum level of control with the Conservation Authority: No control of potential increases in Regional storm peak flows (i.e., only conveyance of flood through SWM facility required), or Increased Regional storm peak flows are to be reduced or controlled as directed by the Conservation Authority.
Culverts	Per MTO Directive B-100	See following Table E-2

Table E-2: Level of Service for Bridges and Culverts (per MTO Directive B 100)

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

E2.05 Hydrology and Hydrologic Modelling

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

$(\text{T.c. urban} / \text{T.c. rural})^{0.5}$

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

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

- 24-hour Soil Conservation Service (S.C.S.).
- 12-hour Soil Conservation Service (S.C.S.).
- 4-hour Chicago distribution.

The Town, T.R.C.A. or L.S.R.C.A. may request other design storm lengths and distributions, for example the 6-hour and 12-hour Atmospheric Environment Service (A.E.S.) storms for evaluation during the pre-consultation process. The Little Rouge watershed is subject to unit flow rates determined by the T.R.C.A.

The Regional storm which applies to all areas within the Town of Aurora is the Hurricane Hazel event. As directed by the Town and relevant Conservation Authority, the more critical result of the 100-year storm or the Regional storm shall be used to establish floodlines and design of the

major drainage system. The design consultant is to also confirm if the T.R.C.A. requires the control of the Hurricane Hazel post development peak flows to pre-development flow rates for each design.

Rainfall data selected for design of the Town's storm drainage facilities was obtained from the Bloor Street station. The following are the A, B, C values for the 3 parameter Chicago distribution design storms to be used in the equation: Intensity = A / (t+B) ^C, as indicated in the following table.

Table E-3: Chicago Distribution Design Storm Parameters and Rainfall Amounts

Return Period	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
A	647.7	929.8	1021	1100	1448	1770
B	4	4	3	2	3	4
C	0.784	0.798	0.787	0.776	0.803	0.820

E2.06 Erosion and Sedimentation Control Design

The design of erosion and sedimentation controls shall be in accordance with the T.R.C.A. and L.S.R.C.A. guidelines, including the "Erosion and Sediment Control Guideline for Urban Construction", dated December 2006. Where applicable other standards may be appropriate, such as O.P.S.D., Region of York, etc.

Erosion and sedimentation controls are to be designed using a "treatment train" approach consisting of at-source controls, conveyance controls and measures prior to discharge of runoff from the site. The sole use of siltation control fence is not acceptable.

Erosion and sedimentation controls shall be designed for various stages of site conditions which change as grading and servicing take place. The typical stages of construction to be reflected on separate erosion and sedimentation control plans are topsoil stripping, post-earthworks construction and post-servicing construction.

Stream crossings or diversions are also to be designed to reflect various stages of construction. Consultants are to meet the local Conservation Authority and M.N.R.F. requirements with respect to construction phasing, construction timing and erosion and sedimentation controls with respect to water course crossings.

E2.07 Stormwater Management and LID Design Submission Requirements

The Town requires complete and comprehensive documentation related to the planning, design, maintenance and operation of storm drainage, L.I.D. and stormwater management facilities as

outlined below with all documentation being dated, signed and stamped by a Professional Engineer.

1. Report Formats

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

2. Stormwater Management (S.W.M.) and L.I.D. Design Report

   The following drawings are documents are to be included with the S.W.M. and L.I.D. design report for low impact development measures and water quality/quantity control facilities. The S.W.M. report is to identify how recommendations from the final F.S.R. Geotechnical, Environmental and Hydrogeological reports have been incorporated into the final design of the facilities.

   a) Site Location Plan.

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

   c) The detailed design of L.I.D. measures based on the Town's requirements and the current Conservation Authority design manual. The description of inspection, maintenance and long-term replacement or rehabilitation requirements (either municipal or private landowner obligations) are to be provided.

   d) Engineering drawings for stormwater facility which should identify the following:

      - Permanent, extended detention, highest water levels on plan view and include all ponding levels for various return periods in tabular form.
      - Section/details of major overland flow routes.
      - Section/details of maintenance access roads.
      - Section/details of erosion protection at inlet/outlet structure and on spillways.
      - Fencing limits.
      - Location of facility signage.
      - Borehole location and existing groundwater elevation.

- Existing and proposed grading elevations and transition slopes.
- Sediment forebay details including lining and separation berm.
- Details of sediment drying area and/or bypass pipe for cleaning purposes.
- Section/details of inlet/outlet structures.

e) Descriptions, drawings and details of proposed L.I.D. measures including description of inspection, maintenance and long-term replacement or rehabilitation requirements and obligations of the Town or private landowners.

f) Landscaping/restoration plans and details.

g) Erosion and sediment control plans and details.

h) Excerpts from approved Master Plans, Functional Studies or Conservation Authority documentation which outline requirements for quantity/quality control and facility design requirements.

i) Identify any deviations from the Town Design Guidelines including an explanation based on site specific conditions.

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

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

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

m) Table summarizing:

i. Post-development peak flows and storage volumes compared to allowable unit watershed release rates as determined by the Conservation Authority, or

ii. Pre-development and post development peak flows and storage volumes based on output from hydrologic modeling.

n) A table summarizing on-site detention and on-site water quality control measures for development of lots or blocks in the subdivision (i.e., will be under Site Plan control) if these measures are part of the S.W.M. design.

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

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

q) Sample or supporting calculations for the following:

i. extended detention drain-down time (hours)

ii. major system overland flow and velocity to confirm conveyance within R.O.W. and/or defined flow routes

iii. 100-year hydraulic grade line to confirm basements will be protected

iv. erosion control sizing and flow velocity at inlet/outlet structures and spillways

v. sediment forebay length and width in conformance with M.E.C.P. manual

vi. major system inlet grating sizing (assuming 50% blockage)

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

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

3. S.W.M. Facility and L.I.D. Certification, Operations and Maintenance (O&M) Documentation

The following table summarize the stages of required stand-alone documentation to be submitted.

Table E-4: SWM Facility and LID Certification, Operations and Maintenance (O&M) Documentation

Stage	Maintenance Manual	Maintenance Checklist (included with Manual)	Record Drawings, Documents and Certification
Draft Plan Application	“Preliminary S.W.M. Facility and L.I.D. O&M Manual”	Preliminary checklist required	N/A

Stage	Maintenance Manual	Maintenance Checklist (included with Manual)	Record Drawings, Documents and Certification
Detailed Design Submission	"Design S.W.M. Facility and L.I.D. O&M Manual" required based on detailed design	Checklist updated based on detailed design	N/A
Subdivision "Completion" (i.e., preliminary acceptance and start of maintenance)	"Final S.W.M. Facility and L.I.D. Certification, O&M Manual" based on construction records	Final checklist based on construction records	Refer to Appendix H11 including: Pond topographic and/or bathometric surveys taken at time of construction including CAD files submitted. S.W.M. facilities Record Drawings, post-construction modelling and Engineer's certifications required.
Final Acceptance (i.e., end of maintenance period prior to assumption)	Addendum letter to Final manual documenting final pond volumes. S.W.M.F. / L.I.D. operation during the maintenance period and recommending Final Acceptance. The Cost estimate section of the O&M Manual is to be updated to reflect current costs.	N/A	Sediment to be removed from ponds just prior to Final Acceptance. Topographic and/or bathometric surveys completed and CAD files submitted.

Items which relate to post construction conditions (i.e., bathometric and/or topographic surveys and descriptions, Record Drawings, post-construction modelling, agency approvals and facility certifications, etc.) are to be provided only in the final version of the manual.

A maintenance checklist is to be provided in the manuals. Separate checklists are to be created for collection system S.W.M. components or L.I.D.s., such as oil and grit separators, infiltration galleries or infiltration trenches, etc., and are to be included in the manual. The manual is to focus on the expected frequency, method of maintenance and annual cost of maintenance that will be required in the following areas:

- Facility inspection/monitoring program (outline seasonal and annual tasks based on the F.S.R., S.W.M. design or draft plan approval conditions).
- Grass cutting.
- Weed control.
- Plantings.
- Trash removal.
- Sediment testing, removal and disposal.

E3.00 Stormwater Management Pond Design and Features

E3.01 General Requirements

Stormwater ponds are required to meet provincial S.W.M. prerequisites as set out by M.E.C.P., the T.R.C.A. and the L.S.R.C.A. regarding water quality, quantity and erosion control. S.W.M. pond locations, functions and design criteria shall be confirmed through consultation with the relevant Conservation Authority and the Town of Aurora. Where stormwater Watershed Plans or Functional Servicing studies have been completed, the design shall follow criteria provided in the approved report. End of pipe facilities are acceptable to the Town when the designs are safe, maintainable, integrated with the surrounding landscape, and aesthetically pleasing. The S.W.M.F. design is also to reflect the recommendations of the Town of Aurora Stormwater Ponds Vegetation and Wildlife Study (Env. Advisory Committee 2007). Volume control (i.e., infiltration) facilities and the need for secondary or “back up” measures are subject to the Town’s evaluation of ownership issues and long-term operation and maintenance of volume control facilities.

The following are considerations that must also be met:

- Matters of public safety.
- Facility aesthetics and compatibility with surrounding topography.

- Reliance on measures not within municipal control.
- Implications for municipal maintenance requirements.
- Protecting the riparian rights of private landowners.
- Protection of municipal infrastructure and maintaining an acceptable level of protection to residents whose homes drain into a municipal drainage system.
- Conflicts with land use.

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

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

The Town requires integration of stormwater pond grading design with the surrounding landscape. The design is to consist of varied contour grading to ensure public safety, provide improved aesthetics, support of a variety of plantings and vegetation and provide passive recreational activities (i.e., walking trails, bike paths, vistas, etc.). Safety aspects must be given special consideration. This includes identifying the use of gentle slopes in areas where passive recreation takes place, an increasing density of appropriate plantings and vegetation on steeper slopes, handrails/guardrails at headwalls and placing signs which inform of the function and potential hazards of SWM ponds.

Stormwater management pond design criteria are to follow the M.E.C..P “preferred” criteria and are summarized in the following table:

Table E-5: Stormwater Pond Design Criteria

Permanent Pool	Maximum Slopes	7:1 for 3 m distance below normal water level (N.W.L.) location
	Maximum Slopes	4:1 from 0.5 m below N.W.L. to bottom of pond
	Average Depth	1.0 to 2.0 m
	Maximum Depth	2.5 m
Extended Detention	Maximum Slopes	7:1 for 3 m distance above N.W.L. location
	Maximum Slopes	4:1 to top of extended detention
	Maximum Depth	1.0 m
Flood Storage	Maximum Slopes	4:1 above the maximum extended detention level up to the high-water level (H.W.L.)
	Maximum Depth	2.0 m for combined Extended Detention and Flood Storage
	Maximum Slopes	4:1 beyond H.W.L. as required
Other	Design of sediment forebays at each inlet to the pond, meeting M.E.C.P. design guidelines in order to maximize sedimentation in the forebays.	
	A minimum 3.0 m wide platform at a maximum cross-slope of 4% provided adjacent to residential properties.	
	A horizontal terrace of 3.0 m required for continuous slope changes in elevation greater than 3.0 m.	
	Freeboard to top of pond of 0.3 m above the H.W.L. (based on routing of Regional Storm flow assuming blocked outlet conditions). (H.W.L. = maximum water level to convey the Regulatory event through pond)	
	Emergency overflow weir (to pass the Regulatory event) with capacity of no less than 0.1 $m^3/s/ha$.	
	Clay core berms with slope toe drains required if N.W.L. is higher than surrounding grade.	
	Impermeable pond lining material, subject to approval of the Town, to prevent groundwater inflow where necessary and designed by a Geotechnical Engineer.	

	A subdrain system under the S.W.M. facility, connected to a pump chamber manhole to lower groundwater levels and protect an impermeable pond liner during pond dewatering and clean-out operations. System to be designed where necessary by a Geotechnical Engineer.
	Safety-related signage and safety equipment shall be placed near pond access points or at locations approved by the Town, including those visible from the right-of-way. The signs are to educate and advise the public of the purpose, characteristics and dangers associated with the facility.
	Offset gates to control vehicular access to the maintenance road.
	Pond inlet and outlet pipes are to be equipped with grates per the O.P.S.Ds. Headwalls are to be equipped with non-climbable standard fencing.
	Maintenance vehicle access roads suitable to support municipal equipment but also designed to support vegetation growth on the surface of the roadway.
	Berms constructed of suitable material, inspected by a geotechnical engineer and compacted to a minimum 95% Standard Proctor density.

E3.02 Stormwater Pond Safety Features

Public safety must be kept paramount in the design of S.W.M. facilities. The parameters listed in Table E-5 are safety related and are to be adhered to in the design of S.W.M. ponds.

Fencing requirements for Stormwater Management Facilities are to adhere to Section 3.4.2 “Stormwater Management Landscaping” of the Town’s Landscape Design Guidelines, June 2015.

E3.03 Stormwater Pond Operations and Maintenance Features

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

- Maintenance vehicle access roads and turn-around areas at sediment forebays, outlet pools and control structures having a maximum gradient of 10%, minimum width of 4 m, a minimum inside turning radius of 10 m and including a 10 m long loading platform at

the forebay and outlet pool locations. Maintenance roads may be required to other locations with the pond block as determined by the Town. Maintenance roads should have maximum cross fall of 2%.

- All maintenance vehicle access roads construction shall be structurally designed to support municipal equipment and allow for vegetation growth on the surface of the roadway.

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

- In order to facilitate sediment removal operations, either of the following may be proposed and are subject to review and approval of the overall approach to sediment management and removal:

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

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

- A minimum 3 m wide platform at a maximum cross slope of 4% is to be provided around the property boundary of the stormwater block adjacent to residential lots.

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

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

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

- The use of an oil-grit separator device upstream of S.W.M. facilities is preferred.

E3.04 Retaining Walls

The use of retaining walls to achieve grading requirements within stormwater management pond blocks is strictly prohibited. The grading criteria for stormwater ponds outlined in Table E-5 is to be applied to the design without the addition of retaining wall structures.

In cases around storm sewer inlets or outlets, headwalls in the form of armour stone, pre-engineered, large-scale precast stone or patterned concrete systems (as opposed to rip rap slope protection, small-scale retaining wall stone or gabion baskets) will be required. These alternatives are to include an engineering design and shop drawing stamped by a registered professional engineer for any structure not covered under Ontario Provincial Standard Drawings.

E3.05 Landscaping in Stormwater Ponds

Landscape design for Stormwater Management Ponds shall conform to Section 3.4 “Stormwater Management Landscaping” of the Town’s Landscape Design Guidelines, June 2015, as amended.

E3.06 Buried Tanks for Municipal Stormwater Management

Buried tanks are generally not acceptable for municipal stormwater management purposes due to the increased cost and complexity to inspect, maintain and clean-out tanks versus open stormwater management ponds. Extensive long-term rehabilitation or replacement costs are anticipated with these structures which may not be applicable to standard municipal stormwater management ponds. Based on further review of the details provided by the Applicant, the Town may consider the use of buried tanks at their discretion.

E4.00 Major Drainage System

E4.01 General

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

E4.02 Hazard Lands and Floodlines

Development proponents are to consult with the relevant Conservation Authority to confirm the extent of Regulated Areas and the requirements to delineate hazard lands, environmental areas and floodlines. Stormwater management facilities are to be designed and constructed outside

of the Regional storm floodline and environmentally sensitive areas as directed by the Town and/or the relevant Conservation Authority.

E4.03 Watercourse Erosion and Channel Bank Stability

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

E4.04 Channels and Spillways

The proposed criteria for an open channel design shall be submitted to the Town for approval by the Consulting Engineer, prior to the actual design being undertaken. The Consulting Engineer shall also be responsible for obtaining the approval of the design from the M.E.C.P., the local Conservation Authority and the M.N.R.F. (if under the Ministry's jurisdiction) to determine if the open channel concept is favourably considered.

Overflow weirs and spillways typically form part of the major overland drainage system. These facilities are to be designed for the greater of the 100-year storm or the Regional storm peak flow with a minimum of 0.3 m of freeboard above the depth of flow for the design storm, as noted in Table E-5.

The use of erosion protection measures which encourage vegetation cover while withstanding the design velocity and remaining stable during the design storm will be considered. Channel lining materials will be subject to M.N.R.F. review and comment with respect to fisheries habitat. Engineered channels may be subject to natural channel design and bio-engineering methods. The use of rip rap as a means for erosion control is subject to specific review and approval by the Town. Gabion structures are not acceptable. All rip rap applications are to include appropriate filter fabric as recommended by design engineers.

E4.05 Major System Design Criteria

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

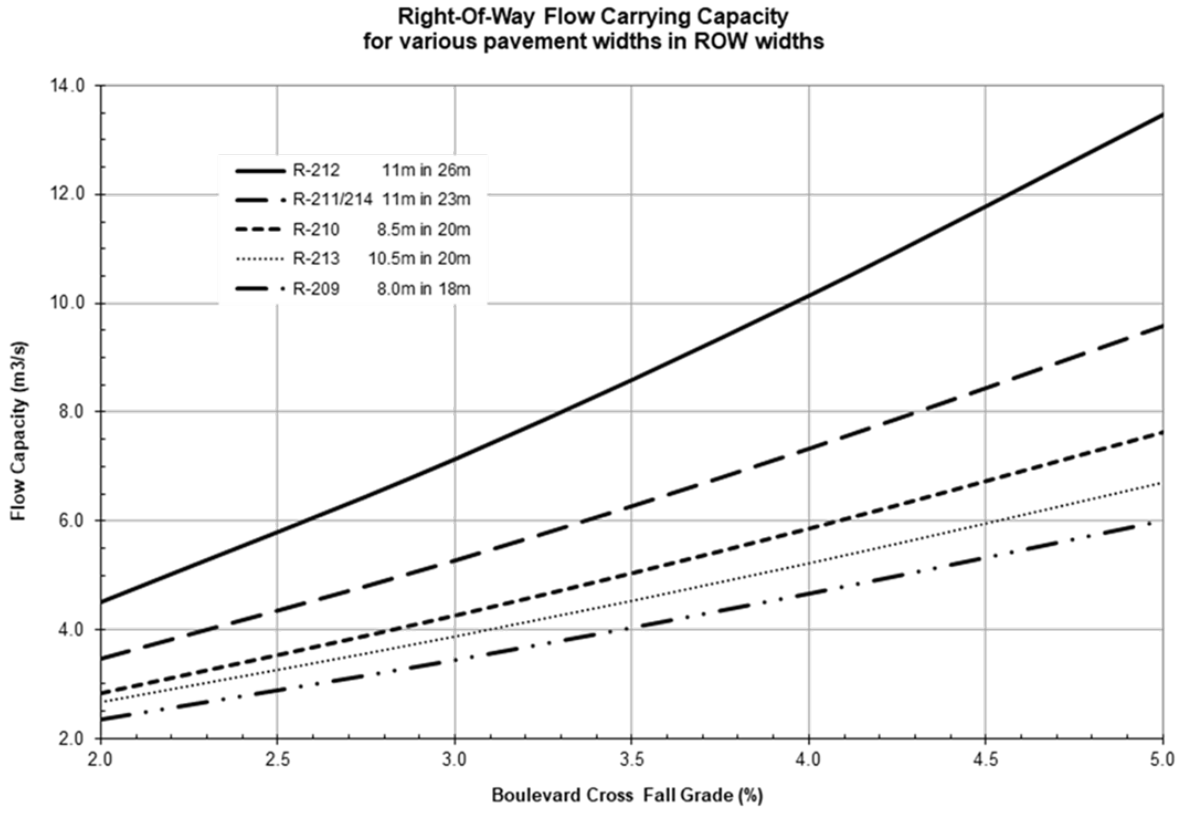
Fences, garden sheds and other flow impediments significantly reduce the flow carrying capacity of swales on private property. Overland flow from public property onto swales on private property must be limited to no more than 0.1 m3/s, or a drainage area of 1 ha, whichever

is smaller. Otherwise, overland flow must be limited to road rights of way, walkways and easements, free of fences and other impediments to flow.

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

Figure E-1 provides the maximum road allowance carrying capacity for overland flow for various pavement and road allowance widths. This table shall be used to confirm the capacity of the overland conveyance system relative to the expected design flows.

Figure E-1: Right of Way Flow Carrying Capacity



E5.00 Minor Drainage System

E5.01 General

Urban stormwater conveyance systems may include open channels and swales, storm sewers, maintenance holes and catchbasins, foundation drainage collectors (F.D.C.), roof leader

collectors (R.L.C.), clean water systems (C.W.S.), roadways and road allowances. The design of stormwater conveyance systems shall follow “dual drainage” principles consisting of a minor (typically a storm sewer) and major (road allowances or channels) drainage facilities.

E5.02 Design Criteria

Residential roof leader downspouts shall discharge to grassed or vegetated surfaces, private rain barrels or dedicated clean water collector sewers as approved. Residential roof leader downspouts shall not outlet onto driveways or be connected to storm sewers which collect road allowance and foundation drainage. The architectural design of townhouse blocks shall specifically address roof design, eavestrough locations and roof leader downspout locations to meet the above criteria. Non-residential developments shall locate and provide roof leader downspout outlets as noted on approved Site Plans.

The design of the storm sewer drainage system shall provide un-surcharged conditions up to the 1:5 year storm. The Town may require use of 1:10 year design storm criteria for high value commercial development, and for downtown business areas. In such cases, some internal control in the form of temporary ponding on parking areas furthest away from the building or underground storage may also be required. The Town requires the Applicant to provide a maintenance hole located at the streetline to control discharges into the storm sewer system. Goss traps or alternative oil and grit separator inlets, approved by the Town, shall be placed in parking lot catchbasins where there are nearby fueling areas.

The Town requires on site stormwater quality and quantity control measures on industrial, commercial and institutional developments or re-development projects as part of a “Treatment Train” approach. Consultants shall specify in F.S.R’s. and on detailed designs an appropriate level of quantity control that may be achieved through surface, underground and/or rooftop ponding and control. Water quality control is to be provided through a required oil-grit separator located just upstream of the property line inspection manhole and other L.I.Ds. as selected by the Consultant. Site Plan approvals will be based on the on-site control measures approved with the Draft Plan and detailed design.

The storm sewer system design shall include capacity for connection of foundation drains or weeping tiles and the storm sewers shall be at an appropriate depth to provide connection to foundation drains by gravity only. A hydraulic gradeline (H.G.L.) analysis shall be completed and submitted to the Town for review and approval.

Other Roof Leader Collector (R.L.C.) sewers or clean water systems (C.W.S.) may be required based on the reports and environmental evaluations completed prior to Draft Plan approval. These reports are to provide the criteria for hydraulic design of the collection system and the receiving stormwater facility, infiltration gallery, etc. These collection systems are to be designed and constructed according to the Town’s guidelines for minor system storm sewers and are subject to review by the Town and the local Conservation Authority.

During preparation of the Preliminary Functional Servicing Study prior to Draft Plan approval, the maximum ponding elevations in S.W.M. blocks and the resulting H.G.L. in the storm sewer system is to be determined with sufficient level of detail to prevent the use of basement sump pumps in the development. As an alternative to connecting foundation drains or weeping tiles to the storm sewer, a Foundation Drain Collector (F.D.C.) sewer system may be considered by the Town.

E5.03 Hydraulic Gradeline (H.G.L.) Analysis

A hydraulic gradeline analysis is required to protect structures from flooding and damage during 100 year design storm events. The hydraulic gradeline is to be a minimum of 0.5 m below finished basement floor elevations, or as specified by Town staff during pre-design consultations.

The design engineer shall prepare and submit an operational hydraulic gradeline digital model (Excel, S.W.M.5., etc.) based on 100 year design storm flow rates. The model is to account for the total head loss including pipe friction head loss, manhole entrance/exit losses and bend losses at maintenance holes in determining water surface elevations. The submission shall detail for each sewer length the critical design finished centerline of road elevation, the design depth below centerline of road to the finished basement floor elevation and identify the calculated separation between the basement floor and the 100 year hydraulic gradeline elevations for comparison to the minimum requirement. The analysis is to conclude for each sewer length if the design criteria has been met.

Table E-6: Storm Sewer Head Loss Components

Pipe Head Losses*
Pipe friction losses calculated based on Manning's equation: $h_f = ((19.6 * n^2 * L) / (R^{1.33})) * (V^2/2g)$ Where, h_f = head loss due to friction, m n = Mannings roughness coefficient L = length of pipe, m R = hydraulic radius V = flow velocity, m/s

Manhole Head Loss Components**	**Coefficient (K)**
Entrance and Exit Losses: Straight through manhole with only one inlet and one outlet pipe: $h_m = K * (V_2^2 / 2g)$ where, V_2 is the outflow velocity (m/s)	0.05
Junctions: Junction maintenance holes where one or more lateral pipes connect to a manhole in addition to the incoming and outgoing main pipes, based on the angle of the lateral pipes to the mainline: $h_m = K * (V_2^2 / 2g)$ where, V_2 is the outflow velocity (m/s) 90 degree lateral pipe(s) 60 degree lateral pipes(s) 45 degree lateral pipes(s) 22.5 degree lateral pipes(s)	 0.75 0.65 0.50 0.25
Bend Losses: In addition to entrance and exit losses and junction losses, head loss due to changes in direction at maintenance holes is to be calculated: $H_b = K * (V_2^2 / 2g)$ Where, V_2 is the outflow velocity (m/s) 90 degree bend 60 degree bend 45 degree bend 22.5 degree bend	 0.50 0.43 0.35 0.20

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

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

The design of storm sewers shall be computed on the Town's standard Storm Sewer Design Sheet (i.e., Appendix A2 – Storm Design Sheet) in spreadsheet format. All storm sewer minor system designs shall be based on a 5-year frequency unless otherwise directed by the Town.

a) All storm sewers shall be designed according to the modified rational formula:

$$Q = 2.778 (ACCai)$$

Where,

Q = Run-off quantity in m^3/sec.

A = Area in hectares (ha)

C = Run-off coefficient

Ca = Antecedent Precipitation Factor

i = Average rainfall intensity in mm/hr

The product of C x Ca shall not be greater than 1.00.

b) Rainfall intensities shall be calculated in accordance with the values for the 3 parameter equation:

Intensity = A / (t+B) ^C, where:

i. A, B and C parameters are provided in Table E-3, and

ii. "t" is the Time of Concentration.

E5.04 Run-off Coefficients and Imperviousness Values

Wherever possible, run off coefficients and imperviousness values are to be determined based on the characteristics of watershed surfaces, ground slope and soil conditions which affect run off flow rates. Imperviousness values are to be determined from the coverage of pavement, roof tops, sidewalks, patios and other impermeable materials over the development area.

Where developments consist of various densities of impervious materials or land uses, determination of a suitable run-off coefficient is to be justified by submitting weighted coefficient calculations. The following describes typical runoff coefficient values for the 5-year return period storm sewer design:

Table E-7: Run-off Coefficients for 5 Year Return Period Rational Method Design

Parks, Grassed Areas	0.15 – 0.30
Estate residential	0.45
Single-family residential (frontage greater than 12.2 m)	0.60
Single-family residential (frontage equal to or less than 12.2 m)	0.65
Semi-detached residential	0.65
Townhouses, row houses, etc.	0.75
Apartments	0.85
Schools and churches	0.75

Industrial	0.75 – 0.85
Commercial	0.85 – 0.90
Paved areas	0.90 – 0.95

An appropriate run off coefficient may also be determined from the following:

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

Where,

"I" is the site imperviousness ratio.

Run off coefficients for higher return period storms shall be modified by the Antecedent Precipitation Factor "Ca" to account for saturated ground conditions, reduced depression storage and infiltration capacity during these events.

The following factors shall be applied, to the extent that the product of C x Ca does not exceed 1.00:

Table E-8: Run-off Coefficient Modification Factors for Rational Method and Modified Rational Method Design

Design Storm Return Period	Run-off Coefficient Modification Factor (Ca)
5 Year	1.00
25 Year	1.10
50 Year	1.20
100 Year	1.25

E5.05 Time of Concentration

Times of concentration (T), calculated in the storm sewer designs are to use a 10-minute inlet entry time at the head of the system plus the travel times contributing to that sewer section being sized. The entire upstream contributing drainage area and longest travel times are to be considered in the design with the following exception.

Occasionally there are circumstances where the surface water inflow into developing lands from drainage areas having low run off potential (low run off coefficients) and longer times of concentration can result in underestimating the design flow and required sewer sizes.

In these cases, the longer times of concentration are to be used only where the introduction of developed lands does not cause higher flow rates. Where undeveloped lands drain into

developed lands, the shorter times of concentration of the developed lands are to be used, along with only the lower portion of the undeveloped area contributing run off.

The portion of the undeveloped land area contributing to the flow is to be calculated proportional to the square root of the ratio of the applicable times of concentration. For example, an urban drainage system, having a time of concentration of 15 minutes, would drain approximately 70% of an undeveloped area, having a time of concentration of approximately 30 minutes, draining to that same point (i.e., (15/30)0.5 = 0.7). Based on this calculation, the sewer design uses the urban area's rainfall intensity and only the rural area contributing to the urban drainage system is reduced to this percentage of the total rural area.

E5.06 Storm Sewer Design

Storm sewers should be sized to convey the peak design flow in accordance with Manning's equation, whereby the friction slope is assumed to the same as the bed slope of the pipe. The sizing of sewers at slopes greater than the critical slope is limited by inlet capacity and not friction slope. Table E-9 lists the maximum allowable flow rate for each sewer size. The table also lists the maximum pipe slopes based on a full flow velocity of 5 m per second. The critical slope is based upon the pipe flowing 85% full. These factors have been accounted for in the programming of the Town's Appendix A2 – Storm Sewer Design Sheet. Although the Manning's formula is to be used as a basis for sewer design, the values listed in Table E-9 will supersede the results of Manning's calculations where applicable.

Pipe Capacity

The sewers will be designed according to the Manning equation:

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

and

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

Where,

Q = flow m^3/sec.

R = A/P

A = flow area (m^2)

P = wetted perimeter (m)

R = hydraulic radius (m)

S = slope of pipe (m/m)

n = roughness coefficient as noted below

For full flow:

A = Pipe cross section area (m^2) = $\pi(d/2)^2$

P = Pipe circumference (m) = πd

d = Pipe size/diameter (m)

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

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

Concrete pipe – all sizes n = 0.013

Concrete box culverts n = 0.015

Corrugated Steel Pipe n = 0.024

Table E-9: Allowable Storm Sewer Capacities and Gradients

Diameter (mm)	Q max (m^3/s)	Slope min* (%)	Slope critical (%)	Slope max (%)
300	0.12	0.40	1.34	8.4
375	0.20	0.40	1.25	8.0
450	0.32	0.30	1.17	6.3
525	0.47	0.30	1.12	5.1
600	0.66	0.30	1.07	4.3
675	0.88	0.30	1.03	3.6
750	1.1	0.30	0.99	3.1
825	1.5	0.30	0.96	2.8
900	1.8	0.30	0.93	2.5
975	2.2	0.30	0.91	2.2
1,050	2.7	0.30	0.89	2.0
1,200	3.7	0.30	0.85	1.7
1,350	5.0	0.30	0.81	1.4
1,500	6.5	0.25	0.79	1.2
1,650	8.2	0.25	0.76	1.1

Diameter (mm)	Q max (m^3/s)	Slope min* (%)	Slope critical (%)	Slope max (%)
1,800	10	0.25	0.74	0.99
1,950	12	0.25	0.72	0.89
2,100	14	0.25	0.70	0.80
2,250	16	0.25	0.69	0.73
2,400	19	0.25	0.67	0.67
2,700	24	0.25	0.65	0.57
3,000	29	0.25	0.62	0.50
Based on the following criteria:				
	Velocity min	Velocity max		
	0.75 m/s	4.5 m/s		
*Minimum design grades for pipe storm sewers, regardless of flow velocities obtained.				

E5.07 Minimum Sizes

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

E5.08 Minimum Cover

Typically, a minimum cover of 2.7 m (from future road grade) is required to the top outside edge of the pipe barrel for the storm sewer. However, where specifically approved by the Town, minimum frost cover of 1.5 m may be provided on storm sewers where servicing limitations exist, or where foundation drain collector sewers are used. In any case, the minimum depth of cover is to be demonstrated to provide a minimum 2% slope on storm service connections.

The maximum depth of sewers with direct lateral connections shall be 6.0 m (measured from finished centerline of road elevation to invert of sewer). In cases where deeper sewers are required these shall be considered trunk sewers and no direct lateral connections will be permitted. Separate local sewers constructed above the trunk sewers will be required for connection of laterals. Maintenance holes are to be common wherever possible with drop structures.

E5.09 Location

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

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

E5.10 Sewer Alignment

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

For pipe sizes 900 mm diameter and larger, the sewer alignments shall be such that the maximum change in direction at a manhole shall be 45 degrees.

E5.11 Limits

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

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

E5.12 Pipe Crossings

A minimum vertical clearance of 0.2 m shall be provided between the outside of the pipe barrel at the point of crossing for storm and sanitary sewers. A minimum vertical clearance of 0.5 m shall be provided for all sewer and watermain crossings. It is preferred wherever possible to watermain cross above all sewers.

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

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

E5.13 Changes in Pipe Size

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

E6.00 Sewer Pipe

E6.01 Materials

The type and classification of all storm sewer pipe and the sewer bedding type shall be clearly indicated on all profile drawings for each sewer length. Concrete or plastic pipe will be permitted for storm sewers 375 mm in diameter and smaller. All storm sewer mains 450 mm diameter and over shall be constructed with reinforced concrete pipe.

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

- Pipes up to 375 mm – Non-Reinforced Concrete Pipe, CSA Standard A257.1 M1982, Classes 1, 2 and 3.

- Pipes 450 mm or greater – Reinforced Concrete Pipe, CSA Standard A257.2 M1982, Strength Classification 50 D, 65 D, 100 D and 140 D.

Polyvinyl Chloride (PVC) pipe is permitted for sewers up to 375 mm diameter. PVC products shall conform to the requirements of CSA B182.1, CSA B182.2, ASTM D3034, ASTM F1760 and ASTM F1336. The pipe must be manufactured with factory assembled spigot gasket and integral bell joints. Externally ribbed pipe will not be permitted. PVC pipe for storm sewers shall be any colour except green.

High density polyethylene (H.D.P.E.) pipe shall conform to the requirements of CSA Specification B182.6 and shall have a smooth inside wall and corrugated outside wall (such as H.D.P.E. BOSS Poly-Tite or equivalent) with minimum stiffness of 30 kPa.

Storm sewer leads from catchbasins shall be constructed with PVC DR35 or BOSS Poly-tite H.DP.E.. pipe.

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

E6.02 Pipe Bedding and Backfill

The class of pipe and the type of bedding shall be selected to suit loading and proposed construction conditions. Details of the types of bedding are illustrated in O.P.S.D. 802.010 and 802.030. In general, the following materials shall be used for storm sewers in new developments.

- Type “2” bedding (20 mm crusher run limestone).

- HL-6 12 mm stone bedding with no fine aggregates and Granular “B” cover (no large diameter material permitted in the Granular “B”).

The selection of bedding and backfill materials shall be contingent on soil conditions of the project site and subject to approval of the Town. The class of pipe will be selected to suit this bedding detail. Alternate granular materials for pipe bedding may be specified, subject to the approval of the Town, however, clear stone bedding will not be permitted. Bedding and trench compaction shall be carried out in conformance with OPSS.MUNI 501. The width of trench at the top of the pipe must be carefully controlled to ensure that the maximum trench width is not exceeded unless additional bedding or higher strength pipe is used. The recommendations of a Geotechnical Engineer will be required in determining strength of pipe required and construction methods to be used.

E6.03 Video Record

All newly constructed storm sewers shall be inspected with digital CCTV equipment upon satisfactory completion of all other testing, prior to the Town’s issuance of Building Permits and also prior to Final Acceptance. Appendix H9 provides the Town’s sewer performance guidelines and repairs guidelines and is the basis for evaluation of visual and CCTV sewer and service connection inspections.

A permanent record in digital form shall be supplied, illustrating a continuous record of the sewer installations, service connections, maintenance holes, etc. A report identifying any unusual or substandard conditions shall also be submitted. Protruding laterals that prevent complete inspection of a sewer line without reversals are not acceptable. The Town inspector shall be advised prior to the work being done.

Prior to starting the CCTV inspection, an information screen shall describe the sewer location and provide the Town manhole ID numbers.

The following shall be provided:

1. A separate digital report (including summary and video) will be provided for each inspection. Each report will be numbered, and each sewer inspection will have a unique number identification.

2. The reports and digital video files shall have identification showing the inspection company and names of staff completing the inspection, the report number, date and identification of the sewer location.

3. An assessment of any structural defects based on a numerical protocol in accordance with the latest edition of the Manual of Sewer Condition Classification (M.S.C.C.) produced by the Water Research Center. The structural assessment is to be included in the digital report.

The digital record and pipeline evaluation shall be prepared by a pipeline inspection firm with staff experienced and qualified by N.A.S.S.C.O. in this field. The CCTV digital inspection files and summary report shall be reviewed by the Development Engineer and upon being satisfied the results meet the Town's criteria submit the documents with a recommendation to the Town for acceptance. Digital files are to be submitted on a flash drive device or through the Town's File Transfer Protocol (F.T.P.) website as directed by the Town Engineer. The Town will verify the inspection results prior to recommending issuance of Building Permits.

All digital CCTV files and reports provided from inspections are to become the property of the Town of Aurora.

E7.00 Maintenance Holes

E7.01 Location

Maintenance shall be constructed at the following locations:

- At changes in pipe size.
- At pipe junctions.
- At connections with rear lot catchbasin lead pipe.
- At changes in pipe slope.
- At changes in pipe alignment.
- At changes of pipe material (example: PVC to concrete).
- At either the beginning or end of radial pipe sections.

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

E7.02 Maximum Spacing

The maximum spacing between maintenance holes shall be as follows:

Table E-10: Maximum Storm Sewer Maintenance Hole Spacing

Pipe Size	Maximum Manhole Spacing
300 mm to 900 mm	110 m
975 mm and over	180 m

E7.03 Maintenance Holes Types

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

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

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

Manhole covers shall be as per O.P.S.D. 401.010 Type “B”

E7.04 Maintenance Hole Design

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

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

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

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

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

6. Where the difference in elevation between the obvert of the inlet and outlet pipes exceeds 0.6 m, a drop structure shall be placed on the inlet pipe.

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

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

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

10. The maintenance hole stack opening shall meet O.P.S. requirements.

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

E7.05 Grades for Maintenance Hole Frames and Covers

Storm sewer maintenance holes shall have Bibby Auto Stable adjustable frames and covers and be as per O.P.S.D. 401.010, Type “A”. All maintenance holes, located within the travelled portion of a roadway, shall have the rim elevation set flush with the surface of the base course asphalt. The concreting and setting of the frame and cover shall be completed in accordance with the details provided in the Standard Drawing. A maximum of 300 mm of modular rings shall be permitted on maintenance holes in new subdivisions. No concrete shall extend over the edge of the manhole.

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

All maintenance hole frames and covers shall have a mastic asphalt compound applied after parging.

E7.06 Drop Structures

Drop structures shall be used when invert levels of inlet and outlet sewers differ by 0.6 m or more. The size of the drop pipe shall be one size smaller than the storm sewer diameter and shall have a maximum size not exceeding 300 mm in diameter. Wherever feasible, sewer systems should be designed to avoid the use of drop structures. Internal drop structures are not permitted. Precast drop structures are permitted at the discretion of the Town. All drop structures shall be constructed in accordance to OPSD 1003.030 or 1003.031 as applicable.

E7.07 Head Losses

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

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

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

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

The minimum drops across maintenance holes shall be as follows:

Table E-11: Minimum Drop Required Across Storm Maintenance Holes

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

E8.00 Catchbasins

E8.01 Location and Spacing

Catchbasins shall be selected, located and spaced in accordance with the conditions of design. The design of the catchbasin location and type shall take into consideration the lot areas, the lot grades, pavement widths, road grades, intersection locations and pedestrian travel. Catchbasins shall be located upstream of sidewalk crossings at intersections, and upstream of all pedestrian crossings. Catchbasins shall be located a minimum 1.2 m from driveway or sidewalk curb depressions (refer to Table B-6).

The hydraulic capture capacity of various catchbasin inlet types shall be based on information provided in the Ministry of Transportation Drainage Manual, or an approved alternative source. To ensure that the capture or inlet capacity matches that of the storm sewer, the spacing of catchbasins on streets may be varied and require the use of additional structures. The maximum allowable drainage path to a catchbasin is as follows:

Table E-12: Maximum Street Catchbasin Spacing

Road Gradient	Pavement Width	Maximum Spacing
0.5% to 3.0%	8.5 m	90 m
	15.0 m	70 m
3.1% to 5.0%	8.5 m	75 m
	15.0 m	55 m
5.1% to 6.0%	8.5 m	60 m
	15.0 m	45 m

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

Double catchbasins shall be normally required when the catchbasin intercepts flow from more than one direction. Single catchbasins may be used in the case where the total length of drainage of the catchbasin, from both directions, is less than 95 m, subject to the analysis of the major-minor system.

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

E8.02 Catchbasin Types

Catchbasins must be of the precast type as shown on the S-302. Rear yard catchbasins shall be installed without sumps.

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

E8.03 Catchbasin Connections

In general, catchbasins located in close proximity to a manhole shall have their leads connected to the manhole. Long catchbasin connections (in excess of 20 m) shall be connected to a manhole or, alternatively, the lead can be connected to the sewer and a 1,200 mm manhole catchbasin used in lieu of the normal 600 mm square catchbasin.

Table E-13: Catchbasin Connection Requirements

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

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

**The lot grading design shall minimize the use of rear lot catchbasins as noted in the Grading Design criteria.

Frame and cover for catchbasins shall be as noted in the following section.

a) Residential areas – per Aurora Standard S-304 as directed by the Town.

b) Collector and arterial roads and commercial and industrial areas – per O.P.S.D. 400.110.

c) Rear lot catchbasins – per O.P.S.D. 400.120.

d) Parking lots – per O.P.S.D. 400.020.

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

All catchbasin tops shall have a mastic asphalt compound applied after parging.

E8.04 Catchbasins at Intersections

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

E8.05 Grades for Catchbasin Frames and Grates

All catchbasins located within the travelled portion of a roadway shall have the frame elevation set flush with the surface of the base course asphalt. The adjusting and setting of the frames and grates shall be completed immediately prior placement of surface course asphalt.

Temporary asphalt curbing shall be placed behind all catchbasins within the travelled portion of the roadway at the stage of base course asphalt. Asphalt curbing shall be placed in accordance with O.P.S.D. 601.01 between the two adjacent expansion joints, as shown on the Standard Drawing.

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

E9.00 Inlets, Outfalls and Special Structures

E9.01 General

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

E9.02 Inlets

For other than minor swales, where catchbasins with bird cage tops are used, inlet structures shall be fully designed by the Consulting Engineer. Inlet grates shall generally consist of inclined parallel bars or rods set in a plane at approximately 18° with the top away from the

direction of flow. Gabions or rip rap shall be provided at all inlets to protect against erosion and to channel the flow to the inlet structure.

Hydraulic design calculations for inlet structures must be performed in accordance with guidelines established by the Ministry of Transportation, Ontario, Drainage Manual and are to allow for 50% blockage in these calculations.

The design of any culvert on a new or reconstructed watercourse where an inlet grating is required must provide a measure of safety and minimize the risk of entanglement or entrapment of a person. Inlet design shall account for 50% blockage as per Section D2.07.

E9.03 Outlets

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

Safety railings or chain link fence with 38 mm by 38 mm diamond “non-climbable” mesh shall be provided along the top of all headwalls 0.6 m in height or greater. Railings may also be required along shorter headwalls where a risk to pedestrian safety has been identified. The site-specific conditions must be reviewed in determining the requirement for safety railings or fencing and must have due regard to public health and safety.

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

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

Rip rap, concrete, river stone, vegetative mats or other erosion protection acceptable to the Town, the Conservation Authority and M.N.R.F. as appropriate shall be provided at all outlets to prevent erosion of the watercourse, and to the area adjacent to the headwall. The extent of the erosion protection shall be indicated on the Engineering Drawings and shall be dependent upon the velocity of the flow in the storm sewer outlet, the soil conditions, the flow in the existing watercourse and site conditions.

E9.04 Open Channels and Roadside Ditch Design

The proposed criteria for an open channel design shall be submitted to the Town for approval by the Consulting Engineer, prior to the actual design being undertaken. The Consulting Engineer shall also be responsible for obtaining the approval of the design from the M.E.C.P., the M.N.R.F. and the local Conservation Authority as appropriate, if the open channel concept is favourably considered.

The minimum side slopes of roadside ditches shall be three 3:1 (H:V) and in some cases 4:1 for backslopes in urban estate residential areas. The designer shall provide for dry weather flow in the design of open channels. The maximum velocity for sod lined channels shall be 1.2 m/s, and for concrete lined channels shall be 2.5 m/s, for the 100 year or Regional Storm flow.

E10.00 Storm Sewer, Foundation Drain and Clean Water System Connections

E10.01 General

The installation of a storm sewer service connection may serve a maximum of two residential buildings (i.e., double service). A single connection is to be made to the main sewer and a wye fitting used to provide separate connections to each building per Standard Drawings M-404 to M-406. No connections should be made to trunk sewer mains without approval of the Town and the Region of York.

E10.02 Connection Size and Grade

Single family, semi-detached and townhouse units shall have a minimum 150 mm diameter double storm service connection, installed at a minimum grade of 2% from the storm sewer to the property line. All domestic service connections shall have a 150 mm x 125 mm x 125 mm PVC watertight wye test fitting installed at the property line, per Standard Drawing S-301. Individual 125 mm diameter services shall be extended 1.5 m at a minimum 2% grade into each lot from the wye test fitting and shall be fitted with a manufactured watertight plug.

The service shall be extended further during the building program to the building envelope at a minimum grade of 2%.

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

E10.03 Depth of Connection

The storm sewer and foundation drain connections shall be installed to a sufficient depth to provide for the drainage of weeping tiles around the foundation of the house in accordance with the Standard Detail Drawings.

PVC risers shall be used on all service connections when the depth to invert of the storm sewer exceeds 4.5 m. The riser section shall be used to bring the service to a maximum depth of 3.0 m. The riser connection shall be as per O.P.S.D. 1106.010.

E10.04 Connection to the Storm Sewer

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

E10.05 Storm Drain Materials

Storm drain connections pipes and test fittings shall be constructed of polyvinyl chloride (DR 28) pipe or with the same DR as the main line sewer if it is PVC PVC pipe to be white in colour.

E10.06 Location

Storm service connections configuration shall be as per Standard Drawings M-404 to M-406.

After construction, the end of the service connection extended 1.5 m into the lot shall be marked by a suitable length of 50 mm x 100 mm lumber, extending from the obvert of the connection to a point 0.9 m above grade. The top of this marker shall be painted white.

E10.07 Connections for ICI Blocks

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

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

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

E10.08 Construction, Inspection and Testing

Construction of all sewers, service connections and appurtenances shall be in accordance with the Specifications and Standard Detail Drawings of the Town of Aurora or in their absence any O.P.S. Drawings and Specifications).

Inspections of all storm sewers and maintenance holes are to take place prior to the release of Building Permits and prior to Final Acceptance, as noted in the Town’s checklists (refer to

Appendix G). Applicants may elect to undertake additional inspections at their own discretion at the completion of the building program and prior to the placement of top course asphalt.

The inspection process shall consist of sewer flushing, visual inspection of appurtenances, deflection testing of thermoplastic pipes and CCTV inspections of sewers and service connections in accordance with the Town's requirements. Should thermoplastic pipes not pass the mandrel deflection testing, repairs shall be undertaken without using re-rounding methods.

The inspection and testing of service connections to storm sewers, clean water collector, rainwater leader collector or foundation drain collector sewers shall be in accordance with the requirements for sanitary sewer connections as noted in Section C6.03. Service connections are to be inspected from the sewer main to the building foundation wall prior to occupancy of the structure. The CCTV inspection and documentation requirements for all storm drainage-related sewers and service connections shall also be in accordance with those for the sanitary sewer system as outlined in Section C6.04.

Section F Watermains and Appurtenances

Section F Watermains and Appurtenances

F1.00 Jurisdiction

The Regional Municipality of York is responsible for the supply, treatment and storage of water for municipal water systems within the boundaries of the Town of Aurora.

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

The Town of Aurora is licensed under the Safe Drinking Water Act, 2002, to operate the Class 2 drinking water systems within the Town. Proposed alterations or additions to the current drinking water system must be applied for through the Town. It is the applicant's responsibility to obtain the current documentation and application forms from either the Town or the M.E.C.P. when making applications for approvals.

All watermain design, construction, commissioning and assumption shall conform with the Town's Drinking Water Works Permit and the Municipal Drinking Water Licence, the M.E.C.P. Watermain Disinfection Procedure, and AWWA C651 Disinfecting Watermains, or latest amendment.

Any connection to a water system and the use of said water is also governed by the Town's current Water Use By-law.

F2.00 Hydraulic Design

F2.01 General

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

Watermains in subdivisions, or any proposed internal phases of a plan of subdivision, shall have a minimum of two connections to the existing water network to provide redundancy of supply. The Town will require a computer analysis for all or any phased portion of the proposed watermain systems. The analysis shall be completed using such software as determined by the Town from time to time.

The Town will provide a copy of the municipal water system software model which is to be used by the Development Engineer to design extensions of the existing pipe system throughout the proposed development. The Applicant may be required to complete hydrant flow testing of existing areas in order to support the revised modelling. The revised model is to be submitted to the Town for integration with the Town's "master" copy of the model and to comment on the

hydraulic analysis. The Development Engineer is also to submit a Watermain Hydraulic Analysis Report with the model documenting the following:

a) Describe water system phasing of the ultimate development plan, if any, and structure the submitted model and report document to support each phase of development.

b) Proposed watermain layout including proposed geodetic node elevations.

c) Calculations which determine node demands for each design scenario (i.e., average demand, maximum day demand and peak hour demand) and document the required fire flow rates.

d) Figures, tables and drawings to illustrate the proposed watermain extension and the model results.

e) Report discussion of the model results, recommendation for acceptance by the Town and confirmation that the analysis meets the requirements of completing a Form 1 submission to the Town.

f) Hard copies of the model results with submission of digital input and output model files.

F2.02 Fire Flows

The requirements for fire flows shall be discussed and agreed upon with the Town prior to proceeding with the detailed design. The Town may require the Applicant to determine site specific requirements based on the "Water Supply for Fire Protection, A Guide to Recommend Practice", prepared by the Fire Underwriters Survey of the Insurance Bureau of Canada. The Town will determine if site specific requirements are to be met in place of the Town's minimum fire flow requirements. In general, the following summarizes the minimum fire flows required:

Table F-1: Minimum Fire Flow Requirements

Land Use	Minimum Required Fire Flow	
	L/min	L/s
Single Family / Semi-Detatched	7,000	117
Townhouse / Row House	7,500	125
Apartment	9,000	150
Commercial	12,000	200
Institutional / Schools	15,000	250
Industrial	15,000	250

F2.03 System Pressures

The Town will identify and direct the location of pressure zone districts and the creation of boundaries between each district. The maximum sustained operating pressure shall not exceed 700 kPa (100 psi). If pressure in a localized area is above this level, a pressure-reducing valve shall be installed on each service connection within that area.

The normal operating pressure should be approximately 350 to 620 kPa (50 to 90 psi). Under normal conditions of maximum day demand, the pressure shall not drop below 275 kPa (40 psi) at any point in the water system.

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

F2.04 Friction Factors

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

Table F-2: Watermain Roughness Coefficients

Pipe Diameter (mm)	C-Factor
150	100
200 – 250	110
300	120
400 – 450	130
600 or greater	140

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

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

F2.05 Residential Domestic Demand and Peaking Factors

Domestic water demand shall be calculated on the basis of an average day consumption rate of 400 L per capita per day. Water demand for long term care facilities shall be as described in Section E2.06.

Maximum day and peak hour factors shall be 2.0 and 3.0 respectively.

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

Table F-3: Residential Occupancy Density

Residential Land Use	Occupancy Density
Single Detached Dwellings	3.8 persons per unit
Semi-detached Dwellings	3.8 persons per unit
Townhouses	3.5 persons per unit
Apartments	2.5 persons per unit

F2.06 Industrial, Commercial and Institutional (ICI) Water Demands

A population equivalent of 80 persons per hectare shall be used for design purposes to estimate the water consumption for large commercial areas unless more specific data is available. Peaking factors as per residential demand noted above are to be applied to determine maximum day and peak hour demands. Average day water consumption for commercial, industrial and institutional uses shall be calculated from the following table:

Table F-4: Average Day ICI Land Use Water Demands

Land Use	Average Day Water Demand
Commercial	28 m^3/ha/d
Industrial	28 m^3/ha/d
Institutional	
a) General	28 m^3/ha/d
b) Hospitals / long-term care home	390 L/bed/d
c) Schools	110 L/student/d
d) Places of Worship	To be determined based on comparable local water consumption records

F3.00 Watermain Design

F3.01 Locations and Depth of Watermain

Watermains shall be located as shown on the Standard Town of Aurora Roadway Cross-section. This location shall generally be on the north or east side of the street.

The minimum depth of cover shall be 1.8 m below the centerline of road.

F3.02 Pipe Materials

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

Watermain pipe greater than 300 mm diameter shall be PVC, H.D.P.E. or C.P.P. material of pipe class and specification subject to approval of the Town. Watermain pipe material proposed to be installed by directional drilling methods, regardless of size is to be approved by the Town.

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

All chemicals and materials that are used for the construction, alteration, and operation of the drinking water system, that come into contact with the drinking water, shall conform to the applicable standards: American Water Works Association (AWWA), American National Standard Institute (ANSI), Safety Criteria Standards NSF60, NSF 61, NSF372, and the Municipal Drinking Water Licence and Drinking Water Works Permit.

F3.03 Sampling Stations

Water sampling stations will be required where directed by the Town. Sampling station shall conform to Standard Drawing W-109. The station shall be designed to allow for pumping or draining of residual water in the enclosure and to protect the station and the water service from freezing. Proposed sampling station products are subject to review and approval of the Town.

F3.04 Bedding and Backfill

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

F3.05 Horizontal Separation between Watermains and Sewers

M.E.C.P. guidelines regarding pipe separations are to be followed and state as follows:

Sewers/sewage works and watermains located parallel to each other shall be constructed in separate trenches maintaining a minimum clear horizontal separation distance of 2.5 m in accordance with the Procedure F 6 1: "Procedures to Govern the Separation of Sewers and Watermains", dated July 1984, as amended.

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

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

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

F3.06 Watermain Crossing Sewers

M.E.C.P. guidelines regarding pipe crossings are to be followed and state as follows:

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

M.E.C.P. Design Guidelines for Sewage Works 2008 (Chapter 5. Design of Sewers):

- The sewer should be designed and constructed equal to the water pipe and should be pressure tested at 350 kPa (50 psi) to assure water tightness; and

- Either the watermain or the sewer line should be encased in a watertight carrier pipe which extends 3 m (10 ft) on both sides of the crossing, measured perpendicular to the watermain.

F3.07 Utility Crossings

Watermains crossing over or under other utilities shall be designed with a 300 mm minimum clear separation between the outside edges of the watermain and the utility.

F3.08 Dead Ends

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

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

a) Where watermain is located on a cul-de-sac the configuration of the dead end shall be as illustrated on Standard Drawing W-108.

b) Where watermain is located at the termination of a phase within an approved plan of subdivision, and the schedule for construction of subsequent phases are known to be imminent, the watermain is to terminate with a temporary hydrant, preceded by a valve to facilitate the future extension of the watermain without disruption to the existing users.

c) Where watermain is located at the termination of an approved plan of subdivision, and the schedule for construction of future adjacent developments are not known to be imminent, the watermain is to terminate with a metered automatic flushing devise, preceded by a valve per Town Standard W-128. The flushing devise is to be equipped with a positive outlet to the storm sewer or to a surface outlet with adequate erosion protection, graded such that the discharge will not adversely affect adjacent lands or private property. Details of this system will be at the direction of the Town. The cost of all flushed water is to be borne by the Applicant.

F3.09 Minimum Sizes

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

Table F-5: Minimum Watermain Pipe Sizes

Land Use	Minimum Watermain Pipe Size
Residential areas	200 mm diameter*
Commercial areas	250 mm diameter**
Industrial and Institutional areas	250 mm diameter**

*For cul-de-sacs only, a 150 mm watermain may be permitted at the discretion of the Town.

**To be sized according to the anticipated water demand.

F3.10 Tracer Wires

A tracer wire shall be provided along the top of all Polyvinyl Chloride (PVC), High Density Polyethelene (H.D.P.E.) and Concrete Pressure Pipe (C.P.P.) watermains to permit future field tracing. These tracer wires shall be attached to the top of the watermain per Town standard W-100. Tracer wires shall be No. 12 gauge stranded copper (T.W.H.), complete with plastic coating.

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

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

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

F3.11 Thrust Restraint

Mechanical joint restraints are to be installed on bell and spigot joints for all watermains constructed in fill material, in compacted sewer backfill and at all tees, horizontal bends, vertical bends, hydrants, end of mains and valves. The details and length of joint restraint shall be as specified by the manufacturer of the approved mechanical joint restraint products. The use of concrete thrust blocks is only permitted where they are deemed absolutely necessary by the Town.

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

Mechanical restraints are to be identified on all plan and profile drawings.

All mechanical restraint systems shall be installed with cathodic protection as outlined in Section E7.00.

F3.12 Connections

The Town requires the following when tapping PVC watermain:

a) Tapping shall be carried out by experienced personnel familiar with the requirements of the pipe and tapping saddle manufacturers guidelines.

b) The procedures that will be followed shall be reviewed by the Contractor and the Development Engineer, subject to the approval of the Town or its agent, prior to installation. It is expected that tapping cutter sharpness, use of torque wrenches to achieve required saddle bolt tightness, tapping pressures, checking of pipe coupons for a clean edge will be considered.

c) The Development Engineer shall witness all tapping of all pipe and provide a report broken down for each tap that comments on the procedures followed as outlined above.

d) The Town shall be notified prior to when taps are done at least 48 hours in advance.

e) Qualified Town staff shall be present in all instances when tapping of watermains occurs.

f) The Development Engineer shall provide to the Town the date and batch number of all installed watermain and the manufacturer of the tapping saddles.

F4.00 Valving Requirements

F4.01 Type

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

F4.02 Size

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

F4.03 Number, Location and Spacing

Three valves are required at a tee intersection and four valves are required at a cross intersection with the valves being located at a point where the projected streetlines intersect the watermain per Standard W-121. All valve boxes shall be located in boulevards and out of pavement areas wherever possible. In no case shall a valve be located in a driveway.

Valve spacing along a watermain shall not exceed 150 m, or to permit the isolation of no more than 40 lots.

F4.04 Valve Boxes and Chambers

All valves equal to or less than 250 mm diameter shall be located within three pieces, sliding type valve boxes as per Standard Drawing W-104.

Valves 300 mm diameter and larger located within a valve chamber shall be as Town Standard W-102. The frame and cover shall be set flush to finished grade.

Wherever possible, chambers shall be provided with a “P” trap, back flow preventer valve and connection to a storm sewer. Said connection shall be a 100 mm diameter PVC pipe. Where a connection is not possible, a granular sump is to be provided under the chamber, with the drain and “P” trap directed to the sump. In areas of high groundwater, the Town may waive this requirement. All joints and adjustment rings are to be waterproofed.

All chambers are to have the tracer wire per Standards W-102 and W-103.

F4.05 Air Relief Valves

Air relief valves shall be installed at all significant high points of the water distribution system for pipes 250 mm and larger, as determined by the Town. Air relief valves shall be double-acting type, combination air release valve. Chambers are to be provided with drainage connections wherever possible.

Air relief valves shall be housed within a chamber as specified on Standard Drawing W-110 and drained to storm sewers where possible. The chambers are to be equipped with “P” traps to prevent movement of gases.

F4.06 Drain Valves

Drain valves shall be located at the low points of all watermains 300 mm in diameter and greater and conform to Standard W-111. Chambers are to be provided with drainage connections.

F5.00 Fire Protection

F5.01 General

All fire protection design requirements shall be reviewed with the Town at the preliminary design stage. Following the commissioning of the water system, fire hydrant protection barriers are to be installed and maintained around all hydrants until the building program and site restoration are completed at the Town’s discretion.

F5.02 Hydrant Spacing

Hydrants shall be installed on all watermains 150 mm in diameter and larger based on both of the following criteria:

a) A maximum spacing as measured along the center line of road of 120 m in lower density residential areas and 90 m in medium and higher density residential, industrial and commercial areas, and;

b) In all residential areas shall ensure full coverage (meaning coverage to the full extent of the lots or blocks within the plan) based on a 75 m radius from each hydrant.

F5.03 Branch Valves and Boxes

All hydrants installed on watermains up to and including 300 mm in diameter shall be installed with a 150 mm diameter branch valve attached to the watermain with an anchor tee per Standard W-105.

F5.04 Locations of Hydrants

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

Hydrants shall be located 1.2 m minimum clear distance from the edge of any driveway or house service connection. Other aboveground utilities such as light standards, transformers, street signs or boulevard trees shall be located no closer than 2.0 m from a hydrant.

The hydrant is to be set at such a height that the distance from the finished ground around the hydrant to the bottom of the flange is between 75 mm and 100 mm.

F5.05 Type

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

All hydrants shall be installed in accordance with O.P.S. specifications and be installed with mechanically restrained joints (without thrust blocks). The hydrant drain holes shall be plugged and this is to be reflected on the Record Drawings.

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

F5.06 Colour of Hydrants

The hydrant body and all nozzle caps shall be painted as per Standard W-126 and be fitted with reflective markers to identify tested flow rate.

F5.07 Hydrant Anti-Tampering Devices

Accepted ant-tampering devices shall be installed on all hydrants after watermain passes all required testing and system water quality is accepted by the Director of Planning and Development Services.

Materials

To be cadmium or zinc plated steel with a 75 mm yellow reflective adhesive stripe on the entire length of both sides.

c) Designed so that operating nut and nozzle caps cannot be turned, secured to the hydrant by banding strap.

d) Banding strap to be of metal material which is easily broken by hydrant key for emergency use by the Fire Department.

F5.08 Hydrant Flow Testing

All testing and commissioning procedures are to be as outlined in the Drinking Water Quality Management Standards prepared by the M.E.C.P. All new hydrants associated with an approved development shall be flow tested. The test results are to be compiled and a report prepared by the Development Engineer documenting the results obtained compared to the required fire flows included in the watermain design. Any test results not meeting the design requirements are to be investigated by the Development Engineer, resolved to the satisfaction of the Town, re-tested and documented. The report and the test results are to be submitted to the Town.

F5.09 Fire Hydrant Inspection and Maintenance in Unassumed Subdivisions

All the following requirements regarding hydrant inspections shall be the responsibility and at the cost of the Applicant.

All fire hydrants shall be inspected in accordance with Town Operations Services Department requirements to meet Provincial Fire Codes as follows:

a) Spring/summer inspection shall be completed by May 31 of each year and an inspection report provided to the Town that also includes a schedule for repair of any deficiencies.

b) Fall/winter inspection shall be completed by October 31 of each year and an inspection report provided to the Town that also includes a schedule for repair of any deficiencies. The fall inspection is primarily to ensure that the hydrant barrel has been pumped out; other visual deficiencies should be noted.

The Town's Operations Services Department is to be contacted to obtain the appropriate hydrant inspection reports.

In addition to the Town's Operations Services Department required inspections, the following Development inspections are required as part of the Completion and Assumption process and are documented in the Subdivision Municipal Checklists, included in Appendix I:

- Completion Certificate Checklist inspection.
- Assumption Checklist inspection.

At the discretion of the Town, the Town Infrastructure Operations and Development inspections may be combined.

There are two options available for these inspections except for the Building Permit Checklist inspection that will be done by the Town Infrastructure Operations Department:

1. Infrastructure Operations Department conducts the inspections on behalf of the Applicant, OR,

2. The Applicant performs the inspections using a qualified contractor. A qualified contractor shall have a M.E.C.P. Water License comparable to the Distribution System License and be acceptable to the Town.

The Applicant shall indicate that they will undertake inspections by the following dates, or the Town will do the inspections:

- Spring (summer) inspection by April 1 of the inspection year.
- Fall (winter) inspection by September 1 of the inspection year.
- Development related inspections as required.

Requests for water system inspections, all correspondence and inspection results shall be made to the Town's Development Services Department with copies to the Operations Services Department and Town Development Review Consultant. If the Town does an inspection, they will provide the results to the Town's Development Services Department who will forward to the Applicant and Development Engineer.

All inoperable or leaking fire hydrants shall be repaired immediately, all other deficiencies shall be repaired in accordance with schedules as required by the Town.

The hydrant inspector, whether the Town or a qualified contractor, shall be responsible for pumping out the hydrant and replacing the anti-tampering devices (A.T.D.) after all inspections.

Once the Town has taken over operation of the water system, they will flush the system to ensure that the water remains potable. These operations are in addition to the required inspections.

F6.00 Service Connections

F6.01 General

Individual service connections shall be installed to each lot, semi-detached unit or townhouse unit within the development. Refer to Section K6.05 of these guidelines for requirements related to non-residential water service connections.

F6.02 Material

All water service connections 50 mm in diameter and smaller shall be constructed of Type K soft copper tubing. A section of Type K soft copper tubing water service shall be installed with the subdivision servicing, connected to the curb stop and extending 1.5 m internal to the lot for future connection by the builder or site servicing contractor.

All water service connections 100 mm in diameter and larger shall be constructed of PVC piping, conforming to the requirements of Section E8.00.

F6.03 Water Service Sizing

All water service connections for single, semi-detached and townhouse residential lots shall be made with single service pipes a minimum of 25 mm diameter from the watermain to the building per Standard W-107. Pipe couplings are not permitted between the main stop and the curb stop.

Water services to non-residential lots or blocks where Site Plans have not been submitted shall be a single 200 mm diameter service from the watermain to the street line. A water service to an “in-fill” non-residential Site Plan shall be a minimum of 100 mm diameter, subject to the Town’s review of a hydraulic analysis of the approved design flow for the Site Plan. In either case, where a hydraulic analysis demonstrates the existing or minimum water service size is inadequate, it shall be replaced.

F6.04 Location

Single water service connections shall be installed to each lot as shown on Standard Drawings M-404, M-405 and M-406. Typically, and except where approved by the Town, residential water services shall be located 3.0 m offset from the side lot line furthest away from the driveway location in order to avoid conflict with the driveway. In no case shall the service be located so that the curb stop is located within the driveway. In any case, where the final house siting and driveway results in impacts to the curb stop, the entire water service shall be relocated to the satisfaction of the Town. The water service shall be extended 1.5 m internal to the lot for future connection by the builder or site servicing contractor.

Connections for non-residential lots or blocks shall be located by the consultant to provide flexibility for future internal site servicing.

The location of each water service shall be shown on the General Plan of Services, all Plan and Profile Drawings and Composite Utility Plans.

The minimum cover over water services shall be 1.8 m.

Water services shall be staked at the property line with a 50 mm x 100 mm wood marker buried 1.2 m below the ground and painted blue.

F6.05 Connections to Supply Main

Qualified Town staff shall be present in all instances when tapping of watermains occurs. Water service connections 50 mm in diameter and smaller may be tapped into the supply main, with the following restrictions:

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

No connections shall be made to any trunk watermain without written approval from the Town and Region of York.

F6.06 Location of Curb Stop, Control Valve and By-Pass Valve

The curb stop on all water service connections 50 mm in diameter and less shall be located on Town property at the street limit, a minimum of 1.2 m from the outer edge of a driveway. Applicants of non-residential subdivisions or Site Plans shall install a tee in the boulevard to create a main water service (for future metering) and a by-pass water service. Gate valves are to be installed on both services located at the property line. Refer to Standard W-113 which shows the private meter chamber and the configuration of valving.

F7.00 Corrosion Protection

F7.01 General

All ferrous watermains, ferrous fittings, tracer wires and copper water service connections shall have corrosion protection provided by means of sacrificial anodes. The minimum corrosion protection requirements noted herein based on O.P.S.S.MUNI 442 are to be confirmed by a Professional Engineer in the Geotechnical Report prepared for the proposed development based on site specific soils conditions.

F7.02 Valves, Hydrants and Fittings on Non-Ferrous Watermains

One 5.4 kg (12 lbs) zinc anode shall be installed on every water service, valve, and fitting connected to a non-ferrous watermain. One 10.9 kg (24 lbs) zinc anode shall be installed on every hydrant base. All valves and fittings are also to be protected with petrolatum and denso tape or wax tape systems. One 5.4 kg (12 lbs) zinc anode shall be connected to each 1,000 m segment of tracer wire.

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

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

Subject to recommendations from the consulting Geotechnical Engineer and specific approval from the Town, 175 g zinc “Protector Caps”, or approved equal, may be considered as an alternative.

All valves and metallic fittings shall have mechanical join ends and shall be wrapped in petrolatum and/or Denso tape.

F7.03 Valves, Hydrants and Fittings on Ferrous Watermains

All water services, valves and fittings installed on ferrous watermains shall be cathodically protected by a 14.6 kg (32 lbs) magnesium anode. All valves and fittings are also to be protected with petrolatum and tape or wax tape systems. One 5.4 kg (12 lbs) zinc anode shall be connected to each 1,000 m segment of tracer wire.

Additional anodes connected to the pipe at appropriate spacing shall be specified.

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

Bonding cables shall be seven strand, coated copper wire, connected to the fittings and watermain by a thermite weld (Cad weld).

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

All valves and metallic fittings shall have mechanical join ends and shall be wrapped in petrolatum and/or Denso tape.

F7.04 Connecting Non-Ferrous Watermains to Ferrous Watermains

When connecting a non-ferrous watermain to a ferrous watermain, the ferrous watermain shall be cathodically protected by a 14.6 kg (32 lbs) magnesium anode.

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Section G Lot Grading

Section G Lot Grading

G1.00 General

The grading of all lots and blocks in new developments must be carefully monitored by the Consulting Engineer in order to provide sites that are suitable for the erection of buildings and to provide satisfactory drainage from all lands within the development. In this regard, the design of the grading for all developments will be of primary concern to the municipality and the following criteria shall be used in the preparation of all lot grading plans for new developments in the Town of Aurora.

It is imperative that the overall initial Draft Plan of Subdivision be laid out to be compatible with the lot grading criteria outlined in this section. Lots requiring rear yard drainage swales may require extra depth than the adjacent lots to the rear to allow adequate space to create a rear yard amenity area as outlined in this section.

Grading for infill lots shall meet the requirements of Section F, and Standard Drawing M-403.

G1.01 Objectives

1. All areas shall be graded in such a way as to provide proper positive drainage, maximum use of land and ease of maintenance.

2. The subdivision area grading and detailed lot grading shall be designed to minimize the use of retaining walls in all applications. Where site constraints require the use of a retaining wall, it shall be subject to Town Approval.

3. Where in the opinion of the Town, the area of a lot is occupied by a substantial 3:1 (h:v) graded slope, which would otherwise be useable space graded to a maximum of 5%, the Town may require the Applicant to include a notification clause to this effect in the Purchase and Sale Agreement of the lot.

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

5. Drainage flows must be directed away from houses. The front yards of all lots shall be graded to drain towards the street. Driveways shall not be utilized as drainage outlets and shall not receive drainage from roof downspouts.

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

7. The use of rear lot catchbasins and retaining walls should be minimized and shall be subject to Town Approval. Overland flow outlets must be provided for all rear lot

catchbasins with no impact on building envelopes. The maximum allowable depth of ponding in any swale is 0.30 m.

8. The area draining across a sidewalk shall be minimized by designing the development such that if a sidewalk is placed in front of lots that have back to front drainage patterns, the lots behind the lots with the sidewalk must also have back-to-front drainage.

9. No alterations to existing boundary elevations or adjacent lands shall be undertaken unless written agreement with the adjacent property owner is obtained and submitted in a format acceptable to the Town.

G2.00 General Grading Plan

G2.01 Drawing Requirements

The drawing scale shall be 1:500 for single family or semi-detached areas; and 1:200 for multi-family areas.

G2.02 General

All general lot grading drawings are to include the information outlined below:

1. All lots and blocks within the subdivision are to be shown and are to be numbered in accordance with the plan proposed for registration.

2. Existing contours are to be shown at maximum 0.5 m intervals within the subdivision limits and 15 m beyond the subdivision limits.

3. Proposed centreline road elevations are to be shown at 20 m stations along all roads within and abutting the subdivision. (Elevations are to be shown for the 20 m stations in accordance with the profile drawings.)

4. Lots proposed to be brought to grade with compacted or “engineered” fill to support structure foundations are to be indicated on the drawings.

5. Proposed elevations are to be shown for all lot corners and intermediate points of grade change. On large blocks, a proposed elevation is to be shown at 15 m intervals along the frontage of the block and at reasonable intervals along the side and rear of the block to clearly illustrate the grading of the block in relation to the surrounding lands and house types.

6. The specified house grade shall be shown for all lots. For “split” type drainage patterns, the specified rear of house grade shall also be shown. The specified minimum basement floor elevation for each lot shall also be shown where it may be impacted by hydraulic grade line issues.

7. The direction of the surface water run-off from the rear of all the lots shall be indicated by means of an arrow pointing in the direction of the run-off.

8. Sideyard swales are to be constructed on the common property line. Rearyard swales shall direct drainage to rear lot catchbasins or to sideyard swales as approved by the Town.

9. Side and rear yard swales for infill lots shall be contained within the new lot and be a minimum of 0.45 m from the lot line.

10. A “useable area” (typically rear yard areas) is to consist of a minimum of 3 m from the back of the house graded at 2% and a further 2 m wide area graded at 2% to 5%. Terracing may start at a minimum distance of 5 m from the back of the house.

11. All swales, other than the normal side yard swales, are to be shown along with the invert elevations of the swale at regular intervals (i.e., centreline of each lot for rear yard swales).

12. All rear yard catchbasins shall be shown along with the rim elevation of the catchbasin and the invert elevation of the outlet pipe. (The use of RLCB’s is to be avoided wherever possible.)

13. Servicing of any lots or blocks with foundation drain sewers or roof leader collectors or clean water systems is to be indicated.

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

15. Existing elevations are to be shown on adjacent lands approximately 15 m, or greater if required, from the subdivision limit to enable assessment of the grading between the subdivision and the adjacent areas. (The interval of those elevations shall be dependent upon the degree of development of the adjoining lands with the developed areas requiring the most information.) The lot grading plan must accommodate drainage patterns on adjacent property.

16. The lot grading plan shall make note of the Town of Aurora Standard Drawings that are applicable to the grading of the development.

17. The lot grading plan shall note all existing slopes that are to be left in an undisturbed state. Temporary fencing shall be required along the top of these slopes to prevent disturbance to the existing vegetation.

18. An undisturbed area having a width of 0.6 m and a maximum slope of 2% shall be provided at the boundary limits adjacent to other properties, in order that the existing boundary elevations shall be maintained. Such grading must be stipulated on the approved lot grading plan. Approved slit fencing shall be shown along the boundary of

the subdivision. No filling up to or upon private lands shall be tolerated unless written permission is obtained from the adjacent Owner. Where two developments are concurrently underway, the common boundary elevations are to be established to mutually beneficial elevations, agreed to by each party.

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

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

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

22. Where storm sewer servicing is available, foundation drainage using sump pumps is not permissible.

G3.00 Lot Grading Design

G3.01 Type of Drainage Pattern

Back to front drainage is desirable in instances where drainage contributing to each side yard swale is restricted to the lots directly adjacent to the swale and no external flows or flow from the rear yards of neighboring lots is captured by the side yard swale.

Rear yards which drain through abutting lower back to front type lots are permitted where:

a) Sufficient fall is available between the adjacent streets to achieve desired grades for swales and yards as per the criteria outlined in this section.

b) The drainage from the upstream lot is limited such that a minimum of 50% of the roof area of the upstream lot drains to the front yard.

Split lot drainage with rear yard catchbasins is required where difficulties in providing side yard swales are encountered.

The following criteria also govern when establishing drainage patterns:

a) The maximum flow allowable to any side yard swale shall be the lesser of either flow from five rear yards or the flow from an area of 750 m2 (measured from where the swale crosses the front property line).

b) The maximum length of a rear yard swale to an outlet point (road allowance or catchbasin) shall be a total of 50 m, with no individual path longer than 35 m.

c) Rear yard swales that discharge across a public domain sidewalk or walkway shall be the lesser of 25 m in length or convey flow from a maximum area of 750 m2 (measured from where the swale crosses the road allowance property line).

Walkout, back split and front split lots will be permitted where required due to topography constraints. In all cases the grade differential between the front and rear yard specified house grade shall be governed by the required sloping required along the side of the building envelope. Grades shall vary from a minimum 2% to a maximum 4:1 slope and shall be confined to the building side yard area.

In determining maximum permissible grade differential between front and rear property line elevations compatibility with existing, adjacent homes will be considered by the Town. While these standards do not set out maximum allowable grade differentials the Town will limit the grade differential on a site-specific basis based on the particular circumstances unique to each subdivision. Lots with a front to rear grade differential greater than 2.4 m are considered extraordinary and will require specific approval from the Town. These circumstances or similar cases where large sloped areas exist in the lot grading design may require advisory clauses and sign-off clauses to be inserted into Purchase and Sale Agreement of all prospective Purchasers.

G3.02 Specified House Grade (S.H.G.)

The specified house grade, or building envelope grade, represents the highest lot elevation adjacent to the proposed building. This elevation shall be a minimum of 0.15 m above invert of the highest swale adjacent to the building. The top of foundation for any building will be a minimum of 0.15 m above the specified house grade.

The following criteria shall apply to detached and semi-detached units:

1. Rear to Front Lot Drainage – The S.H.G. for this type of lot grading will be based on the highest apron swale invert (swale breakpoint) at the rear of the building. (Refer to Standard Drawing M-400 for additional details.)

2. Split Drainage – The S.H.G. for this type of lot grading will be based on the highest sideyard swale invert (swale breakpoint) adjacent to the building. (Refer to Standard Drawing M-401 for additional details.)

3. Backsplit, Walkout and Front Walkout Drainage – The S.H.G. for this type of lot grading will be noted for the front and rear of the building. The S.H.G. will be based on the highest sideyard swale invert (swale breakpoint) adjacent to the building. (Refer to Standard Drawing M-402 for additional details.)

The following criteria shall apply to on-street townhouses:

1. End Units – The S.H.G. will be based on the criteria noted above for detached and semi-detached units.

2. Interior Houses – S.H.G. will be the highest exterior elevation adjacent to the unit and will be a minimum of 0.15 m above an adjacent swale, or a minimum of 2.0% above the streetline or lot line elevation.

3. Units with common driveways to have the same S.H.G. based on the higher S.H.G. calculated on the basis of the above criteria.

4. Elevation changes in lot grading between units of a townhouse block having different S.H.G.'s are to consist of 3:1 minimum embankment or approved retaining wall construction.

5. Split or walk out house types, front and back S.H.G.'s are to be established using applicable criteria above.

6. The maximum number of townhouse units within a block, sited at same SHG shall be as per the following:

   - On road grades of under 2% – no more than four units.
   - On road grades of 2% to 4% – no more than two units.
   - On road grades of over 4% – each unit is considered individually.

7. Where the difference in S.H.G. elevations between units exceeds 0.5 m, retaining walls should be used.

G3.03 Slopes

1. Yard surfaces shall have a minimum slope of 2% and a maximum slope of 5% with the exception of the "useable area" noted below. Where additional elevation difference is required beyond the maximum slope of 5%, terracing is permitted. In this instance yard surfaces shall have a maximum slope of 3:1 (horizontal:vertical) to a maximum vertical grade differential of 1.8 m. An intermediate level area (2% slope) of at least 1.5 m in width is required between successive terraces. In the case of terraces in the sideyards between adjacent walkout, back split or front split houses, the maximum slope of the terrace shall be 3:1 (horizontal:vertical).

2. Lots which have substantial areas of terracing which impact the use-ability of a significant portion of the lot beyond 5.0 m from the back of the house, in the sole opinion of the Town, may require advisory clauses and sign-off clauses to be inserted into Purchase and Sale Agreement of all prospective Purchasers.

3. Where a noise fence and earth berm in combination is proposed for noise mitigation purposes, the berm and fence shall be constructed entirely on the lots. Should the fence prevent access to a portion of the lot area, advisory clauses and sign-off clauses are to

be inserted into Purchase and Sale Agreement of all prospective Purchasers and the clauses are to be registered on the land title of the lot.

4. Finished lot grades in sodded areas within 0.6 m of a property line are to be no greater than 5% slope to allow for grass cutting adjacent to property line fencing.

5. Rear yards shall be graded such that minimum of 3.0 m is to be graded at 2% slope from the back of the house, with a further 2 m wide area being graded between 2% and 5% or as may be dictated by the Town's Zoning By law. This is noted as the rear lot "useable area".

6. The maximum permissible grade along rear lot line between lot corners shall not exceed 5%.

7. All lots shall have a 0.6 m wide apron at a 2% slope away from the house along at least one side of the house in order to permit the construction of a walkway to the rear of the house.

8. A minimum separation of 0.15 m shall be provided between brick line and the final ground elevation of all houses.

G3.04 Swales

1. Swales shall have a minimum and maximum longitudinal grade of 2% and 5% respectively and maximum side slopes of 3:1. At the discretion of the Town, shallower swale design grades may be considered in areas with highly permeable soils and consistently low groundwater table elevations.

2. Swales shall range in depth from a minimum of 0.15 m to a maximum of 0.45 m.

3. Swales parallel to the rear lot lines shall be located at a distance based on the depth of swale but under no circumstances will the invert of the swale be permitted to be located more than 1.2 m from the rear lot line.

4. Drainage flows which are carried around houses are to be confined in defined swales located as far from the house as possible. The depth of these swales should be kept as close as possible to the minimum of 0.15 m.

5. All sideyard swales shall be located on common lot lines. Rearyard swales are to be offset from the lot line.

6. Refer to Section F3.01 with respect to the maximum allowable drainage area contributing to swales.

7. Basement windows located on the side of a dwelling adjacent to an overland flow route swales hall be a minimum of 300 mm above the 100 year flow event.

G3.05 Rear Lot Catchbasins (R.L.C.B.)

1. The use of rear lot catchbasins is to be avoided wherever possible. Notwithstanding this objective, the Town may direct the design and installation of rear lot catchbasin(s). These would serve as provisional future drainage inlets where site, soils and groundwater conditions between lots may cause concern for resident's use of the lot areas.

2. All rear lot catchbasin grates are to be bird-cage style per O.P.S.D. 400.120. The centerline of the catchbasin top is to be 0.6 m from the rear lot line. The catchbasin frame to be set at the elevation of the invert of the lowest swale.

3. Rear yard catchbasin leads shall be a minimum diameter of 250 mm and a minimum slope of 1.0%. The leads shall be encased in concrete from the catchbasin to the street line.

4. All catchbasin leads are to be in easements having a total minimum width of 1.8 m consisting of 1.2 m width on one lot and 0.6 m width on the adjacent lot. The lead pipe is to be located a minimum of 0.5 m from lot line within the 1.2 m wide easement.

5. Rear lot catchbasin leads shall be connected directly to maintenance holes whenever possible. The layout of the storm sewer shall have consideration to this requirement to maximize the number of R.L.C.B. leads which can connect directly to maintenance holes.

6. When rear lot catchbasins are required, the designer must consider the impacts that a plugged catchbasin will have with respect to flooding depth and area which will be impacted. The grading design must incorporate allowance for secondary drainage outlets, such that ponding will not exceed 0.3 m.

G3.06 Required Plot Plan Information

Prior to application for a building permit, individual plot plans (individual house siting plans) for each lot shall be prepared and shall be submitted to the Applicant's Consultant for approval.

These lot grading plans shall include the following:

- Lot description and house number, including Registered Plan Number.
- Dimensioned property limits and house location.
- House type; normal, side split, back split, etc.

- An indication if fill has been placed on the lot in such a manner as to support the house foundations (i.e., engineered fill).
- Finished first floor elevation.
- Finished garage floor elevation.
- Finished and original grades over septic tile beds.
- Finished basement floor elevation (all locations).
- Elevation of underside and top of footings.
- Top of foundation wall (all locations).
- Existing and proposed lot grades for each of the corners of the lot and intermediate points of grade change.
- Existing trees to be maintained.
- Driveway locations, widths and proposed grades.
- Curb cut locations and dimensions.
- Finished road grades adjacent to the lot.
- Location of house entrances.
- Location of rainwater downspouts and sump pump discharge locations if permitted.
- Location of walkways.
- Arrows indicating the direction of all surface drainage and swales.
- Location and elevation of swales.
- Location of patios, decks and/or porches.
- Location of terraces, retaining walls and tree wells.
- Location and dimensions of all easements.
- All yard catchbasins with rim elevations.
- Location and invert elevations of all storm, sanitary, foundation drain, roof leader and clean water collector services at the lot line.

- Hydrants, luminaire poles, bell and cable TV pedestals, hydro transformers and point of supply for hydro service.
- Location and type of any private sewage disposal system and reserve areas and private wells.
- Location of all road features along frontage and flankage of lots (curb lines, catchbasins, sidewalks, etc.).
- Lot grading certificate by Applicant's Consultant in accordance with the Subdivision Agreement requirements.
- Site benchmark information from approved engineering drawings.
- Identify the location of the sump pump outlet to grade where sump pumps are permitted in areas without storm sewer services.

Lot grading plot plans shall be stamped and signed by the builder's Architect and the Applicant's consulting engineer responsible for the design of the subdivision. After approval and certification by the Applicant's Consultant, the lot grading plans shall be forwarded to the Town for review and approval.

G3.07 Retaining Walls

The lot grading design is to avoid the use of retaining walls. Specific permission from the Town will be required for any retaining walls being proposed. All reasonable alternatives must be investigated prior to the use of retaining walls. All retaining walls considered as "Designated Structures" as per the Ontario Building Code (O.B.C.) Section 1.3.1.1 shall require a building permit from the Town of Aurora.

The O.B.C. describes a Designated Structure as a retaining wall exceeding 1 000 mm in exposed height adjacent to,

a) Public property.

b) Access to a building.

c) Private property to which the public is admitted.

Where retaining walls are necessary and agreed to by the Town, the structures shall be free-standing gravity walls constructed of reinforced poured concrete, large size heavy pre-cast concrete blocks (135 kg sections) or armor stone. No wood or gabion basket retaining walls will be permitted. Tie back systems are to be avoided in all applications. If in the sole opinion of the Town tiebacks cannot be avoided, the tiebacks are to be located entirely on the same property as the retaining wall. In addition, a restrictive covenant will be required over the installed

tiebacks to protect its structural integrity, resulting from the potential alteration of grading, planting of trees and vegetation, proposed swimming pool installation, etc.

All retaining walls 0.6 m and higher must include a railing or guard. The guard must meet the structural requirements of the O.B.C. All retaining walls 1.0 m and higher, must include an engineering drawing or shop drawing stamped by a registered professional engineer for any structure not covered under Ontario Provincial Standard Drawings. Final post-construction certification from a Professional Engineer will be required for each wall constructed 1.0 m or higher clearly stating that the wall has been designed to suit the site conditions, that construction of the wall has been inspected by the Engineer and that it has been constructed in accordance with the design.

Detailed drawings for retaining walls shall include the following notes and illustrate:

a) That “The walls have been designed in accordance with accepted engineering principles”.

b) That “The wall is suitable for the geotechnical condition of the site and for the loading type”.

c) A weeping tile and outlet locations shown.

d) A filter cloth envelope surrounding the compacted free draining granular material.

e) Sufficient top of wall and bottom of wall elevations.

f) Type and material of wall.

g) A cross-section for the length, type, and location of any tiebacks.

h) The location, type, and fastening of the 1.2 m black vinyl chain link fence.

i) Surcharge load used and appropriate design calculation.

j) A swale at top of wall, if drainage directs to the wall.

G3.08 Sodding and Ground Cover Requirements

1. Lots (including drainage ditches or swales) are to be completely top-soiled and sodded with a minimum 300 mm depth of topsoil and No. 1 Nursery Sod.

2. Clear stone (19 mm gradation) at a minimum depth of 100 mm shall be placed inside yard areas between houses with a distance less than 1.2 m instead of sod. A transition run out area to drain the subgrade shall be provided at the clear stone/sod interface. This shall be detailed on the grading plans.

G3.09 Acoustic Barrier Requirements

The acoustic assessment should review all potential stationery and transportation noise sources following Ministry of the Environment, Conservation and Parks (M.E.C.P.) Environmental Noise Guideline recommendations.

The Planning and Development Services Department does not support the exercising of the 5 dBA “cushion” for transportation noise sources as permitted in the M.E.C.P. guidelines NPC-300, or latest revision thereof) for the sound level in the Outdoor Living Area. Where acoustic walls/fences are proposed, they should comply with the following requirements:

a) Acoustic barriers and walls are to conform to the findings of the approved Noise Study for the proposed development.

b) The maximum allowable height for any acoustic wall/fence shall be 2.5 m. Any additional height must be accommodated through effective use of grading and berming.

c) All acoustic fencing shall be constructed entirely onto the private lot side.

d) Acoustic fence gates shall have a 1.2 m clear opening.

e) Gate installations allowing direct access from private property to public lands are not permitted.

f) Acoustical fence details shall be shown on the engineering plans and on the Landscape Plans. The drawings shall incorporate the fence details and construction type. The berm details with shall have sufficient elevations, and include the type of soil used, and footing depth.

g) Acoustic barriers shall be designed, and their construction certified by a Professional Engineer. (Appendix B-6)

G3.10 Site Alteration Applications

Prior to proceeding with any site alteration as defined by By law 4751-05 P, as amended, the applicant must follow the requirements of the Town’s Site Alteration Standards, September 2019, as amended.

G4.00 Certification

G4.01 Approvals

Prior to the release of any lot from the conditions of the Subdivision Agreement, the Applicant’s Consultant shall provide certification to the Town that the following requirements have been met.

a) Grading and drainage of the lot is in accordance with the approved lot grading and drainage plans. The Applicant's Consultant shall submit lot grading certificates to the Town of Aurora per the form letter noted in Appendix B-3. If the grading differs from the approved lot grading plan, the Consulting Engineer shall provide details of the variance from the approved plans and shall include his recommendations for rectification of the area if required.

b) If retaining walls have been constructed the Applicant's Consultant shall also submit retaining wall certificates to the Town of Aurora per the form letter noted in Appendix B-5.

c) If acoustic barriers have been constructed the Applicant's Consultant shall also submit acoustic barrier certificates to the Town of Aurora per the form letter noted in Appendix B-6.

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Section H Traffic Signs and Pavement Markings

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H1.00 Traffic Controls

The proposed location and type of all street name signs, traffic control signs, signalization, parking and pavement markings shall be shown on the Pavement Marking and Signage Plan. The plan shall be prepared by a Professional Engineer skilled in municipal traffic design.

All traffic control devices, including warning and regulatory signs, street signs, parking restrictions, etc., shall conform to the Ontario Traffic Manual (O.T.M.).

H2.00 Signage

The Applicant is responsible for installation of all regulatory, warning and information signs. Permanent street name signs and all regulatory signs, excluding parking restriction signs, must be installed upon completion of the base course asphalt and prior to the issuance of the first building permit for the subdivision. Signs indicating parking restrictions are to be installed prior to the occupancy of any initial dwelling or building being issued in a development. All signs shall be maintained by the Applicant and adjusted as necessary following placement of top course asphalt and boulevard grading, until “Final Acceptance” is granted by the Town.

H2.01 Street Name Signs

Location

Street name signs shall be placed at each intersection and shall identify each street at the intersection. The locations of the street name signs are to be shown on the Pavement Marking and Signage Plan and shall be installed on common posts with the stop signs or other signs wherever possible. The locations of the street name signs are shown in the Town of Aurora Standard Drawing WS-213. At intersections with Regional roads, the requirements of the Region of York will dictate sign locations.

Type

The street name signs shall display the same message on each side of the sign. Sign messages shall be white lettering on a green background; both lettering and background to be fabricated from Scotchlite reflective sheeting, High Intensity Grade (as manufactured by 3M Canada Limited). Lettering shall be fabricated from 2270 Silver Sheeting: PA Series C. All lettering shall be upper case text and 100 mm in height. The street name sign blades shall be extruded aluminum manufactured from 50S T6C aluminum alloy. The blades shall have a width of 2.3 mm and a length of 610 to 915 mm. Correct spacing must be adhered to in order that the message will appear aesthetically correct.

Installation

Street name signs shall be mounted on hot-dipped, galvanized steel, cold-rolled “U” channel (80,000 psi) posts 3.65 m in length. Channel posts shall have a minimum thickness of 5 mm and a minimum width of 62 mm.

H2.02 Traffic Control and Advisory Signs

Location

Traffic control and advisory signs shall be located in accordance with the Ontario Traffic Manual. All “No Parking” and “No Stopping” zones should be clearly identified with signs in accordance with the Manual.

In school zones “no parking” is to be implemented on the side of the road where the school is located; and “no stopping” is to be implemented on the opposite side of the street.

All roads under the jurisdiction of the Town of Aurora shall be posted with a 40 km/hr maximum speed limit in urban areas and 80 km/hr in rural areas.

All signs shall be mounted approximately at right angles to the direction of and facing the traffic that they are intended to serve. On curbed alignments, the angle of placement is to be determined by the course of the approaching traffic rather than by the roadway edge at the point where the sign is located. Signs for different purposes should not be placed closer together than 30 m.

Type

All signs are to be in accordance with the Ontario Traffic Manual and constructed of engineering grade, reflective materials.

Installation

All traffic control signs shall be mounted on hot-dipped, galvanized steel, cold rolled “U” channel (80,000 psi) posts 3.65 m in length. Channel posts shall have a minimum thickness of 5 mm and a minimum width of 62 mm. The posts shall be pre punched with a minimum of 24 holes at 50 mm centres, compatible with standard bolt hole arrangements for traffic control signs.

Stop Control

Stop control shall be used in an urban setting when traffic signals are not warranted or not yet installed in accordance with the following:

Table H-1: Stop Control Requirements

Intersection Classification	Stop Sign*	Stop Bar	Center Dividing Line Marking (10 m long)
Local to Local	✓	✓	-
Local to Collector	✓	✓	✓
Collector to Collector	✓	✓	✓
Road to Arterial/Highway	✓	✓	✓

Note: *Minor street control

All-way stop control should be reviewed and only provided in accordance with requirements outlined in Book 5 of the O.T.M.

All stop signs shall be approved by Town Council and the appropriate By-law shall be passed prior to installation (Note: The subdivision must be registered in order for the By-law to be passed).

Documentation

Consultants are to complete and submit to the Town before execution of the Subdivision Agreement, Schedule II and Schedule IX for passage of No Parking and Stop controlled intersection respectively into the Town's By-laws. Templates of these schedules are included as Appendices H4 and H5 in these Design Guidelines.

H3.00 Pavement Markings

Pavement Markings for traffic control shall be provided and conform to the current standards of the Ontario Traffic Manual. All markings are to be completed with approved traffic paint in accordance with O.P.S. specifications. Approved markings are to be placed in accordance with applicable O.P.S. specifications.

Pavement markings shall be indicated on the plans for all stop bars, pedestrian crossings, centre and lane lines, as required or directed by the Town for all subdivision streets. Stop bars are required at all stop-controlled intersections of any road with another road. The following general guidelines are applicable:

1. Following placement of base asphalt, temporary water-based pavement markings shall be applied and maintained as directed by the Town prior to placement of top course asphalt.

2. Following placement of top course asphalt, durable pavement markings are to be used for stop bars, crosswalks, and arrows in order to obtain a Certificate of Completion. Water based paint marking may be used for center dividing lines however, during the maintenance period all water-based paint markings are to be maintained in good condition and will require re-painting as directed by the Town. Applicants may elect to implement durable paint markings in place of water-based markings. Conflicting pavement markings to be removed through a non-destructive process.

3. Durable (thermoplastic) markings shall be used on any road which intersects an arterial road, at the intersection and back to a distance of 100 m from the arterial road.

4. Prior to assumption any water-based paint markings previously applied are to be re-painted. Durable pavement markings will be inspected by the Town and repairs or replacement if necessary, will be the responsibility of the Applicant.

5. Glass beads shall be provided for all temporary and permanent line painting – refer to O.P.S.S. 1750.

6. Prior to pavement marking application, all surfaces shall be cleaned and dry to the satisfaction of the Town.

H3.01 Directional Dividing Lines

Directional dividing lines shall be applied generally as follows (other factors may warrant otherwise as per site specifics or as per requirements outlined within the O.T.M.):

Local Roads

- Directional dividing lines are not required along low volume local roads.

Collector Roads

- Where peak hour volumes are less than 500 vehicles per hour, a continuous directional dividing line is not necessary. Apply a 30 m minimum approach (i.e., barrier line) to intersections.

- Where peak hour volumes are greater than 500 vehicles per hour, a continuous directional dividing line is necessary.

- On both sides of a painted or flush-type median.

- At flared intersection approaches or where there is a taper in the roadway.

Arterial Roads

- A continuous directional dividing line is necessary on all arterial roadways.

Lane Lines

- Lane lines shall be used on roadways to separate two or more adjacent lanes of traffic moving in the same direction.

- In locations where there are lane lines, a solid (yellow) line shall be provided along the centerline of the road accordingly.

Edge Lines

- Edge lines are generally not required for local and collector roads unless there are extenuating circumstances (refer to O.T.M.).

- Edge lines shall be installed for rural arterial roads, but not for urbanized.

Crosswalks (Decorative or Parallel Lines)

All crosswalk pavement markings shall comply with current editions of the O.T.M. and T.A.C. Geometric Design Guide for Canadian Roads (current addition) and guidelines from York Region (as amended).

The Town will determine if parallel line style crosswalks or zebra-style crosswalk markings are to be used on a case-by-case basis.

Crosswalk pavement markings shall be used in combination with other traffic control devices such as traffic control signals, pedestrian signals, ground-mounted signs (i.e., stop, yield, pedestrian crossing) and overhead signs.

Crosswalks are required generally as follows:

- At intersections where there is substantial conflict between vehicle and pedestrian movements.

- In the vicinity of parks and trails, where the crossing forms an integral part of the trail system.

Crosswalks in between intersections shall be accompanied with proper signage to warn drivers that there is pedestrian activity ahead.

School Crosswalks and Signage

School signs shall be provided as per the requirements of the Town and in accordance with current editions of the O.T.M. and T.A.C. Geometric Design Guide for Canadian Roads (current addition) and guidelines from York Region (as amended). If there is a requirement for a crossing guard, the crossing shall be constructed to the standard of a designated School Crossing.

Regular crosswalks in the vicinity of the school shall be provided taking into consideration that children will be present and extra caution is warranted.

School signs shall be provided as per the requirements of the Town and in accordance with the O.T.M.

Note: Additional school crosswalks and signage will be considered during the site plan approval process for the school.

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Section I Street Lighting and Utilities

Section I Street Lighting and Utilities

A Composite Utility Plan (C.U.P.) is to be submitted to the Town to ensure that conflicts between utilities, municipal services, street trees and driveways are avoided. The plan will indicate the location of all underground and all aboveground services and utilities. The Consultants shall execute the coordination of all utilities and municipal services.

The hierarchy of municipal servicing and utilities shall generally apply when determining installation locations. These are, in descending order, municipal sewers and watermains including appurtenances, hydro, street trees, gas, telephone, cable, and other. The Town requires that the use of aboveground utility furniture be minimized in all new developments.

Composite utility plans shall be submitted with each engineering package following the first engineering submission. The engineering package will be reviewed only as a complete submission.

Street lighting requirements for lands developed under Site Plan control are provided in Section K of these guidelines.

I1.01 Location of Utilities

The location of utilities within the road allowance shall be as detailed on the Town of Aurora Standard Drawings. Any above-ground utility infrastructure exceeding 0.9 m in height proposed within the road allowance shall be clear from the intersection traffic sight line.

All utility wiring is to be installed in conduits. Hydro transformers are to be housed in suitable enclosures and mounted on transformer pads installed at the final surface of ground. Bell telephone and Cable TV junction boxes are to be mounted at the surface in approved standard enclosures, provided by the appropriate utilities.

Hydro kiosks, switch gear, Outside Plant Interface (i.e., O.P.I. unit per Bell Canada) or other infrastructure larger than standard low-profile transformers or junction boxes are to be installed in easements located outside of road allowances. The locations of these structures are to be discussed with the Town early in the design process in order to obtain specific approvals for these sitings.

All utility surface features are to be installed wherever possible, at projections of property lines. However, factors such as lot widths, street trees and streetscape design, clearances to other services, sidewalk locations and maximizing on-street parking capacity are to be considered when coordinating utility locations. Generally, the Town requires that the use of above-ground utility furniture be minimized in all projects. Should the utilities determine that underground utility vaults are preferred, advanced discussions are required with the Town to establish suitable locations and clearance requirements. If overhead hydro or communication cables are

located adjacent to the existing development, along the frontage of the site on existing roads, these services are to be buried as part of the program to service the internal roads.

The following summarizes the utility clearances required.

Table I-1: Public Utility Clearance Requirements

	Condition/Utility	Gas Line	Hydro	Bell, CATV	Water/Sewer Lines
1	Minimum Vertical Distance	0.3 m	0.3 m	0.3 m	1.2 m
2	Minimum Horizontal Distance	0.9 m	3.0 m aboveground to utilities on side where access doors are located; 1.0 m to utilities on remaining sides.	0.3 m	1.2 m
3	Minimum Distance Below Ditch Inverts	0.6 m	1.0 m	0.3 m	1.7 m
4	Minimum Distance from Structure/ Chambers	0.3 m	0.3 m	0.3 m	0.6 m
5	Minimum Distance from Hydrants	0.3 m	1.0 m	0.3 m	0.6 m

I1.02 Dedicated Fibre Optic Service Conduit

The Applicant is to provide one 50 mm diameter PVC conduit on collector roads, where directed by the Town, dedicated for Town use and constructed in common trench with other utilities. The conduit is required to facilitate fiber optic servicing of existing and future municipal or community-oriented facilities. The conduit location in the joint utility trench is noted in Standard WS-507.

I1.03 Composite Utility Plan

All utilities are to be shown on the Composite Utility Plan and to be submitted for the review and approval of the Town showing utilities including street lighting poles, lighting power centers, transformers, switching cubicles. This drawing shall be prepared at a scale of 1:500, unless otherwise approved, and show the locations of all municipal services including sewers, watermains, laterals, maintenance holes, catchbasins, sidewalks and driveways, utilities including street light poles, cross-road ducts, spare utility ducts, Canada Post mailbox, and the locations of all street trees, entrance features, retaining walls, fencing, etc. It is the Consulting

Engineer's responsibility to ensure there are no conflicts resulting from the design of the various utilities and the municipal roads and services. The utility design and layout shall incorporate the Town's Urban Design Guidelines and the approved project-specific Urban Design Guidelines report with regards to streetscape design and street trees. The Consulting Engineer shall coordinate with the utility representatives and the Applicant's landscape architect early in the design process.

All details of any entranceway features and structures within the proposed right of way are to be indicated on the Composite Utility Plan, as circulated to the various utilities. The drawings shall also indicate the presence of any pumping stations or other such facilities that may necessitate particular service requirements.

The Composite Utility Plan is to be approved by all individual utility agencies identified on the drawing and Canada Post, prior to approval of all drawings and prior to construction. Any revisions to the approved Composite Utility Plans will require approval of each agency. This shall be done by noting the revision in the title block of the drawing and having the title block of the drawing initialed by a representative of each agency.

I1.04 Composite Utility Plan Preparation

The Composite Utility Plan is to include the following:

1. Show municipal addresses (house numbers), as well as lot numbers.

2. Specify pole, conduit and fixture being used.

3. Specify locations of transformers, switch gear, telephone and cable television pedestals or vaults and the means of disconnects, power and control centers.

4. The dimensions of switch gear (including surrounding grounding systems) and utility vaults in order to ascertain the clearances to other services or aboveground structures. Switch gear, transformers and utility vaults are to be drawn to scale.

Lighting pole installation is to clearly show locations with respect to property line and offset.

The typical road cross-section shall be shown or referenced on the Utility Drawing. A maximum of two items of street furniture will be permitted on any lot. Utility clearances are shown in Table I-1 which represents the minimum clear separation distance for public utilities.

In addition to the aforementioned information, each C.U.P. shall have a signature block provided for approval of each of the utilities as shown below:

ACCEPTED BY	NAME	DATE
Alectra		
Enbridge Gas		
Bell Canada		
Rogers		
Canada Post		
Town of Aurora		

Standard Notes on Utility Drawings shall be as follows:

1. Utilities are to be located as shown on the approved standard road cross sections and the Composite Utility Plan. Joint use utility trench alternative is provided in Standard WS-507.

2. 1.2 m separation is to be maintained between edge of driveway and all street furniture.

3. All gas services to be installed at the opposite side of the lot from the electrical service.

4. Underground electrical to have 1.2 m horizontal clearance at hydrant locations. Underground electrical shall clear maintenance holes and catchbasins by minimum of 1.0 m; otherwise concrete encasement is required.

5. Hydro primary and cables to be concrete encased over split duct at watermain and hydrant connection crossings.

6. Road crossings for shall be as per O.P.S.D. 2101.01 and 2103.02.

7. Gas mains shall clear underground structures by 300 mm minimum.

I1.05 Community Mailbox Requirements

In general, community mail centres and/or site individual super mailboxes shall be placed in locations approved by the Town of Aurora. The design of the community mail centre must incorporate such criteria as pedestrian safety, traffic flow and aesthetics. The Town may require the Applicant to furnish the following amenities within the community mail centre:

- Fencing.

- Landscaping.

- Pedestrian lighting.
- Concrete pad or interlocking stone finished surface.
- Adjacent car bays parallel to the travelled portion of the roadway.

In general, individual super mailboxes shall be located near the rear lot line of flankage lots on concrete pads. The location of super mailboxes shall in no way restrict site lines at intersecting roads. When establishing the spacing of street lighting within a residential subdivision, consideration must be given for the placement of a streetlight adjacent to the location of super mailboxes. Parallel car bays may also be located adjacent to super mailboxes to ensure a continuous traffic flow. The length of bays will be governed in general by the number of super mailboxes.

The approval of Canada Post Corporation with respect to location of community mail centres and/or site individual super mailboxes will be required prior to the approval of the Engineering Drawings by the Town.

I2.00 Street Light Design

I2.01 General Requirements and Technical References

Lighting systems designs shall be prepared, signed and sealed by a Professional Engineer with expertise in the discipline of street and roadway lighting. The Town's Design Guidelines provide general direction to the consulting engineer who shall prepare competent designs based on good engineering practice and having regard to the following industry references:

- IES Handbook 10th Edition: Illuminating Engineering Society – The Lighting Handbook/Reference and Application.
- ANSI Standard C78.377-2008 "Specifications for the Chromaticity of Solid State Lighting".
- ANSI C136.31-2010 "Roadway and Area Lighting Equipment – Luminaire Vibration".
- ANSI/IEEE C.62.41.2: Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
- ANSI/IEEE C62.45: Recommended Practice on Surge Testing for Equipment Connected to Low Voltage (1000 V and less) AC Power Circuits.
- ANSI/IES RP-08-14: Recommended Practice for Roadway Lighting.
- ANSI/IES RP-22-11: Recommended Practice for Tunnel Lighting.

- ANSI/IES RP-33-14: Recommended Practice for Lighting for Exterior Environments.
- ASTM B117 – American Society for Testing Materials: Standard Practice for Operating Salt Spray (Fog) Apparatus.
- IEC Spec 529 – International Electrotechnical Commission: International Protection Marking.
- Guide for the design of Roadway Lighting – 2006 Edition – Transportation Association of Canada (T.A.C.).
- I.E.S.N.A. T.M-15-11: Luminaire Classification System for Outdoor Luminaires.
- I.E.S. L.M.-79-08: Approved Method for Electrical and Photometric Measurements of Solid State Lighting Products.
- I.E.S. L.M-80-08: Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- I.E.S.N.A. L.M.-67-94: Calculation Procedures and Specifications of Criteria for Lighting Calculations.
- I..ES. L.M.-82-12: Approved Method for the Characterization of LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature.
- I.E.S.N.A. T.M.-10-00: Addressing Obtrusive Light (Urban Sky Glow and Light Trespass) in Conjunction with Roadway Lighting.
- I.E.S.N.A. T.M.-11-00: Light Trespass; Research, Results and Recommendations.
- I.E.S. T.M.-21-11: Projecting Long Term Lumen Maintenance of LED Light Sources.
- I.E.S./I.D.A. M.L.O.: Model Lighting Ordinance with user’s guide.
- CSA C653-13: Photometric Performance of Roadway and Street Lighting Luminaires.
- CSA C22.2 NO. 250.0-08 (R2013) – Luminaires.

I2.02 Design Criteria

The street lighting system shall be designed by a qualified Professional Engineer in accordance with A.N.S.I./I.E.S.N.A. RP-8-14 – Illuminating Engineering Society of North America's American National Standard Practice for Roadway Lighting. All street lighting systems for roadways, walkways and public areas shall meet the requirements of the Town and Hydro One.

The consultant shall state in the submission that the lighting design has been completed based on A.N.S.I./I.E.S.N.A. RP-8-14, or any revised edition. The consultant is to evaluate the conditions and land uses surrounding the site and take these into account in preparation of the lighting design. The consultant is to employ only the Luminance design method. However, where A.N.S.I./I.E.S.N.A. RP-8-14 allows for use of Illuminance methodology in specific cases as acknowledged in Section J2.04 of the Town's Design Guidelines, the consultant shall state these instances in the lighting design submission.

The distance between grid lines in the longitudinal direction of the photometric analysis should be one tenth (1/10) of the spacing between luminaires, or 5.0 m, whichever is smaller. At intersections the grid spacing is 2.0 m throughout the calculation area.

The design engineer is to provide the luminaire manufacturer's recommendation for selection of the Light Loss Factor (L.L.F.) value for design. For L.E.D. technology the L.L.F. is expected to be between 0.8 and 0.9.

When establishing the spacing of street lighting within a residential subdivision, consideration must be given for the placement of a streetlight adjacent to the location of community mailboxes. In determining the position of a light standard, the designer shall take into consideration the location of driveways, living room windows and other aspects of the site. The objective is to provide a sense of security and to minimize light spill and other disturbances within the development plan and to adjacent properties. Pole spacing shall be supported by detailed photometric calculations. Maximum spacing shall not exceed 50 m. Both one-sided and staggered pole arrangements are permitted. Opposite pole arrangements may be considered at areas of increased pavement widths in order to meet illumination requirements. Each streetlight power pedestal is to be energized at 240 volts split neutral. The main breaker is to be 60-amp, full size neutral, with up to four individual circuits, 120-volt, 40-amp single pole breakers. Each 120-volt, 40-amp breaker is to feed a circuit in each direction to a maximum of six streetlights.

Road crossings are to be sited such that they do not terminate under driveways and shall be installed at right angles with respect to the boulevard. A minimum clearance of 1 m shall be maintained from the edge of the driveway to the road crossing. The location of road crossings is to be referenced to a fixed point such as transformers or property lines and shown on the street lighting drawings.

I2.03 Classifications and Definitions

The A.N.S.I./I.E.S.N.A. R.P.-8-14 standard is based on evaluation of Roadway Classifications and Pedestrian Conflict Area Classifications. Minimum required light levels are based on I.E.S.N.A. and T.A.C. recommendations accounting for the combination of various classes of roadways, sidewalks, walkways and pedestrian activities. The objective is to address both potential vehicle/vehicle conflicts and vehicle/pedestrian conflicts based on these classifications.

Roadway Classifications and Definitions (per A.N.S..I/I.E.S.N.A. R.P.-8-14)

The consultant shall document the classification of roadways (i.e., arterial or major, collector, local or lanes) and pedestrian facilities (i.e., sidewalk, walkway/bikeway and pedestrian underpass) assigned in the lighting system design to the development plan. The determination of roadway pedestrian facility classifications shall have regard for the Official Plan roadway designation and A.N.S.I./I.E.S.N.A. descriptions. Each area shall be illustrated and/or described to demonstrate the basis of the design.

Pedestrian Conflict Classifications (per A.N.S.I./I.E.S.N.A. R.P.-8-14)

The consultant shall document the assignment of pedestrian conflict area in the lighting system design to the development plan. The areas shall be based on the classification definitions of "low, medium or high" potential conflicts with vehicular traffic. The choice of an appropriate level of pedestrian activity will be based on pedestrian forecasts which are subject to the Town's approval. The assignments are to be illustrated and/or described in the design submission to the Town.

I2.01 Design Methodology

Straight Roadways, Streets and Sidewalks

The recommended Luminance levels for straight roadways and the recommended Illuminance levels for sidewalks are noted below:

Table I-2: Straight Roadways Luminance Levels and Sidewalks Illuminance Levels

Roadway Classification	Pedestrian Conflict	Avg. Luminance L_{avg} (cd/m^2)	Avg. Uniformity Ratio (L_{avg} / L_{min})	Max. Uniformity Ratio (L_{max} / L_{min})	Max. Veiling Luminance Ratio (LV_{max}/ L_{avg})	Sidewalk Average Illuminance E_{avg} (lux)
Local	Low	0.3	6.0	10.0	0.4	3.0
	Medium	0.5	6.0	10.0	0.4	5.0
	High	0.6	6.0	10.0	0.4	10.0
Collector	Low	0.4	4.0	8.0	0.4	3.0
	Medium	0.6	3.5	6.0	0.4	5.0
	High	0.8	3.0	5.0	0.4	10.0
Arterial	Low	0.6	3.5	6.0	0.3	3.0

Roadway Classification	Pedestrian Conflict	Avg. Luminance L_{avg} (cd/m^2)	Avg. Uniformity Ratio (L_{avg} / L_{min})	Max. Uniformity Ratio (L_{max} / L_{min})	Max. Veiling Luminance Ratio (LV_{max}/ L_{avg})	Sidewalk Average Illuminance E_{avg} (lux)
	Medium	0.9	3.0	5.0	0.3	5.0
	High	1.2	3.0	5.0	0.3	10.0

Source: I.E.S.N.A. R.P.-08-14

Where: L_{avg} is the minimum maintained average pavement luminance

L_{min} is the minimum pavement luminance

LV_{max} is the maximum veiling luminance (a measure of the glare produced by the lighting system

Where directed by the Town, the consultant shall provide dedicated sidewalk lighting as directed in I.E.S.N.A. R.P.-08-14 based on use of horizontal and vertical illuminance criteria.

Intersections

Intersections shall be designed based on Illuminance criteria, road classifications and pedestrian area classifications noted as follows:

Table I-3: Intersection Illuminance Levels

Street Functional Classification	Average Maintained Illumination at Pavement by Pedestrian Area Classification in [Lux/FC]			Uniformity Ratio (E_{avg} /E_{min})
	High	Medium	Low	
Arterial/Arterial	34/3.4	26/2.6	18/1.8	3.0
Arterial/Collector	29/2.9	22/2.2	15/1.5	3.0
Arterial/Local	26/2.6	20/2.0	13/1.3	3.0
Collector/Collector	24/2.4	18/1.8	12/1.2	4.0
Collector/Local	21/2.1	16/1.6	10/1.0	4.0
Local/Local	18/1.8	14/1.4	8.0/0.8	6.0

Source: I.E.S.N.A. R.P.-08-14

Roadway Curves and Cul-de-Sac

The Illuminance design method shall be used for lighting design of the cul-de-sac portion of dead-end roadways. This analysis is based on the area which begins at the point of curvature of the pavement curb return and targets the illuminance lighting values of the roadway approaching the cul-de-sac. For this purpose, the equivalent illuminance can be calculated using the ratio of 1 cd/m^2 = 15 lux for an R3 pavement or 1 cd/m^2 = 10 lux for an R1 pavement.

For roadways with gradual curves consisting of a centerline radius greater than or equal to 600 m, lighting systems shall be designed using the luminance method. Luminaires shall be perpendicular to the tangent of the centerline roadway curve. The road classification and pedestrian conflict level criteria shall determine the lighting requirements.

Where the centerline radius of the roadway is less than 600 m, the illuminance lighting design methodology shall be used. The equivalent ratio of 1 cd/m^2 = 15 lux for an R3 pavement and 1 cd/m^2 = 10 lux for an R1 pavement can be used.

Pedestrian Walkways and Bikeways

The illuminance calculation is the primary method used to establish lighting levels for pedestrian walkways and bikeways. The Town's Department of Operations Services Department/ Parks Division is to be contacted specifically regarding lighting requirements for walkways and bikeways within municipal parks.

In cases where the security of pedestrians and cyclists is of concern, a minimum illumination level of 10.0 Lux (1.0 FC) with an average-to-minimum uniformity ratio no greater than 4 to 1 will apply. The application of this criteria will be determined by the Town. Alternatively, the following illumination lighting shall apply:

Table I-4: Pedestrian Walkways and Bikeways Illuminance Levels

Pedestrian Area Classification	Sub-Category	E_{avg} [Lux/FC]	EV_{min} [Lux/FC]	E_{avg}/E_{min} *
High	N/A	10.0/1.0	5.0/0.5	4.0
Medium	N/A	5.0/0.5	2.0/0.2	4.0

Pedestrian Area Classification	Sub-Category	E_{avg} [Lux/FC]	EV_{min} [Lux/FC]	E_{avg} /E_{min} *
Low	Rural/Semi-Rural Areas	2.0/0.2	0.6/0.06	10.0
	Low Density Residential (2 or fewer dwelling units per acre)	3.0/0.3	0.8/0.08	6.0
	Medium Density Residential (2.1 to 6.0 dwelling units per acre)	4.0/0.4	1.0/0.1	4.0

Source: IESNA RP-08-14

Where: Rural/Semi-rural are areas:

- with very low residential density away from urban areas;
- cities or large towns or areas that are partly rural;
- between rural and urban.

E_{avg} is the minimum maintained average horizontal illuminance at pavement

E_{min} is the minimum horizontal illuminance at pavement

EV_{min} is the minimum vertical illuminance at 1.5 m above pavement

*Horizontal illuminance only

Pedestrian/Vehicular Underpass Areas

The lighting design criteria for pedestrian and/or vehicular underpass areas shall be as follows:

Table I-5: Pedestrian/Vehicular Underpass Areas Illuminance Levels

Description	E_{avg} [Lux/FC]	EV_{min} [Lux/FC]	E_{avg} /E_{min} *
Daytime	100.0/10.0	50.0/5.0	3.0
Nighttime	40.0/4.0	20.0/2.0	3.0

Source: I.E.S.N.A. R.P.-08-14

Where: E_{avg} is the minimum maintained average horizontal illuminance at pavement

E_{min} is the minimum horizontal illuminance at pavement

EV_{min} is the minimum vertical illuminance at 1.5 m above pavement

*Horizontal illuminance only

I3.00 Submissions

I3.01 Street Lighting Submissions

Street lighting design, layout and detail drawings are to be submitted to the Town by an Electrical Consultant, signed and stamped by a Professional Engineer, and are to be included with the submission of engineering drawings. One hard copy and one electronic digital copy of the following are to be provided, unless otherwise specified by the Town in writing:

1. A Design Engineer Certification Letter confirming that the design has been completed in conformance with A.N.S.I./I.E.S.N.A. Recommended Practice R.P.-8-14, T.A.C.: Guide for he the Design of Roadway Lighting – 2006, and the Electrical Safety Authority (E.S.A.) requirements.

2. Details of proposed luminaires, poles and arms including the Manufacturer's technical data sheets, photometric file and TM-21 data.

3. For each Luminaire type, product cut-sheets shall be submitted that include the Luminaire input current, L.E.D. drive current, nominal Correlated Color Temperature (C.C.T.) and the Light Loss Factor (L.L.F.) and associated calculations.

4. Calculations and distribution diagrams as per the Town's Design Guidelines including photometric analysis (AGi32 software or approved equivalent) in electronic format for all streets and intersections. A photometric drawing is to be prepared showing the results of the photometric analysis on the development plan. A table summarizing the lighting analysis results and statistics relative to the applicable design parameters is to be included on the photometric drawing.

5. Photometric files in electronic I.E.S. format from the luminaire manufacturer.

6. Streetlights must be numbered on the drawings, in accordance with the Town's asset identification numbers. A request is to be made to the Town to provide the necessary quantity of asset identification numbers.

7. Street lighting layout and electrical drawings in AUTOCAD and PDF format showing the following:

a) The location and identification of switch gear, transformers, pedestals, power and control centers, streetlights, luminaires and poles.

b) A Street Light Pedestal Chart on each drawing listing the streetlight pole numbers that area associated by circuit number to the numbered streetlight pedestal on the drawing.

c) The wiring layout throughout the plan including road crossings.

8. Include manufacturer's shop drawings for all materials to be supplied. The Applicant's Consultant shall be responsible for the review/approval of any required shop drawings submitted by the Contractor/supplier for verification or compliance to the lighting design and Town specifications.

9. A summary of the electrical street lighting loads.

10. A capital cost estimate for the proposed street lighting installation works (including wiring, poles, pedestals, etc.).

I3.02 Alectra Design Drawing Circulation

The civil design Consultant and the Applicant are to review and approve the Alectra electrical design drawing prior to circulation to the Town for its endorsement. The Consultant is to ensure the Hydro One design provides kiosks and switch gear equipment in an easement outside of the Town's road allowances as determined at the pre-design meeting. In addition, the Consultant is required to coordinate the Hydro One design with other utilities and consultants to ensure the necessary physical clearances and sitings meet the Town's requirements.

I4.00 Specifications

I4.01 Light Poles

Streetlight poles shall be in accordance with the Town material specifications and O.P.S.D. Standard or O.P.S..D Modified Drawings. All concrete poles to have a minimum of two coats of transparent, protective sealer (i.e., "cap seal") applied from the base of the pole to approximately 3 m above the top of the hand hole box.

Residential Areas

Poles in residential areas are to be 9.1 m, Class A, spun reinforced concrete, octagonal, direct buried, polished finish, complete with cast zinc hand hole and cover (per Stresscrete No. E 300-APO-G-S90 S/F FC (Brown), or approved equivalent). Pole colour is to be selected to closely match hardware in adjacent areas and supplied with matching 1.8 m decorative scroll arm bracket (per StressCrete 170, Powerlite AS5SEBK, or Cooper SCA5001BK).

Industrial Areas

Standard poles for industrial areas are to be 9.1 m, Class B, spun reinforced concrete (round), direct buried, complete with cast zinc hand hole and cover (per StressCrete No. E 300-BPR-G-M00 S/F 120, or equivalent). Poles are to be supplied with 1.8 m polished aluminum elliptical arm bracket (per Powerlite RE6MA).

Heritage/Commercial Areas

Streetlight poles fronting commercial properties or special heritage areas are subject to approval of the Town and selection may take into consideration urban design guidelines and architectural control documents.

Walkways

Light poles for walkways shall be a 6.4 m long, direct buried, decorative, tapered, octagonal, spun concrete pole (per StressCrete No. E21-APO-G-S90 C/W 140-25/35). A matching colour 0.15 m long arm bracket shall be specified. The pole finish shall be Saluki Bronze (brown).

I4.02 Lighting Luminaires

Prior to undertaking detailed design, consultants shall confirm with the Town the luminaires acceptable to each project. All standard street lighting luminaires are to be consist of Light Emitting Diode (L.E.D.) technology. All L.E.D. luminaires shall be tested in accordance with LM80 methods. The following criteria applies to the selection of luminaires:

- Low glare from luminaires.
- Readily available product for ease of replacement.
- Products which are consistent with the town's urban design guidelines and will allow the town to maintain a consistent aesthetic look and feel throughout the town, including heritage appearance as applicable.

Luminaires shall be Fully Cut-Off and classified as "Dark Sky Friendly" as determined by the International Dark Sky Association, with no up-light characteristics.

Luminaire detail sheets are to be included in the engineering drawing set.

Residential Areas

Subject to the Town's approval for compatibility with the Town's Urban Design Criteria for residential development, the following luminaires may be considered:

- Philips Lumec's L4OU "coach style" L.E.D. luminaire.

- Cree XSP “cobra head style” L.E.D. luminaire.

Generally, the “coach style” luminaire will be applied in residential areas for consistency with Urban Design Guidelines. The maximum allowable heat value for luminaires on rural, local residential and minor collector residential roadways is 3000K. On major residential collector or arterial roads, the maximum allowable heat value is 4000K. Luminaires are to be equipped with an individual photo sensor. The colour and style shall closely match existing hardware in adjacent developments. The mounting height of the fixtures is to generally be 7.6 m above the finished grade complete with individual photocell sensors.

Industrial Areas

In industrial areas, the Cree XSP “cobra head-style” L.E.D. luminaire shall be specified complete with individual NEMA photocell sensors. The maximum heat value for luminaires on local and collector industrial class roadways is 3000K. On major collector or arterial industrial roads, the maximum heat value is 4000K. The mounting height of the luminaire is to be 7.6 m above the finished grade.

Heritage/Commercial Areas

Streetlight luminaires fronting heritage and/or commercial areas are subject to approval by the Town and selection may take into consideration urban design guidelines and architectural control documents.

Walkways

Walkway luminaires shall be proposed by the consultant and be of the “Shoe Box” style. The colour shall be Saluki Bronze (brown) polyester powder coated compatible with the walkway light pole specification. The luminaire mounting height shall be 4.6 m and the luminaire shall have a maximum heat value of 3000K. The proposed luminaire shall be submitted with specifications sheet for the Town’s review and approval.

I4.03 Street Light Pedestals

Standard street lighting pedestals are to be metal enclosures per Pedestal Solutions, No. SLS1 (240 V), or approved equivalent, being dark green in colour, short 690 mm and mounted on a precast concrete base (per Utilicon UP1420, or equivalent). A detail sheet showing the specified streetlight pedestal is to be included in the engineering drawing set.

I4.04 Manufacturer’s Warranty

The Applicant shall provide to the Town a 10 year manufacturer’s warranty certificate, in the Town’s name, for L.E.D. luminaires and components confirming that the luminaire housing and all of its internal components, including but not limited to L.E.D. drivers and light engines shall be covered against defective workmanship, material and premature light source failures. The

Applicant is also to provide a manufacturer's certificate indicating that the service life of the L.E.D. luminaires is 100,000 hours of operation or greater.

The warranty shall commence on the date of receipt of material from the supplier. The supplier/manufacturer shall provide the Town with appropriate warranty certificates and shipping documents as proof of the date of shipment.

I5.00 Installation

I5.01 Street Light Pole Installation

Streetlight poles shall be installed as per O.P.S.S.MUNI 615 and O.P.S.D. 2225.010 and the manufacturer's recommendations. Pole hand hole locations shall be as per O.P.S.D. 2220.010. Streetlight pole detail sheets are to be included in the engineering drawing set.

Installation of street light poles shall adhere to the following requirements:

- All LED fixtures should be adjustable voltage to accommodate where necessary variations in the source power circuits.
- Any external electrical distribution equipment shall be contained and sealed in stainless steel weather-proof cabinets.
- All electrical feeds shall be underground, no aerial feeds will be permitted.
- Streetlight poles shall have the Town Standard Pole ID Tag affixed upon installation. The ID Tags are available from the Operational Services Department.
- Poles shall be installed with minimum clearance distance of 0.45 m from the edge of sidewalks, multi-use pathways, bicycle lanes, or any other travelled portions of the roadway.

I5.02 Underground Services and Wiring

All wiring must conform to the Ontario Electrical Safety Code (Latest Edition) and be acceptable to the Electrical Safety Authority.

Each streetlight pedestal is to be energized at 240 volts split neutral. Main breakers 60-amp, full size neutral, with up to four individual circuits, 120-volt, 40-amp single pole breakers is to be provided. Each 120-volt, 40-amp breaker feeds a circuit in each direction to a maximum of six streetlights.

Streetlight cables shall be installed in 50 mm diameter rigid ducts per O.P.S.S.MUNI 603, Standard Drawings O.P.S.D. 2101.010 and O..PS.D. 2103.020 and meeting Hydro One's requirements. Rigid ducts shall be PVC with solvent weld fittings and conform to C.S..A C22.2,

No. 211.2. Ducts shall be direct buried bedded in earth to a minimum depth of 900 mm and only in special cases where directed by the Town shall be bedded in concrete per O.P.S.D. 2100.060. Treatment in accordance with O.P.S.D. 2103.050 is required where ducts cross other utilities. Cables shall be installed per O.P.S.S.MUNI 604.

For all conduit, both when it is left empty for future use or has wiring installed in it, the Contractor shall install a 400-N test nylon fish line in the conduits (1.5 m of line coiled at each end of each conduit run).

Backfill shall conform to the requirements of O.P.S.S.MUNI Form 1010, consisting of Granular "A" to road subgrade compacted to 100% Standard Proctor Density.

For the installation of a grounding system, construction shall be as per O.P.S.S.MUNI 609. For the removal of electrical equipment, construction shall be as per O.P.S.S.MUNI 617.

Streetlight cables from the power pedestal or disconnect to the hand hole in the pole shall be 2-#6 Copper RWU-90 with 1-#6 stranded copper green jacketed ground wire. Note that jacket colours shall be as follows: Black (line); White (neutral) and Green (ground). Voltage Drop shall be considered as per Ontario Electrical Safety Code.

Streetlight cables from the hand hole to the fixture shall be 2-#12 Copper RWU-90 complete with 1-#12 stranded copper green jacketed ground wire. Note that jacket colours shall be as follows: Black (line); White (neutral) and Green (ground), such that the entire circuit has an acceptable power drop. Compression type connectors shall be used throughout. All wiring connections shall be made in the hand holes of streetlight holes. A waterproof CSA fused connector kit complete with a 10 Amp ceramic midget fuse located within the pole handhole shall separate the line end from the load end all as per O.P.S.D. 2255.010.

The final installation shall be inspected by and subject to Electrical Safety Authority and the Town's approval.

I6.00 Street Light Energization and Certification Procedure

The Town requires the following procedure regarding the commissioning of streetlights:

1. The agreement between the Applicant and Alectra to energize the street lighting system is to be executed and a copy provided to the Town before the Town will issue the first Building Permit.

2. The Electrical Consultant is required to inspect all equipment and works associated with streetlight construction including but not limited to underground wiring, streetlight pole and installation, fixture and installation, fuses and connections.

3. Once the street light construction is complete, the Electrical Consultant is required to provide a Letter of Certification to the Town, signed and stamped by a Professional

Engineer, stating that the consultant has reviewed and inspected the street light equipment and installation and certifies that same has been supplied and constructed in general accordance with the design and drawings.

4. The streetlight system is to be energized prior to issuance of the first Occupancy Certificate by the Town.

5. The E.S.A. Certificate of Inspection and construction Record Drawings shall be attached to the above noted Certification.

6. In order to confirm that lighting levels meet those presented in the detailed design, the following measurement procedure shall be employed:

    a) To reduce the effects of meter accuracy and differences in sensors, the following practices should be considered.

    b) Use a meter with the highest overall accuracy.

    c) Set the meter to the lowest available measurement range if not auto adjusted.

    d) Use the same meter or at least the same make and model of meter, for pre- and post-measurements as well as measurements between sites, to ensure comparability of readings if it is required.

    e) Where possible, avoid extreme temperatures (toward the limits of the meter's stated operating temperature range).

    f) Identify a horizontal grid of measurement points on the site surface that contains the expected minimum and maximum of each different exterior area.

    g) Ensure that measurements are not affected by sources of ambient light that are not part of the typical operating conditions, which could include any of the following:

        i. Daylight – Take measurements well after sunset; even a modest amount of daylight on the horizon can affect the measurements.

        ii. Temporary construction lighting.

        iii. Vehicle lights.

        iv. Lighting for neighboring structures – For neighboring lighting controlled by occupancy sensors, conduct all measurements while this lighting is off.

h) At each measurement point on each grid, measure and record the horizontal illuminance on the ground or finished surface.

i) Ensure that rain, fog, or winds that might introduce particulates into the air, or other conditions that might obscure the light between the fixtures and the meter, are not present for the measurements.

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Section J Lands Developed Under Site Plan Control

Section J Lands Developed Under Site Plan Control

J1.00 Site Plan Control

J1.01 Site Plan Agreement

The Applicant of lands under Site Plan Control, as specified in both the Town's Official Plan and Site Plan Control By-Law, shall be required to enter into a "Site Plan Agreement" with the Town of Aurora prior to the commencement of construction of any building or service within the parcel of land, unless exempted by the Director of Development Services.

J1.02 Regional Municipality of York Responsibility

The Region of York is responsible for all trunk sanitary sewers and trunk watermains that are constructed or proposed for construction on all road allowances, blocks and registered easements within the Town of Aurora. No local service connections are allowed to any York Regional mains, without written consent from the Region.

J1.03 Town of Aurora Requirements

The following Reports, Studies and supporting design documentation is required as part of the Site Plan Application Engineering Submission materials:

- Transportation Impact Study (T.I.S.). This study must conform to the Region of York's Transportation Mobility Plan Guideline for Development Applications. A Parking Study may also be required if a parking variance is required, where determined by the Town.
- Geotechnical Report.
- Hydrogeological and Water Budget Study.
- Noise Impact Study and Air Quality Impact Study (as required).
- Environmental Impact Study (s) and Record of Site Condition (as required).
- Water Supply Analysis (may include updates to the Town's water model as required).
- Existing Sanitary Sewer System capacity analysis (as required).
- Stormwater Management Report.
    - Phosphorous budget calculations in accordance with L.S.R.C.A. Any deficit to be offset by a cash compensation in accordance with L.S.R.C.A.

- Detailed cost estimate including a 10% engineering fee and contingency shall be submitted. The estimate shall be broken into internal site works (all works within the private side of the lot/block) and external works (works on Town lands and/or easements).

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

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

J1.04 Professional Engineer

The Applicant shall retain a qualified Professional Engineer to prepare all engineering drawings, supervise the construction of all engineering services and certify to the Town that all works have been constructed in accordance with the approved drawings and Town standards. All engineering drawings, design sheets, forms and reports are to be signed and stamped by a Professional Engineer. The Site Plan Development Engineer shall act as the Applicant's representative in all matters pertaining to the design and construction of the services in the development.

J2.00 Engineering Drawings

J2.01 Requirements

Engineering drawings are required for each development. All engineering drawings shall be prepared from one base plan, being consistent with the submitted Site Plan and prepared at a minimum scale of 1:200. These drawings shall be titled as follows:

- Site Plan.
- Standard Notes for Site Plans.
- Erosion and Sedimentation Control Plan.
- Site Grading Plan.
- Site Services Plan.
- Landscape Plan.

- Electrical Services Plan.
- Photometric Plan (as required).
- Drainage Area Plan.
- Traffic Management Plan (subject to confirmation by the Town).
- Construction Management Plan.

Additional engineering drawings shall be prepared where required, or when requested by the Town. Prior to receiving a Building Permit, all plans must be approved by the Town.

J2.02 Site Plan

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

1. The S.P.A. number, when assigned by the Town.
2. A key plan. The key plan shall have sufficient map information to locate the site relative to adjacent roads and lots and other lands under control of the applicant. The key plan shall be at a scale of 1:10,000.
3. A north arrow.
4. A geodetic benchmark, including description.
5. Site plan statistics, including areas and dimensions of the proposed development (bearings and distances).
6. Street names, Lot and Registered Plan numbers, easements on or adjacent to the property.
7. The outline of all existing buildings on or adjacent to the development, including Municipal address. All proposed buildings, including building and unit numbers. Building and landscaping setback dimensions.
8. Existing site features including trees, utilities and watercourses.
9. The location and elevation of all boreholes, monitoring wells and test pits.
10. Existing and proposed roadways, driveways, laneways, loading areas, parking spaces, curbs, sidewalks, pedestrian crossings garbage enclosures and snow storage areas, including dimensions, radii and proposed materials.

11. The location of the proposed fire route, including indication of heavy-duty road paving. The location of the proposed fire department connection (Siamese connection).

12. Vehicle turning movements for the fire route, loading areas and garbage truck pickup areas.

13. Existing and proposed retaining walls, screens, noise fences, berms, and privacy fences, including materials, height and reference to details.

14. The location of proposed and existing light fixtures and poles.

15. The location of proposed aboveground infrastructure, including catchbasins, maintenance holes, valves, hydrants, and electrical transformers.

16. Pavement markings and signage, including stop, no parking, fire route signs and pedestrian crossings.

17. Locations and dimensions of wells, septic systems and pumping stations where applicable.

J2.03 Sedimentation and Erosion Control Plan

The sedimentation and erosion control plan is to show all the necessary measures proposed to ensure that the effects of soil erosion will not adversely affect adjacent properties or watercourses. The controls are to be planned, designed and illustrated on the plan in accordance with the Town's and local Conservation Authority requirements. Notes describing the process to install, inspect and maintain the erosion and sedimentation control measures are to be included. This plan shall also indicate proposed tree removals and tree preservation measures.

J2.04 Site Grading Plan

The Site Grading Plan shall show the following information:

1. Centreline grades at 15 m intervals along all existing streets bounding the property and existing grades.

2. A legend indicating all drawing information and symbology.

3. Contours at maximum 0.5 m intervals to indicate the existing elevations of the site. These contours are to extend to a minimum distance of 15 m beyond the property limits to indicate the grading and drainage patterns of the adjacent lands. As an alternate to contours, spot elevations may be noted on the drawings to illustrate existing conditions, provided that these elevations were obtained from field survey on a regular grid pattern with the interval not to exceed 15 m.

4. Cross sections as required to clarify the proposed grading, particularly in relation to adjacent lands.

5. Proposed elevations on paved areas, around proposed buildings, along swales, along roadways, parking areas, driveways, catchbasin rim elevations, and any other elevations necessary to establish the grading and drainage patterns for the development. Arrows to be used to indicate direction of the surface drainage.

6. All building elevations to be established and referenced to a “Finished First Floor” or a “Finished Entrance Floor” elevation, and a “Finished Basement Floor” elevation.

7. A typical roadway cross-section to indicate the pavement and granular base design.

8. The location and detail of all curbs.

9. The location of embankments, retaining walls, stairs, play areas, swimming pools, etc.

J2.05 Site Services Plan

The Site Services Plan shall show the following information:

1. All existing underground services on the streets and easements adjacent to the property.

2. The basement floor elevations where applicable.

3. The location, size, length, grade, invert elevations, rim elevations, material and bedding requirements for all sanitary sewers and sanitary maintenance holes to be constructed within the development. Control maintenance holes are to be provided outside the road allowance, at the property line. The length of sewer connection from the building to the first manhole shall note exceed 30 m.

4. The location, size, length, grade, invert elevations, rim elevations, material and bedding requirements for all storm sewers, storm maintenance holes and all stormwater management measures including storage pipe/tanks and control devices, etc. to be constructed within the development. Control maintenance holes are to be provided outside the road allowance, at the property line. The length of sewer connection from the building to the first manhole shall note exceed 30 m.

5. The location, size and material specifications for all watermains including hydrants, valves and water meters to be constructed within the development. All watermains including hydrants, valves, and water meters shall be in accordance with the applicable Town Standards.

6. Water service connections and meters for Site Plan developments are to be designed in accordance with Town Standard W-115 to W-120, or as directed by the Town.

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

8. The location of all roof water leader downspouts.

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

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

The locations of water supply wells to be constructed within the development where required.

J2.06 Landscape Plan

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

All maintenance holes, catchbasins, hydrants, valves, streetlights, slopes, berming, fencing and other servicing features that appear above grade shall also be shown on the Landscaping Plan.

J2.07 Electrical Services Plan and Photometric Plan

The Electrical Services Plan shall be prepared by a qualified Electrical Consultant. The plan shall show all details, specifications and notes of the electrical distribution system and the street and parking lot lighting systems. All hydro lines are to be located underground, unless expressly approved by the Town.

The design of all site and parking lot illumination must be in accordance with the guidelines of the Illuminating Engineering Society of Canada (I.E.S.N.A.) National Standard Practice for Lighting (latest version). Luminaires shall be Light Emitting Diode (L.E.D.) technology. The design engineer is to provide the luminaire manufacturer's recommendation for selection of the Light Loss Factor (L.L.F.) value for design. For L.E.D. technology the L.L.F. is expected to be between 0.8 and 0.9.

To confirm the design meets the required lighting levels, a photometric plan indicating the resulting lighting levels across the site, at the property line and 10 m onto adjacent properties is required to assess light trespass. The photometric analysis shall be prepared based on an adequate number of lighting zones based on the design criteria and the configuration of the site plan.

The following details are to be included in the drawing submission:

1. A summary table of the site lighting statistics based on the photometric analysis and comparison to the required standards noted below. The table is also to confirm the L.L.F. used in the calculations.

2. A detail drawing and specification sheet of the selected luminaires proposed for the site. Note that all luminaires shall be of L.E.D. technology, classified as Fully Cut-Off and designated as “Dark Sky Friendly” as determined by the International Dark Sky Association, with no up-light characteristics.

3. A detail drawing and specification sheet for the selected light poles.

4. A detail drawing and specification for the light pole base foundations.

The standard for industrial/commercial site including service stations and car dealerships is noted in Table J-1:

Table J-1: Site Plan Lighting Requirements

Type	Location	Illumination				
		Minimum (lux)	**Average (lux)**	**Uniformity (Ave / Min)**	**Maximum (lux)**	**Uniformity (Max / Min)**
General Commercial / Retail Plots		5			75	15:1
Service Station with Light Surroundings	Approach & Driveway		20			
	Pump Island		100			
	Building Facades & Service Areas		30			
Car Dealership (Secondary Business Areas or Small Towns)	Front Row				50-100	5:1
	Other Rows				25-50	10:1
	Entrances				25-50	5:1
	Driveways				10-20	10:1
Private Residential	Rear Lane Way		4	6:1		

Type	Location	Illumination				
		Minimum (lux)	**Average (lux)**	**Uniformity (Ave / Min)**	**Maximum (lux)**	**Uniformity (Max / Min)**
Light Trespass: Property adjacent to Residential, Farmlands, Open Space and Environmental areas					3	

The following criteria shall apply to condominium corporation laneway lighting:

1. The maintained average illuminance shall be 4 Lux and the Average to Minimum illumination ratio 6:1.

2. There shall be single-sided lane way lighting poles installed at least 0.5 m behind the curb along the rear lane ways.

3. The luminaires shall be Fully Cut-Off and classified as “Dark Sky Friendly” as determined by the International Dark Sky Association, with no up-light characteristics and L.E.D. technology decorative fixtures as per the Town standard for public roadways.

4. Alternative fixtures are subject to review and acceptance by the Town.

5. There shall be an independent metered power supply and distribution to the streetlights under the control of the condominium corporation.

J2.08 Drainage Area Plan

A plan shall be prepared to a scale of 1:1,000 or 1:2,000, dependent upon the size of the watershed area, to show the nature of the drainage of the lands surrounding the development site, and to show all external drainage areas that are contributory to the drainage system for the development. The external drainage areas shall be divided into smaller tributary areas, and the area and location to which the tributary area is considered in the design shall be clearly shown. The Plan shall clearly show all existing contours used to justify the limits of the external drainage areas.

In lieu of precise information on development on the whole or any part of a watershed area, the latest zoning By-law and Official Plan issued by the Town of Aurora shall be used to determine the correct values of the run-off parameters to be used for all external areas in the design and to determine the specific areas to which these values apply.

An internal storm drainage plan shall be prepared to a scale of 1:200 and shall include all roads, laneways, lots, blocks and other lands within the development. The proposed storm sewer system shall be shown on this plan with all maintenance holes numbered consecutively from the outlet. These maintenance holes shall be the tributary points in the design, and the area contributing to each manhole shall be clearly outlined on this plan. The area, in hectares, of each contributing area (to the nearest hundredth) and the run-off parameter used, shall be shown in a circle located within the contributing area. In cases where areas of different run-off parameters may be tributary to the same manhole, the areas and the parameters shall be separately indicated on the plan.

Stormwater management techniques, including water budget assessments and the use of Low Impact Development techniques (L.I.D.) shall be employed over all sites in accordance with requirements identified under Section D, subject to the Town's approval.

J2.09 Traffic Management Plan (T.M.P.)

In certain cases, the Town may require preparation of a Traffic Management Plan as part of the drawing set that would include all on-site traffic control, parking signs and pavement markings. The T.M.P. is to reflect the findings and recommendations of the T.I.S. and a Parking Study noted in Appendix G and show any measures to address potential impacts on adjacent roads, site access and vehicle and pedestrian movements around the site including underground parking garages. Large vehicle turning movements (fire, delivery, garbage trucks and snow plowing equipment) shall be identified on this plan.

J2.10 Construction Management Plan (C.M.P.)

A Construction Management Plan shall be prepared to ensure that construction operations on and adjacent to the proposed development minimizes impact to adjacent public and private lands and ensures public safety at all times. The C.M.P. shall include the following as required by the individual development.

1. Construction phasing limits if applicable.

2. Site access details including location, dimensions and structure makeup. This generally is to conform to York Region Standard DS-217 or approved equivalent.

3. Temporary construction fencing location and details to ensure site security at all times during construction.

4. Site office, material storage and staging areas, worker parking areas, concrete truck washout area.

5. General notes, including but not limited to:

    a) Construction working hours and noise restrictions per applicable Town By-laws.

b) Municipal road cleaning requirements.

c) Site deliveries, material removal and constructed traffic queuing.

d) Crane operations if applicable.

e) Signage and site security.

J3.00 Design Requirements

J3.01 Site Grading Design

Grading design shall meet the requirements of Section G Lot Grading unless otherwise noted.

1. The drainage of the site is to be self-contained. Any external drainage is to be accommodated within the design of the site drainage system.

2. The grading of the site is to be compatible with the elevation of the surrounding lands.

3. Any proposed retaining walls are to be designed, constructed and certified in accordance with Section F3.07 of these guidelines.

4. All grassed embankments shall have a maximum slope of 3:1.

5. Drainage shall be directed away from buildings and conveyed by sheet flow or in defined swales. The grade of grassed or other landscaped areas shall have a maximum slope of 5.0% and a minimum slope of 2.0%. Finished lot grades in sodded areas within 0.6 m of a property line are to be no greater than 5% slope to allow for grass cutting adjacent to property line fencing.

6. Swales on grassed areas shall have a minimum slope of 2% and a maximum slope of 5% as well as such that the velocity for the flow contained does not exceed 1.25 metres per second. Where approved by the Town in areas of granular soils and low water tables, lower swale grades may be considered if it is deemed by the Town to be necessary.

7. The maximum length for any drainage swale shall be 75 m.

8. The minimum depth for any drainage swale shall be 150 mm.

9. The maximum depth for any drainage swale shall be 450 mm.

10. The maximum side slope on any drainage swale shall be 3:1.

J3.02 Roadway and Driveway Design

1. All roadways shall be designed in accordance with Section B Roads, unless noted otherwise.

2. The necessary pavement markings and signage for internal roadway traffic control, parking space designations and site accesses are to be shown on the plans. and shall be in accordance with Section G Traffic Signs and Pavement Markings, unless otherwise noted.

3. Pavement design suitable for heavy duty traffic and fire routes shall be provided by the consulting geotechnical engineer. The minimum pavement design for all industrial, commercial and multiple-family residential roadways shall be:

Regular Duty

a) Subgrade compacted to 95% proctor density.

b) 200 mm compacted depth of 50 mm crushed limestone.

c) 150 mm compacted depth of 19 mm crushed limestone.

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

e) 25 mm compacted depth of HL3 asphalt surface course.

Heavy Duty

a) Subgrade compacted to 95% proctor density.

b) 300 mm compacted depth of 50 mm crushed limestone.

c) 150 mm compacted depth of 19 mm crushed limestone.

d) 75 mm compacted depth of HL8 asphalt base course.

e) 50 mm compacted depth of HL3 asphalt surface course.

4. All residential driveways in multi-unit plans shall be paved with asphalt or an approved alternate from the edge of the roadway to the building or garage. The minimum asphalt pavement design for all driveways shall be:

a) Subgrade compacted to 95% proctor density.

b) 150 mm compacted depth of 20 mm crushed limestone.

c) 50 mm compacted depth of HL3 asphalt.

5. All roadways serving projects shall be designed to facilitate passage of emergency and service vehicles. The minimum width of a roadway for two-way traffic with no street parking shall be 6.50 m. Refer to Section J3.03regarding fire route requirements. Driveway geometry is to be in general conformance with O.P.S.D. 350.010 with the following revisions:

   a) The minimum width of a driveway entrance for two-way traffic shall be 6.50 m.

   b) Curb returns having a minimum radius of 7.50 m radius and centerline of pavement to have a minimum radius of 12.0 m.

   c) The Town may require the submission of turning envelopes of design vehicles with the Site Plan submission. The required design vehicles will be determined by the Town.

6. The Town does not support the use of proposed dead-end streets within Site Plans. Where dead end streets are unavoidable, provision shall be provided for vehicle turning with the use of turning circles.

7. The minimum grade for any driveway shall be 0.5% and the maximum grade shall be 6.0%. The desirable range for driveway grades is 2% to 5%. Driveway grade beyond this range shall only be permitted with Town approval. All driveway aprons shall be sloped towards the roadway.

8. Driveway entrances shall be such that the minimum sight distance shall be per the Region of York standards or the T.A.C. design manual. The sight distance requirements are to be based on roadway design speed versus the posted speed and are to account for turning sight distances where applicable.

9. Sidewalks in the street boulevard are to be continuous through the driveway entrances to properties developed under Site Plan control.

10. Driveway entrances are to be paved from the curb to the property line and defined with barrier curb per O.P.S.D. 350.010. Where curb exists at the proposed entrance location, it is to be removed and replaced with a poured drop curb section. Cutting of existing curb is not permitted.

11. If rural entrances are to be relocated or decommissioned, existing culverts are to be removed and the ditch regraded and restored with a minimum 150 mm depth of topsoil and nursery sod.

J3.03 Fire Routes

The Town of Aurora requires submission of a completed Fire Route application form for every site plan development. The form is available on the Town's website. The fire route will be signed accordingly and enforced by a site-specific By-law.

The designated fire route providing access through the property shall meet the following requirements or the latest requirements stipulated under the Ontario Building Code:

1. Be connected to a public road allowance.

2. Have a clear width of 6 m.

3. Have a centerline radius of not less than 12 m, and a curb radius of 9m.

4. Have an overhead clearance not less than 5 m.

5. Have a change in gradient not more than 1 in 12.5 over a minimum distance of 15 m.

6. Dead-end sections of the access routes are not permitted (see Section K3.02.6)

7. Shall consist of heavy-duty asphalt or concrete or other material acceptable to the Town in order to support the expected loads of firefighting equipment and to permit accessibility under all climatic conditions.

J3.04 Site Boundary Conditions

Design of the site servicing and grading is to include all screening, fencing and berming along the property boundaries in accordance with Town requirements, the approved noise report recommendations and the landscaping plan. These features and associated details are to be included on the drawings submitted for Site Plan approval.

J4.00 Storm Sewers and Stormwater Management under Site Plan Control

J4.01 General

All future development blocks within a plan of subdivision shall have a storm drain installed from the mainline storm sewer to the street limit of the proposed block. Stormwater management shall be in accordance with the approved Secondary Plan supporting documentation, subdivision plan or other requirements of the Town and the local Conservation Authority. A separate Stormwater Management Report is to be prepared to demonstrate how stormwater quality and quantity are to be controlled on the site.

J4.02 Storm Sewer Design and On-Site Stormwater Management

All storm sewers within a development proceeding under Site Plan control are to be designed in accordance with Section E Storm Drainage and Stormwater Management, including level of service.

The estimation of peak design flow rates can be done using the Modified Rational Method or computer model simulation. The Modified Rational Method is typically used to design storm sewers and estimate peak flow rates from small urban areas. Its application should be limited to scenarios where the time of concentration (tc) is less than approximately 30 minutes.

The Modified Rational Method may also be used to design detention storage for small sites, generally less than 5 ha. The following method is described in the Hydrology Handbook (1996). A trapezoidal hydrograph is obtained by setting rising and receding limbs equal to tc. The volume of required detention storage is the area between the trapezoidal inflow hydrograph and the outflow hydrograph, the latter being the allowable controlled discharge. Storage volume is then computed as:

$V p = Qp D – Qo (D+tc)/2$

Where: D = Duration of rainfall (minutes)

Qp = the runoff peak for that duration (m^3/s)

Qo = the maximum allowable discharge from the area (m^3/s)

tc = time of concentration (minutes)

Source: Hydrology Handbook (A.S.C.E. Manuals and Reports on Engineering Practice No. 28), Second Editio pp580-582, Copyright 1996, I.S.B.N. 0-7844-0138-1.

The condition or capacity of the receiving watercourse or sewer will determine the appropriate release rate. As a minimum, the 2 year through 100 year design storms are to be controlled to predevelopment rates. Where one control device is proposed, it shall control the full range of design storms and the maximum required storage is to be based on control of the 100 year storm to the 2 year pre-development flow rate or as otherwise directed by the Town or the local Conservation Authority. A spreadsheet model programed with the above post development runoff and storage calculations is to be submitted for review and approval. The storage calculations are to be presented based on a 1-minute timestep to confirm the maximum storage required.

The time of concentration (tc) shall be determined as outlined in Section E5.05.

Computer analyses are best suited to large urban areas, rural areas and designing municipal S.W.M. facilities.

The minimum and maximum duration of design storms are 4 hours and 24 hours respectively.

- 24 hour Soil Conservation Service (S.C.S.).
- 12 hour Soil Conservation Service (S.C.S.).
- 4 hour Chicago distribution (i.e., H.G.L. analyses).
- 4 hour Chicago distribution.

Depending on magnitude of the specific project, the Town or the Conservation Authority may request that other design storm lengths and distributions be used.

A copy of all stormwater management calculations, including storm sewer design sheets, signed and stamped by a Professional Engineer are to be submitted to the Town.

Each site plan development is required to include stormwater pre-treatment devices sized to remove 80% of suspended solids from the runoff from the site before entering the municipal sewer system. Calculations demonstrating the correct sizing of the units are to be included in the stormwater management report.

J4.03 Site Water Budget and LID Design

A site-specific water budget and L.I.D. design report is to be prepared per the requirements of Sections A 3.02 q), E2.02 and E2.03.

J4.04 Storm Sewer Connection Size

The storm drain connection for all site plans shall be sized individually according to the intended use of the lands, to any on-site stormwater management control requirements and in accordance with the requirements of Section E. The minimum connection sewer size is 300 mm diameter.

J4.05 Depth of Storm Sewer Connection

The depth of the storm drain connection shall be governed by the grading of lands and the extent of the area to be served. The depth of the connection shall be sufficient to provide for drainage of all lands within the block, but in no case shall the depth to the top of the pipe be less than 1.5 m.

Where storm sewers are aligned parallel to building foundations, the sewer setback from the foundation shall be sufficient to ensure that the trench excavation for the sewer is beyond the area of influence for the foundation bearing. Trench cross sections may be requested to illustrate that this requirement is met.

J4.06 Storm Control Maintenance Hole

A storm sewer control manhole is to be installed immediately inside the property line and is to be accessible for inspection of the sewer and incoming flow by the Town. The control manhole is to be sized based on the O.P.S.D. to accept the outflow sewer from the private development and the municipal service connecting the main storm sewer.

J4.07 Connection to Main Sewer

The connection of the storm drain to the storm sewer may be made at a maintenance hole or directly to the storm sewer if the size of the connection is less than one-half of the size of the storm sewer. If the connection size is greater than one half the size of the main sewer, the connection must be made to a manhole on the storm sewer. A control manhole must be installed on the private lands within 1.5 m of the street limit for all site plans, unless otherwise approved by the Town.

J4.08 Storm Drain Materials

Storm sewer materials are to meet the requirements of Section E6.01.

J4.09 Bedding for Storm Drain Connections

Storm sewer bedding is to meet the requirements of Section E6.02.

J4.10 Construction

All storm drain connections shall be constructed in accordance with the specifications and Standard Detail Drawings of the Town of Aurora, current at the time of approval of the Engineering Drawings by the Town.

J5.00 Sanitary Sewers

J5.01 General

All future development blocks within a plan of subdivision shall have a sanitary drain installed from the mainline sanitary sewer to the street limit of the proposed block. Sanitary sewer design for the block shall be in accordance with the approved Secondary Plan supporting documentation, subdivision plan or other requirements of the Town and Region.

Where the proposed development land use zoning differs from the current approved land use zoning, a detailed design study may be required to ensure that the receiving sanitary system has sufficient capacity for the proposed development. All tributary sanitary drainage areas, including future development lands, are to be considered in assessing the capacity of the receiving system. The Town will not consider the use of on-site sanitary flow storage to address

the issue of existing system capacity. Any required upgrades to the Town's sanitary sewer system, resulting from the proposed development will be the responsibility of the applicant.

J5.02 Sanitary Sewer Design

All sanitary sewers within a development proceeding under Site Plan control are to be designed in accordance with Section C Sanitary Sewers and Appurtenances.

J5.03 Sanitary Sewer Connection Size

The sanitary drain connection for all site plans shall be sized individually according to the intended use of the lands, and in accordance with the requirements of Section C. The minimum connection sewer size is 200 mm diameter.

J5.04 Depth of Sanitary Sewer Connection

The depth of the sanitary drain connection shall be governed by the grading of lands and the extent of the area to be served. The depth of the connection shall be sufficient to provide for drainage of all lands within the block, but in no case shall the depth to the top of the pipe be less than 1.5 m.

Where sanitary sewers are aligned parallel to building foundations, the sewer setback from the foundation shall be sufficient to ensure that the trench excavation for the sewer is beyond the area of influence for the foundation bearing. Trench cross sections may be requested to illustrate that this requirement is met.

J5.05 Sanitary Control Maintenance Hole

A sanitary sewer control manhole is to be installed immediately inside the property line and is to be accessible for inspection of the sewer and incoming flow by the Town. The control manhole is to be sized based on the O.P.S.D. to accept the outflow sewer from the private development and the municipal service connecting the main sanitary sewer.

J5.06 Connection to Main Sewer

The connection of the sanitary drain to the storm sewer may be made at a maintenance hole or directly to the sanitary sewer if approved by the Town.

J5.07 Sanitary Drain Materials

Sanitary sewer materials are to meet the requirements of Section C3.02.

J5.08 Bedding for Sanitary Drain Connections

Sanitary sewer bedding is to meet the requirements of Section C3.13.

J5.09 Construction

All sanitary drain connections shall be constructed in accordance with the specifications and Standard Detail Drawings of the Town of Aurora, current at the time of approval of the Engineering Drawings by the Town.

J6.00 Domestic Water Supply and Fire Protection Water Connections

J6.01 General

All sites are to include a water connection from the main to the street line in accordance with the standards of the Town. All watermain design is to meet the requirements of Section F1.00 Watermains and Appurtenances.

J6.02 Commissioning, Testing and Certification of Water Connections

All testing and commissioning procedures are to be as outlined in the Drinking Water Quality Management Standards of the Town. For all new piping 100 mm diameter and larger, the Development Engineer is to inspect its construction, supervise the sampling, testing and commissioning of the system and certify to the Town that the required standards have been met. The completed forms and results of water sample testing from the new system is to be submitted to the Town prior to occupancy of the buildings.

J6.03 Pipe Specifications

The water system design, including materials and bedding is to meet the requirements of Section F.

The provision of the pipe, the size and the need are to be established by an architect or engineer as necessary for the applicable use of the site. Design parameters will include the fixture demands of the proposed use, requirements for fire suppression, building code requirements, etc.

Generally, only one service connection pipe is permitted to any site and should be such as to provide for fire suppression systems and domestic needs. All water flows into the site are to be metered.

J6.04 Metering

All flows are to be metered and the meter product material is to be as stipulated by the Town, all at the cost of the proponent.

J6.05 Connections to Main

All connections to the Municipal water system are to be approved by the Town. Connection configuration will be assessed by the Town on a site-specific basis. The specific requirements for each site plan connection are to be developed in conjunction with the Consultant based on the expected use and scale of the site, buildings, etc. The proponent should pre consult with Town staff to determine the approach to be used for the specific application. The following shall apply:

There shall be no private watermains within the public road allowance.

The system shall include a backflow preventer at the private/public interface or as the first control device within a building's mechanical room providing no branching or services are designed between the control valve at the property line and the mechanical room.

Each condominium corporation shall have at least one independent connection to a municipal watermain. Two connections are recommended to each condominium corporation.

J6.06 Fire Hydrants and Fire Department Sprinkler Connections

For fire protection purposes, hydrants are required to be located within 90 m horizontally of any portion of a building perimeter required to face a street. The architect and engineering consultant are to review the Ontario Building Code requirements with respect to hydrant coverage for each application.

The fire department connection for an automatic sprinkler system shall be located such that the distance from the fire department connection to a hydrant is unobstructed over a distance of no more than 45 m.

All fire hydrants shall Meet the requirements of Section F5.05 and F5.06.

J7.00 Private Servicing of Residential Lots

J7.01 General

All private wells and/or waste-disposal systems shall be constructed in accordance with the appropriate legislation and regulation administered by the M.E.C.P. and such requirements specified by the York Regional Health Unit.

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

J7.02 Water Supply Systems

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

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

3. Each well shall be capable of delivering at least 9 L/minute of essentially sand free water for a continuous 6-hour period or 2, 4-hour periods during any given 24 hour period, as determined by a controlled-discharge pumping test.

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

5. Where in-house fire sprinkler systems are proposed, water volumes and pumping rates greater than those mentioned above may be required. An architect or development engineer in consultation with the applicant's hydrogeologist is to propose a design flow based on the structure characteristics. A combined well pumping capacity and storage system to meet the required flows and volumes is to be designed and submitted.

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

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

J7.03 Waste Disposal Systems

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

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

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

J7.04 Certification of Services

The Applicant shall retain a qualified Consultant approved by the Town who specializes in the design of private well and sewage systems. This Consultant will be responsible to both the Applicant's Consultant and the Applicant to complete the design, supervise and provide on-site inspection for the installation of private systems on the lots, and certify that the private systems have been installed in accordance with all approved drawings and to the satisfaction of the Town, York Region Health Unit, and the M.E.C.P.

J7.05 Landscaping Design

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

J7.06 Electrical Design Requirements

The requirements for the design of the electrical distribution system and the street lighting shall be agreed upon with Alectra and the Town of Aurora.

J8.00 Final Submissions and Approvals

J8.01 "Construction Record" Drawings

After all construction is complete, the design drawings shall be amended to incorporate the changes and alterations made during construction in order that the drawings as amended represent the services and conditions as construction. One (1) digital copy (in PDF format) of the construction record drawings, signed by a Professional Engineer, is to be submitted to the Town of Aurora.

J8.02 Site Plan Certification

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

J8.03 Final Inspection

Upon completion of all construction, the Applicant shall request the Town of Aurora to carry out a final inspection of the works. All deficiencies found during this final inspection shall be immediately corrected by the Applicant. This final inspection is carried out for the benefit of the Town of Aurora and shall in no way relieve the Applicant of his obligations under the Condominium Act and the Site Plan Agreement.

The Engineer shall provide a letter certifying that all works have been constructed in accordance with the plans and specifications as indicated on the Construction Record drawings.

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Section K Conveyance of Easements and Blocks

Section K Conveyance of Easements and Blocks

K1.01 Easements and Blocks

The Town shall require blocks of land or easements to be conveyed without consideration, free and clear of all liens and encumbrances, to the minimum width requirements, or to a greater width as determined by the Town in the following circumstances.

In general, all municipal sewers and watermains are intended to be located within municipal lands or along rights of ways and not located on private lands.

K1.02 Easements are Required

The Town shall require an easement to be conveyed without consideration, and all prior liens and encumbrances shall postpone their interest in favour of such an easement, to at least the minimum requirements to the Town of Aurora Design Guidelines.

- Rear and side yard drainage swales where drainage from more than one lot or 0.5 ha, whichever is greater, is provided.
- Rear and side yard piped storm drainage systems, including catchbasins, French drains, maintenance holes and other appurtenances.
- Easements for sanitary sewers, storm sewers or watermain.
- Easements for walkways and trails where private property acts as a public corridor or as a shared corridor between private properties.
- Easements for road drainage shall be employed only where a block of land is impractical in the opinion of the Town.

K1.03 Conveyance of Blocks of Land are Required

Conveyance of blocks of land are required for:

- All overland flow routes, open channels and defined drainage systems accommodating a major storm.
- Walkways, bicycle paths and community mail centres.
- Valleys, streams, open channels, watercourses (whether flowing or intermittent), seepage areas, wetlands, natural bodies of water and floodplain lands identified by the Town as being environmentally significant requiring protection or designated as hazard or open space lands.

- Stormwater Management facilities, including detention and retention ponds, water quality control facilities and infiltration facilities.
- Storm sewers, watermains and sanitary sewers (other than private connections).
- Where underground services are required beyond the limits of a subdivision or site plan.

K2.00 Easement Requirements

K2.01 General

With the exception of easements for storm sewer and rear lot catchbasins, easements should be located on one side of the common lot line between adjacent lots. Pipes shall be centered on the easement. The easements will not be permitted to straddle common lot lines. Buildings or building extensions will not be permitted to encroach over the limits of the Town easements.

Easements shall be sized to permit open excavation to accommodate future maintenance of the services and shall consider the use of trench boxes, soils angle of repose, space required for casting of excavated material and construction staging. Site-specific conditions including the location and elevation of existing or proposed foundations which may affect future maintenance or replacement works are to be addressed in determining the easement requirements.

Where two pipes are to be located on one easement, the minimum width of easement shall be the width of easement required for the larger of the two pipes plus half the width of easement for the smaller pipe, rounded to the next 1.0 m increment. Additional easement width may be required to ensure adequate separation between the two pipes and a minimum separation of 3.0 m between the easement limit and the nearest pipe.

K2.02 Storm Connections for Rear Yard Catchbasins

In all cases, a storm connection for a rear yard catchbasin shall be made to a storm manhole in the road allowance to facilitate inspection and potential maintenance or rehabilitation in the future.

The minimum width of permanent easements for leads to rear yard catchbasins shall be a total of 1.8 m for 250 mm diameter pipe sizes. The easement will consist of 1.2 m easement on one lot and 0.6 m easement on the adjacent lot. The lead pipe is to be located 0.5 m from the lot line in the 1.2 m wide easement. For pipe sizes from 300 mm to 450 mm, an easement 3.0 m wide is required entirely located on one lot. In this case, the lead shall be centered on the easement. For pipe sizes greater than 450 mm, criteria under Section K3.02 shall apply.

K2.03 Drainage Swales

The minimum width of permanent easements for lot drainage swales shall be 3.0 m. Additional easement widths may be required depending on the critical depth of swales proposed. Drainage swales are to be centred over easements.

K3.00 Blocks of Land Requirements

K3.01 General

Blocks of land shall be of sufficient dimension to accommodate the proposed facility, access from a public right-of-way, and maintenance requirements. Block widths shall permit open excavation to accommodate future maintenance and shall consider the use of trench boxes, soils angle of repose, space required for casting of excavated material and construction staging. Site specific conditions including the location and elevation of existing or proposed foundations which may affect future maintenance or replacement works are to be addressed in determining the block requirements.

The minimum width of blocks of land for open drainage channels shall be the width of top of open channel plus 3.0 m along one side of the channel for maintenance requirements. The top width of the channel is to be determined using 4:1 sideslopes or flatter without the use of retaining walls.

Valley lands (crest of slope to crest of slope) may be contained within blocks of land to be conveyed to the Town of Aurora, or the appropriate authority, as a condition of development. Blocks of land shall include 3.0 m platform widths on both sides. Blocks of land will not be considered as part of parkland dedication requirements.

K3.02 Storm and Sanitary Sewer Mains

The minimum width of blocks for storm and sanitary sewers shall be in accordance with the following:

Table K-1: Minimum Block Width for Sewers

Size of Pipe	Depth of Invert	Minimum Width of Block
Up to 600 mm	3.5 m maximum	3.0 m
750 mm to 1,500 mm	3.5 m maximum	4.5 m
1,650 mm and up	4.0 m maximum	4.0 m plus 3 times I.D. of pipe, rounded to next 0.5 m increment

K3.01 Watermains

The minimum width of blocks for watermains shall be in accordance with the following:

Table K-2: Minimum Block Width for Watermain

Size of Pipe	Depth of Invert	Minimum Width of Block
Up to 450 mm	3.7 m maximum	3.0 m
600 mm and up	3.7 m maximum	6.0 m

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Appendix A Design Sheets

Appendix A Design Sheets

Appendix A1 Sanitary Design Sheet

Appendix A2 Storm Sewer Design Sheet

Appendix A3 Hydraulic Gradeline Sheet

TOWN OF AURORA

SANITARY SEWER DESIGN SHEET

Sheet No. _____ of _____

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

Q= 400 l/cap day (average)

Project / Subdivision _______________________________

Residential Flow = P x q x M (l/s)

Infiltration Flow = 0.26 l/s/ha

Total Flow = Res + Infilt + Ind.

Date:

Designed by:

Company

LOCATION			AREA AND POP.				FLOW					PIPE						
STREET	FROM U/S MH	TO D/S MH	Area	Accum. Area	POP.	Accum. POP.	M'	Res. Flow	Infilt. Flow	Ind./ Comm.	Total Flow	Length	Dia.	Slope (%)	CAP.	Vel.	Actual Vel.	Remarks

TOWN OF AURORA

STORM SEWER DESIGN SHEET

Sheet No. _____ of _____

Consultant: ____________________

Design by: ____________________

Checked by: ____________________

Date: ____________________

Q= 2.78 x ACI

I = 929.8 / (4 + t)^0.798

T(INIT.) = 10 min

Project / Subdivision ______________________________

STREET	FROM U/S MH	TO D/S MH	Area ha.	C	AC	I mm/hr.	Flow l/s	Diameter nn	Length m	Slope (%)	CAP. l/s	Vel. m/s	Sect. Time	Accum. Time	Actual Vel.	Remarks

TOWN OF AURORA

HYDRAULIC GRADE LINE ANALYSIS

Sheet No. _____ of _____

EL. FROM STREETLINE TO BASEMENT (m)= 1.70
ALLOWABLE DISTANCE FROM BASEMENT TO HGL (m)= 0.50
STARTING DOWNSTREAM HGL (if above obvert) (m) =

Project / Subdivision ______________________________

Date:
Designed by:
Company

LOCATION			INVERTS		FLOW	PIPE DATA								LOSSES					HGL			HGL VS. BASEMENT SEPARATION			
STREET	FROM U/S MH	TO D/S MH	U/S INVERT (m)	D/S INVERT (m)	100 YR. PIPE FLOW (L/s)	DIA. (mm)	LENGTH (m)	n	PIPE AREA (m^2)	HYD. RAD$^{2/5}$	SLOPE (%)	Q cap. (L/s)	Q/Qcap (L/s)	L/D	f	Vf	$V^2/2g$	hl	HGL (U/S) (m)	HGL SURCHARGE ABOVE U/S OBV. (m)	HGL (D/S) (m)	MH TOP U/S (m)	BASEMENT EL. U/S (m)	U/S HGL TO BASEMENT (m)	REMARKS

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Appendix B Standard Letter Forms

Appendix B Standard Letter Forms

No.	Description	Date
B-1	Overall Site Completion Certification Letter	November 2020
B-2	Interim Lot Grading Certification Letter	November 2020
B-3	Final Lot Grading Certification Letter	November 2020
B-4	Lot Grading Reduction of Securities Letter	November 2020
B-5	Retaining Wall Certification Letter	November 2020
B-6	Certification of Completion of Noise Attenuation Works	November 2020
B-7	Stormwater Management Facility Certification Report	November 2020

SAMPLE FORM – OVERALL SITE COMPLETION CERTIFICATION LETTER

Company's Letterhead
(Engineering Firm)

Date:

Town of Aurora
Planning and Development Services – Engineering Division
100 John West Way, Box 1000
Aurora, Ontario
L4G 6J1

Attention: _____
(Director of Planning and Development Services)

Dear Sir:

Re: Engineer Certificate of Completion
(Subdivision or Project Name)
(Subdivision Owner Name)
(Registered Plan No.)

The undersigned hereby certifies that all aboveground and underground public works pertaining to the mentioned subdivision have been completed in accordance with the approved engineering drawings and in accordance with the requirements and specifications as per the subdivision agreement with the Town of Aurora.

I further certify that the maintenance period, as stipulated in the agreement, has expired, and that all deficiencies have been rectified to the Town's satisfaction, and that requirements for final acceptance as set out in the agreement for Planning and Development Services have been complied with.

Sincerely,

_____, P.Eng
(Name) , P.Eng
(Company Name)

ENGINEERS SIGNATURE AND STAMP REQUIRED ON THIS LETTER.

SAMPLE FORM - INTERIM LOT GRADING CERTIFICATION LETTER

Date

Town of Aurora
100 John West Way, Box
1000 Aurora, ON
L4G 6J1

Attn: (Technical Assistant)
Technical Assistant, Planning and Development Services

Re: Interim Lot Grading Certificate
Builder
Name
Lot(s):
Plan:
Date of Inspection:

Based on our recent visual inspection, we hereby certify that the above-noted lot(s) meet the following criteria for "interim occupancy" at the time of our inspection:

1. The grading roughly conforms to the detailed lot-grading plan and there is positive drainage away from the dwelling.

2. There is adequate vehicular access from street to dwelling and there is satisfactory pedestrian access from the driveway to the front door.

3. The municipal number is clearly and permanently affixed to the outside of the dwelling.

4. The adjacent property is in a suitable condition such that it does not appear to pose a safety hazard.

5. The lot is clear of building materials and debris.

6. All other items specifically cited in the *[insert applicable agreement (Subdivision Agreement or Site Plan Agreement or Vacant Land Condominium Development Agreement)]* pertaining to interim occupancy are complied with.

Yours truly,

CONSULTING ENGINEER FIRM

Name of Counsulting Engineer

See Reverse for Comments
Yes ___ No___

cc: Building Administration
Department Builder
Developer

SAMPLE FORM - FINAL LOT GRADING CERTIFICATION LETTER

Date

Town of Aurora
100 John West Way, Box
1000 Aurora, ON
L4G 6J1

Attn: (Technical Assistant)
Technical Assistant, Planning and Development Services

Re: Final Lot Grading Certificate
Builder
Name
Lot(s):
Plan:

Based on our visual inspection conducted on [*insert date*], we hereby certify that the above- noted lot(s) are graded and sodded in general conformity with the general lot grading plans for this development and the approved plot plan. The lot(s) have been sodded for a minimum of one winter and spring season. The driveway(s) has been paved and all required lot improvements have been completed.

Accordingly, we request the release of the applicable securities as stated in the *[insert applicable agreement (Subdivision Agreement or Site Plan Agreement or Vacant Land Condominium Development Agreement)].*

This approval shall not relieve the Builder of his responsibility to correct any settlements or deficiencies, which may occur prior to assumption of the development by the Town.

Yours truly,

CONSULTING ENGINEER FIRM

Name of Consulting

Engineer cc: *Builder*
Developer

SAMPLE FORM

LOT GRADING REDUCTION OF SECURITIES CERTIFICATION LETTER

Date

Town of Aurora
100 John West Way, Box
1000 Aurora, ON
L4G 6J1

Attn: (Technical Assistant)
Technical Assistant, Planning and Development Services

Re: Lot Grading Reduction Certificate
Builder
Name
Lot(s):
Plan:

Based on our visual inspection conducted on [*insert date*], we hereby certify that the above- noted lot(s) are graded and sodded in general conformity with the general lot grading plans for this development and the approved plot plan.

Accordingly, we also request a reduction in the securities held in respect to this lot(s) as stated in the *[insert applicable agreement (Subdivision Agreement or Site Plan Agreement or Vacant Land Condominium Development Agreement)].*

Minor lot grading deficiencies may have been present at the time of the inspection, however they do not pose a safety hazard and the cost of rectification is less than the amount of the securities to be retained after the reduction.

Yours truly,

CONSULTING ENGINEER FIRM

Name of Consulting

Engineer cc: *Builder*
Developer

SAMPLE FORM – RETAINING WALL CERTIFICATION LETTER

Company's Letterhead
(Engineering Firm)

Date:

Town of Aurora
Planning and Development Services – Engineering Division
100 John West Way, Box 1000
Aurora, Ontario L4G 6J1

Attention: _____
(Director of Planning and Development Services)

Dear Sir:

Re: Construction of Retaining Wall
(Subdivision or Project Name)
(Municipal Address of Wall)
(Lot No. and Plan No.)

This letter is to certify that the retaining wall at the above location has been constructed in accordance with the design drawings prepared by_____, dated_____.

We also confirm that the wall is suitable for the type of loading and for the geotechnical condition of the said location.

Sincerely,

_____ , P.Eng
(Name) , P.Eng
(Company Name)

ENGINEERS SIGNATURE AND STAMP REQUIRED ON THIS LETTER.

SAMPLE FORM

CERTIFICATION OF COMPLETION OF NOISE ATTENUATION WORKS

Company's Letterhead
(Engineering Firm)

Date:

Town of Aurora
Planning and Development Services – Engineering Division
100 John West Way, Box 1000
Aurora, Ontario
L4G 6J1

Attention: _____
(Director of Planning and Development Services)

Dear Sir:

Re: Certificate of Completion of Noise Attenuation Works
(Subdivision or Project Name)
(Property Location)
(Registered Plan No.)

The undersigned hereby certifies that all noise attenuation works pertaining to the mentioned subdivision have been completed in accordance with the approved Noise Attenuation Report and in accordance with the requirements and specifications as per the subdivision agreement with the Town of Aurora.

Sincerely,

_____ , P.Eng
(Name) , P.Eng
(Company Name)

ENGINEERS SIGNATURE AND STAMP REQUIRED ON THIS LETTER.

SAMPLE FORM

STORM WATER MANAGEMENT FACILITATION CERTIFICATION REPORT

Company's Letterhead
(Engineering Firm)

Date:

Town of Aurora
Planning and Development Services– Engineering Division
100 John West Way, Box 1000
Aurora, Ontario
L4G 6J1

Attention: _____
(Director of Planning and Development Services)

Dear Sir:

Re: Stormwater Management Facility Certification Report
(*Subdivision or Project Name*)
(*Subdivision Owner Name*)
(*Registered Plan No*.)

The undersigned hereby certifies that the Storm Water Management Facility for the above noted project is functional and meets the design requirements for the volume capacity in accordance with the approved engineering drawings and in accordance with the requirements and specifications as per the subdivision agreement with the Town of Aurora.

I further certify that the as-constructed survey provided has been constructed in general conformance with the approved design and the MOE Certificate of approval No. (*Number required*).

Table 1: Design and As-Constructed Features

Pond Structure *	Design	As-Constructed	Deviation
Inlet Headwall Invert (m)			
Permanent Pool Volume (m)			
Orifice Plate Diameter (mm)			
Orifice Plate Invert (m)			
Extended Detention Elevation (m)			
Extended Detention Time (hr)			
Manhole Weir Invert (m)			
Manhole Weir Length (m)			
Overflow Spillway Invert (m)			
Overflow Spillway Length (m)			
Top of Pond Elevation (m)			
Maximum Side Slope			
Other:			

*** Note:** Each Pond will have its own required structures; the above is for example only.

Table 2: Stage/Storage/Outflow for Pond

Storm Return Period	Design			As-Constructed		
	Q_{out} from Pond	Storage (m^3)	Elevation (m) NWL= _ _ _	Q_{out} from Pond	Storage (m^3)	Elevation (m) NWL= _ _ _ _
2 Year						
5 Year						
10 Year						
25 Year						
50 Year						
100 Year						

Sincerely,

_____, P.Eng
(*Name*), P.Eng
(*Company Name*)

Attach. 1. Pond Approved Plan
2. Pond As-Constructed Survey
3. As-Constructed Hydrology Modelling and Pond Operating Characteristics
4. Maintenance and Operation Guideline

ENGINEERS SIGNATURE AND STAMP REQUIRED ON THIS LETTER.

Appendix C Drawing General Notes

Appendix C Drawing General Notes

Unless otherwise noted on the drawings, the following applicable requirements shall apply to the works.

1. Sewer Pipe Material

1.1 Concrete pipe 450 mm diameter and larger shall be CSA A257.2 with rubber gaskets conforming to CSA A257.3.

1.2 Polyvinyl Chloride DR35 or better based on depth of the pipe shall conform to CSA B182.1, with bell and spigot gasketed joints, complying with CSA 182.2, and all fittings as provided by the CSA certified manufacturer.

1.3 Polyvinyl chloride ribbed pipe shall conform to CSA B182.4, with bell and spigot gasketed joints, complying with CSA 182.2 and 182.4, and all fittings as provided by the CSA certified manufacturer.

1.4 Sewer pipe bedding and cover shall be per Town of Aurora standard drawing S-300 with bedding material being Type 2 (20 mm Crusher Run Limestone) or HL6 limestone with no fine aggregates. Pipe cover material being Granular “B” Type “I” as per O.P.S.S. 1010 with 100% passing the 4.75 mm sieve (no large diameter aggregate permitted). All pipe bedding and cover material to be placed in uniform layers not exceeding 200 mm in thickness, loose measurement, and compacted to at least 98% standard proctor maximum dry density (S.P.M.D.D.) for cover material and 95% S.P.M.D.D. for bedding.

1.5 All trenches are to be backfilled with suitable native material. Backfill material shall be placed in uniform layers not exceeding 300 mm in thickness, loose measurement, for the full width of the trench and each layer shall be compacted to at least 95% standard proctor maximum dry density.

2. Maintenance Holes

2.1 Steps shall be solid aluminum in accordance with O.P.S.D. 405.020.

2.2 Frames and covers shall be Bibby Auto Stable adjustable frames and covers per O.P.S.D. 401.010, Type “A” for sanitary and Type “B” for storm. Sanitary maintenance holes shall be made watertight by installing a 2 mm rubber gasket between the frame and grate and by installing rubber plugs within the grate’s pick holes.

2.3 Maintenance holes are to be set to base course grade and then adjusted to final grade prior to placement of top course asphalt.

2.4 All sanitary maintenance holes shall be precast concrete with a pre-benched monolithic base containing kor 'n' seal or equivalent sewer connection gaskets.

2.5 All maintenance hole benching and benching slopes to follow O.P.S.D. 701.021.

2.6 All maintenance holes are to be benched to obvert.

All sanitary maintenance hole joints, between base of maintenance hole up to the precast concrete adjustment units shall be sealed with an external rubber sleeve (i.e., Gator wrap or equivalent). The width of the rubber sleeve shall be 225 mm (9") or greater. The seal shall be made of a stretchable, self-shrinking, intra-curing halogenated based rubber with a minimum thickness of 30 mils. The backside of each unit shall be coated with a cross-linked re-enforced butyl adhesive. The butyl adhesive shall be non-hardening sealant with a minimum thickness of 30 mils. The seal shall be designed to stretch around the joint and then overlapped creating a cross-linked and fused bond between the rubber and butyl adhesive.

3. Catchbasins

3.1 Catchbasin frame and cover for local residential roads as per Town Standard Drawing S-304, except at road low points and intersections use catchbasin frame and cover as per O.P.S.D. 400.100. Rear lot catchbasins to have square frame with birdcage grate as per O.P.S.D. 400.120. Catchbasin frame and cover for collector, arterial and industrial roads as per O.P.S.D. 400.100. Catchbasin frame and cover for parking lots as per O.P.S.D. 400.020.

3.2 Single catchbasin lead – min. 250 mm diameter.

3.3 Double catchbasin lead – min. 300 mm diameter.

3.4 All catchbasins shall be initially set to base course asphalt.

3.5 Catchbasins are to have sumps; catchbasin/maintenance holes to be sumpless.

3.5 Rear lot catchbasins are to be sumpless and have a pyramid grate.

3.7 Rear-lot catchbasin leads are to be concrete encased.

4. Service Connections

4.1 Sanitary – 125 mm diameter PVC DR28 (green) with inspection chamber installed on property line, and marker painted black.

4.2 F.D.C./Storm –150 mm diameter PVC DR28 (white), with marker painted white.

4.3 Water – 25 mm diameter, type K soft copper ASTM B-88, marker painted blue. Water Services are not to be located within driveways.

4.4 All services shall extend a minimum 1.5 m beyond the property line and

1.5 Service connections are to conform to M-404, M-405 and M-406.

5. Watermains and Appurtenances

5.1 150 mm to 400 mm diameter – watermain shall be PVC per AWWA C-900, Class 150 and blue in colour, complete with an approved form of electrochemical corrosion protection on all iron fittings.

Greater than 400 mm diameter – watermain shall be Ductile Iron Class 52 A.N.S.I. Spec. A21.4-1974 cement-lined and coal tar coated complete with an approved form of electrochemical corrosion protection.

5.2 Ductile Iron watermain shall have no internal bituminous coating.

5.3 50 mm dia. watermain shall be type ‘K’ soft cooper per ASTM B-88.

5.4 Watermain to be bedded in Granular “A” from 150 mm below invert to spring line. Cover material shall be clear san of approved equivalent from spring line to 300 mm above obvert per Standard Drawing W-100.

5.5 Hydrants to have drainage pits, be painted red and be equipped with chains. The hydrant shall have a 100 mm Storz connection and the Storz nozzle painted black.

5.6 Where watermains and service connections cross above sewers sufficient vertical separation shall be maintained to allow for proper bedding and structural support of the watermain and sewer main. When vertical separation is less than the specified bedding depth, the watermain or service connection shall pass under the sewer with a vertical separation of at least 0.5 m between crown of watermain and the invert of the sewer. All crossing pipes shall be supported.

5.7 Watermains shall have a 2.5 m horizontal clearance from other pipes. Water services shall have a 1.2 m horizontal clearance from other utilities.

5.8 Services shall be installed with continuous copper piping from main to service box without joints.

5.9 Valve chambers are required for all valves 300mm diameter and larger.

5.10 Valve boxes shall be telescopic type.

5.11 Tracing wire is to be 12-gauge, plastic-coated, braided copper tracer wire (T.W.U. 75c 600V) and be installed along all mains per Town of Aurora standard Drawings W-105 and W-106.

5.12 Electrochemical corrosion protection for Metallic Watermain and Appurtenances are as follows:

i. All buried valves and fittings shall be wrapped with Denso and/or PetroGuard tape.

ii. All valves and metallic fittings in chambers to be wrapped with Denso and/or PetroGuard tape or protected by installing ¾" large protecto caps on each both equal or as approved.

iii. All metallic fittings, valves and copper water services shall be fitted with 1 lb. zinc anodes (anode type Z-12-24 as specified in OPSS 442) with the exception of valves that are installed in easements or are 400mm in diameter and larger which shall be fitted with 24 lb. zinc anodes (anode type Z-24-48 as specified in OPSS 442).

iv. All hydrant bases shall be fitted with 24 lb. zinc anodes (anode type Z-24-48 as specified in O.P.S.S. 442).

v. All metallic watermain shall be fitted with anodes that are sized and spaced in accordance with Table 4 of O.P.S.S. 442.

vi. Zinc anode placement and installation shall be carried out in accordance with O.P.S.S. 442 and O.P.S.D. 1109.011. Ground clamps are to be used to connect anode wires to copper water services

vii. No copper conductivity strips to be used.

6. General

6.1 Native subgrade to be compacted to minimum 95% standard proctor maximum dry density and shall be proof rolled.

6.2 Structures within the travelled portion of the road shall be backfilled with Granular "B" Type 1 as per O.P.S.S. 1010 with 100% Passing the 4.25 mm sieve. The Granular "B" backfill shall be compacted to 100% S.P.M.D.D. and have 1V:4H frost tapers from frost line to subgrade.

6.3 Concrete sidewalk shall conform to standards R-200 and R-04 and be 125 mm depth except at driveways where minimum depth is to be 175 mm. All sidewalk to be bedded by 100 mm of 19 mm crusher-run limestone.

6.4 Perforated subdrains to be continuous and shall be capped using an expandable plug on low side of catchbasin.

6.5 All driveways shall be constructed from the curb to the dwelling (except for estate lots) with 150 mm of 19 mm crusher-run limestone and 50 mm of HL3A asphalt, unless otherwise approved. For estate lots, only the apron section of the driveway (from the road to the property line) is required to be constructed with asphalt.

6.6 All dimensions for roadways are to edge of the pavement. See standard cross-section for details.

Minimum pavement (compacted thickness) design is:

For residential – local

- 40 mm – HL3 surface course asphalt
- 50 mm – HL8 binding course asphalt
- 150 mm – 19 mm crusher-run limestone base
- 300 mm – 50 mm crusher-run limestone sub-base

For residential collector and Industrial

- 50 mm – HL3 surface course asphalt
- 75 mm – HL8 binding course asphalt
- 150 mm – 19 mm crusher-run limestone base
- 450 mm – 50 mm crusher-run limestone sub-base

6.7 Precast concrete adjustment units (Moduloc or approved equivalent) for maintenance holes and catchbasins shall have a solvent damp proofing mastic asphalt compound applied after parging. Precast adjustment units to be in accordance with OPSD 704.010.

7. Grading

7.1 All grades and swales shall be a minimum 2% and maximum 5%.

7.2 Driveway grades shall be a minimum 2% and maximum 8%.

7.3 Houses shall have a minimum 0.15 m elevation difference to the adjacent swale low point swale.

7.4 Where slopes exceed 5%, 3:1 slopes shall be used to make up difference.

7.5 All roof drains shall discharge onto splash pads on grassed areas.

7.6 Water service valve boxes shall not be located in driveways.

7.7 All lots to have minimum 200 mm topsoil and sod.

7.8 Minimum separation of 150 mm shall be provided between the brickline and the final ground elevation and 200 mm between siding and the final ground elevation.

7.9 Driveways shall be a minimum 1.2 m clear distance from all street hardware (poles, hydrants, catchbasins, utility pedestals, etc.).

7.10 Swale depth to be according to flow – minimum 150 mm.

7.11 Maximum swale length shall be 90 m.

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Appendix D Standard Detail Drawings

Appendix D Standard Detail Drawings

The Town of Aurora utilizes its own standard drawings, standard drawings from other jurisdictions and Ontario Provincial Standard Drawings, either as presented or in modified form.

Drawing No.	Description	Date
E-500	Electrical Abbreviations and Symbols	Sept/09
E-501	Electrical Legend	Sept/09
E-502	Decorative Lighting Pole Direct Buried	Sep/20
E-503	Telecom/Street (Trafalgar) Lighting Pole Direct Buried	Sept/20
E-504	60 inch or 72-inch Decorative Scroll Arm	Sept/20
E-505	Underground Power Supply Mounting Details	Sept/20
E-506	Power Supply on Steel Poles with Buried Hydro Supply	Sept/20
E-507	Underground Hydro Supply Details	Sept/20
E-508	Aerial Cable Attachment Details	Sept/20
E-509	PVC Junction Box Mounting Details	Sept/20
E-510	Typical Pole Guying Details	Sept/20
M-400	Front Lot Drainage	Sept/20
M-401	Split Lot Drainage	Sept/20
M-402	Lot Drainage for Walkout and Backsplit Dwellings	Sept/20
M-403	Lot Grading Plan Requirements for Infill Lots	Nov/09
M-404	Single Lot Servicing	Nov/16
M-405	Semi-Detached Lot Servicing	Nov/16
M-406	Townhouse Unit Servicing	Sept/20
M-407	Lot Grading Plan Requirements for Pool Construction	Feb/22

Drawing No.	Description	Date
R-200	Concrete Sidewalk	Oct/22
R-201	Sidewalk Ramps	Oct/22
R-201a	Detectable Warning Plate	Dec/15
R-202	Driveway Entrance Detail	Aug/15
R-203	Walkway Detail	Feb/09
R-204	Monolithic Concrete Sidewalk and Retaining Wall	Jan/13
R-205	Typical Cul-de-Sac	Mar/14
R-206	Typical Angle Bend Detail	Feb/09
R-207	Traffic Sign and Pavement Marking Installation Detail	Feb/09
R-208	Street Name Sign Detail	Feb/09
R-209	Typical 18 m Residential Right-of-Way	Jan/13
R-210	Typical 20 m Residential Right-of-Way	Jan/13
R-211	Typical 23 m Residential Right-of-Way	Jan/13
R-212	Typical 26 m Residential Right-of-Way	Jan/13
R-213	Typical 20 m Industrial Right-of-Way	Jan/13
R-214	Typical 23m Industrial Right-of-Way	Feb/17
R-215	Industrial, Commercial & Multi-Residential Entrances Curb Detail	Jul/12
R-216	Residential Driveway Curb Detail	Jan/13
R-217	Rural Entrance	Jan/13
R-218	Interlocking Paver Sidewalk	Jan/13

Drawing No.	Description	Date
R-219	Standard Benchmark Detail	Nov/18
R-220	Temporary Barricade with Emergency Access	Sept/20
R-221	Temporary Turning Circle	Sept/20
S-300	Sewer Bedding and Backfill Details	May/23
S-301	Sewer Service Connection Detail	Sept/20
S-302	Catchbasin and Subdrain Detail	Sept/20
S-303	Sanitary Service Inspection Chamber	Sept/19
S-304	Fish Pattern Catchbasin Crate	Sept/20
W-100	Watermain and Water Service Bedding Detail	May/23
W-101	Standard Water Service Connection for 19 mm and 25 mm Diameter	Jan/09
W-102	Circular precast Valve Chamber for 300 mm Watermain	Sept/20
W-103	Precast Valve Chamber for 350 mm and Larger Watermains	Sept/20
W-104	Valve and Box Installation for 150 mm, 200 mm, and 250 mm diameter Watermains	Sept/20
W-105	Hydrant and Valve Installation	Jan/09
W-106	Standard Water Service Connection 32 mm, 40 mm, and 50 mm Diameter	Jan/09
W-107	Water Configuration for Cul-de-Sacs	Sept/20
W-108	Sampling Station	Sept/20
W-109	Air Valve and Chamber	Sept/20
W-110	Drain Valve and Chamber	Sept/20

Drawing No.	Description	Date
W-111	Check Valve and Chamber Detail	Sept/20
W-112	SENSUS OMNI™+ COMPOUND (C^2) Water Meter Chamber Detail for Domestic Service - 100 mm, 150 mm, 200 mm, 250mm, and 300mm	Feb/22
W-112A	SENSUS OMNI™+ FIRELINE® (F^2) Water Meter Chamber Detail for Fire Rated Meter - 100 mm, 150 mm, 200 mm, 250mm, and 300mm	Feb/22
W-113	Combined Fire and Domestic Water Connections	Sept/20
W-114	Single Building Commercial & Industrial Lot Servicing with Private Hydrants	Sept/20
W-115	Single Building Commercial & Industrial Lot Servicing without Private Hydrants	Sept/20
W-116	Multiple Building Commercial & Industrial Lot Servicing with Single Water Connection	Sept/20
W-117	Multiple Building Commercial & Industrial Lot Servicing with Two Water Connections	Sept/20
W-118	Multiple Unit Industrial/Commercial Lot Servicing	Sept/20
W-119	Townhouse Condominium Servicing	Sept/20
W-120	Water Valve Locations at Intersections	Sept/20
W-121	Water Meter Installation in Building - 19mm, 25mm	Jan/22
W-122	SENSUS OMNI™+ COMPOUND (C^2) Water Meter Installation in Building - 38 mm, 50 mm	Feb/22
W-123	SENSUS OMNI™+ COMPOUND (C^2) Water Meter Installation in Building - 75 mm, 100mm	Feb/22
W-124	Total Isolation of Existing and New Systems	Sept/20
W-125	Connection at Existing Valve 300 mm or Greater Watermain	Sept/20

Drawing No.	Description	Date
W-126	Colour Coding of Hydrants	Sept/20
W-127	Automatic Flushing Device	June/23
W-128	Temporary Watermain Connection Detail from Watermain	Sept/20
W-129	Temporary Hydrant Protection Barrier	Sept/ 20

ABBREVIATIONS

AFG	ABOVE FINISHED GRADE
AC	ALTERNATING CURRENT
AI	ALUMINUM
AWG	AMERICAN WIRE GAUGE
AMB	AMBER
BFG	BELOW FINISHED GRADE
BGRD	BARE GROUND
BLK	BLACK
BLU	BLUE
CCT	CIRCUIT
CE CODE	CANADIAN ELECTRICAL CODE
CU	COPPER
CCTV	CLOSED CIRCUIT TELEVISION
COMM	COMMUNICATION
C/W	COMPLETE WITH
COND	CONDUCTOR
CONT	CONTROL
CDT	CONDUIT
CSA	CANADIAN STANDARDS ASSOCIATION
DB	DIRECT BURIED
DC	DIRECT CURRENT
EC	ELECTRICAL CHAMBER
EMI	ELECTROMAGNETIC INTERFERENCE
ELV	EXTRA LOW VOLTAGE
EQPT	EQUIPMENT
ESA	ELECTRICAL SAFETY AUTHORITY
FOC	FIBRE OPTIC CABLE
ATMS	ADVANCED TRAFFIC MANAGEMENT SYSTEM
GRN	GREEN
GRD	GROUND
HW	ELECTRICAL HANDWELL
HV	HIGH VOLTAGE
HEC	HYDRO ELECTRIC COMMISSION
IESNA	ILLUMINATION ENGINEERING SOCIETY OF NORTH AMERICA
IGRD	INSULATED GROUND (GREEN)
IMPD	IMPEDANCE
IND	INDUCTANCE
ITS	INTELLIGENT TRANSPORTATION SYSTEMS
JB	JUNCTION BOX
LCS	LANE CONTROL SIGN
LV	LOW VOLTAGE
MH	ELECTRICAL MAINTENANCE HOLE
NEUT	NEUTRAL
NIC	NOT INCLUDED IN CONTRACT
NTS	NOT TO SCALE
OESC	ONTARIO ELECTRICAL SAFETY CODE
PCS	PERMANENT COUNTING STATION
PUC	PUBLIC UTILITIES COMMISSION
PVC	POLYVINYL CHLORIDE
PXO	PEDESTRIAN CROSSOVER
RF	RADIO FREQUENCY
RFI	RADIO FREQUENCY INTERFERENCE
RMS	RAMP METERING STATION
TS	TRAFFIC SIGNAL
XFMR	TRANSFORMER
UPC	UNDERPAVEMENT CROSSING
VDS	VEHICLE DETECTOR STATION
WHT	WHITE
YEL	YELLOW

ELECTRICAL SYMBOLS

A	AMPERE	Ω	OHM
F	FARAD	V	VOLT
H	HENRY	VA	VOLT AMPERE
Hz	HERTZ	W	WATT
		Wh	WATT HOUR

IDENTIFICATION CODES FOR EXISTING CABLES, Note 1

BCU	BELL CABLE, UNDERGROUND
CCA	COMMUNICATIONS CABLE, AERIAL
DC	EXTRA LOW VOLTAGE DETECTOR CABLE
GC	GUY CABLE
HC	HYDRO CABLE
LC	LIGHTING CABLE
PC	POWER CABLE
TS	TRAFFIC SIGNAL CABLE
TV	TELEVISION CABLE

IDENTIFICATION CODES FOR EXISTING POLES

A	AUTHORITY OWNED POLE
B	BELL POLE
C	COMMUNICATIONS POLE
GP	GUY POLE
H	HYDRO POLE
HM	HIGH MAST LIGHTING POLE
LS	LIGHTING POLE
TS	TRAFFIC SIGNAL POLE
TV	TELEVISION POLE

NOTE 1. ADD SUFFIX 'U' FOR UNDERGROUND OR SUFFIX 'A' FOR AERIAL.
NOTE 2. ADD PREFIX 'E' TO INDICATE EXISTING. EG. EJB (EXISTING JUNCTION BOX).

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REVISION: **SEPT 2009**

DRAWING NO.: **E-500**

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ELECTRICAL ABBREVIATIONS AND SYMBOLS

DUCTS AND CABLES

DUCTS AND/OR CABLES, UNDERGROUND

DUCTS AND/OR CABLES, SURFACE MOUNTED

Exp

DUCTS AND/OR CABLES EMBEDDED. "EXP" INDICATES EXPANSION JOINT

CABLES, INSTALLED IN EXISTING DUCTS

CABLES, AERIAL

23

UNDERPAVEMENT CROSSING IDENTIFICATION CODE

DUCT STUB WITH PLUG

HCA BCA — HCA BCA

EXISTING CABLES AND/OR DUCTS TO REMAIN IN PLACE

LCU — LCU

EXISTING CABLES AND/OR DUCTS TO BE REMOVED

LCA — LCA

EXISTING CABLES AND/OR DUCTS TO BE ABANDONED

MANHOLES, JUNCTION BOXES

JB36

JUNCTION BOX, EMBEDDED OR SURFACE MOUNTED WITH IDENTIFICATION CODE

HW21

ELECTRICAL HANDWELL, UNDERGROUND WITH IDENTIFICATION CODE

PADS AND FOOTINGS

F43

FOOTING IN EARTH OR ROCK WITH IDENTIFICATION CODE

F44

FOOTING ON STRUCTURE WITH IDENTIFICATION CODE

SF3

SIGN FOOTING WITH IDENTIFICATION CODE

POLES

P24

POLE WITH IDENTIFICATION CODE

EP32

LS

EXISTING POLE TO REMAIN WITH IDENTIFICATION CODE

LS

R33

EXISTING POLE TO BE REMOVED WITH IDENTIFICATION CODE

GUYING

SINGLE GUY WITH SINGLE ANCHOR

DOUBLE GUY WITH SINGLE ANCHOR

DOUBLE GUY WITH DOUBLE ANCHOR

SINGLE GUY WITH SIDEWALK STRUT AND SINGLE ANCHOR

LUMINAIRES

LUMINAIRE

L18

UNDERPASS OR SURFACE MOUNTED LUMINAIRE WITH IDENTIFICATION Code

LUMINAIRE WITH BRACKET

EXISTING LUMINAIRE AND BRACKET TO BE REMOVED

POWER SUPPLY

POWER SUPPLY EQUIPMENT

T

TRANSFORMER

GENERATOR

POWER SUPPLY EQUIPMENT, PAD AND/OR FOOTING MOUNTED.

PE

PHOTOELECTRIC CONTROLLER

SUPPLY 'A' 120/240V, 1ø 3W

POWER SUPPLY EQUIPMENT IDENTIFICATION CODE OTHER DESCRIPTION MAY BE USED FOR TRANSFORMER, GENERATOR, ETC.

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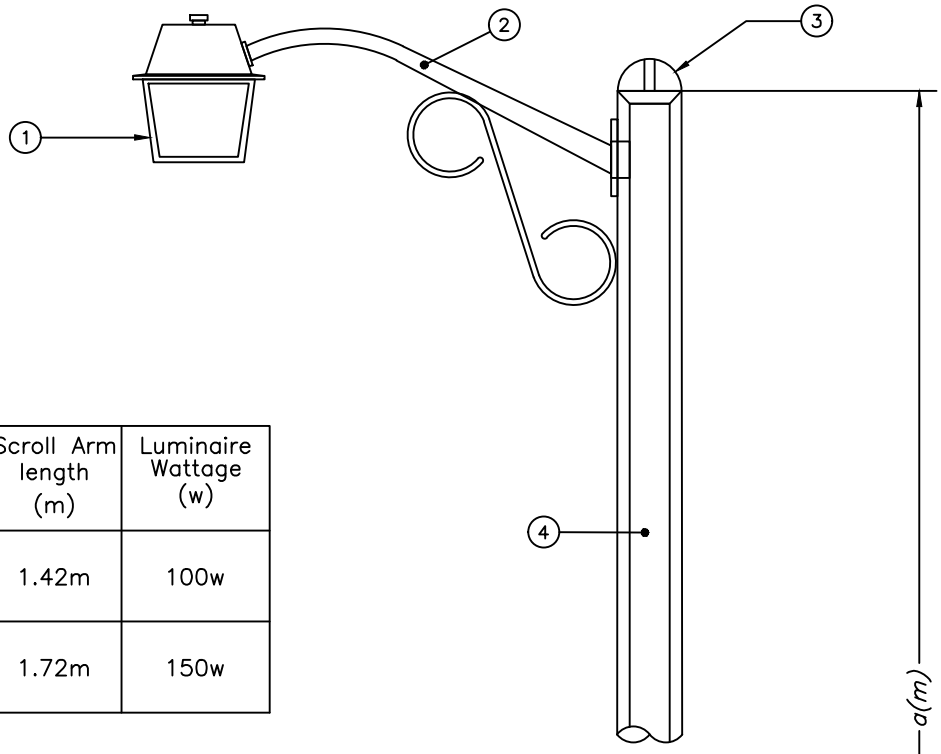
ELECTRICAL LEGEND

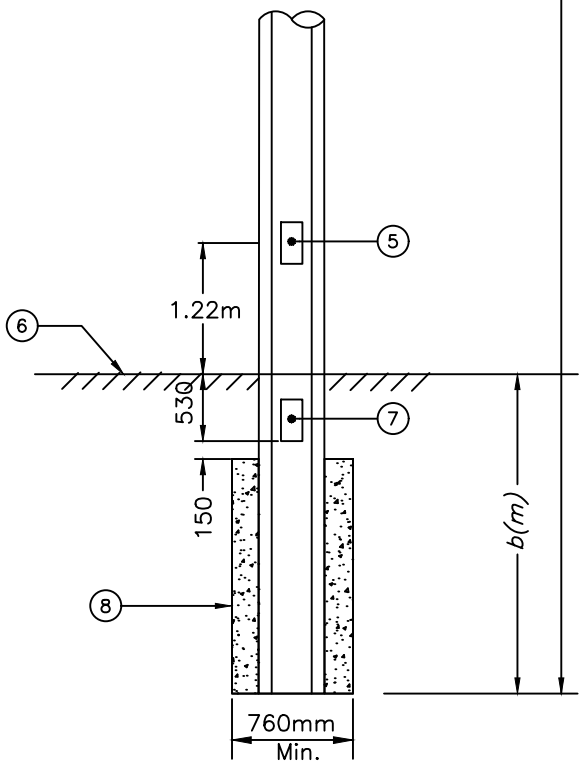
DRAWING NO.: E-501



Pole Length 'a'(m)	Burial Depth 'b'(m)	Scroll Arm length (m)	Luminaire Wattage (w)
8.8m	1.65m	1.42m	100w
9.6m	1.65m	1.72m	150w

MATERIALS:

1. "SPRINGDALE" BLACK COACH STYLE LUMINAIRE
2. BLACK BRACKET SCROLL ARM
3. BLACK FINNED POLE CAP
4. BLACK DIRECT BURIED CLASS 'A' OCTAGONAL PRESTRESSED CONCRETE POLE
5. POLE HAND HOLE
6. FINISHED GRADE
7. UNDERGROUND THROUGH WIRING APERTURE
8. CONCRETE ENCASEMENT IN EARTH



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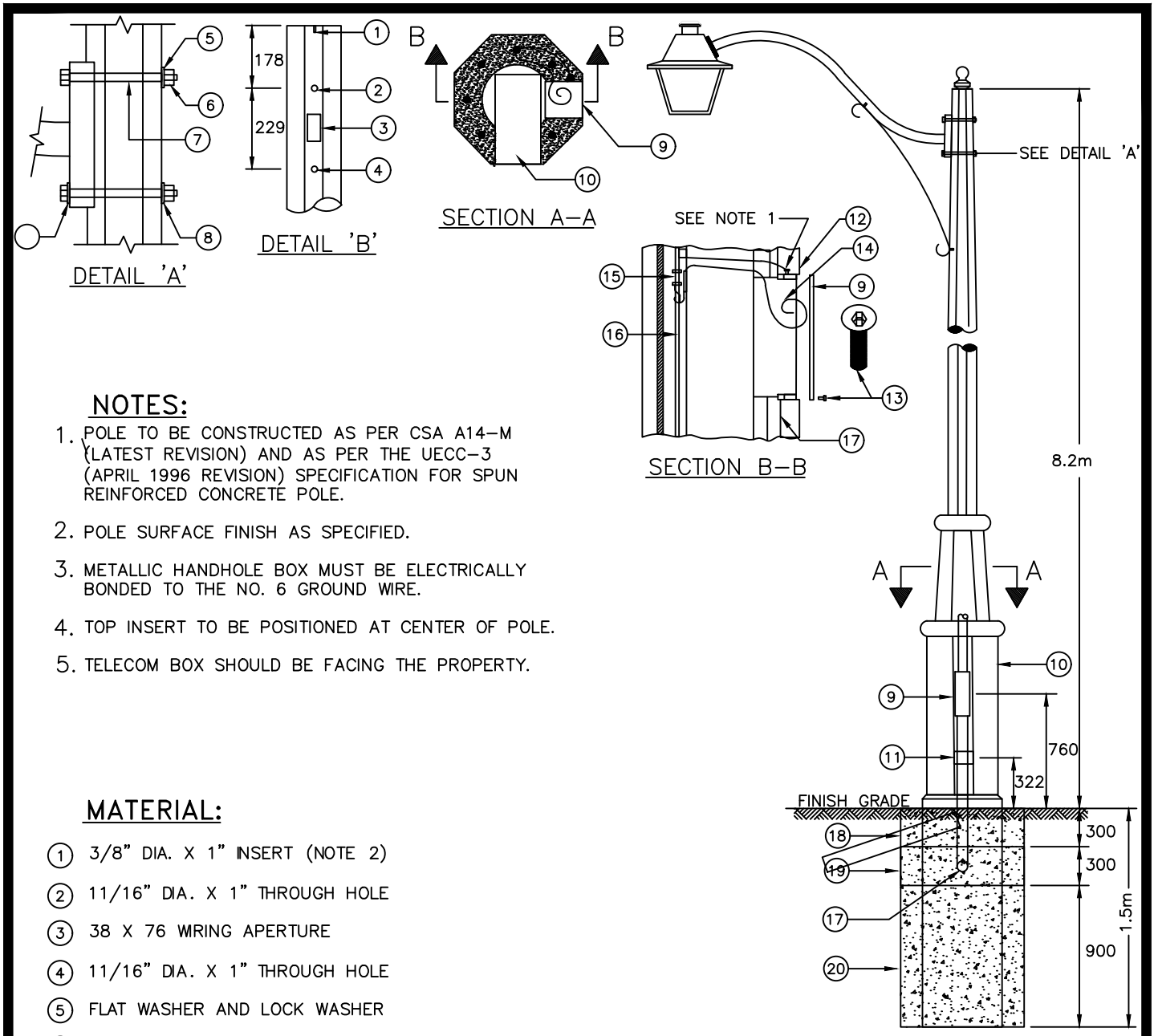
DECORATIVE LIGHTING POLE DIRECT BURIED



NOTES:

1. POLE TO BE CONSTRUCTED AS PER CSA A14–M (LATEST REVISION) AND AS PER THE UECC–3 (APRIL 1996 REVISION) SPECIFICATION FOR SPUN REINFORCED CONCRETE POLE.
2. POLE SURFACE FINISH AS SPECIFIED.
3. METALLIC HANDHOLE BOX MUST BE ELECTRICALLY BONDED TO THE NO. 6 GROUND WIRE.
4. TOP INSERT TO BE POSITIONED AT CENTER OF POLE.
5. TELECOM BOX SHOULD BE FACING THE PROPERTY.

MATERIAL:

(1) 3/8" DIA. X 1" INSERT (NOTE 2)

(2) 11/16" DIA. X 1" THROUGH HOLE

(3) 38 X 76 WIRING APERTURE

(4) 11/16" DIA. X 1" THROUGH HOLE

(5) FLAT WASHER AND LOCK WASHER

(6) NUT

(7) 5/8" X 8" BOLT

(8) FLAT WASHER

(9) DEEP CAST METALLIC HANDHOLE BOX AND COVER. (89X261X127)

(10) TELECOM BOX (NOTE 3)

(11) POLE IDENTIFICATION PLATE

(12) 1/4"–20X3/4" THREADED CORE. ALLEN KEY BUTTON PAN

(13) 1/4"–20X3/4" ALLEN KEY BUTTON PAN HEAD STAINLESS STEEL BOLT.

(14) GROUNDING LEAD– USE NO. 6 AWG MIN. STRANDED CU. WIRE, THREE TURNS, CRIMPED TO STEEL ROD. LEAD TO EXTEND 305MM OUTSIDE THE HANDHOLE.

(15) CRIMP CONNECTOR

(16) STEEL ROD

(17) 2" DIA. PVC DUCT

(18) CLEAN BACKFILL

(19) SAND

(20) LIMESTONE SCREENING

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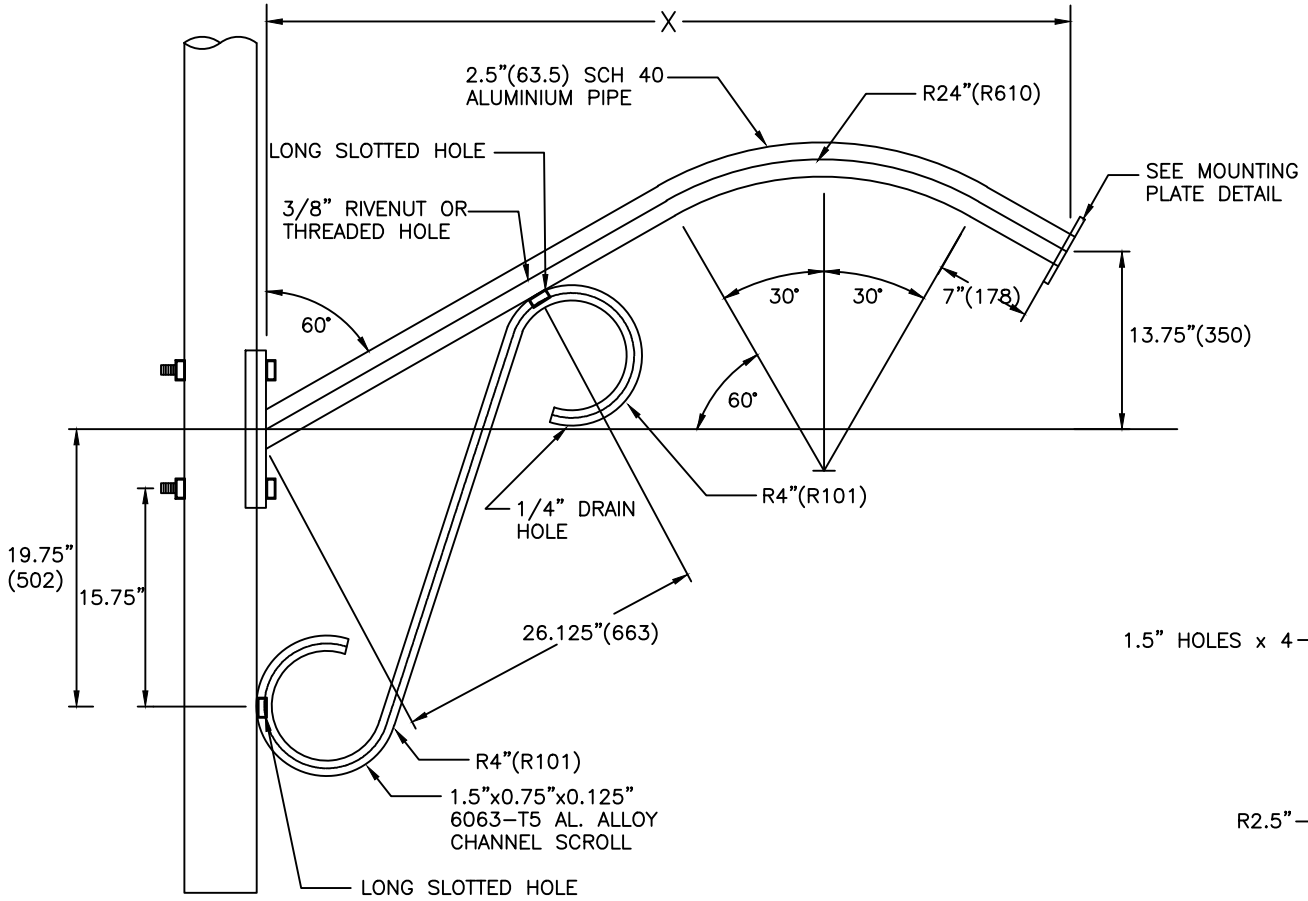
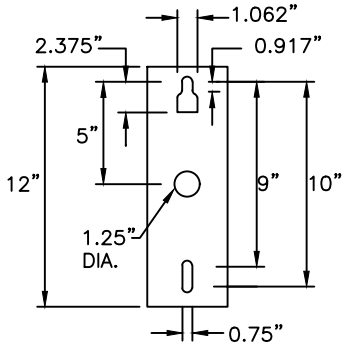
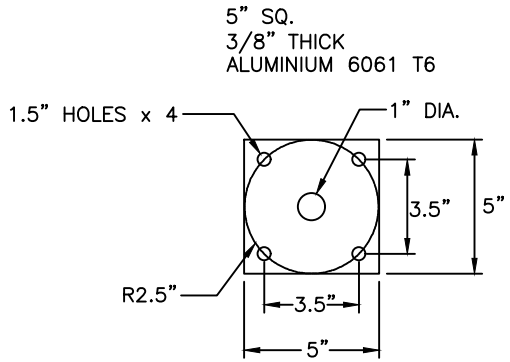
TELECOM/STREET LIGHT (TRAFALGAR) POLE DIRECT BURIED





POLE PLATE



MOUNTING PLATE

ITEM	DETAIL	QTY
1	3/8–16x1–1/2" SS BOLT	2
2	3/8 SS FLAT WASHER	2
3	5/8–11x2" SS BOLTS	2
4	5/8 SS FLAT WASHER	2
5	5/8 SS LOCK WASHER	2
6	5/8–11 HEX HEAD SS NUT	2

ARM LENGTH	X
25' POLE	60"
32' POLE	72"

NOTE:

1. STANDARD ARM FINISH SHALL BE ELECTROSTATICALLY APPLIED POLYECTER POWDER COAT AFTER PHOSPHATE WASH AND HEAT DRY.

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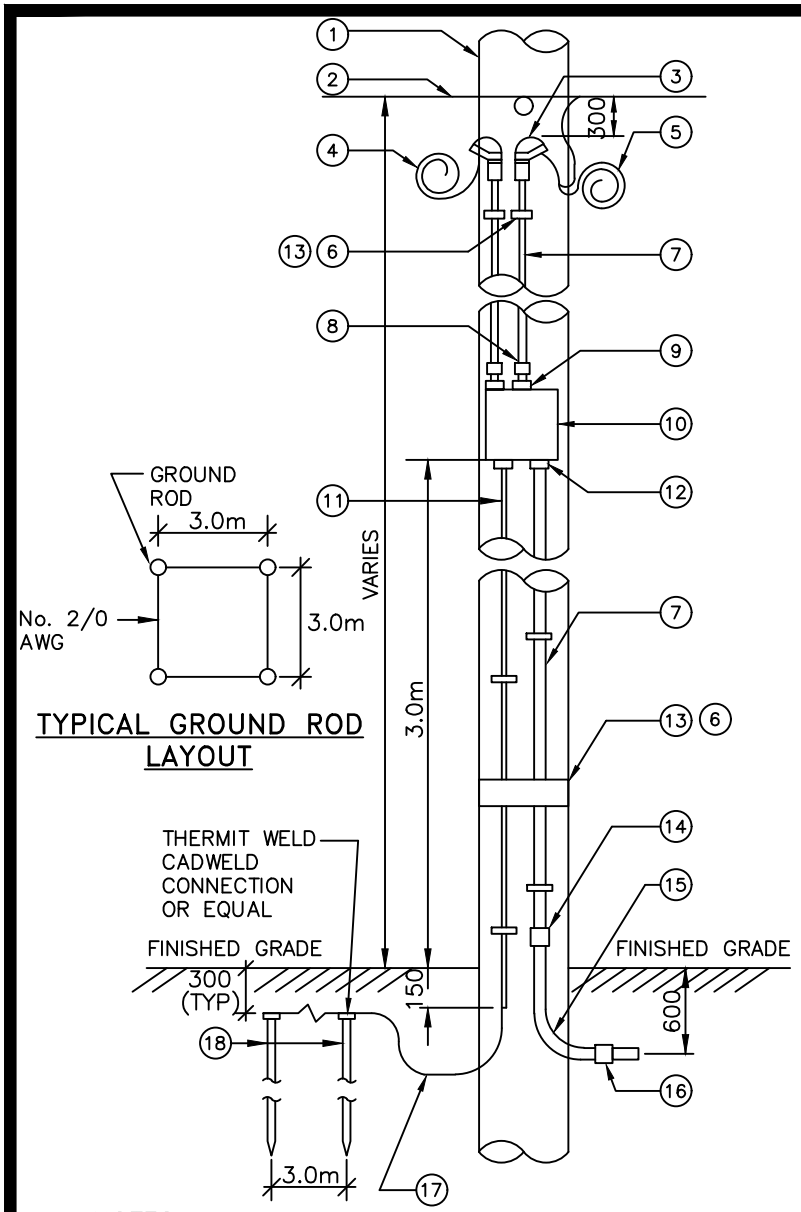
60 INCH OR 72 INCH DECORATIVE SCROLL ARM



TYPICAL GROUND ROD LAYOUT

MATERIALS:

1. EXISTING HYDRO POLE
2. EXISTING NEUTRAL AND SECONDARY BUS, WHERE APPLICABLE
3. 32MM DIA. RIGID PVC ENTRANCE CAP
4. POWER CABLE TO FEED ELECTRICAL EQUIPMENT (WHERE APPLICABLE)
5. LEAVE SUFFICIENT COILS OF CABLES FOR CONNECTION TO SECONDARY BUS OR TRANSFORMER BY LOCAL HYDRO
6. PVC COATED STEEL PIPE STRAPS EVERY 1.2M. SEE NOTE 4.
7. 50MM DIA. RIGID PVC CONDUIT (CSA 136–1966) CONNECTED WITH SOLVENT WELDED COUPLINGS
8. FEMALE ADAPTER AND METALLIC CONDUIT NIPPLE (POLYMER TAPE/TEFLON TAPE TO BE USED FOR NIPPLE ATTACHMENT)
9. ENTRY HUB (METAL) C/W GASKET
10. WEATHERPROOF LOAD CENTRE ENCLOSURE C/W TOP AND BOTTOM HUBS AND CIRCUIT BREAKERS, AS SPECIFIED (TYP.)
11. 38MM DIA. RIGID PVC CONDUIT
12. PVC ADAPTERS
13. SEE NOTE 4
14. 'O' RING EXPANSION COUPLING, RIGID PVC
15. 90° BEND, RIGID PVC CONDUIT
16. RIGID PVC COUPLING
17. 2/0 AWG BARE STRANDED COPPER GROUND WIRE
18. FOUR (4)– 20MM X 3M COPPER CLAD GROUND RODS

NOTES:

1. 16MM WIDE STAINLESS STEEL BAND SHALL BE USED ON CONCRETE POLES INSTEAD OF PVC COATED PIPE STRAPS.
2. WORK ON HYDRO POLE SHALL BE DONE WITH THE APPROVAL OF THE LOCAL HYDRO AUTHORITY.
3. CO–ORDINATE THIS WORK WITH THE LOCAL HYDRO AUTHORITY.
4. MOUNTING DETAILS SHOWN ARE TYPICAL ONLY AND SHALL BE ADAPTED TO SUIT SITE CONDITIONS AND THE LOCAL HYDRO AUTHORITY.

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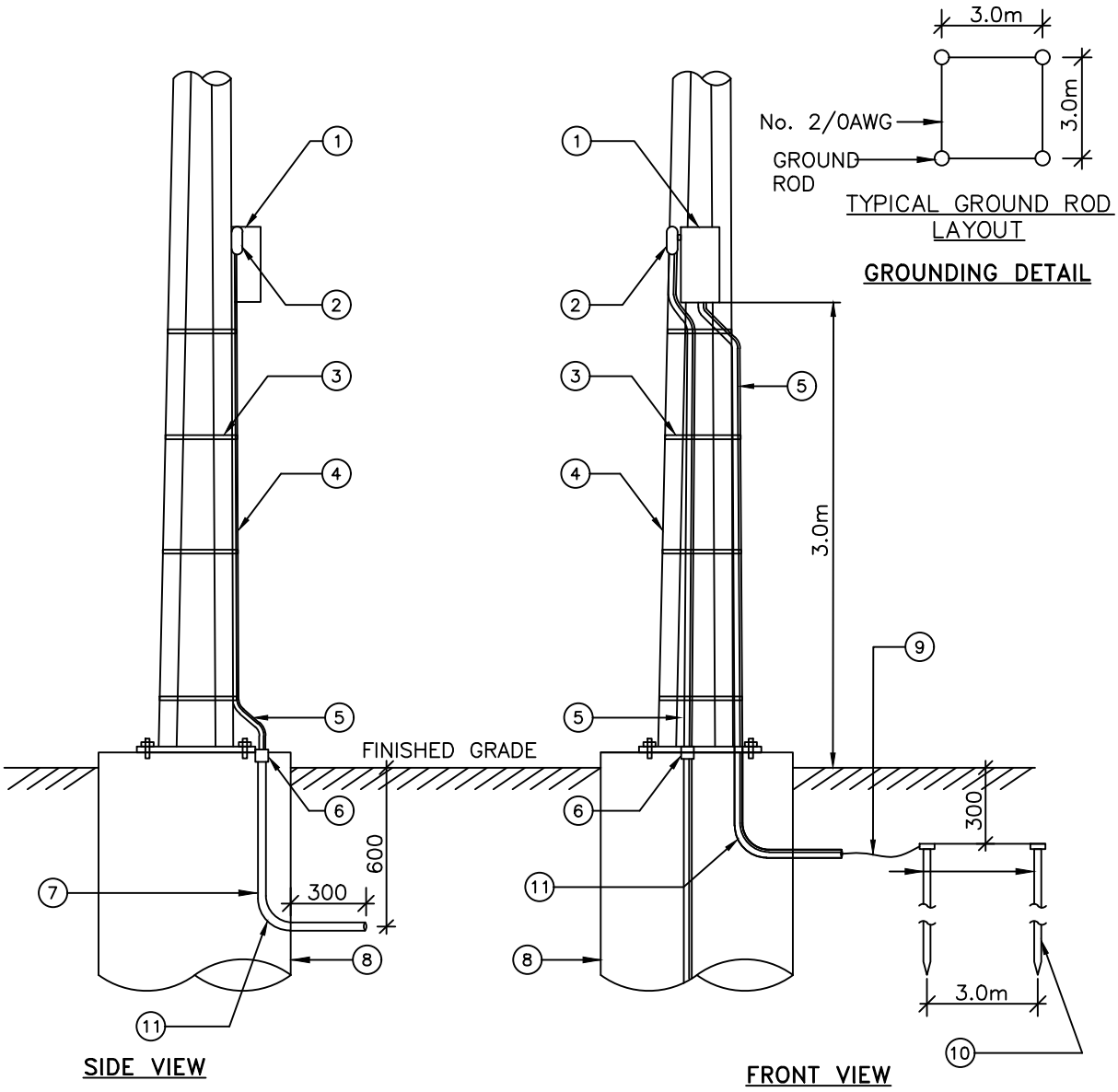
UNDERGROUND POWER SUPPLY MOUNTING DETAILS



MATERIALS:

1. WEATHERPROOF LOAD CENTRE ENCLOSURE C/W TOP AND BOTTOM HUBS AND CIRCUIT BREAKERS, AS SPECIFIED
2. 'LL' FITTING
3. 16 STAINLESS STEEL STRAPPING, 4.5 KN ULTIMATE STRENGTH, EVERY 1.2M
4. STEEL POLE
5. 38MM DIAMETER RIGID PVC CONDUIT
6. REDUCER BUSHING
7. 50MM DIAMETER RIGID PVC CONDUIT
8. CONCRETE FOOTING
9. NO. 2/0 AWG BARE STRANDED COPPER GROUND WIRE
10. FOUR (4)–20MM X 3.0 COPPER CLAD GROUND RODS OR EQUAL WITH THERMIT WELD CONNECTION
11. 90° ELBOW

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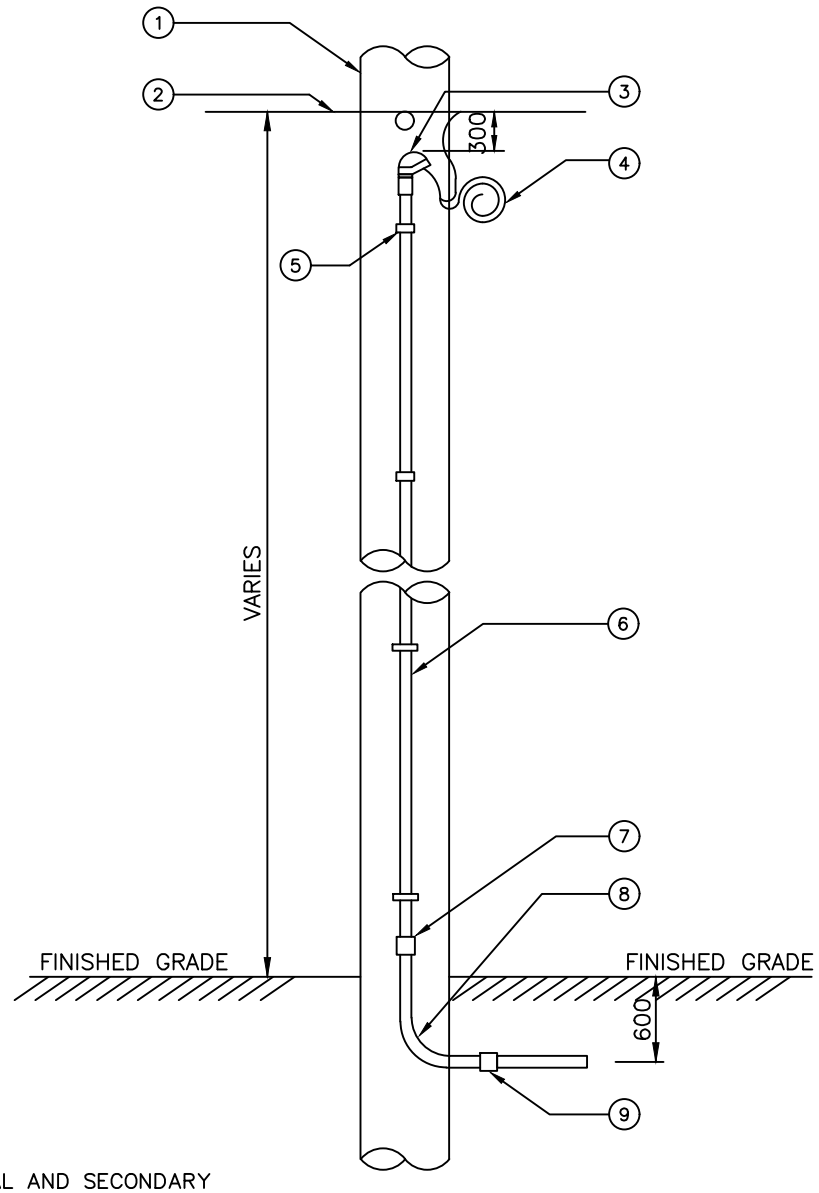
POWER SUPPLY ON STEEL POLES WITH BURIED HYDRO SUPPLY

DRAWING NO.: E-506



MATERIALS:

1. HYDRO POLE
2. EXISTING NEUTRAL AND SECONDARY BUS, WHERE APPLICABLE
3. 32MM DIA. RIGID PVC ENTRANCE CAP
4. LEAVE SUFFICIENT COILS OF CABLES FOR CONNECTION TO SECONDARY BUS OR TRANSFORMER BY LOCAL HYDRO
5. PVC COATED STEEL PIPE STRAPS EVERY 1.2M
6. 50MM DIA. RIGID PVC CONDUIT (CSA 136–1966) CONNECTED WITH SOLVENT WELDED COUPLINGS
7. 'O' RING EXPANSION COUPLING, RIGID PVC
8. 90° BEND, RIGID PVC CONDUIT
9. RIGID PVC COUPLING

NOTES:

1. WORK ON HYDRO POLE SHALL BE DONE WITH THE APPROVAL OF THE LOCAL HYDRO AUTHORITY.
2. MOUNTING DETAILS SHOWN ARE TYPICAL ONLY AND SHALL BE ADAPTED TO SUIT SITE CONDITIONS AND THE LOCAL HYDRO AUTHORITY.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

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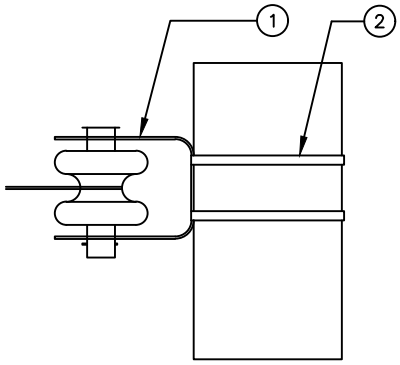
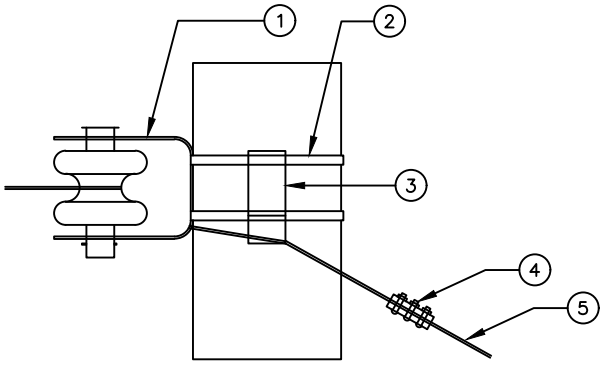
UNDERGROUND HYDRO SUPPLY DETAILS

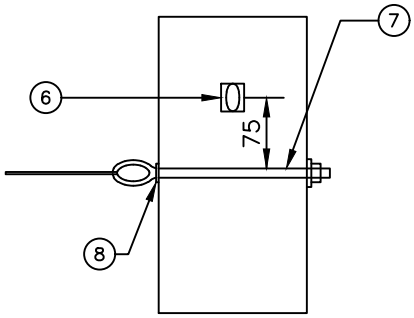
DRAWING NO.: **E-507**



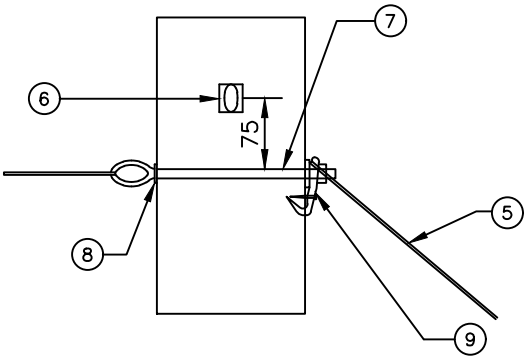
AERIAL CABLE ATTACHMENT DETAIL
STEEL OR CONCRETE POLE



AERIAL CABLE ATTACHMENT DETAIL
STEEL OR CONCRETE POLE
WITH BACK GUY



AERIAL CABLE ATTACHMENT DETAIL
WOOD POLE



AERIAL CABLE ATTACHMENT DETAIL
WOOD POLE WITH BACK GUY

MATERIALS:

1. SECONDARY CLEVIS WITH PORCELAIN SPOOL INSULATOR
2. 16MM STAINLESS STEEL STRAPPING, 4.5KN ULTIMATE STRENGTH
3. GALVANIZED "J" HOOK, EACH SIDE
4. 3 BOLT GUY CLAMP
5. GUY CABLE
6. EYE BOLT, FOR SEPERATE GUY
7. 16MM DIAMETER EYE BOLT, LENGTH TO SUIT
8. 50MM X 50MM DIAMETER GALVANIZED STEEL SQUARE WASHER
9. GUY FITTING WITH CATCH LUG & 10 X 100 GALVANIZED STEEL LAG SCREW

NOTES:

1. NO HOLES ARE TO BE DRILLED IN THE STEEL OR CONCRETE POLES FOR THE ATTACHMENT OF AERIAL CABLES.

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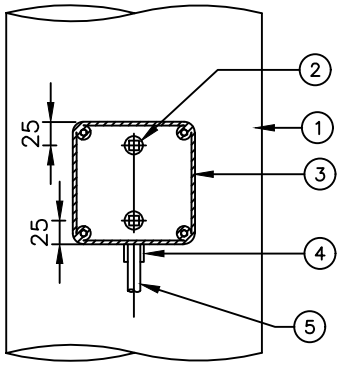
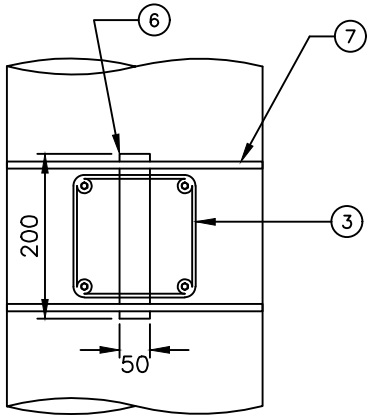
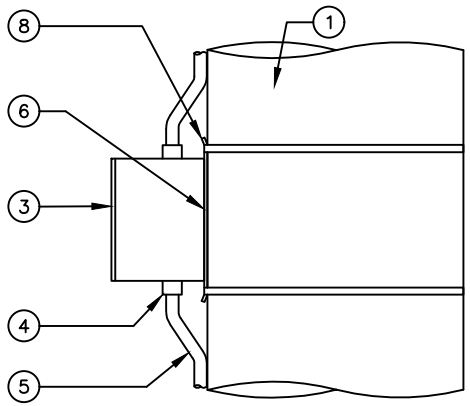
AERIAL CABLE ATTACHMENT DETAILS

DRAWING NO.: E-508

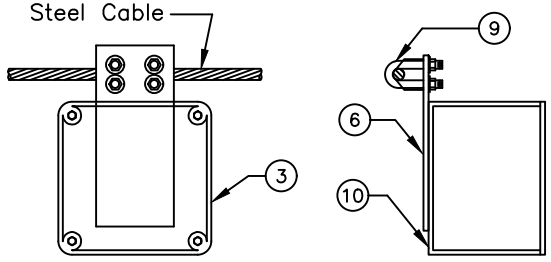


MOUNTING ON WOOD POLE

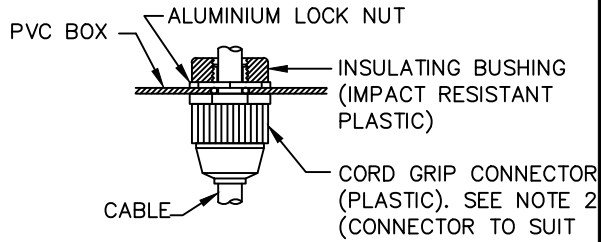




MOUNTING ON CONCRETE OR METAL POLE



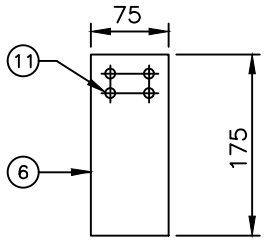
CABLE MOUNTING



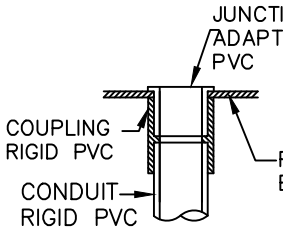
TYPICAL LIQUID TIGHT STRAIN RELIEF CONNECTOR

MATERIALS:

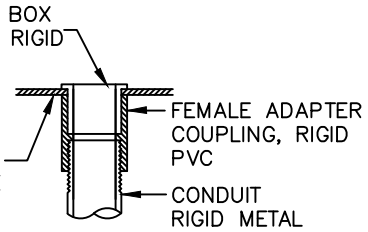
1. POLE
2. 10MM DIA. X 75MM LONG GALV. STEEL LAG SCREWS C/W GALV. STEEL WASHERS SIZED TO FIT. DRILL 12MM DIA. HOLE BEFORE LAGGING
3. 150MM X150MM X150MM RIGID PVC JUNCTION BOX C/W COVER, GASKET AND STAINLESS STEEL COVER SCREWS
4. CONDUIT CONNECTION WHERE APPLICABLE
5. NUMBER AND SIZE OF CONDUITS AS REQUIRED
6. 6MM THICK RIGID PVC MOUNTING PLATE CEMENTED TO JUNCTION BOX
7. 16MM STAINLESS STEEL STRAPPING 4.5 KN ULTIMATE STRENGTH
8. BEND 3MM TO HOLD STRAPPING BOTH ENDS
9. WIRE ROPE CLAMP, GALV. SIZE TO SUIT STEEL CABLE C/W GALV. STEEL LOCKWASHERS & NUTS
10. HOLES TO SUIT WIRE ROPE CLAMP
11. WIRING ENTRANCES FIELD DRILLED TO SUIT (SEE LIQUID TIGHT STRAIN RELIEF CONNECTOR DETAIL)



MOUNTING PLATE FOR CABLE MOUNTING



TYPICAL CONNECTION RIGID PVC CONDUIT



TYPICAL CONNECTION RIGID METAL CONDUIT

NOTES:

1. ALL RIGID PVC CONNECTIONS SHALL BE MADE WITH AN APPROVED SOLVENT CEMENT.
2. FOR CABLE MOUNTING, DRILL WIRING ENTRANCES ON BOTTOM OF JUNCTION BOX ONLY.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: SEPT 2020

DRAWING NO.: E-509

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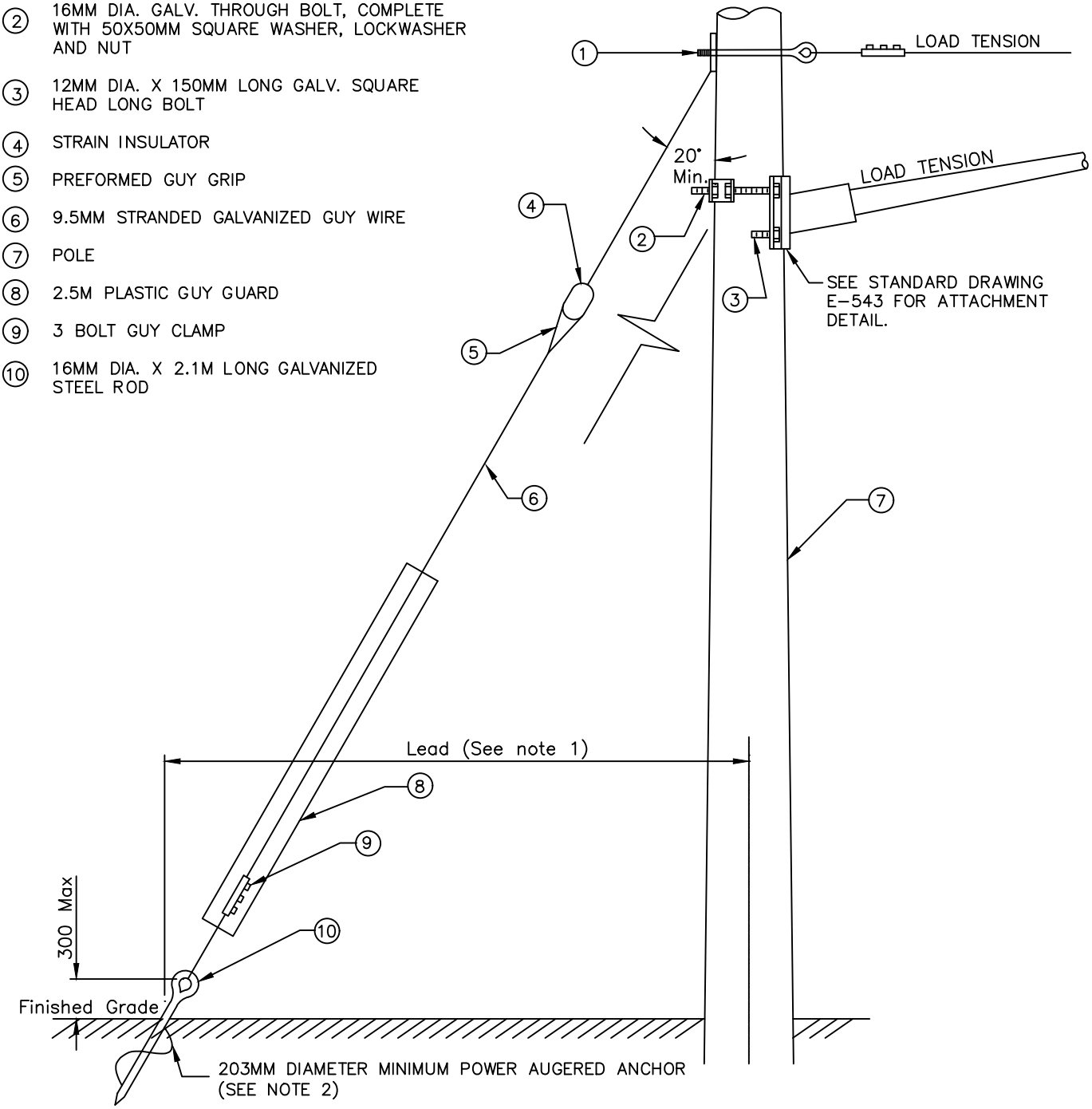
PVC JUNCTION BOX MOUNTING DETAIL

MATERIALS:

1. GUY FITTING
2. 16MM DIA. GALV. THROUGH BOLT, COMPLETE WITH 50X50MM SQUARE WASHER, LOCKWASHER AND NUT
3. 12MM DIA. X 150MM LONG GALV. SQUARE HEAD LONG BOLT
4. STRAIN INSULATOR
5. PREFORMED GUY GRIP
6. 9.5MM STRANDED GALVANIZED GUY WIRE
7. POLE
8. 2.5M PLASTIC GUY GUARD
9. 3 BOLT GUY CLAMP
10. 16MM DIA. X 2.1M LONG GALVANIZED STEEL ROD



NOTES

1. FOR MINIMUM LEAD SETTINGS REFER TO PROPER TABLES AND CHARTS.
2. WHERE IT IS IMPRACTICAL TO INSTALL POWER DRIVEN ANCHORS, 254mm DIAMETER EXPANDABLE TYPE ANCHORS SHALL BE INSTALLED AND NATIVE BACKFILL SHALL BE COMPACTED.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **SEPT 2020**

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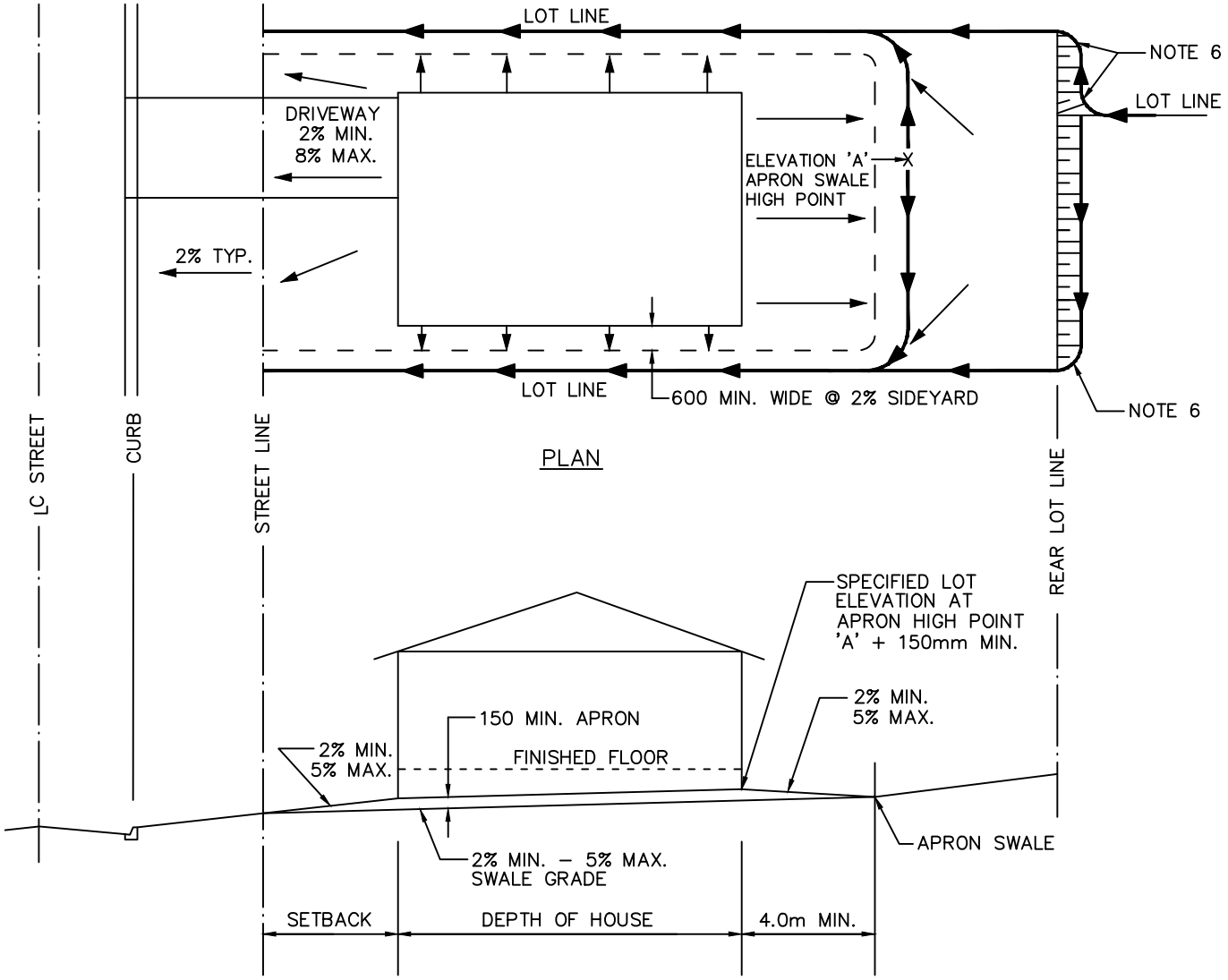
TYPICAL POLE GUYING DETAILS

DRAWING NO.: **E-510**



NOTES

1. DRIVEWAYS SHALL NOT EXCEED THE WIDTH OF THE GARAGE.
2. ALL EMBANKMENTS SHALL BE 3:1 MAX.
3. SIDEWALKS MAY BE PERMITTED IF THE ADJACENT LOT TO THE REAR IS ALSO A REAR TO FRONT DRAINING LOT.
4. ALL DOWNSPOUTS SHALL DISCHARGE ON TO CONCRETE SPLASH PADS.
5. DRIVEWAYS SHALL NOT BE USED FOR OUTLETS FROM SIDEYARD SWALES.
6. DRAINAGE FROM REAR ADJOINING LOTS SHALL BE CONVEYED BY SWALES TO SIDE LOT LINES.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **SEPT. 2020**

DRAWING NO.: **M-400**

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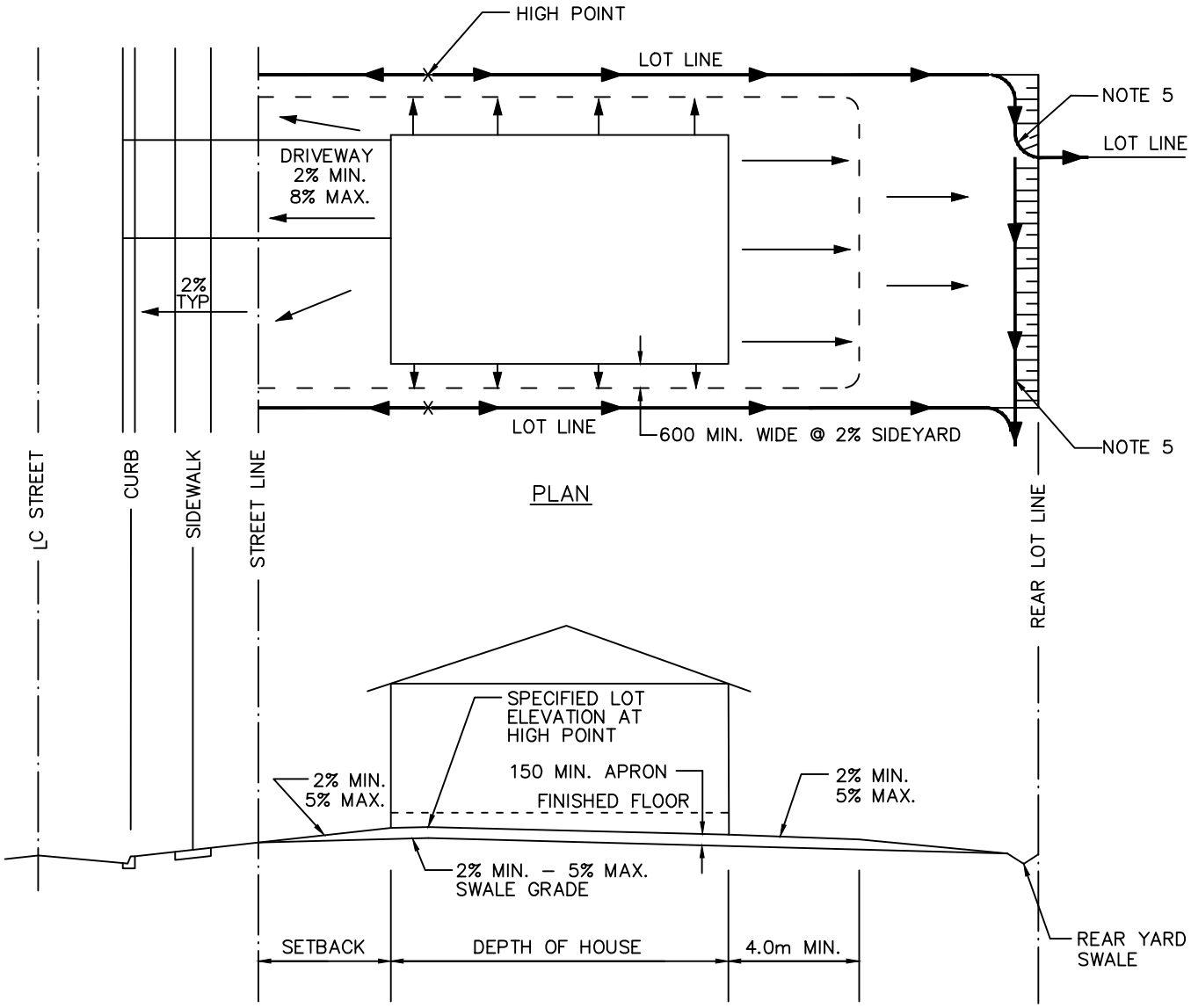
FRONT LOT DRAINAGE



NOTES

1. DRIVEWAY SHALL NOT EXCEED THE WIDTH OF THE GARAGE.
2. ALL EMBANKMENTS SHALL BE 3:1.
3. ALL DOWNSPOUTS SHALL DISCHARGE ONTO CONCRETE SPLASH PADS.
4. DRIVEWAYS SHALL NOT BE USED FOR OUTLETS FOR SIDEYARD SWALES.
5. DRAINAGE TO REAR ADJOINING LOTS SHALL BE CONVEYED BY SWALES TO SIDE LOTS LINES.
6. A MINIMUM OF 50% OF THE ROOF SHALL DRAIN TO THE FRONT OF THE LOT. .

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: SEPT. 2020

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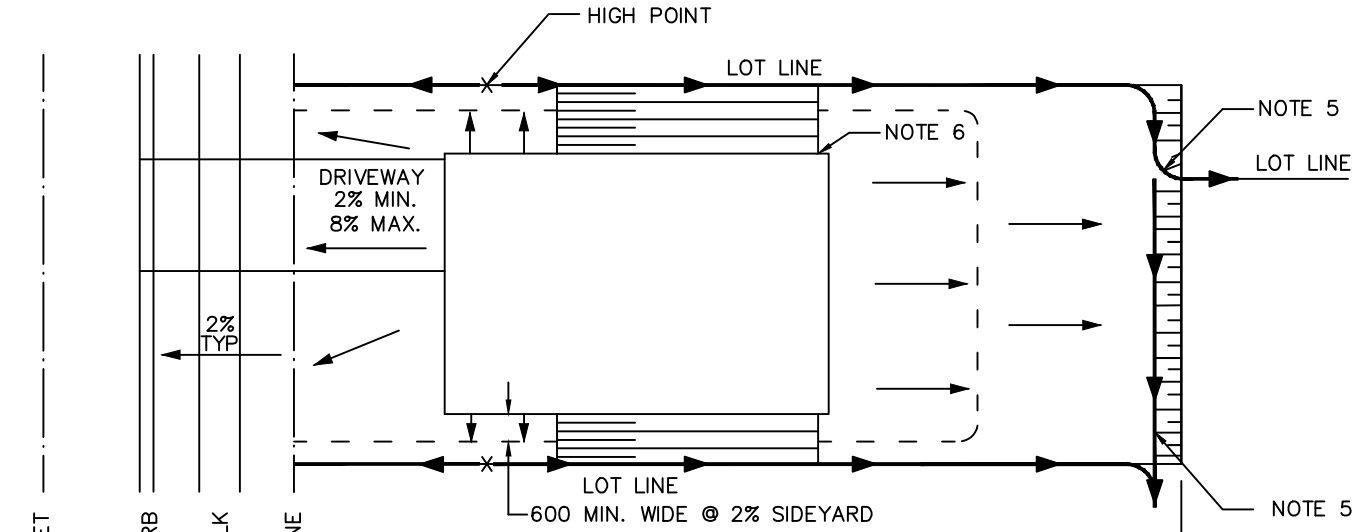
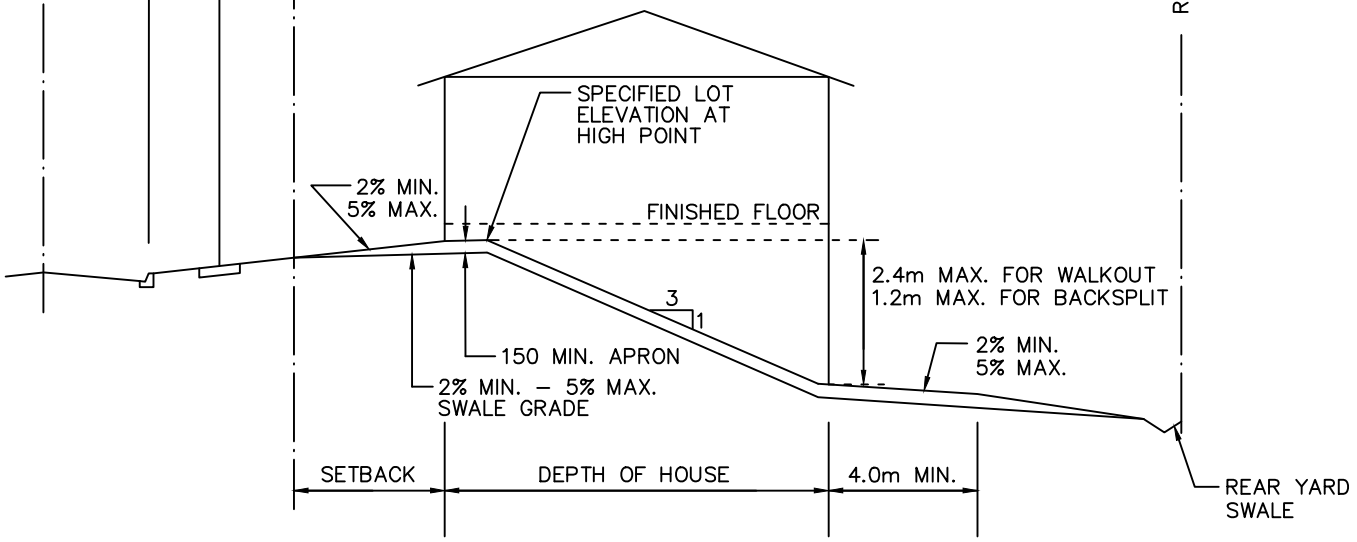
SPLIT LOT DRAINAGE

DRAWING NO.: M-401





PROFILE

NOTES

1. DRIVEWAY SHALL NOT EXCEED THE WIDTH OF THE GARAGE.
2. ALL EMBANKMENTS SHALL BE 3:1.
3. ALL DOWNSPOUTS SHALL DISCHARGE ONTO CONCRETE SPLASH PADS.
4. DRIVEWAYS SHALL NOT BE USED FOR OUTLETS FOR SIDEYARD SWALES.
5. DRAINAGE TO REAR ADJOINING LOTS SHALL BE CONVEYED BY SWALES TO SIDE LOTS LINES.
6. SIDEYARD 3:1 SLOPES SHALL NOT EXTEND BEYOND REAR FACE OF DWELLING.
7. A MINIMUM OF 50% OF THE ROOF SHALL DRAIN TO THE FRONT OF THE LOT.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: SEPT. 2020

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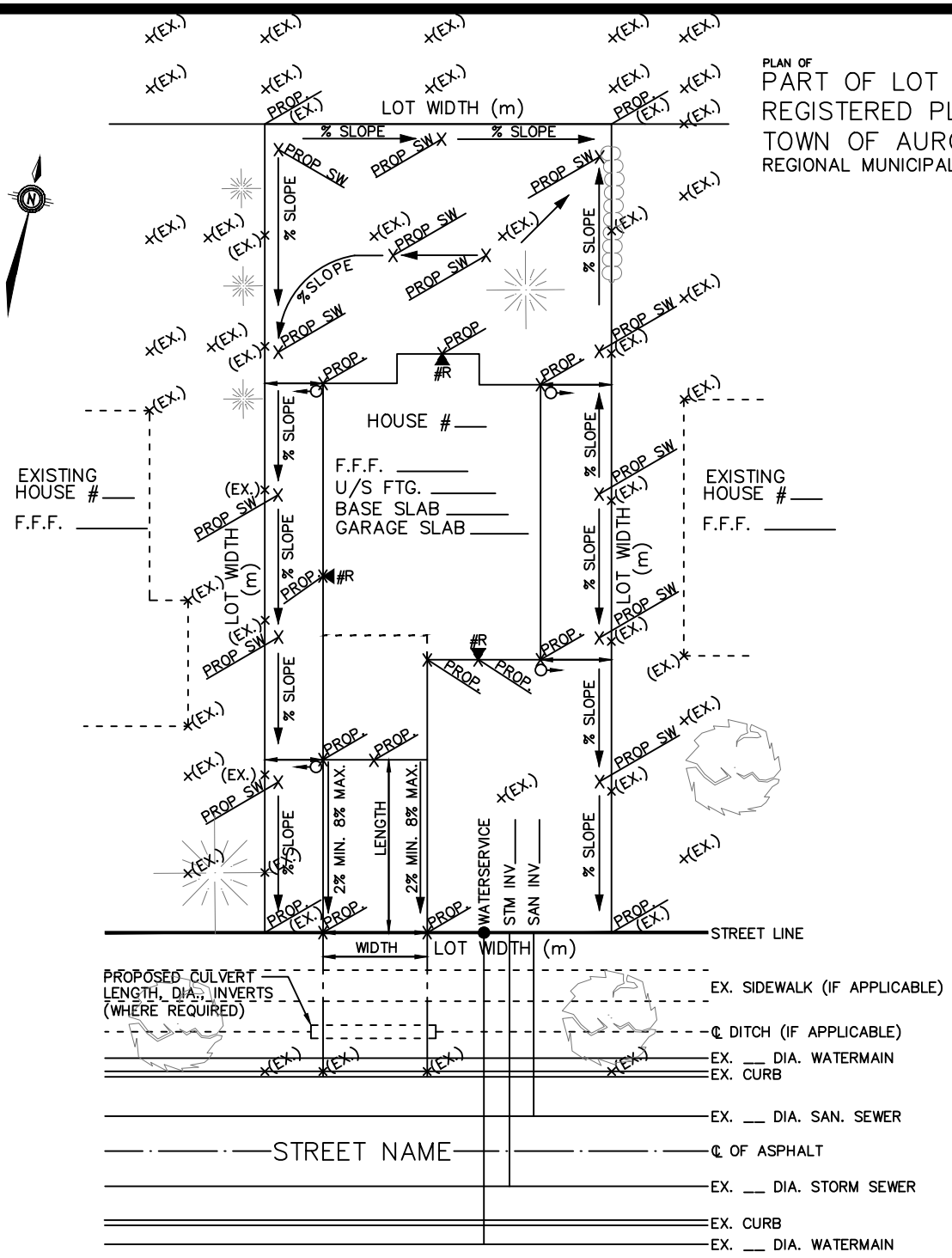
LOT DRAINAGE FOR WALKOUT AND BACKSPLIT DWELLINGS

DRAWING NO.: M-402



LEGEND

ROOF WATER LEADER	O→
EXISTING ELEVATION REQUIRED	×(EX.)
PROPOSED ELEVATION REQUIRED	X PROP.
PROPOSED SWALE ELEVATION REQUIRED	X PROP SW
FINISHED FIRST FLOOR ELEVATION REQUIRED	F.F.F.
UNDERSIDE OF FOOTING ELEVATION REQUIRED	U/S FTG.
BASEMENT SLAB ELEVATION REQUIRED	BASE SLAB
GARAGE SLAB ELEVATION REQUIRED	GARAGE SLAB
℄ OF PROPOSED SWALE & FLOW DIRECTION	→
SWALE GRADIENT REQUIRED	% SLOPE

NOTES:

1. GRADING PLANS SHALL BE DRAWN AT 1:250 SCALE.
2. ALL DRAINAGE SWALES TO BE LOCATED WITHIN THE LOT AND A MINIMUM OF 0.45m FROM LOT LINES.
3. REFER TO DRAWINGS M–400, M–401 AND M–402 FOR DETAILED LOT GRADING SPECIFICATIONS.
4. EXISTING GRADES SHALL BE MAINTAINED WITHIN 0.3m FROM ALL PROPERTY LINES ON PROPOSED LOT.
5. EDGE OF DRIVEWAY SHALL BE MINIMUM 1.2m FROM ALL ABOVE GROUND UTILITIES (HYDRANTS, STREET LIGHTS, PEDISTALS ETC.)

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **NOV 2009**

DRAWING NO.: **M-403**

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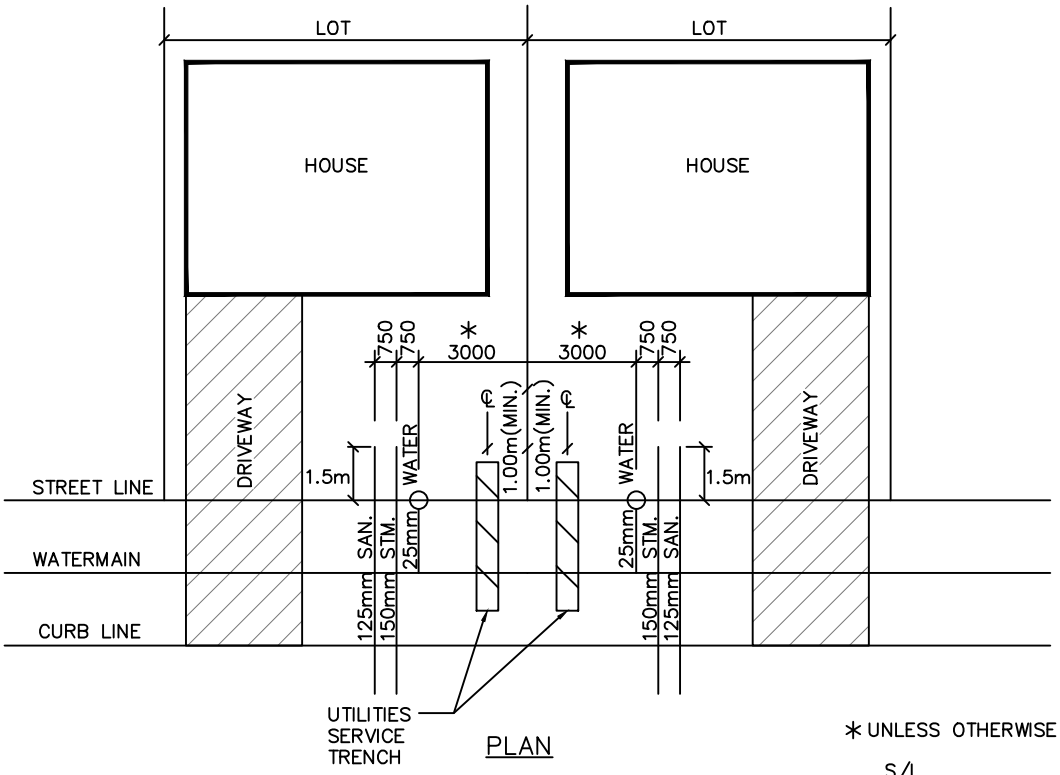
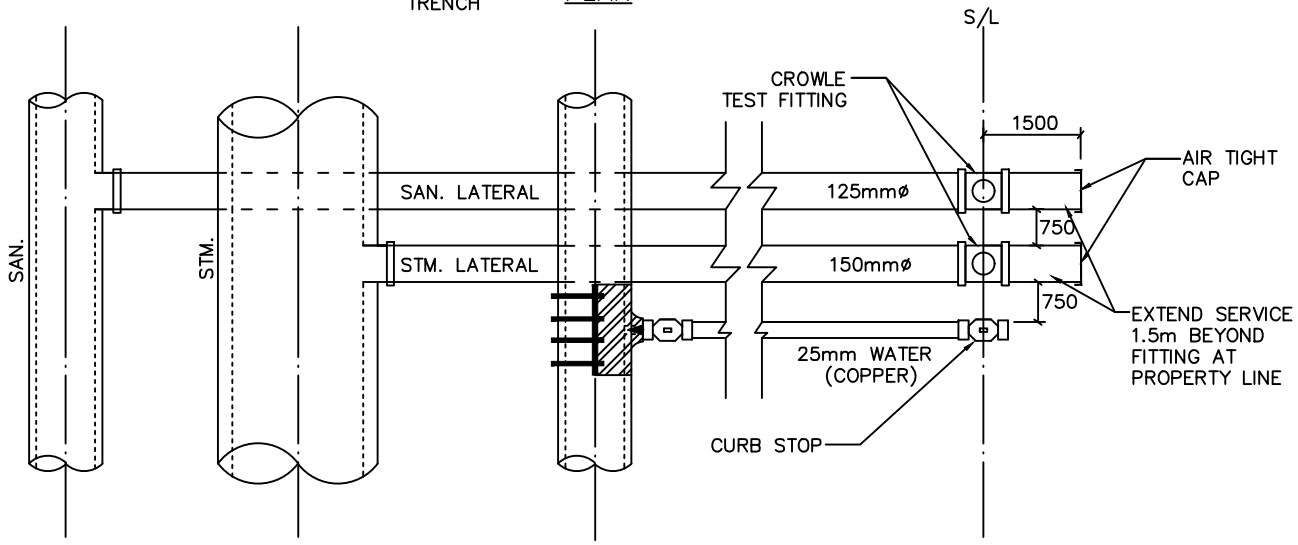
LOT GRADING PLAN REQUIREMENTS FOR INFILL LOTS



PLAN

* UNLESS OTHERWISE SHOWN.



NOTES.

1. HYDRO SERVICES TO BE PAIRED WHENEVER POSSIBLE.
2. HYDRO SERVICES TO BE INSTALLED 1.0m (MIN.) OFF PROPERTY LINE WITH A MINIMUM CLEARANCE OF 1.0m TO WATER. SANITARY, AND STORM LATERAL SERVICES.
3. ON THE DRIVEWAY SIDE HYDRO REQUIRES MIN. 1.2m CLEARANCE BETWEEN THE DRIVEWAY AND PROPERTY LINE.
4. ALL SERVICES TO BE LOCATED AS SHOWN. STORM, SANITARY AND WATER SERVICES TO BE LOCATED ON OPPOSITE SIDE OF LOT TO DRIVEWAY AND PLUGGED.
5. WATER SERVICE MUST BE A MINIMUM OF 1.0m FROM THE DRIVEWAY.
6. THERE SHALL BE 0.75m CLEARANCE BETWEEN SERVICES.
7. MIN. DEPTH OF COVER TO THE SAN. & STM. SERVICES, AT THE STREET LINE TO BE 3.0m.
8. STORM CONNECTION TO BE 0.15m HIGHER THAN SANITARY CONNECTION AT STREETLINE.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **NOV. 2020**

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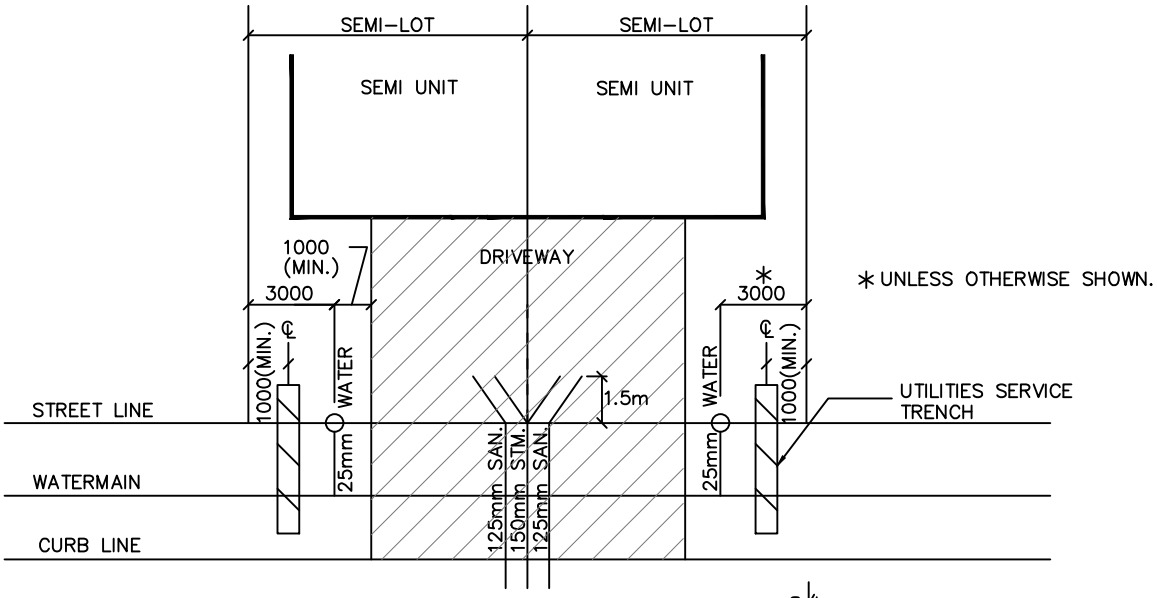
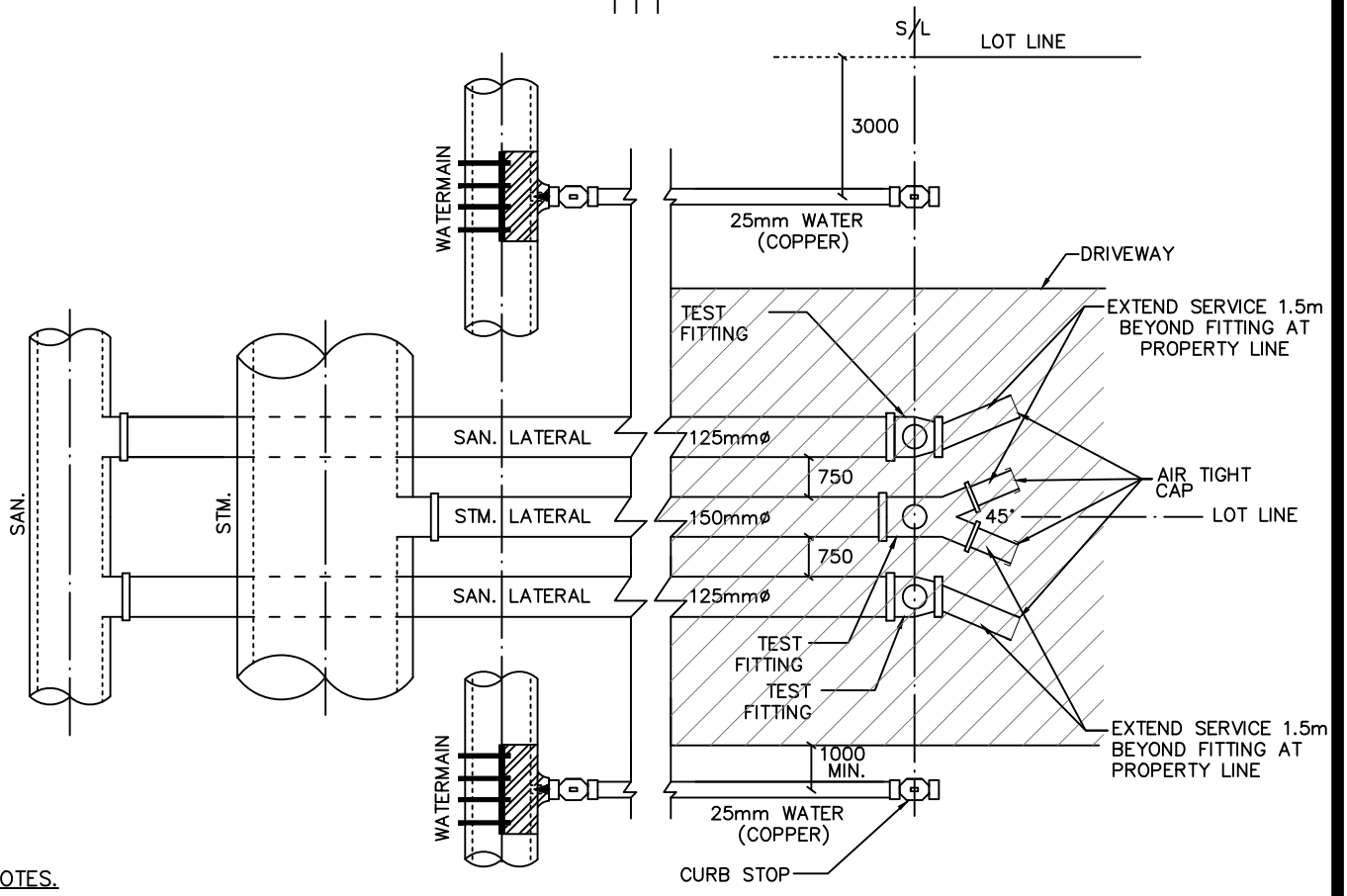
SINGLE LOT SERVICING

DRAWING NO.: **M-404**





NOTES.

1. HYDRO SERVICES TO BE PAIRED WHEREVER POSSIBLE.
2. HYDRO SERVICES TO BE INSTALLED 1.0m MIN. OFF PROPERTY LINE WITH A MINIMUM CLEARANCE OF 1.0m TO WATER. SANITARY AND STORM LATERAL SERVICES.
3. ON THE DRIVEWAY SIDE HYDRO REQUIRES MIN. 1.2m CLEARANCE BETWEEN THE DRIVEWAY AND PROPERTY LINE.
4. WATER SERVICE MUST BE A MINIMUM OF 1.0m FROM THE DRIVEWAY.
5. THERE SHALL BE 0.75m CLEARANCE BETWEEN SERVICES.
6. MIN. DEPTH OF COVER TO THE SAN. & STM. SERVICES, AT THE STREET LINE SHALL BE AS PER SECTION C4.0 AND E10.0.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **SEPT. 2020**

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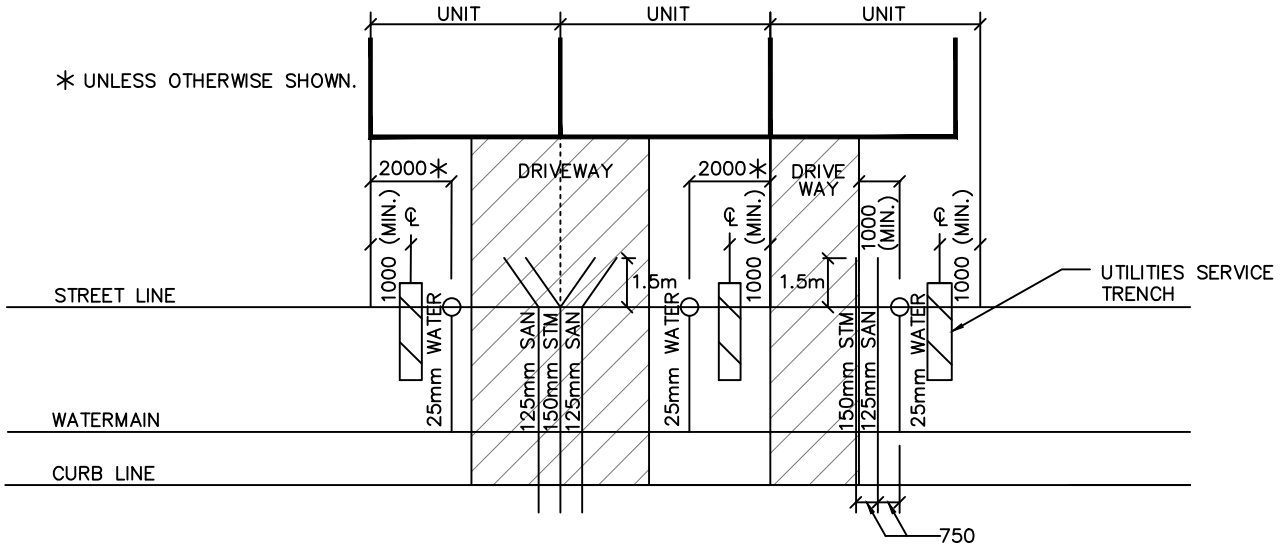
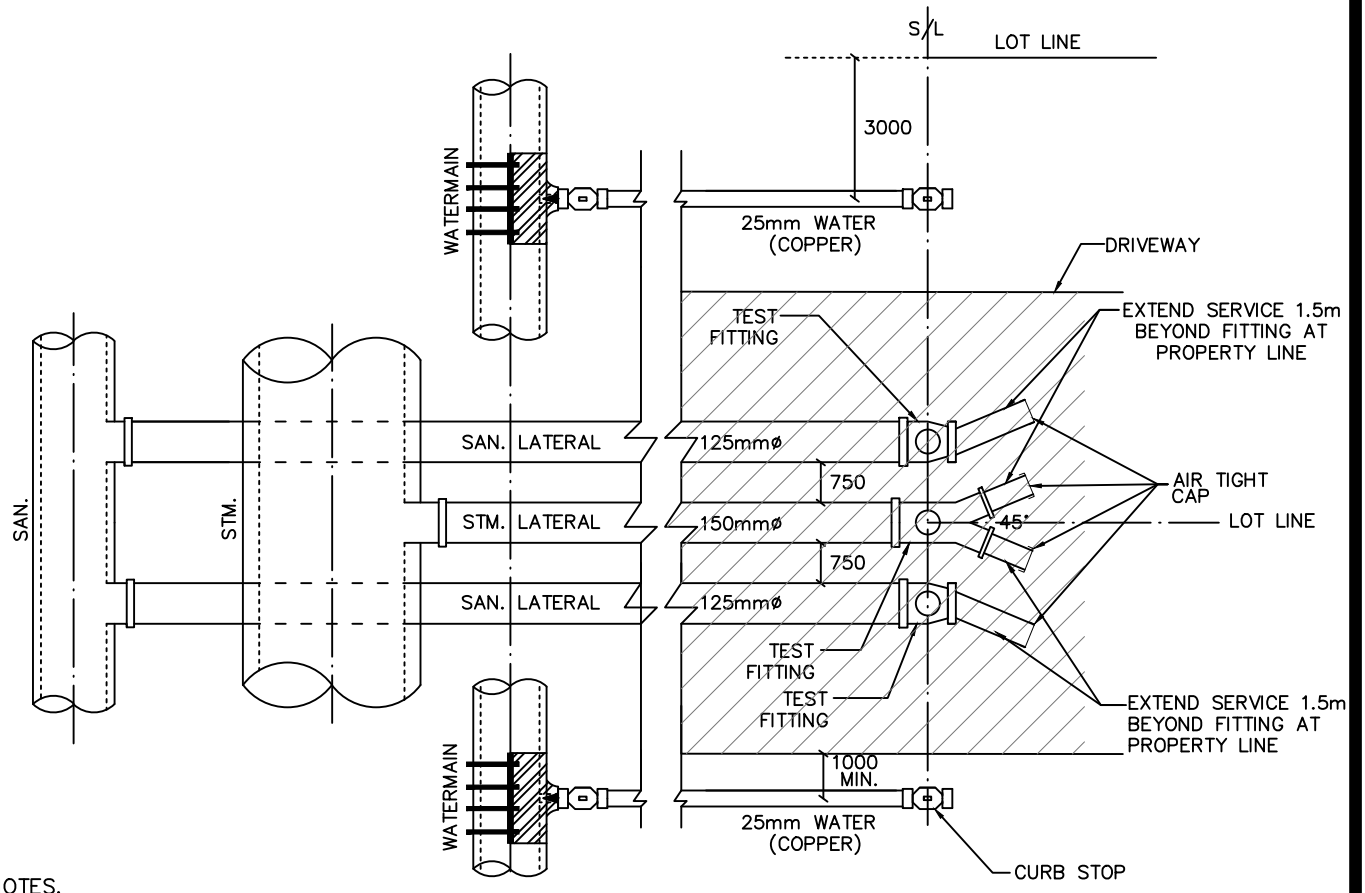
SEMI-DETACHED LOT SERVICING

DRAWING NO.: **M-405**





NOTES.

1. HYDRO SERVICES TO BE PAIRED WHEREVER POSSIBLE.
2. HYDRO SERVICES TO BE INSTALLED 1.0m MIN. OFF PROPERTY LINE WITH A MINIMUM CLEARANCE OF 1.0m TO WATER. SANITARY AND STORM LATERAL SERVICES.
3. ON THE DRIVEWAY SIDE HYDRO REQUIRES MIN. 1.2m CLEARANCE BETWEEN THE DRIVEWAY AND PROPERTY LINE.
4. WATER SERVICE MUST BE A MINIMUM OF 1.0m FROM THE DRIVEWAY.
5. THERE SHALL BE 0.75m CLEARANCE BETWEEN SERVICES.
6. MIN. DEPTH OF COVER TO THE SAN. & STM. SERVICES, AT THE STREET LINE TO BE AS PER SECTION C4.0 AND E10.0.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: SEPT. 2020

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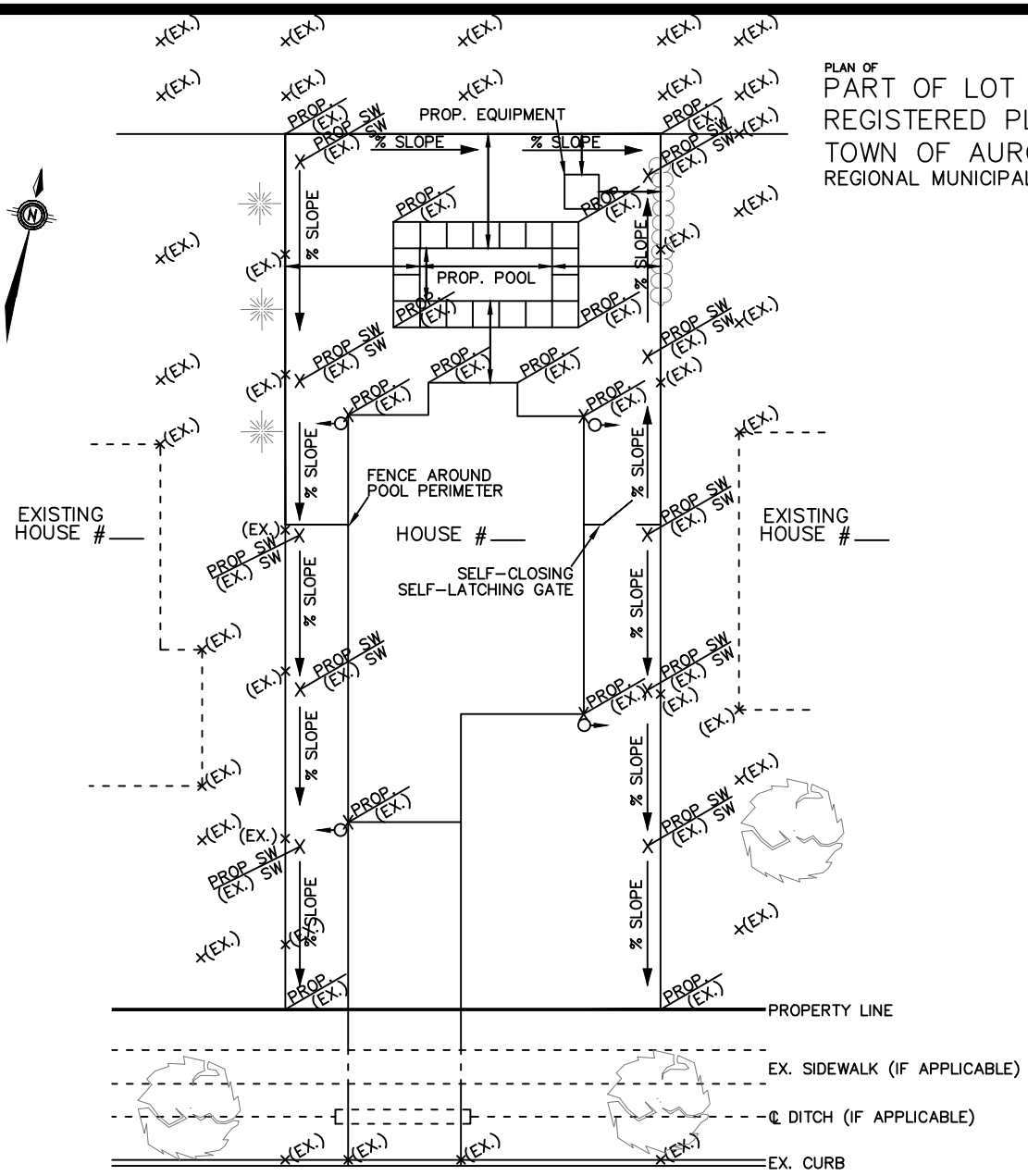
TOWNHOUSE UNIT SERVICING

DRAWING NO.: M-406



LEGEND

ROOF WATER LEADER	O►
℄ OF PROPOSED SWALE & FLOW DIRECTION	——►
SWALE GRADIENT REQUIRED	% SLOPE
EXISTING ELEVATION REQUIRED	×(EX.)
PROPOSED/EXISTING ELEVATION REQUIRED	X PROP. / (EX.)
PROPOSED/EXISITNG SWALE ELEVATION REQUIRED	X PROP SW / (EX.) SW

NOTES:

1. GRADING PLANS SHALL BE DRAWN AT 1:250 SCALE.
2. ALL DRAINAGE SWALES TO BE LOCATED WITHIN THE LOT AND A MINIMUM OF 0.45m FROM LOT LINES.
3. REFER TO DRAWINGS M-400, M-401 AND M-402 FOR DETAILED LOT GRADING SPECIFICATIONS.
4. EXISTING GRADES SHALL BE MAINTAINED WITHIN 0.3m FROM ALL PROPERTY LINES ON PROPOSED LOT.
5. EXISTING DRAINAGE PATTERNS SHALL BE MAINTAINED, INCLUDING SWALES AT 2% MINIMUM AND 5% MAXIMUM.
6. HARDSCAPING AND SOFTSCAPING SHALL BE IDENTIFIED AND LABELED (INTERLOCK, DECK, GARDENS, ETC.).
7. LOCATION(S) AND HEIGHT OF PROPOSED OR EXISTING RETAINING WALLS MUST BE SHOWN.
8. LOCATION(S) OF EASEMENTS WITHIN LOT MUST BE SHOWN.
9. LOCATION OF POOL AND POOL PUMP MUST BE SHOWN.
10. INFILTRATION GALLERIES ARE CONSIDERED NECESSARY IF NEIGHBORING LOTS ARE LIKELY TO BE AFFECTED BY INCREASE IN RUNOFF DUE TO IMPERVIOUS SURFACES.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: FEB. 2022

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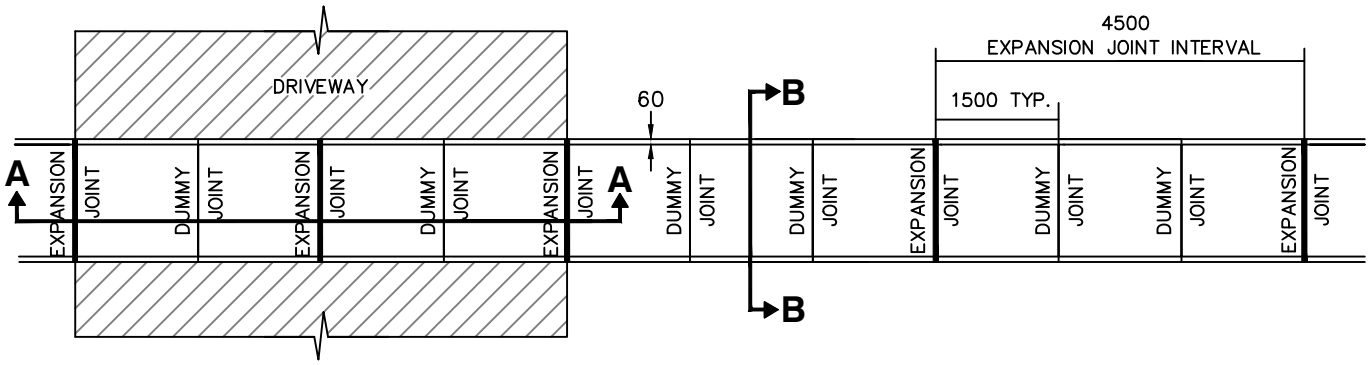
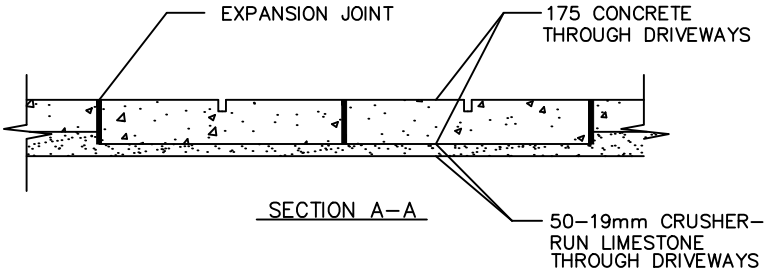
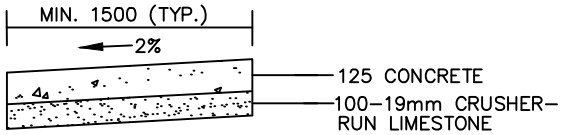
LOT GRADING PLAN REQUIREMENTS FOR POOL CONSTRUCTION

DRAWING NO.: M-407

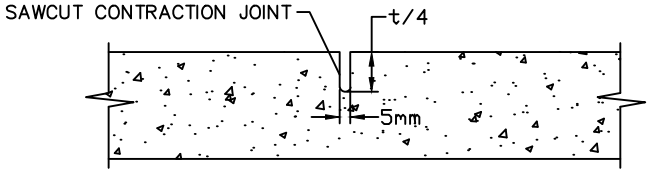




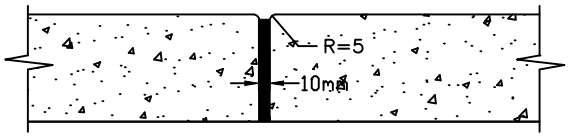
SECTION A–A



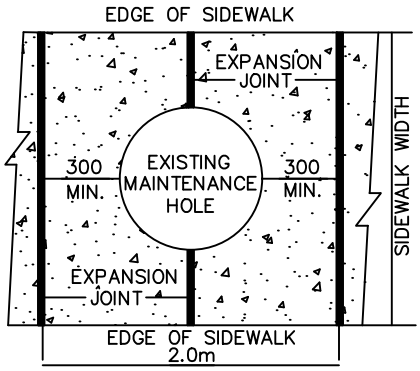
SECTION B–B



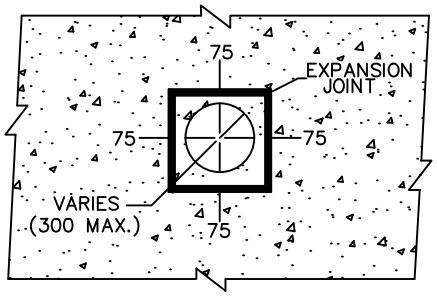
DUMMY JOINT DETAIL



EXPANSION JOINT DETAIL



ISOLATION OF CHAMBERS AND MAINTENANCE HOLES WITHIN THE SIDEWALK



ISOLATION OF POLES, HYDRANTS, AND SERVICES

NOTES

1. EXPANSION JOINTS ARE REQUIRED AT 4.5m INTERVALS AND:
   a) BETWEEN SIDEWALK AND ABUTTING CURB.
   b) ADJACENT TO ABUTTING RIGID OBJECTS (UTILITY POLES, MAINTENANCE HOLES, VALVE BOXES ETC.)
   c) AT THE EDGE OF EACH DRIVEWAY.
   d) AT ALL CONSTRUCTION JOINTS.
   e) ON LOCAL ROADS FOR NEW DEVELOPMENTS, THE MINIMUM SIDEWALK WIDTH SHALL BE 1.5m.
2. DUMMY JOINTS HAVE HAVE A STANDARD SPACING OF 1.5m. IN NO CASE LESS THAN 1.0m OR MORE THAN 2.0m.
3. ALL CONCRETE TO BE 30MPa; 7% +/– 1.5% AIR ENTRAINED.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: OCT 2022

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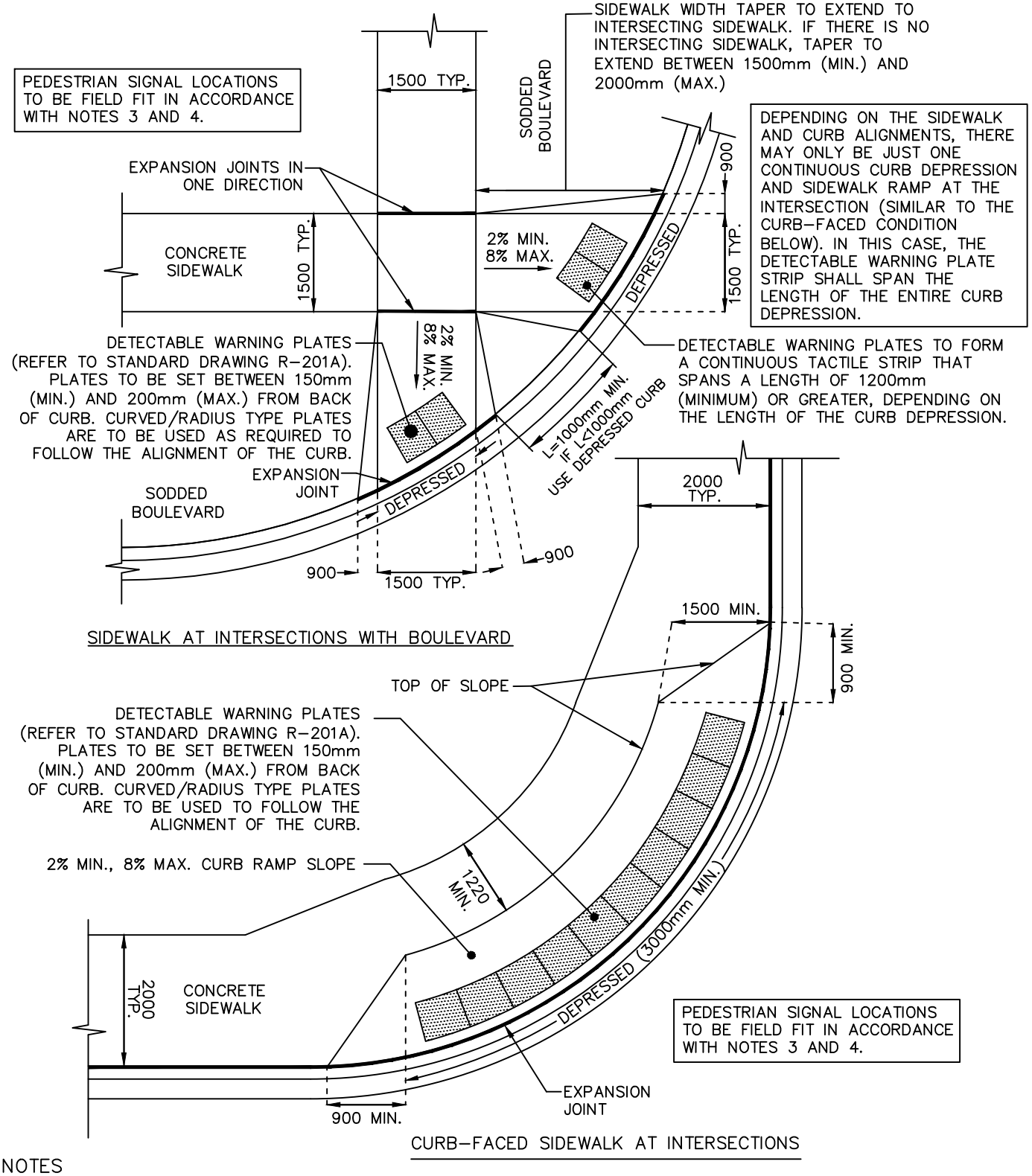
CONCRETE SIDEWALK

DRAWING NO.: R-200



NOTES

1. SEE STANDARD DRAWING R-201A FOR DETECTABLE WARNING PLATE DETAILS.
2. THIS STANDARD IS TO BE USED AS A GUIDE ONLY AND WILL REQUIRE ADJUSTMENTS TO SUIT FIELD CONDITIONS.
3. PEDESTRIAN SIGNAL POLES MUST BE LOCATED WITHIN 1500mm FROM THE BACK OF THE CURB.
4. WHERE TWO PEDESTRIAN SIGNALS ARE INSTALLED ON THE SAME INTERSECTION CORNER, THE POLES MUST BE A MINIMUM OF 3000mm APART.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: OCT 2022

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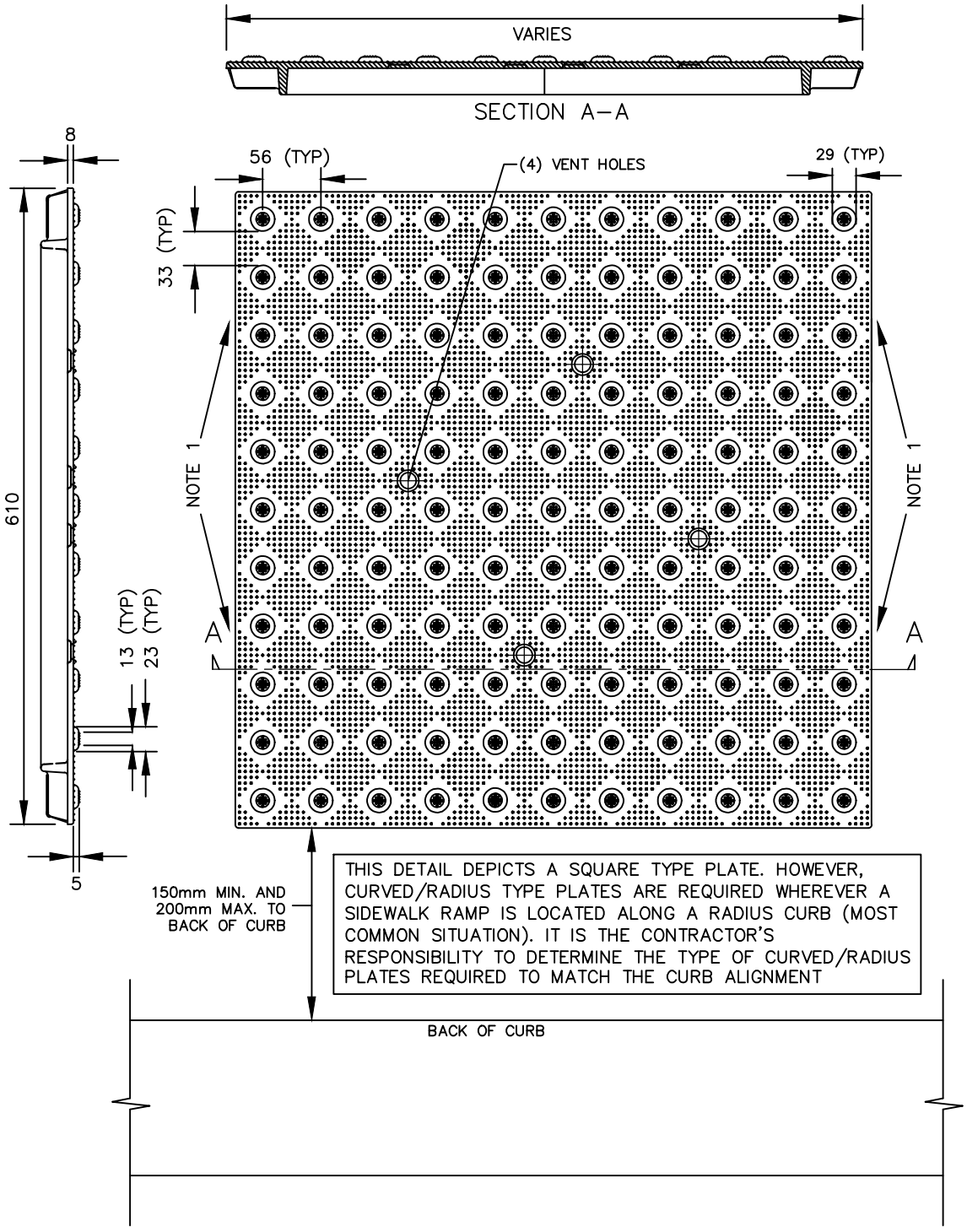
SIDEWALK RAMPS

DRAWING NO.: R-201



NOTES

1. LOCK LUG AND SLOTS TO INTERCONNECT ADJACENT CAST IRON PLATES. ALTERNATIVELY, THE PLATES CAN BE BOLTED TOGETHER.
2. INSTALL PLATES INTO WET CONCRETE TO FINAL POSITION.
3. PRESS ASSEMBLY INTO WET CONCRETE TO FINAL POSITION.
4. SEE STANDARD DRAWING R–201 FOR DETAILS ABOUT LOCATIONS OF TACTILE PLATES.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **DEC 2015**

AURORA
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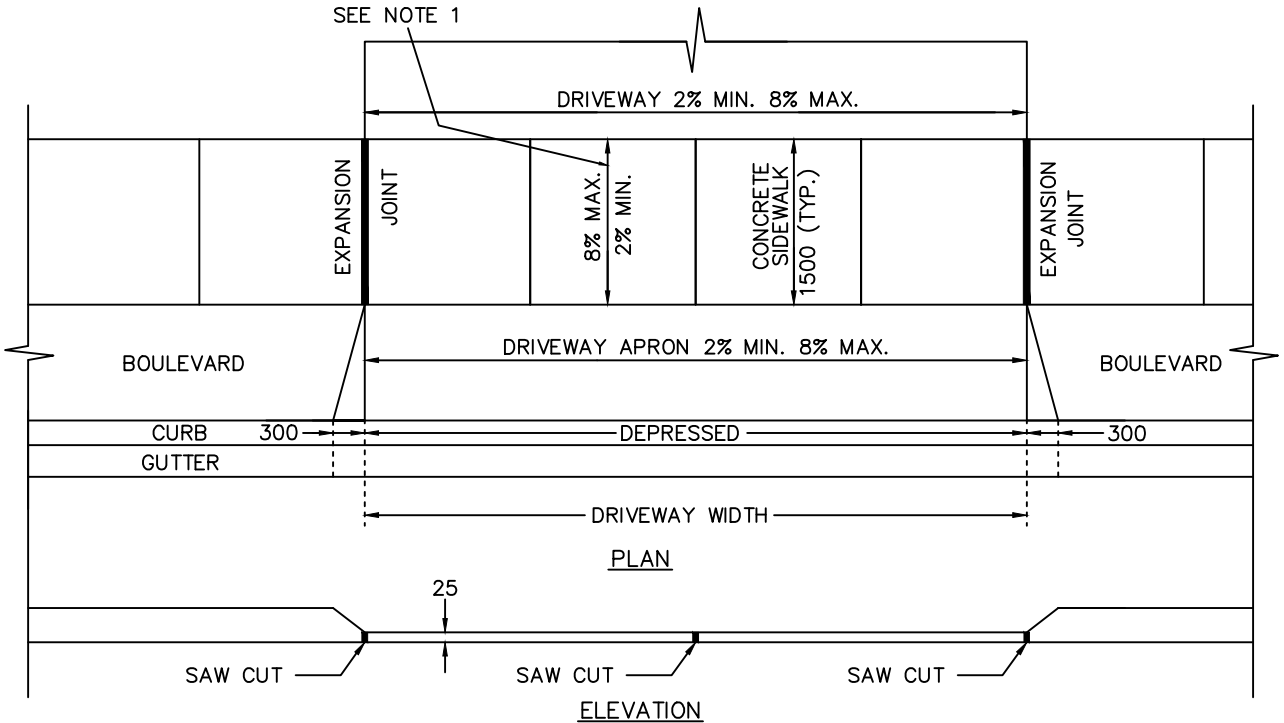
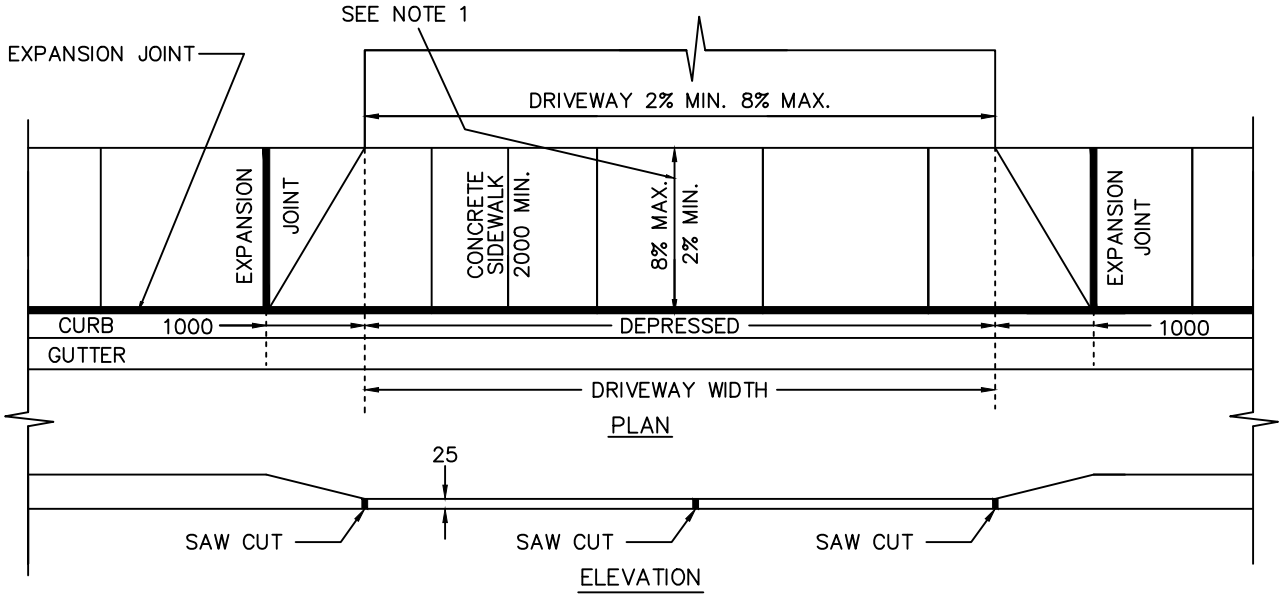
DETECTABLE WARNING PLATE

DRAWING NO.: **R-201A**



DRIVEWAY RAMP WITH BOULEVARD



DRIVEWAY RAMP WITH CURB–FACED SIDEWALK

NOTES:

1. ALL NEW CONSTRUCTION TO FOLLOW AODA REQUIREMENTS FOR SIDEWALK CROSSWALK.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: AUG. 2015

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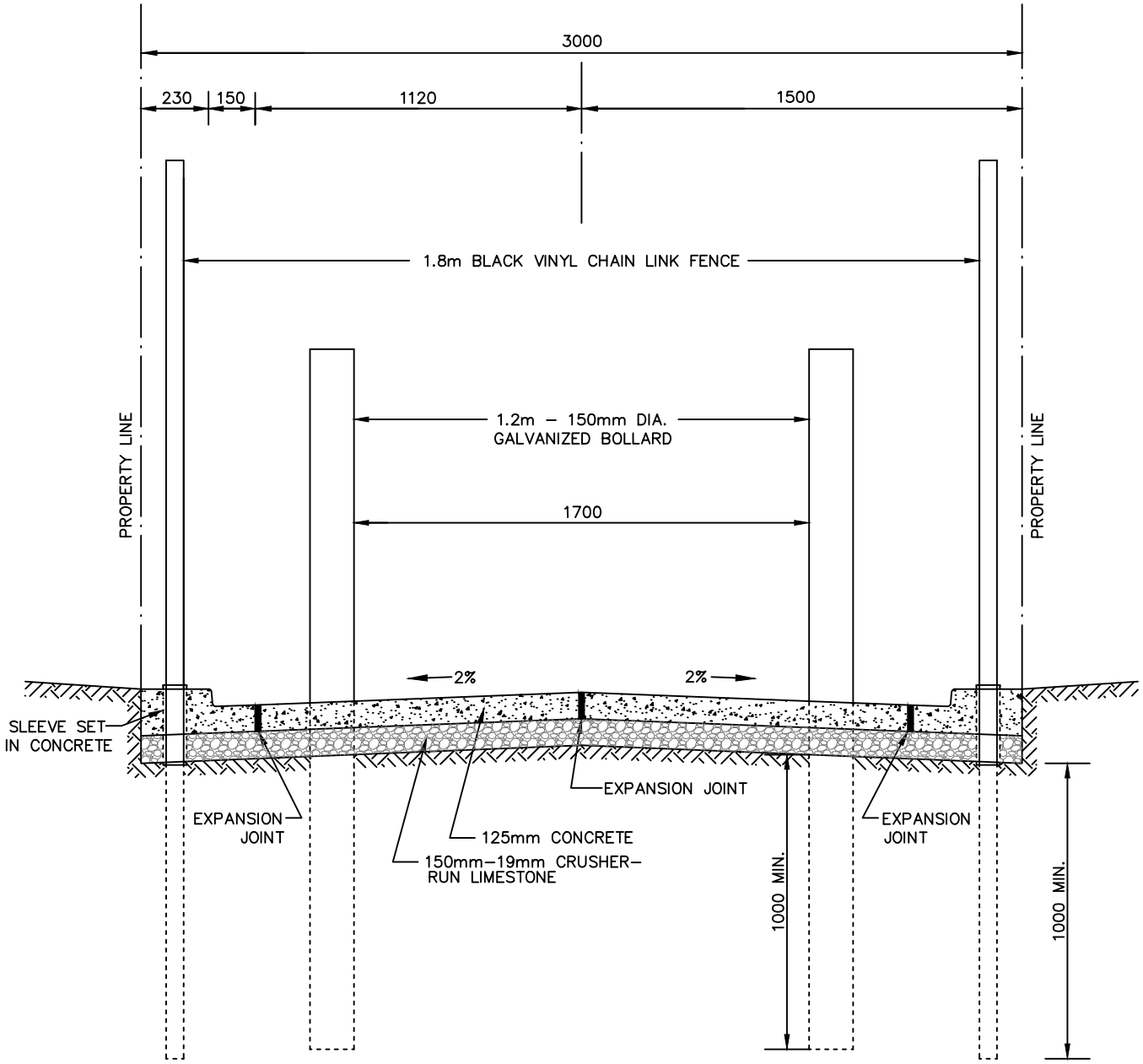
DRIVEWAY ENTRANCE DETAIL

DRAWING NO.: R-202



NOTES

1. TRANSVERSE EXPANSION JOINTS ARE REQUIRED AT 4.5m INTERVALS AND DUMMY JOINTS EVERY 1.5m.
2. ALL CONCRETE TO BE 30MPa; 7% +/– 1.5% AIR ENTRAINED.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: FEB 2009

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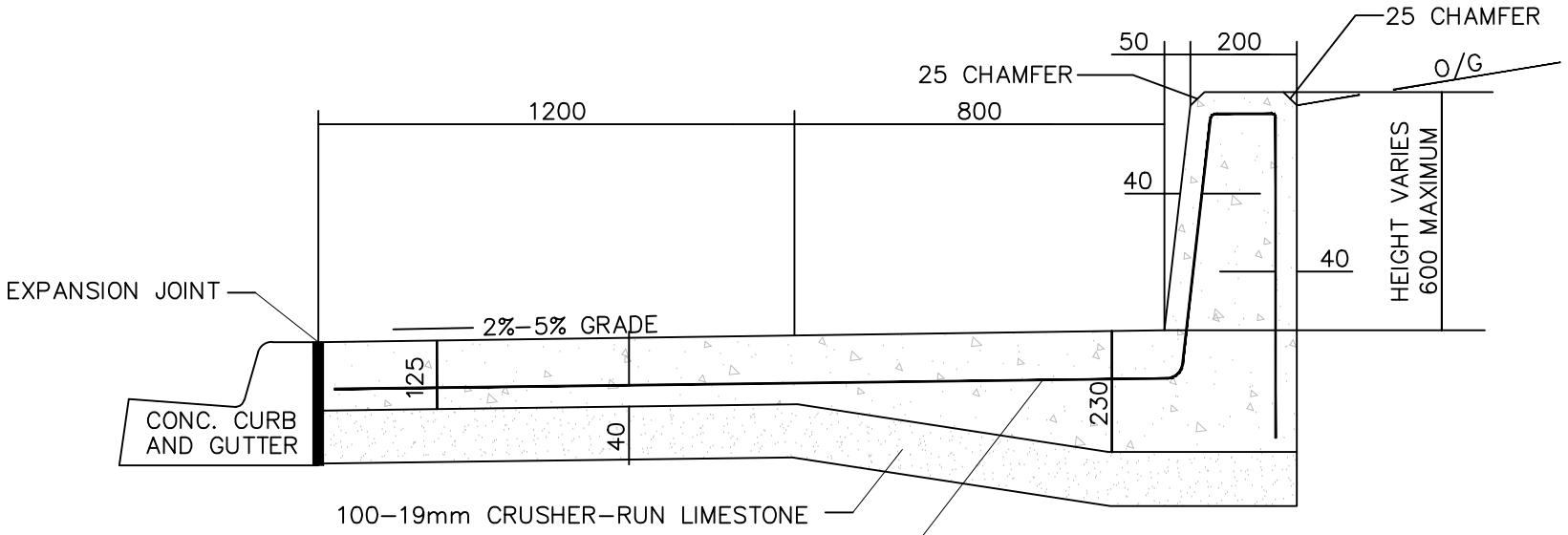
WALKWAY DETAIL

DRAWING NO.: R-203



UNCOATED 150mm SQUARE STEEL WIRE FABRIC (No. 3.8) FOR CONCRETE REINFORCEMENT CONFORMING TO C.S.A. G30.5, 1998 SHALL BE PLACED IN THE SIDEWALK AND RETAINING WALL

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE:

REVISION:
JAN. 2013

DRAWING NO.:
R-204

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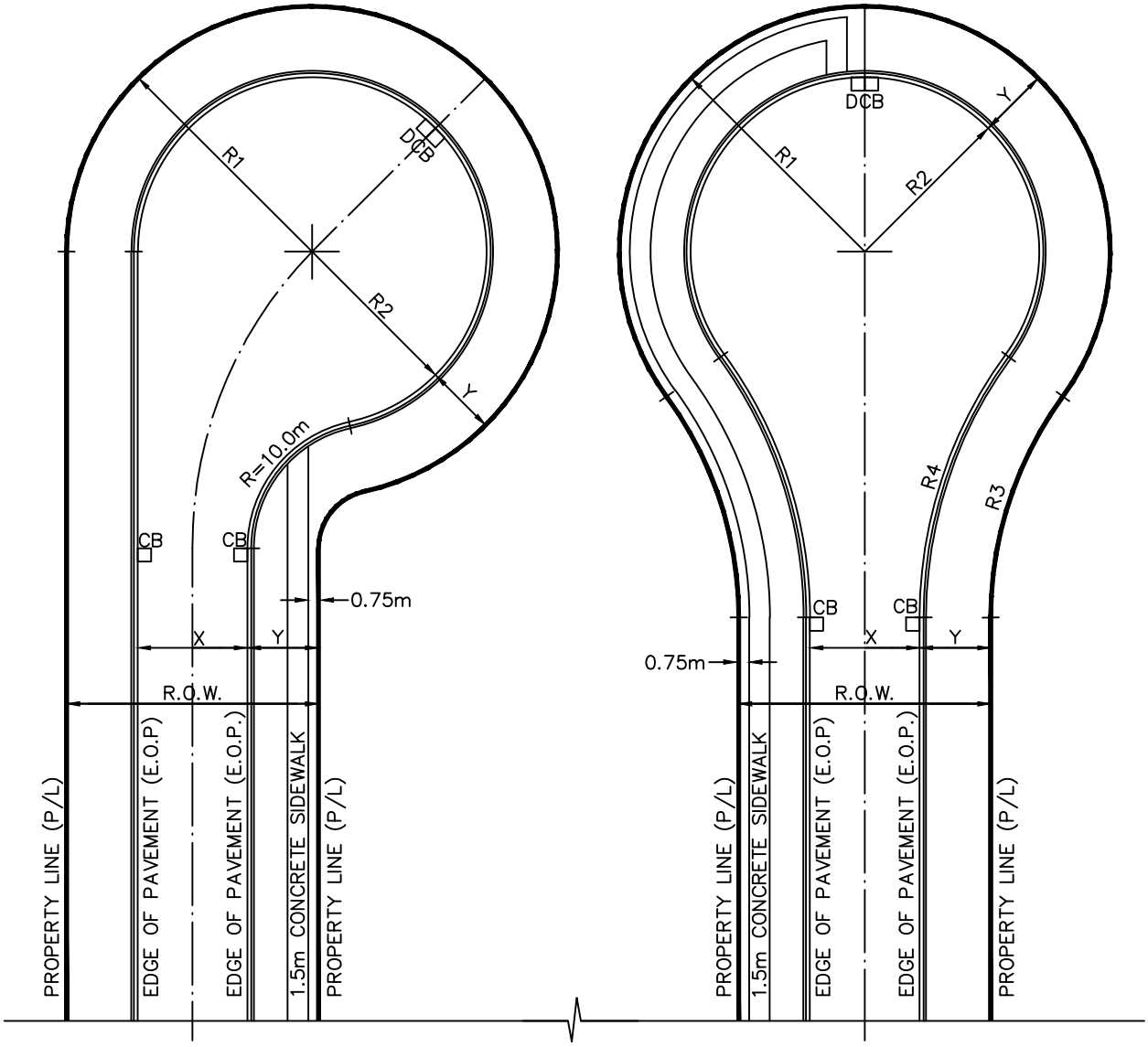
MONOLITHIC CONCRETE SIDEWALK AND RETAINING WALL



	R.O.W. WIDTH	'R1' P/L RADIUS	'R2' E.O.P. RADIUS	'R3' P/L RADIUS	'R4' E.O.P. RADIUS	'X' ROAD WIDTH	'Y' BOULEVARD WIDTH
RESIDENTIAL	18m	18m	13.0m	30.0m	35.0m	8.0m	5.0m
	20m	20m	14.25m	28.0m	33.75m	8.5m	5.75m
INDUSTRIAL	20m	20m	15.25m	28.0m	32.75m	10.5m	4.75m

NOTES

1. THE MAXIMUM PERMITTED LENGTH OF A CUL-DE-SAC SHALL GENERALLY BE 150m OR SERVICING 25 UNITS.
2. GUTTER ELEVATIONS AND GRADES AROUND CUL-DE-SAC SHALL BE DETAILED ON ENGINEERING DRAWINGS.
3. MINIMUM GUTTER GRADE TO BE 1.0%.
4. BOULEVARD WIDTHS TO BE MAINTAINED.
5. CUL-DE-SAC STREETS LESS THAN 350m IN LENGTH MAY NOT REQUIRE SIDEWALK.
6. MINIMUM 1.0m SPACING BETWEEN DRIVEWAY CURB DEPRESSIONS.
7. CATCHBASINS TO BE INSTALLED AS INDICATED DEPENDING ON DIRECTION OF DRAINAGE.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: SEPT. 2020

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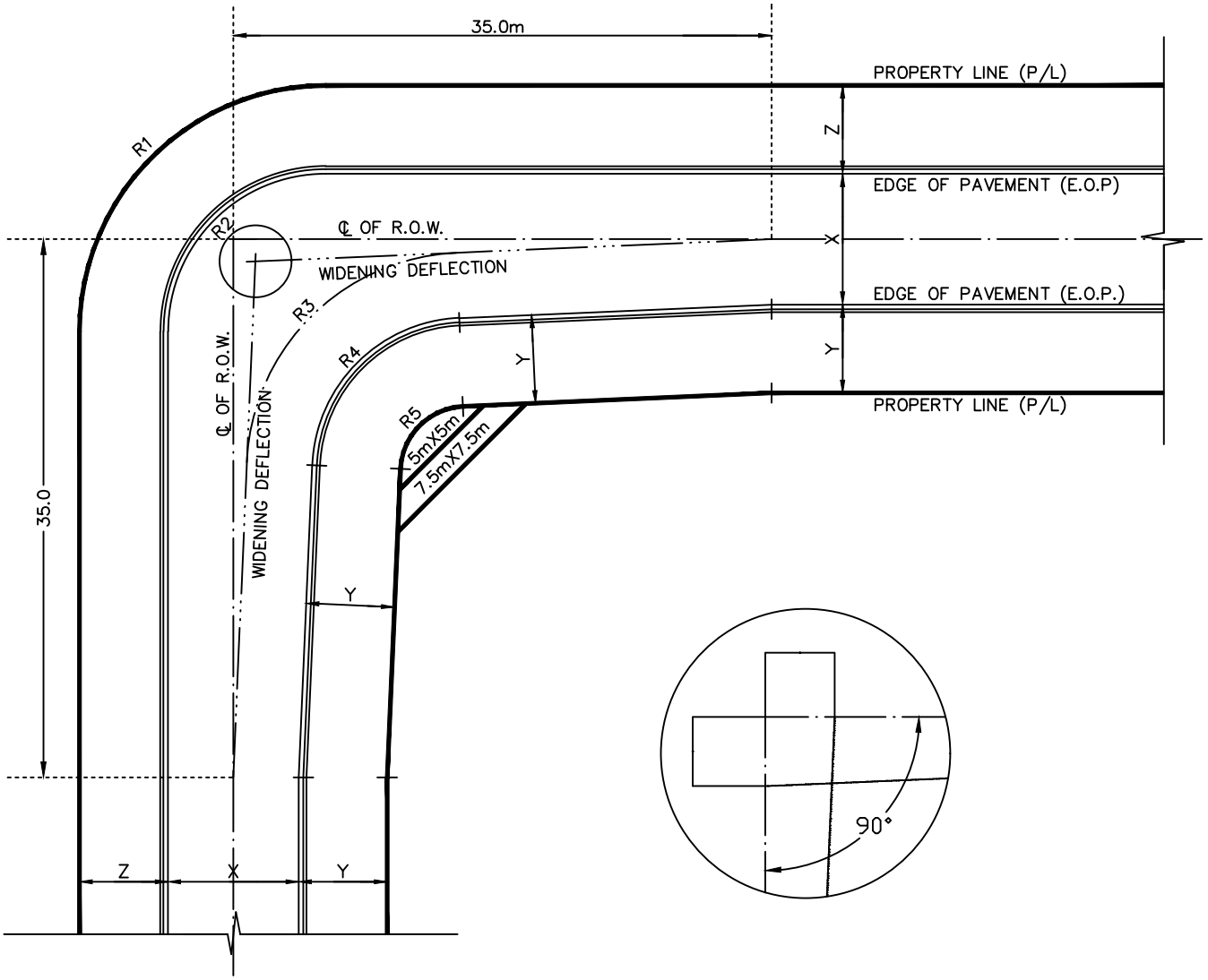
TYPICAL CUL-DE-SAC

DRAWING NO.: R-205



	R.O.W. WIDTH	'R1' P/L RADIUS	'R2' E.O.P. RADIUS	'R3' ℄ RADIUS	'R4' E.O.P. RADIUS	'R5' P/L RADIUS	'X' ROAD WIDTH	'Y' BOULEVARD WIDTH	'Z' BOULEVARD WIDTH
RESIDENTIAL	18m	16.0m	10.5m	14.0m	10.0m	5.5m	8.0m	4.5m	5.5m
	18m	16.0m	11.5m	14.0m	10.0m	4.5m*	8.0m	5.5m	4.5m
	20m	16.0m	10.25m	14.25m	10.0m	4.25m*	8.5m	5.75m	5.75m
INDUSTRIAL	20m	16.0m	11.25m	15.25m	10.0m	4.25m*	10.5m	4.75m	4.75m

* PROPERTY LINE RADIUS IS LESS THAN 5.0m, A 5.0m X 5.0m DAYLIGHTING SHALL BE USED.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **FEB. 2009**

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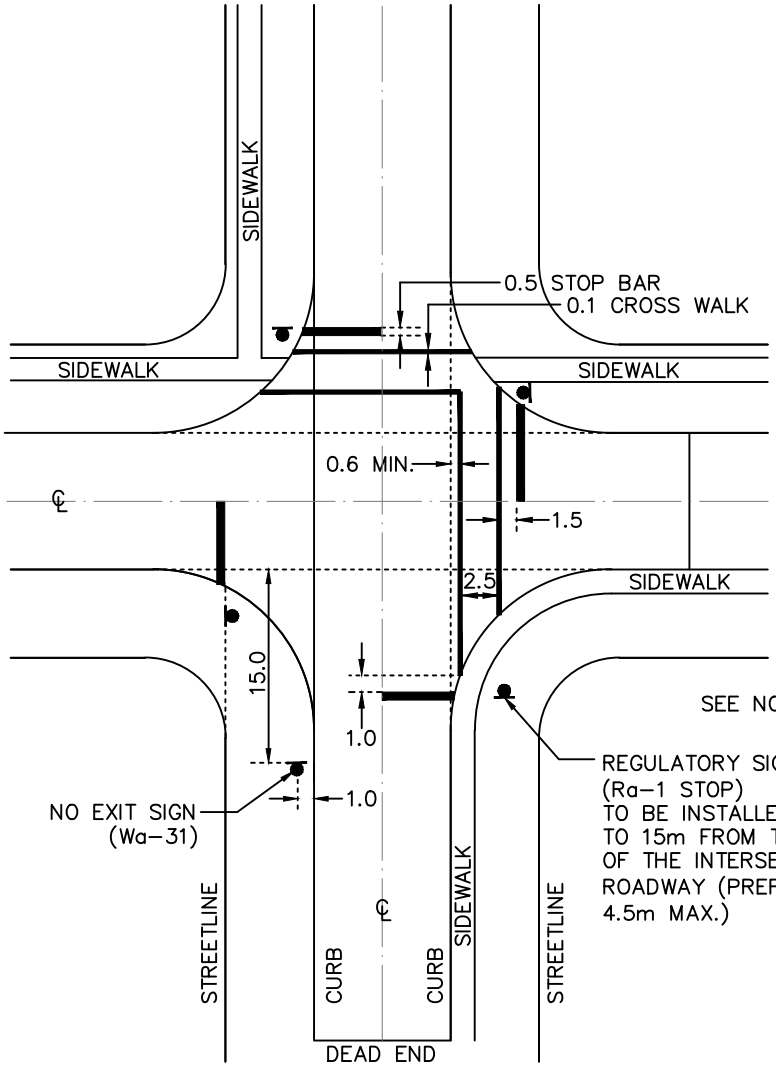
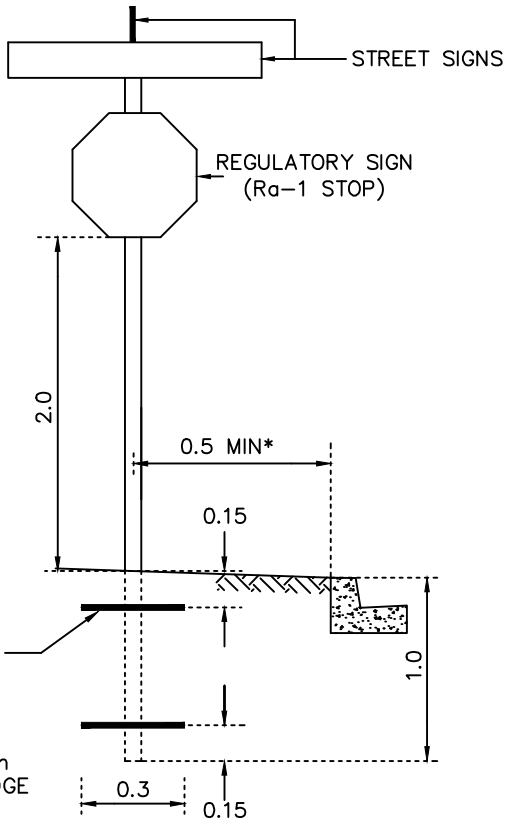
TYPICAL ANGLE BEND DETAIL

DRAWING NO.: **R-206**



LOCATION PLAN



INSTALLATION DETAIL

*SIGN OFFSET TO BE 0.50m FROM BACK OF CURB FACE SIDEWALK.

NOTES:

1. REGULATORY/WARNING SIGNS AS PER OHTA REG. 615/616 OR AMENDMENTS THEREOF.
2. STOP SIGNS (Ra-1) POSTS SHALL BE 75mm X 3.66m ALUMINUM COMPLETE WITH TOP CAP.
3. STOP SIGNS SHALL BE BANDED TO THE POST WITH MINIMUM 12.7mm X .76mm STAINLESS STEEL BANDING AND FLARED LEG STAINLESS STEEL BRACKETS (BANDRIT BRACKETS OR EQUIVALENT).
4. ALL OTHER REGULATORY/WARNING SIGNS SHALL BE MOUNTED ON 3.66M 80,000psi U-FLANGE POSTS WHICH HAVE THE TOP 1200mm PUNCHED ON 50mm CENTRES WITH 11mm HOLES.
5. ALL REGULATORY SIGNS SHALL CONFORM WITH THE CURRENT VERSION OF THE ONTARIO TRAFFIC MANUAL (O.T.M.).
6. ALL WARNING SIGNS AND INSTALLATIONS SHALL CONFORM WITH THE CURRENT VERSION OF THE O.T.M.
7. ALL REGULATORY AND WARNING SIGNS SHALL BE MOUNTED A MINIMUM OF 2.0M ABOVE FINISHED GROUND ELEVATION.
8. ALL REGULATORY AND WARNING SIGN BLANKS SHALL BE ALUMINUM AND BE HIGH DENSITY REFLECTORIZED SURFACES.
9. SIGN POSTS SHALL BE ANCHORED USING 0.3m LONG 15M REINFORCING STEEL BARS INSERTED THROUGH HOLES DRILLED IN SIGN POST OR BY 0.15m LONG ANGLE IRON WELDED TO THE SIGN POST ON EACH SIDE.
10. SIGN POSTS TO BE BACKFILLED WITH 19mm CRUSHER-RUN LIMESTONE.

ALL DIMENSIONS ARE EXPRESSED IN METRES (m) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **SEPT. 2020**

AURORA
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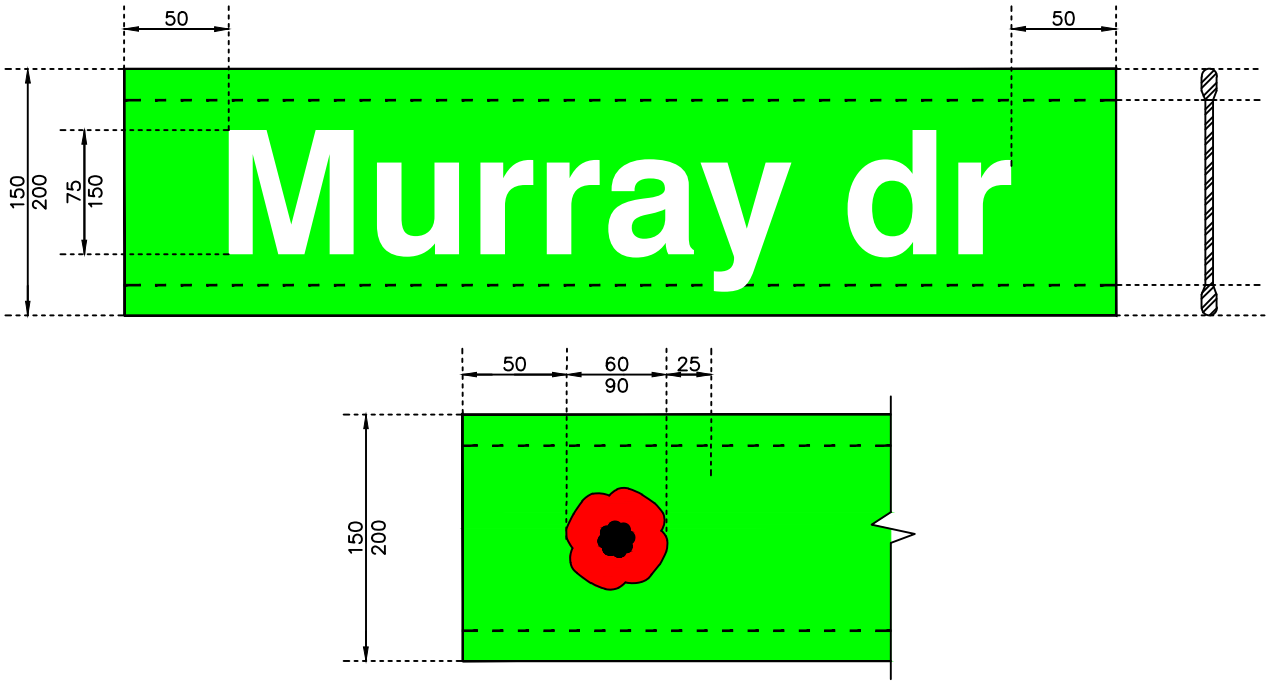
TRAFFIC SIGN AND PAVEMENT MARKING INSTALLATION DETAIL

DRAWING NO.: **R-207**



POPPY DESIGNATED STREET NAME BLADE DETAIL

NOTES

1. SIGN BLADES SHALL BE 150mm WIDE EXTRUDED ALUMINUM (200mm WIDTH AT INTERSECTION OF ARTERIAL ROADS).
2. SIGNS TO HAVE REFLECTIVE COATING (3M ENGINEERING GRADE OR EQUIVALENT) WITH GREEN COLOURED PIGMENT FOR BACKGROUND. ALL LETTERING IN WHITE.
3. LETTERING SHALL BE HELVETICA MEDIUM STYLE CHARACTERS AND SHALL BE APPROPRIATELY SIZED.
   75mm LETTERING FOR 150mm BLADES.
   150mm LETTERING FOR 200mm BLADES.
4. ALL LETTERS SHALL BE LOWER CASE EXCEPT FOR THE FIRST LETTER OF EACH "PROPER NAME" WHICH SHALL BE UPPER CASE.
5. ALL COMMON NAMES SHALL TO BE LOWER CASE; ONLY STANDARD NAMES SHALL BE ABBREVIATED. FOR EXAMPLE:

   STREET (st) ROAD (rd) DRIVE (dr) COURT (ct) AVENUE (ave) CRESCENT (cres) BOULEVARD (blvd)
6. ALL OTHER "COMMON NAMES" SHALL BE SHOWN IN FULL. FOR EXAMPLE:

   lane circle way gate gardens terrace
7. WHENEVER A STREET NAME INCLUDES A DIRECTIONAL ELEMENT, THIS SHALL BE SHOWN AS A LOWER CASE SINGULAR LETTER (NORTH (n), SOUTH (s), EAST (e), WEST (w)).
8. THE FOLLOWING ARE EXAMPLES OF THE STANDARDS DESCRIBED:

Hillary place	St. Andrew's ct
Mill st	St. John sideroad e
Collins cres	Vandorf sideroad
Aurora Heights dr	Industrial parkway n
Crawford Rose dr	Kennedy st w
Little Erica way	Lee gate

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: FEB. 2009

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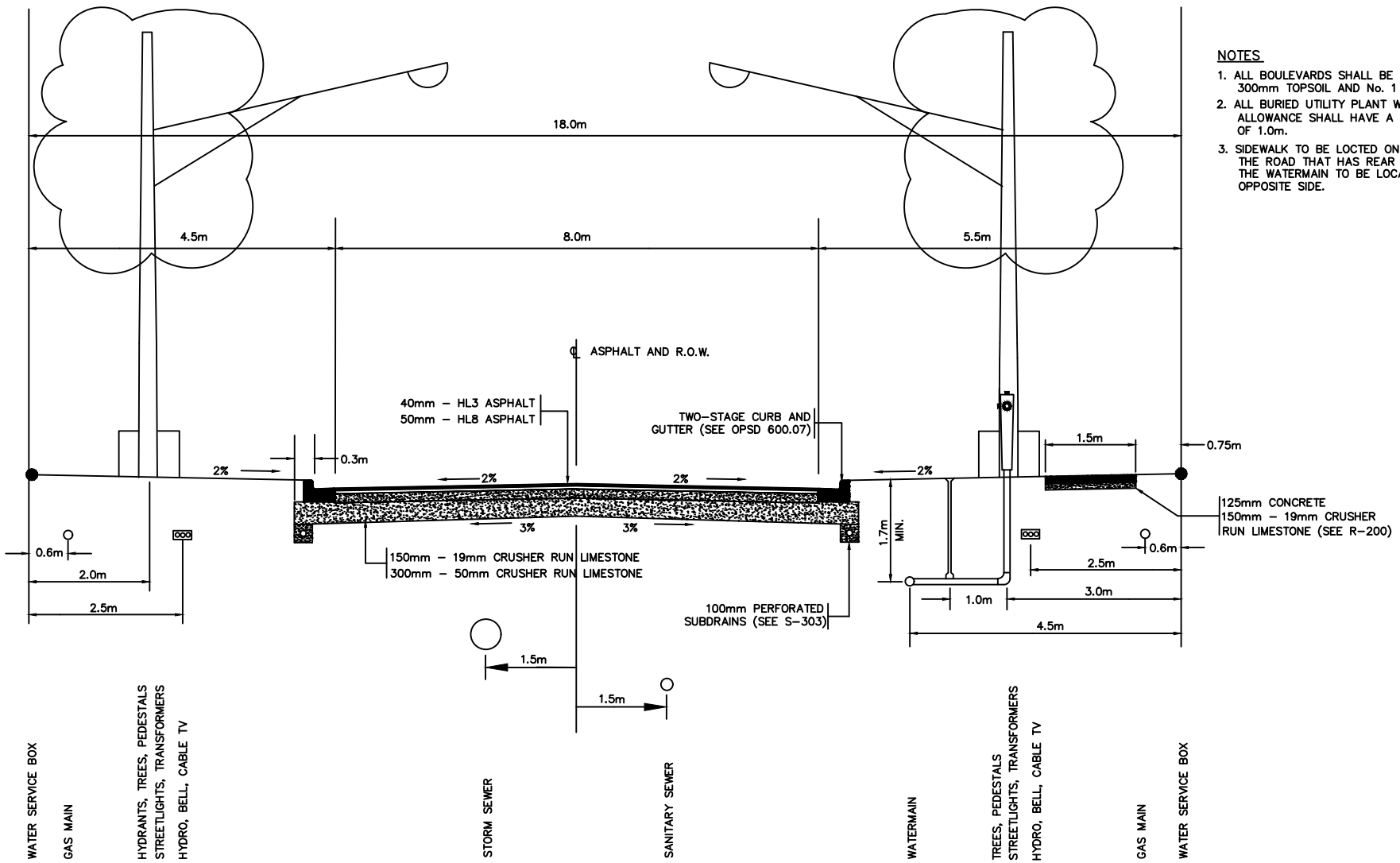
STREET NAME SIGN DETAIL

DRAWING NO.: R-208



NOTES

1. ALL BOULEVARDS SHALL BE LANDSCAPED WITH 300mm TOPSOIL AND No. 1 NURSERY SOD.
2. ALL BURIED UTILITY PLANT WITHIN THE ROAD ALLOWANCE SHALL HAVE A MINIMUM COVER OF 1.0m.
3. SIDEWALK TO BE LOCTED ON THE SIDE OF THE ROAD THAT HAS REAR DRAINING LOTS. THE WATERMAIN TO BE LOCATED ON THE OPPOSITE SIDE.

TOWN OF AURORA

APPROVED:

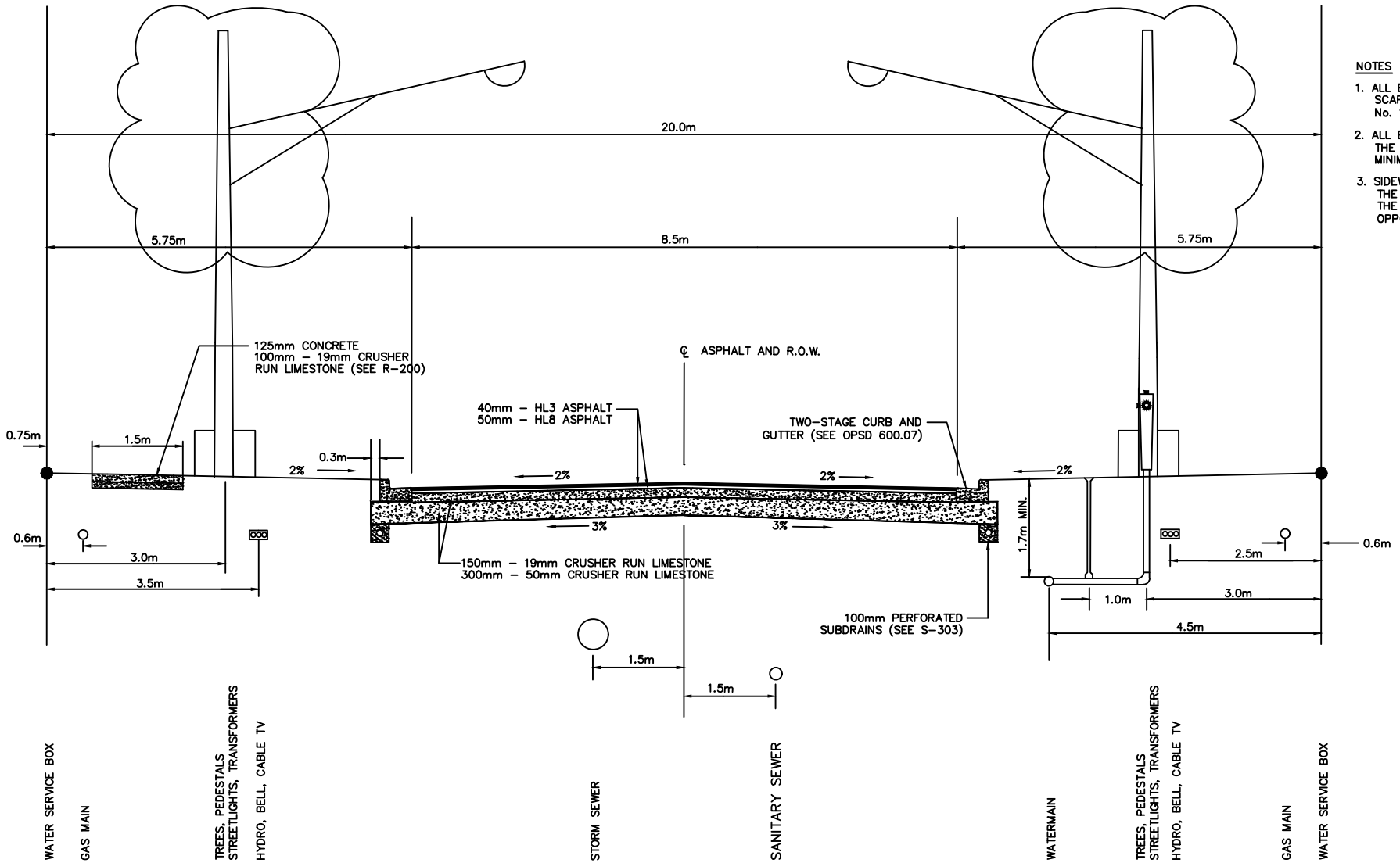
SCALE: N.T.S

REVISION: JAN. 2013

DRAWING NO.: R-209

AURORA You're in Good Company

TYPICAL 18.0m RESIDENTIAL R.O.W.



NOTES

1. ALL BOULEVARDS SHALL BE LAND–SCAPED WITH 300mm TOPSOIL AND No. 1 NURSERY SOD.
2. ALL BURIED UTILITY PLANT WITHIN THE ROAD ALLOWANCE SHALL HAVE A MINIMUM COVER OF 1.0m.
3. SIDEWALK TO BE LOCTED ON THE SIDE OF THE ROAD THAT HAS REAR DRAINING LOTS. THE WATERMAIN TO BE LOCATED ON THE OPPOSITE SIDE.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: JAN. 2013

AURORA
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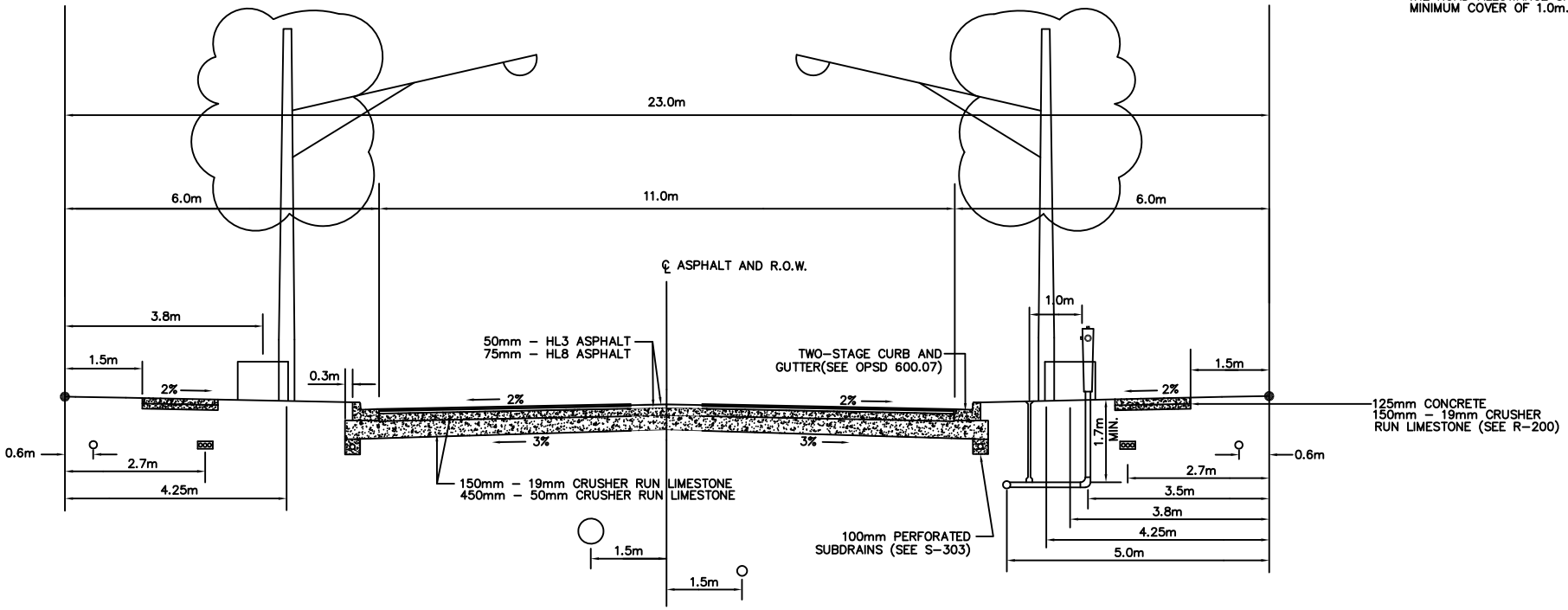
TYPICAL 20m RESIDENTIAL R.O.W.

DRAWING NO.: R-210

NOTES

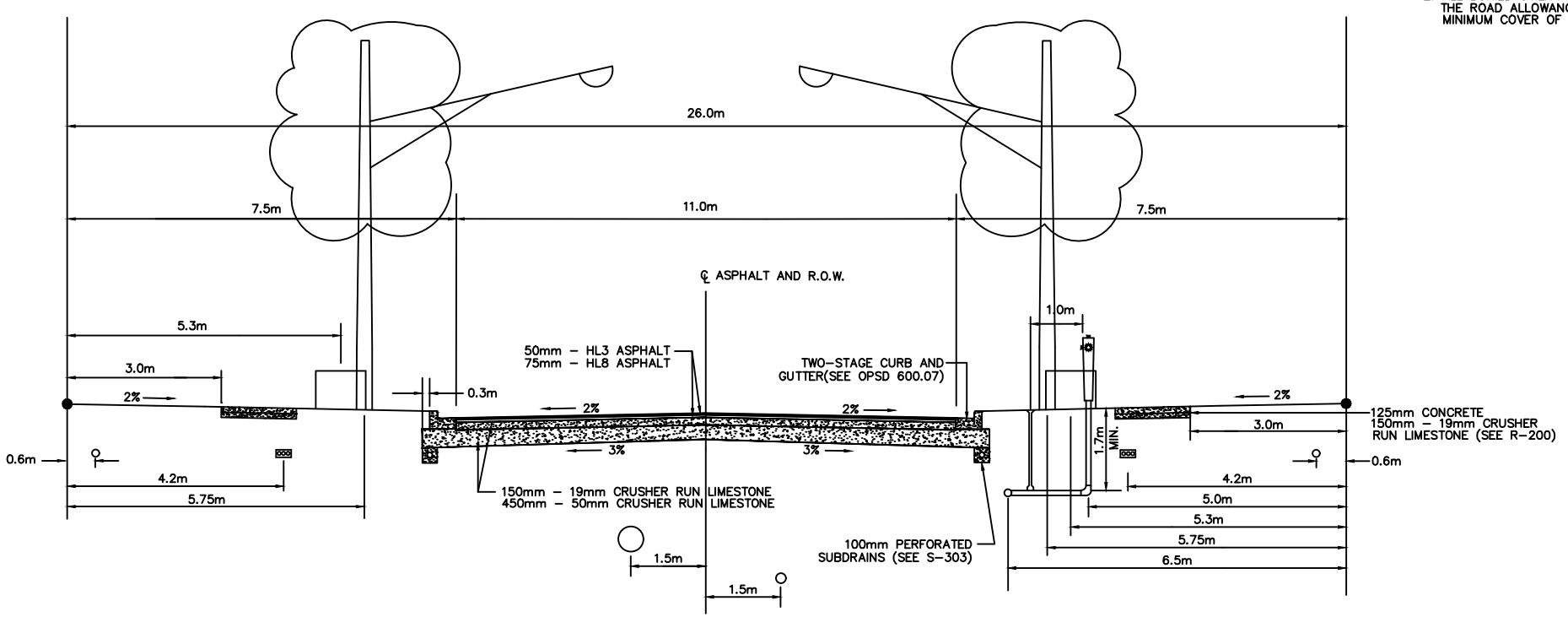
1. ALL BOULEVARDS SHALL BE LAND-SCAPED WITH 300mm TOPSOIL AND No. 1 NURSERY SOD.
2. ALL BURIED UTILITY PLANT WITHIN THE ROAD ALLOWANCE SHALL HAVE A MINIMUM COVER OF 1.0m.



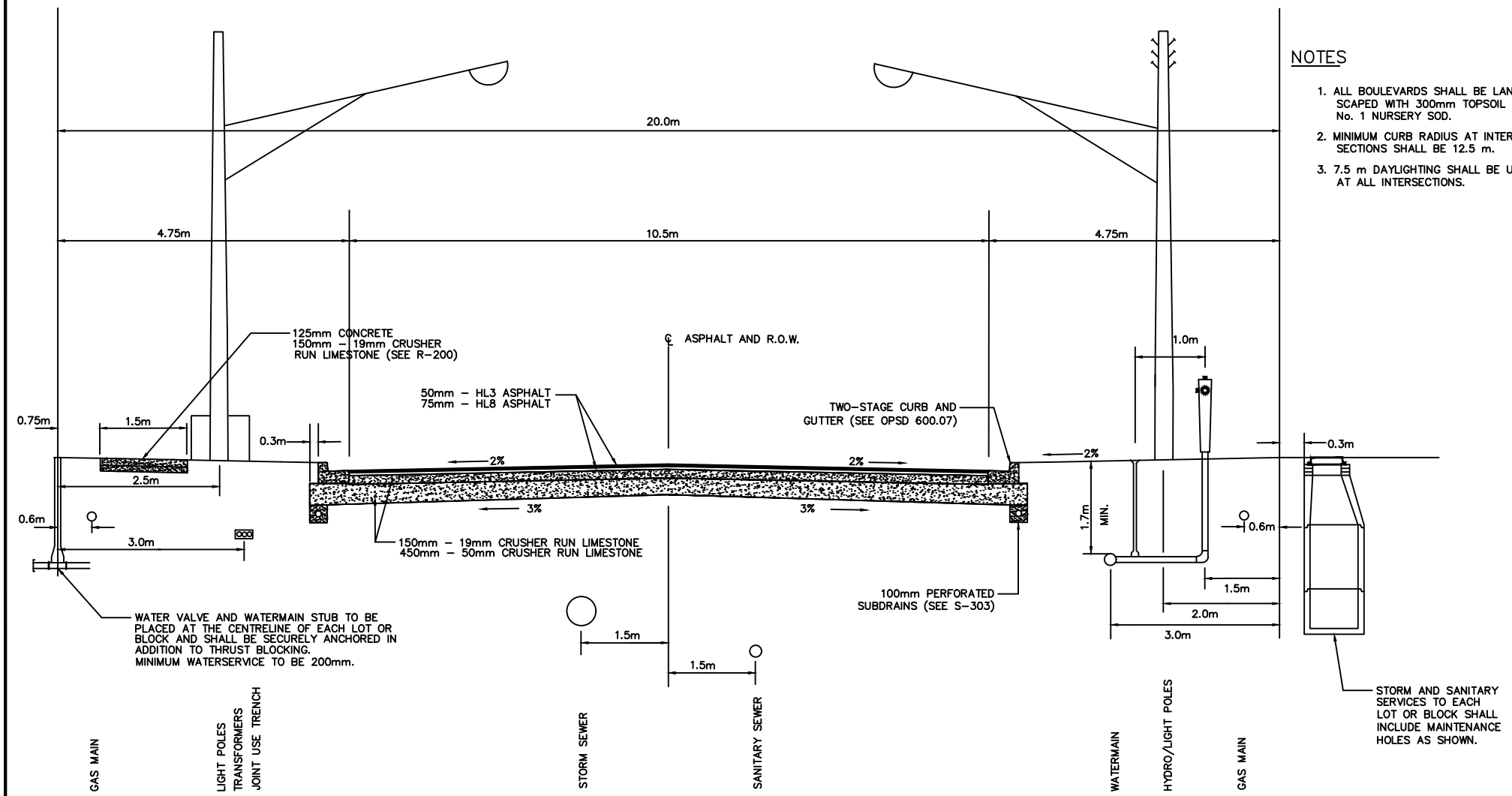
TOWN OF AURORA	APPROVED:	SCALE: N.T.S
AURORA You're in Good Company	**TYPICAL 23m RESIDENTIAL R.O.W.**	REVISION: JAN 2013
		DRAWING NO.: **R-211**

NOTES

1. ALL BOULEVARDS SHALL BE LAND-SCAPED WITH 300mm TOPSOIL AND No. 1 NURSERY SOD.
2. ALL BURIED UTILITY PLANT WITHIN THE ROAD ALLOWANCE SHALL HAVE A MINIMUM COVER OF 1.0m.



TOWN OF AURORA	APPROVED:	SCALE: N.T.S
AURORA You're in Good Company	TYPICAL 26m RESIDENTIAL R.O.W.	REVISION: JAN. 2013
		DRAWING NO.: R-212



NOTES

1. ALL BOULEVARDS SHALL BE LAND-SCAPED WITH 300mm TOPSOIL AND No. 1 NURSERY SOD.
2. MINIMUM CURB RADIUS AT INTER-SECTIONS SHALL BE 12.5 m.
3. 7.5 m DAYLIGHTING SHALL BE USED AT ALL INTERSECTIONS.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: JAN. 2013

DRAWING NO.: R-213

AURORA
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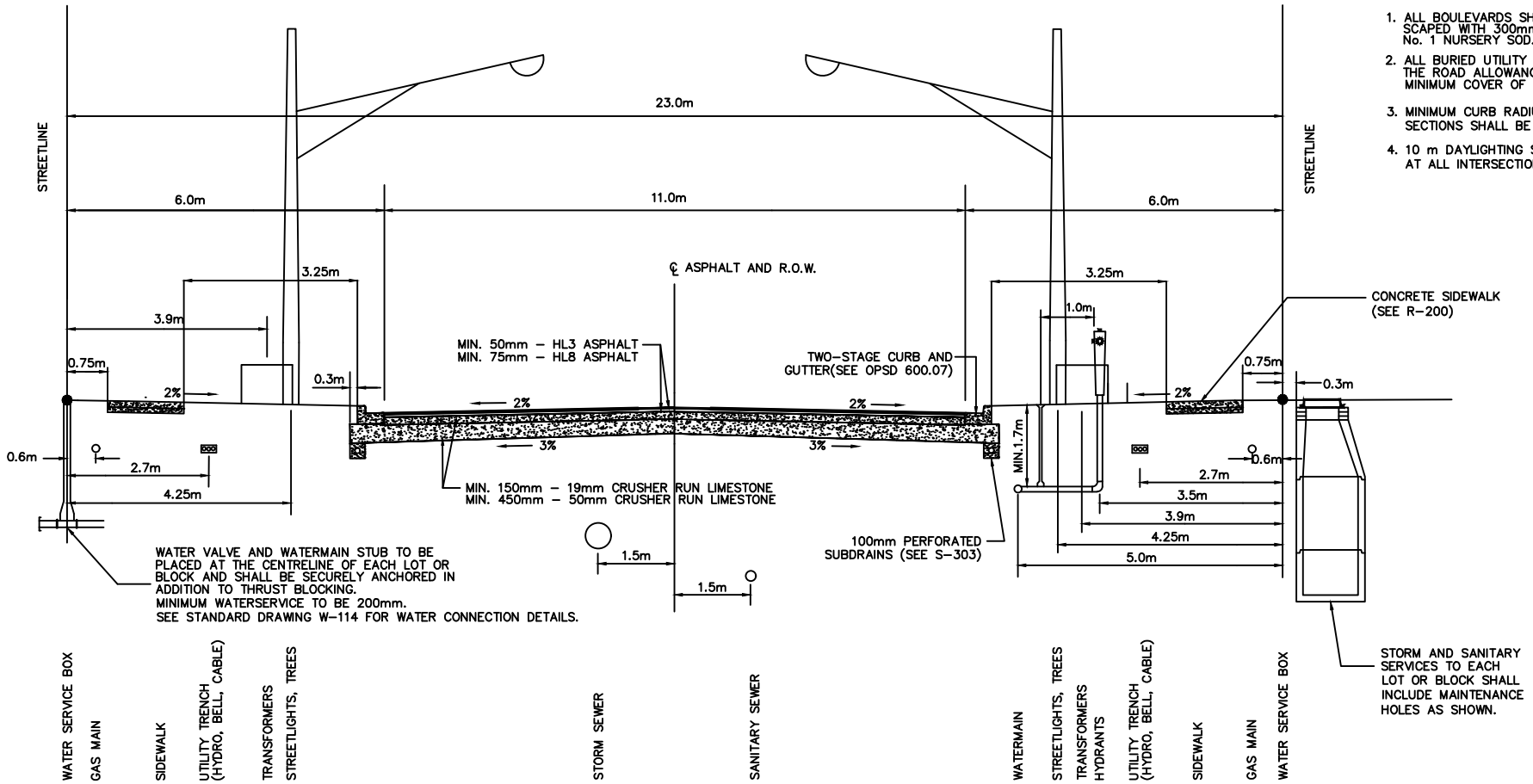
TYPICAL 20m INDUSTRIAL R.O.W.



NOTES

1. ALL BOULEVARDS SHALL BE LAND–SCAPED WITH 300mm TOPSOIL AND No. 1 NURSERY SOD.
2. ALL BURIED UTILITY PLANT WITHIN THE ROAD ALLOWANCE SHALL HAVE A MINIMUM COVER OF 1.0m.
3. MINIMUM CURB RADIUS AT INTER–SECTIONS SHALL BE 12.5 m.
4. 10 m DAYLIGHTING SHALL BE USED AT ALL INTERSECTIONS.

TOWN OF AURORA

APPROVED:

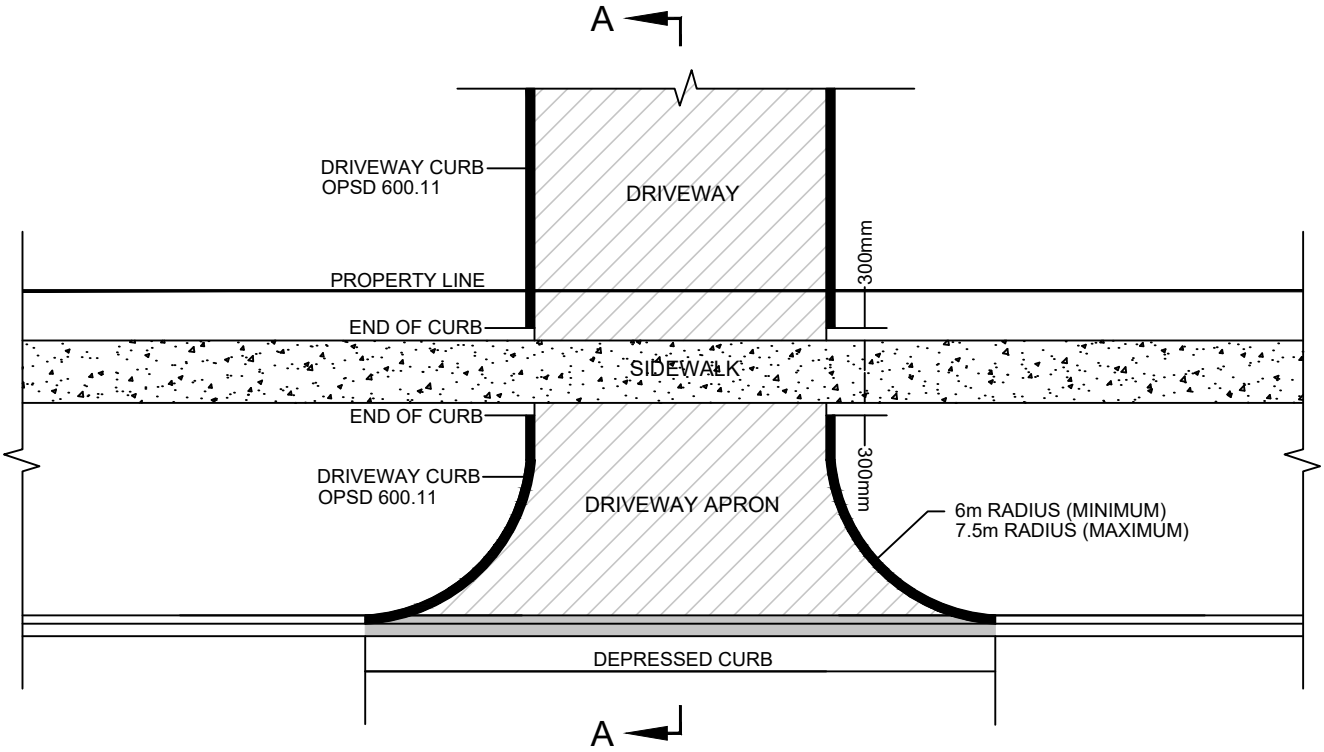
SCALE: N.T.S

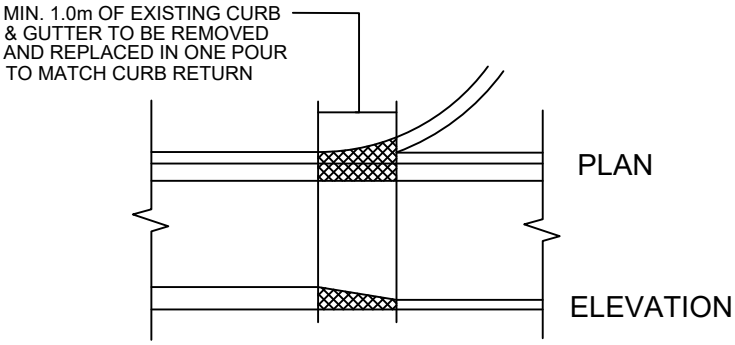
REVISION: FEB 2017

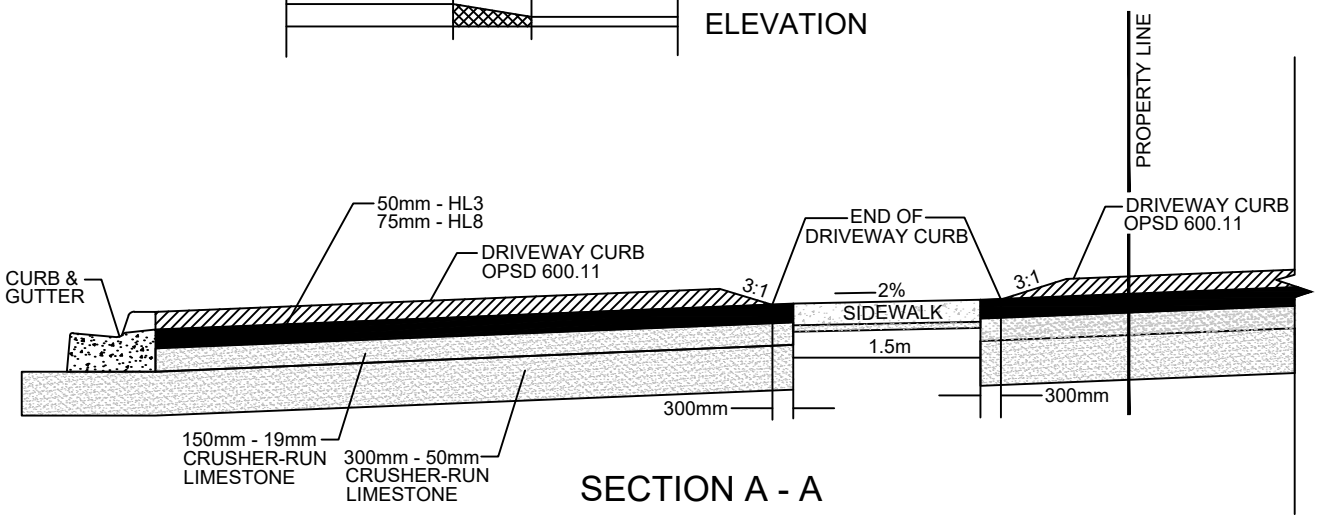
AURORA You're in Good Company

TYPICAL 23m INDUSTRIAL R.O.W.

DRAWING NO.: R-214







SECTION A - A

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE:
N.T.S

REVISION:
JULY 2012

DRAWING NO.:
R-215

AURORA
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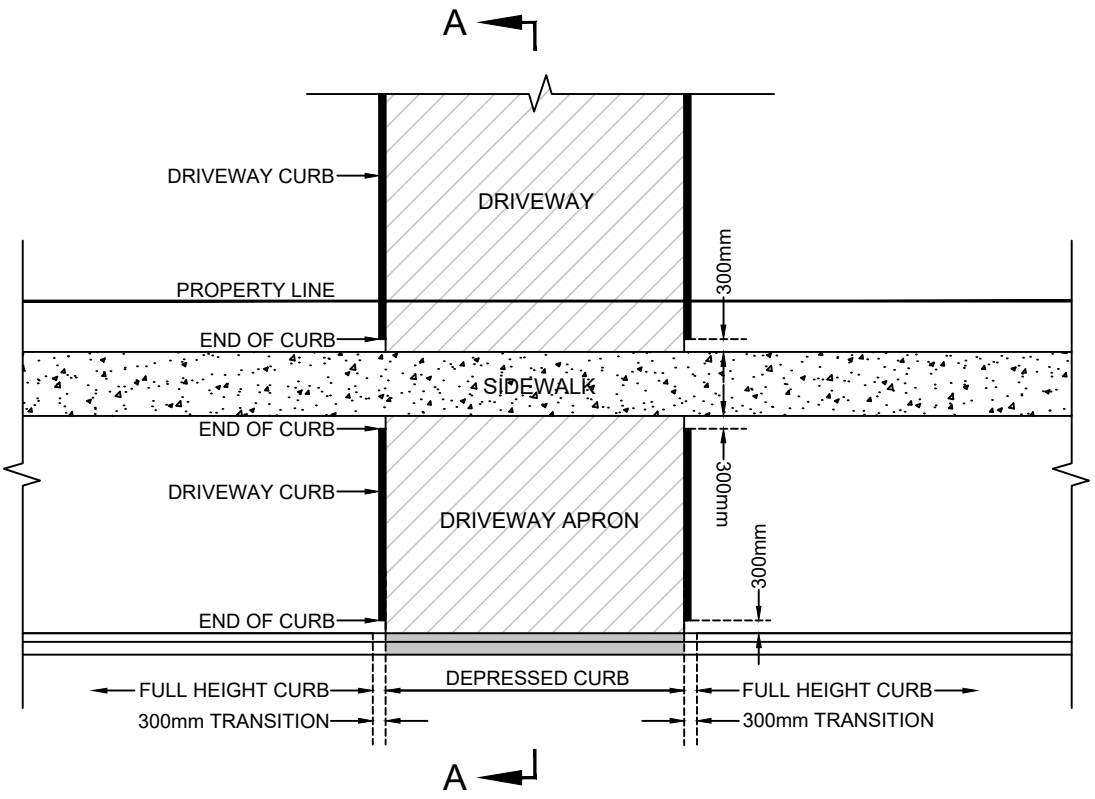
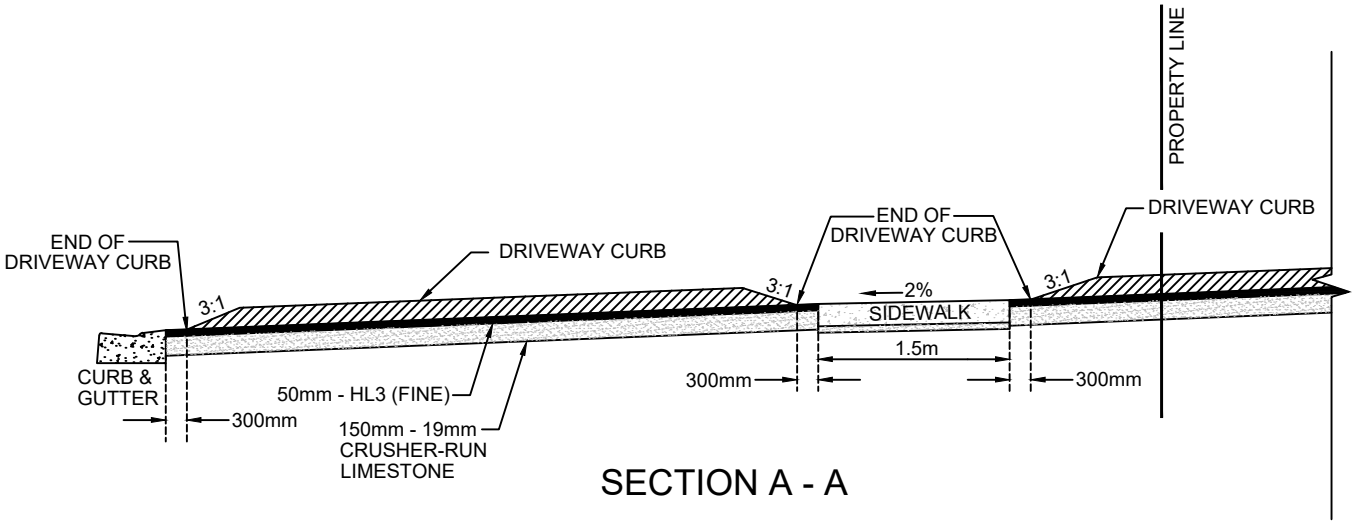
INDUSTRIAL, COMMERCIAL AND MULTI-RESIDENTIAL ENTRANCES CURB DETAIL





SECTION A - A

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **JAN 2013**

AURORA
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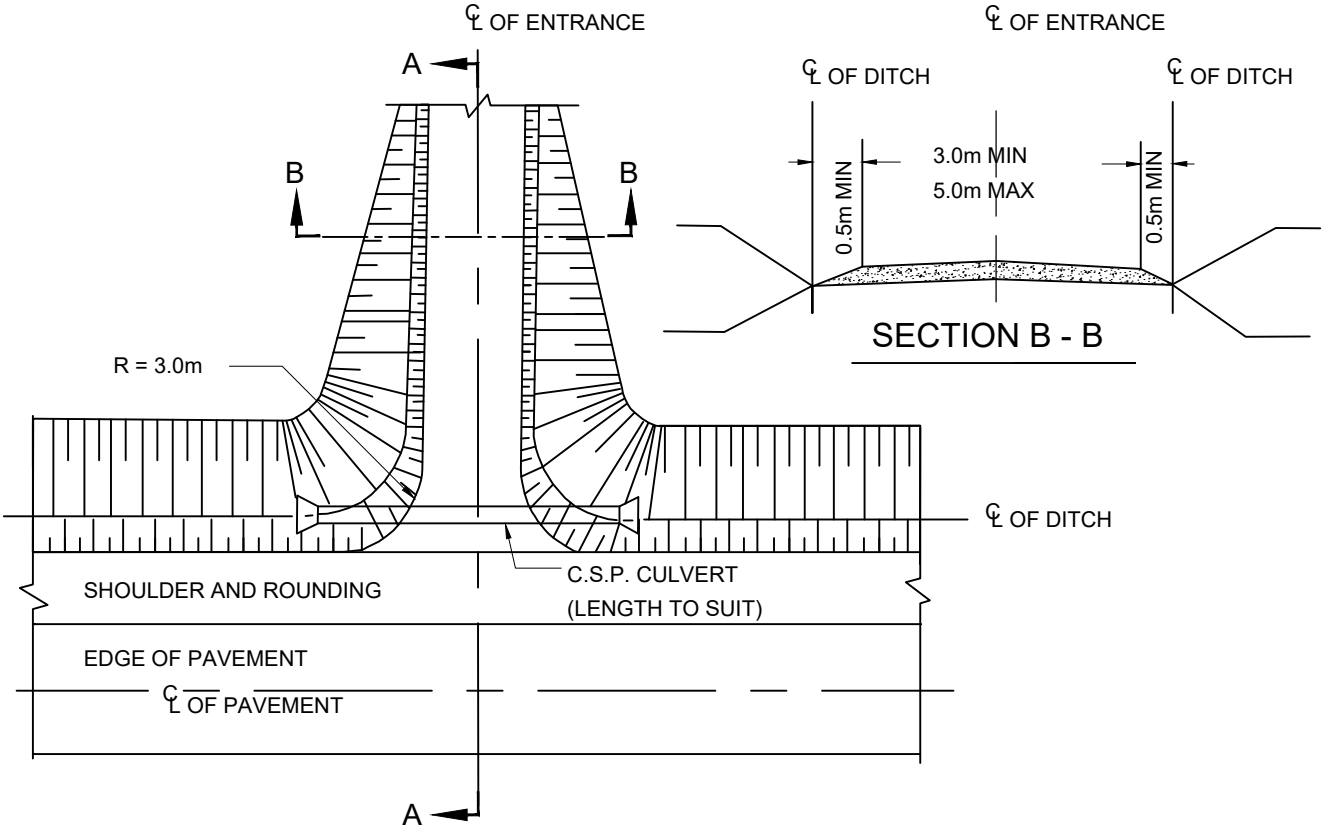
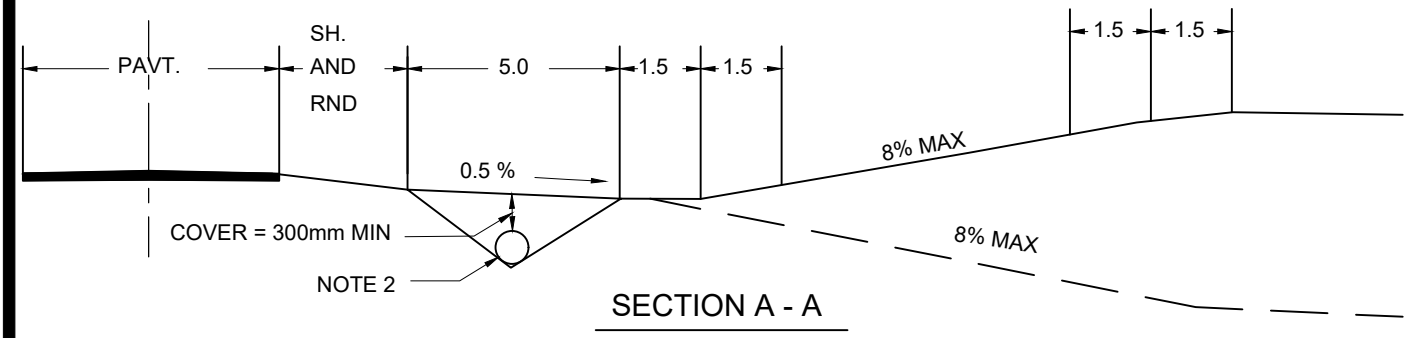
RESIDENTIAL DRIVEWAY CURB DETAIL

DRAWING NO.: **R-216**



PLAN

SECTION B - B



SECTION A - A

NOTES:

1. MAXIMUM GRADIENT: 8 % FOR RESIDENTIAL ENTRANCE
   10 % FOR FARM AND FIELD ENTRANCE
2. DRIVEWAY CULVERT TO BE CORRUGATED STEEL PIPE COMPLETE WITH MANUFACTURED END SECTIONS OR EQUIVALENT END PROTECTION
3. CULVERT TO BE 400mm MINIMUM DIAMETER AND 1.6mm MINIMUM THICKNESS.
4. DRIVEWAY TO BE CONSTRUCTED OF 150mm OF 19mm CRUSHER-RUN LIMESTONE TOPPED WITH 50mm OF COMPACTED HL3A ASPHALT (ALTERNATE SURFACE TREATMENT MUST HAVE PRIOR APPROVAL).
5. ENTRANCES IN "ESTATE LOT DEVELOPMENTS" SHALL BE PAVED FROM THE EDGE OF THE TRAVELED ROAD TO THE STREET LINE, UNLESS OTHERWISE APPROVED.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **JAN 2013**

AURORA
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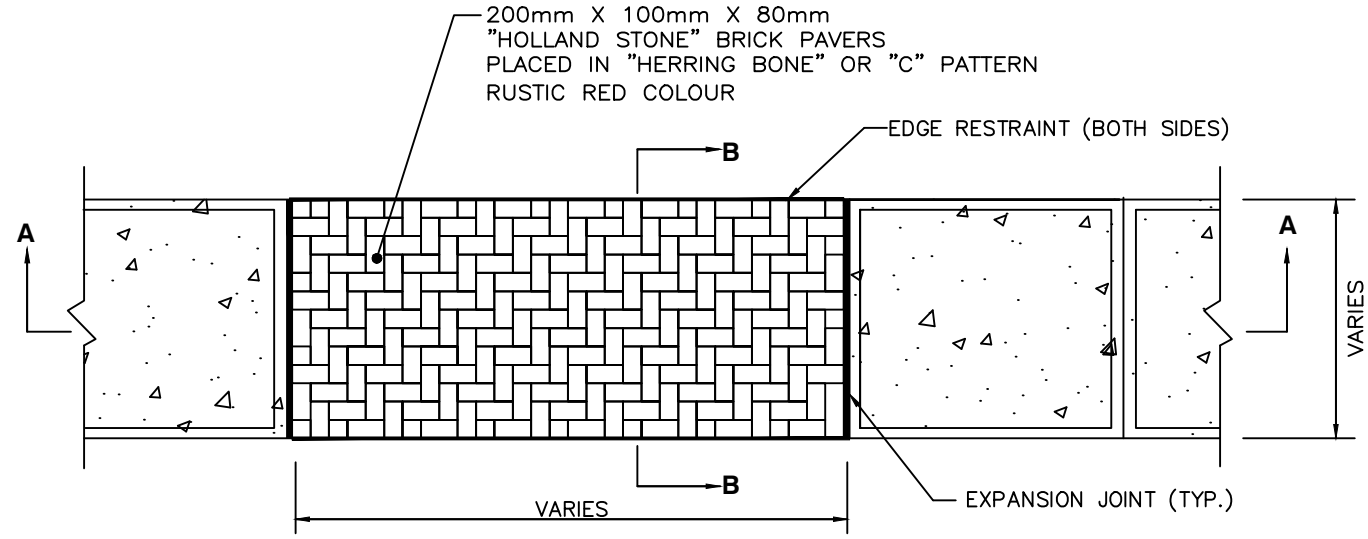
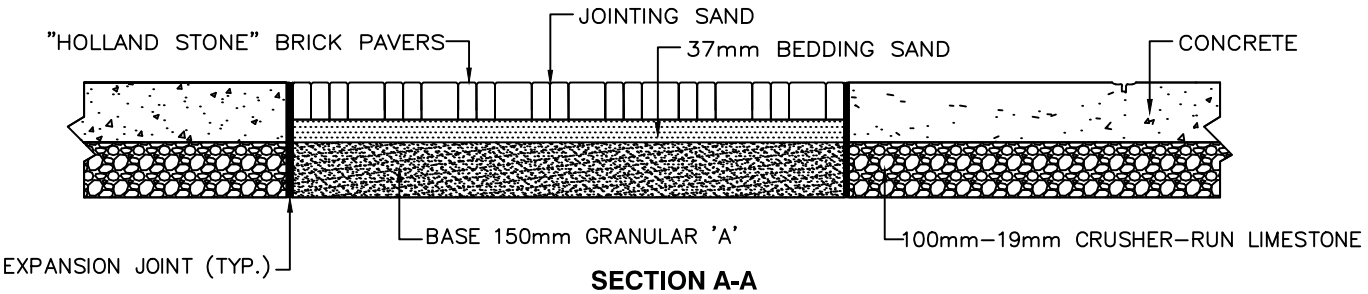
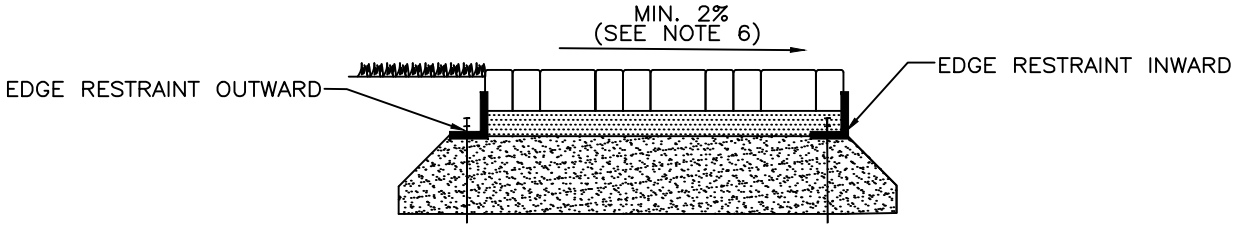
RURAL ENTRANCE

DRAWING NO.: **R-217**





SECTION A-A



SECTION B-B

NOTES:

1. INTERLOCKING STONE TO BE; TYPE: HOLLAND STONE, COLOUR: RUSTIC RED, THICKNESS: 80mm
2. BEDDING SAND TO BE 100% PASSING 4.75mm.
3. JOINTING SAND TO BE 100% PASSING 2.36mm SIEVE AND SHALL BE SWEPT AND COMPACTED INTO JOINTS.
4. JOINTS SHALL NOT BE GREATER THAN 5mm.
5. EDGE RESTRAINT SHALL BE MINIMUM 50mm VERTICAL FACE FROM TOP OF GRANULAR BASE. LOCATION OF WORK SHALL DETERMINE EDGE RESTRAINT INWARD OR OUTWARD.
6. MINIMUM 2% CROSS FALL WHEREVER POSSIBLE, OTHERWISE GRADE SHALL MATCH TO EXISTING SOD, DRIVEWAY, WALKWAY, TREE ROOTS, ETC. TO MINIMIZE DISTURBANCE IN EXISTING AREAS.
7. ALL TREE ROOTS SHALL BE TRIMMED UNDER THE DIRECTION OF A CERTIFIED ARBORIST OR THE ENGINEER.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: FEB. 2013

AURORA
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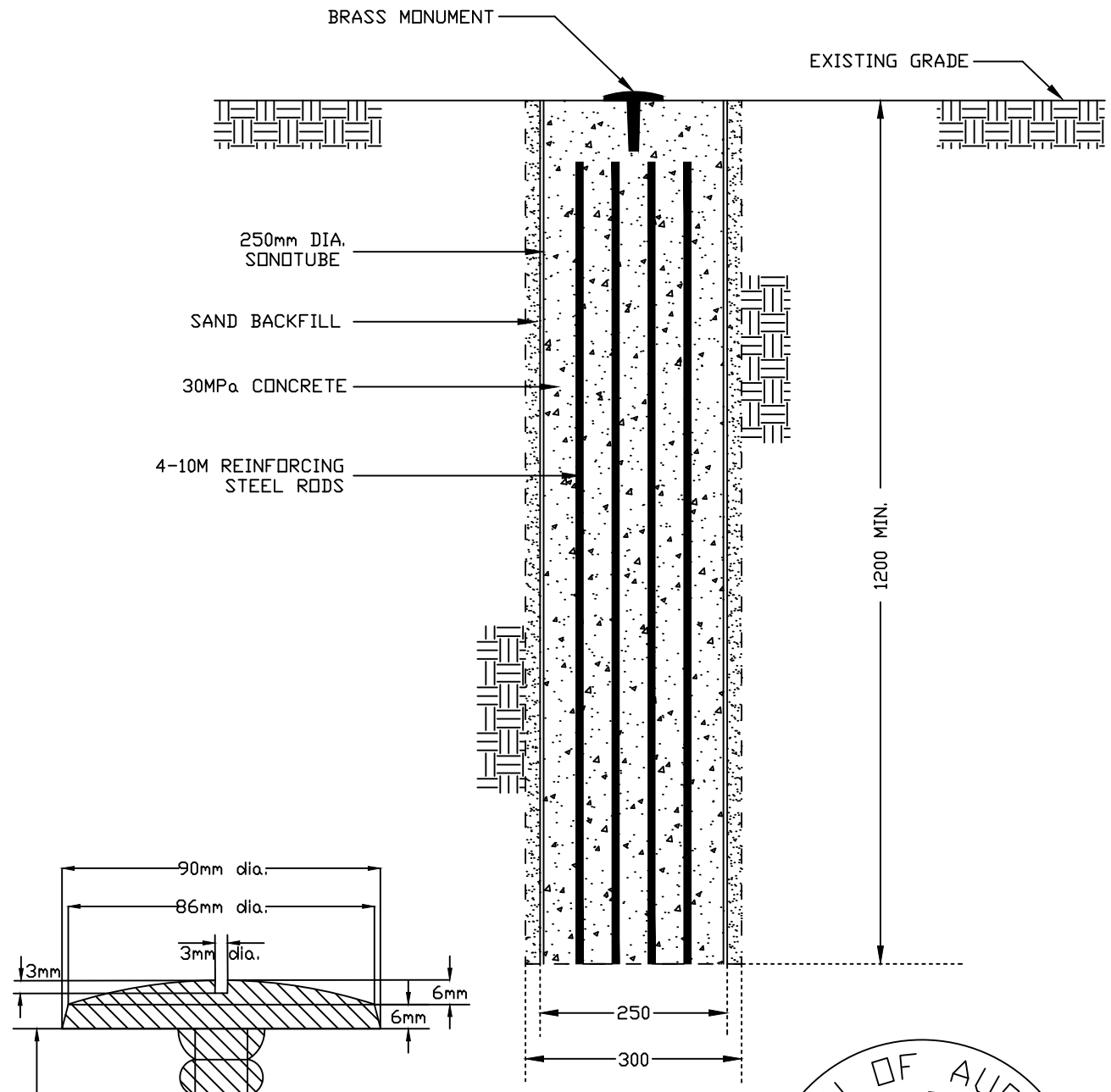
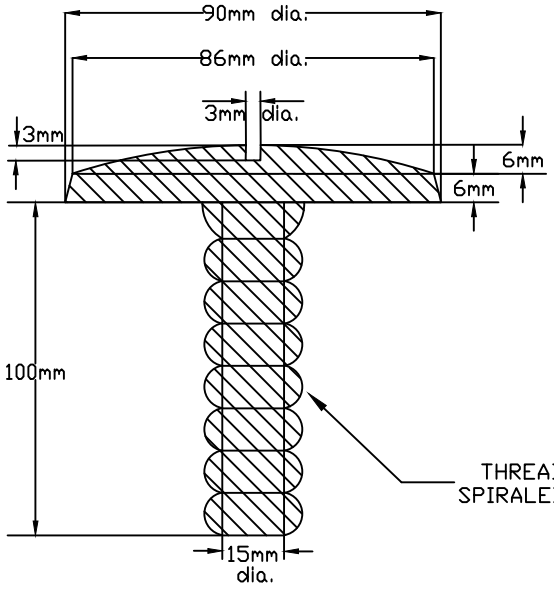
INTERLOCKING PAVER SIDEWALK

DRAWING NO.: R-218





MATERIAL: BRASS

MONUMENT INSCRIPTION

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: NOV 2018

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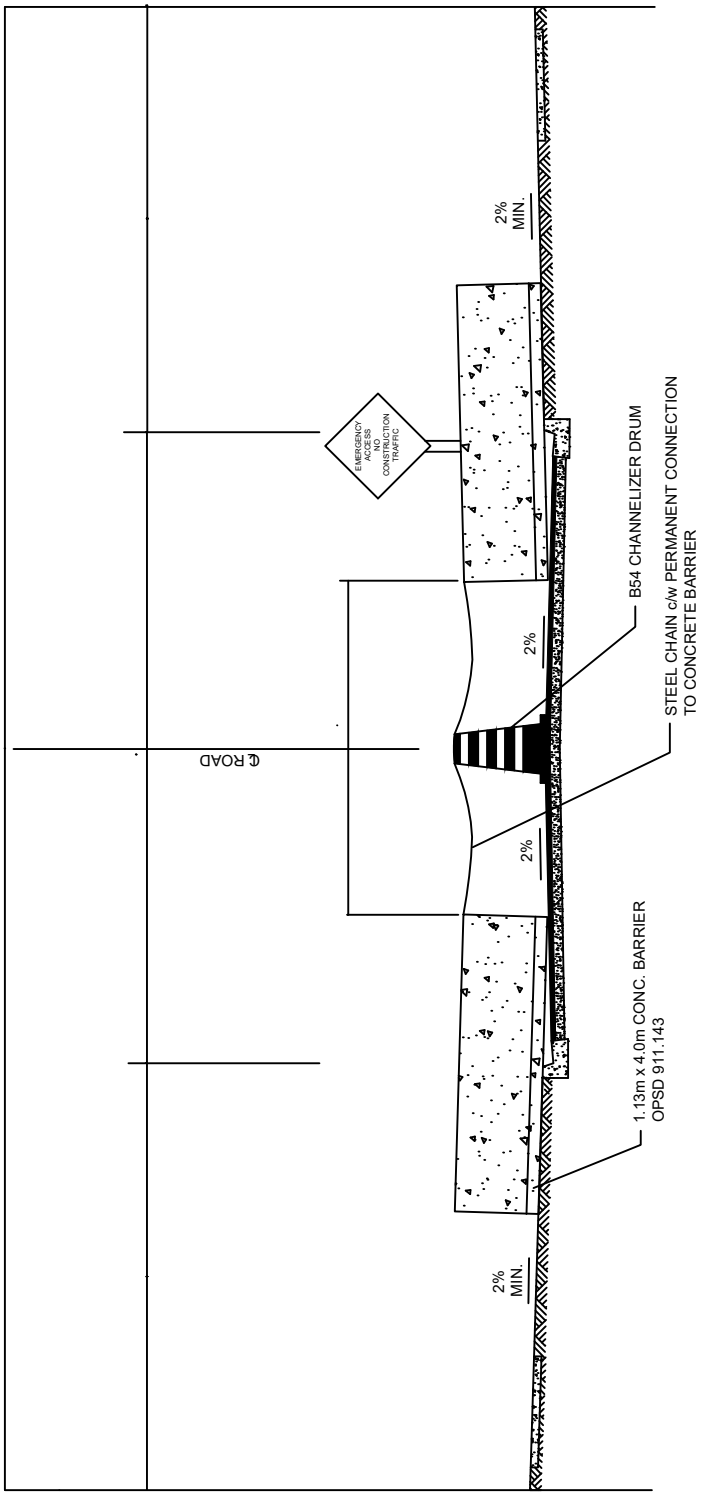
STANDARD BENCHMARK DETAIL

DRAWING NO.: R-219



TOWN OF AURORA

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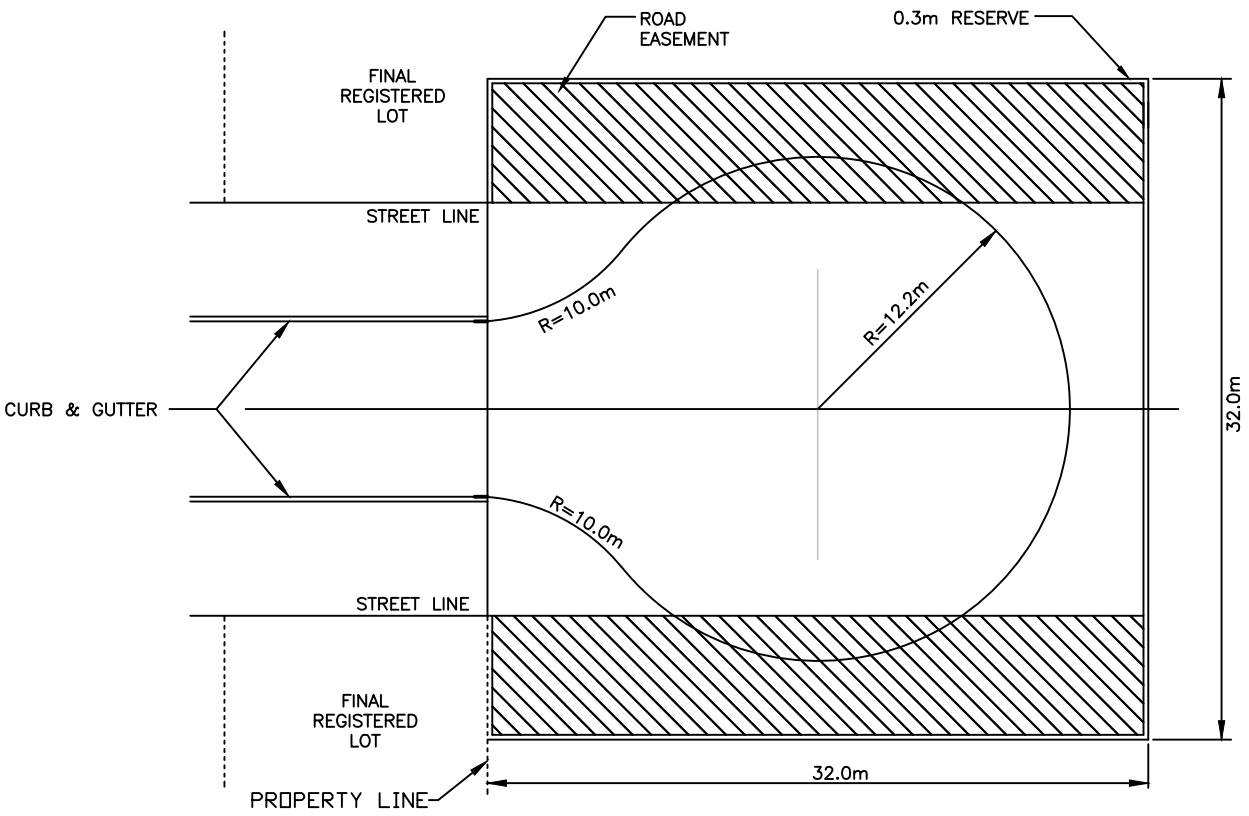
TEMPORARY BARRICADE WITH EMERGENCY ACCESS

SCALE: **N.T.S**

REVISION: **Sept 2020**

DRAWING NO.: **R-220**



TURNING CIRCLE PAVEMENT DESIGN:
40mm HL3 ASPHALT SURFACE COURSE
50mm HL8 ASPHALT BINDER COURSE OR AS PER GEOTECHNICAL REPORT
150mm GRANULAR 'A' OR 19mm C.R. LIMESTONE
300mm GRANULAR 'B' OR 50mm C.R. LIMESTONE

NOTES

1. TEMPORARY TURNING CIRCLES SHALL BE USED ONLY FOR PHASING OF RESIDENTIAL SUBDIVISIONS, SUBJECT TO TOWN APPROVAL
2. ALL DIMENSIONS ARE IN MILLIMETERS OR METERS
3. THE SUBDIVIDER WILL DEPOSIT WITH THE TOWN AN AMOUNT WHICH THE TOWN ENGINEER CALCULATES TO BE THE COST OF REMOVING THE TURNING CIRCLE AND CONSTRUCTING THE STANDARD ROAD FROM THE START OF THE TURNING CIRCLE TO THE LIMIT OF THE SUBDIVISION

TOWN OF AURORA

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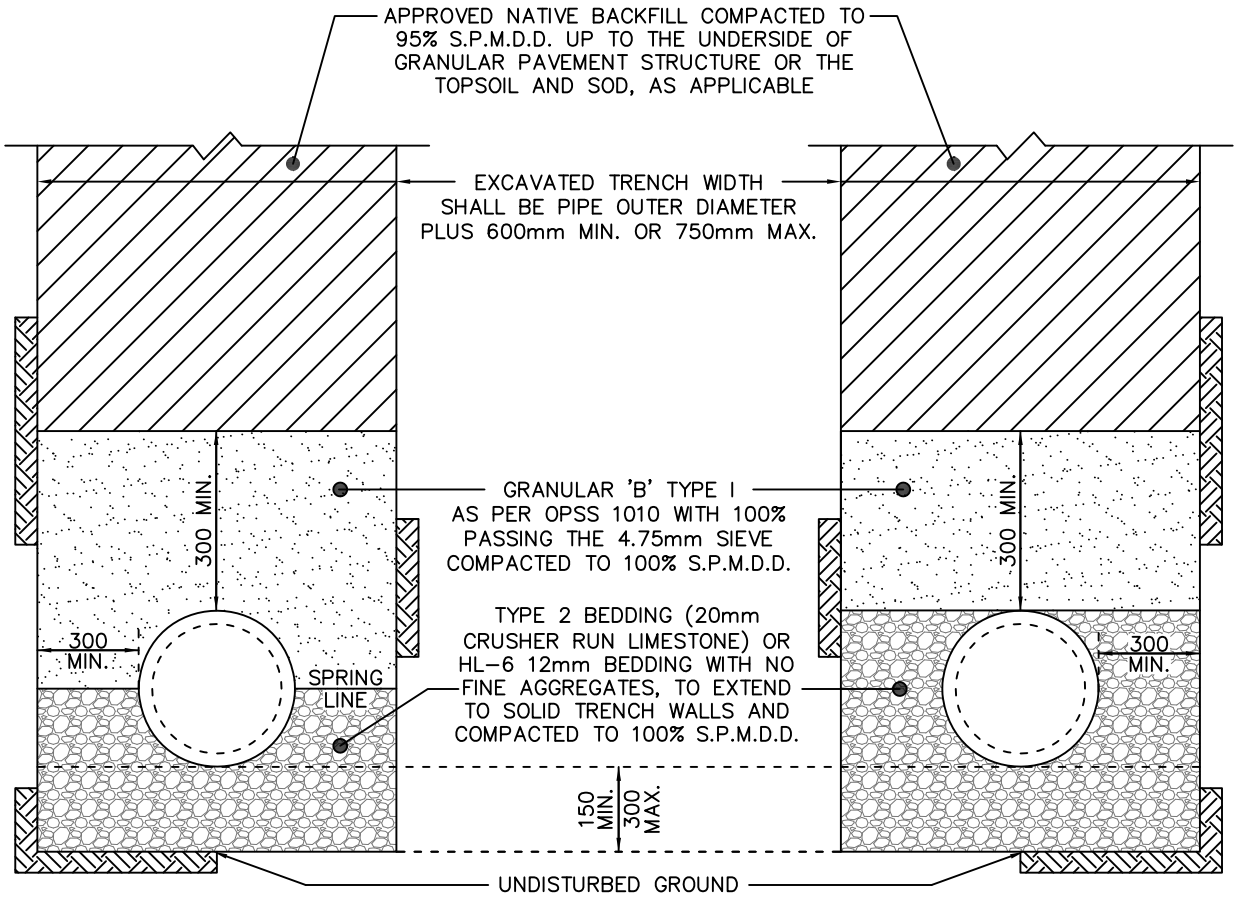
TEMPORARY TURNING CIRCLE FOR RESIDENTIAL STREETS

SCALE: N.T.S

REVISION: Sept 2020

DRAWING NO.: R-221



NOTES

1. THE BEDDING MATERIAL SHALL BE HAND-SHAPED TO LINE AND GRADE TO PROVIDE UNIFORM LONGITUDINAL SUPPORT.
2. GRANULAR MATERIAL SHALL BE PLACED IN TRENCH IN 200mm LAYERS, LOOSE MEASUREMENT, AND COMPACTED TO 100% STANDARD PROCTOR MAXIMUM DRY DENSITY.
3. NATIVE MATERIAL SUITABLE FOR BACKFILL SHALL BE PLACED IN TRENCH IN 300mm LAYERS, LOOSE MEASUREMENT, AND COMPACTED TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY.
4. IN CASE OF OVER-EXCAVATION, THE OVER EXCAVATED AREA SHALL BE FILLED WITH APPROVED MATERIAL IN 200mm LAYERS, LOOSE MEASUREMENT, AND COMPACTED TO 100% STANDARD PROCTOR MAXIMUM DRY DENSITY.
5. IN POOR SOIL CONDITIONS, THE GEOTECHNICAL ENGINEER MAY VARY PIPE FOUNDATION TO SUIT.
6. GRANULAR MATERIAL SHALL BE IN ACCORDANCE WITH THE LATEST OPS SPECIFICATIONS.
7. MINIMUM TRENCH WIDTH SHALL BE PIPE OUTER DIAMETER PLUS 600mm. MAXIMUM TRENCH WIDTH SHALL BE OUTER DIAMETER PLUS 750mm.
8. BLOCKING SHALL NOT BE USED TO BRING THE PIPE TO GRADE.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: MAY 2023

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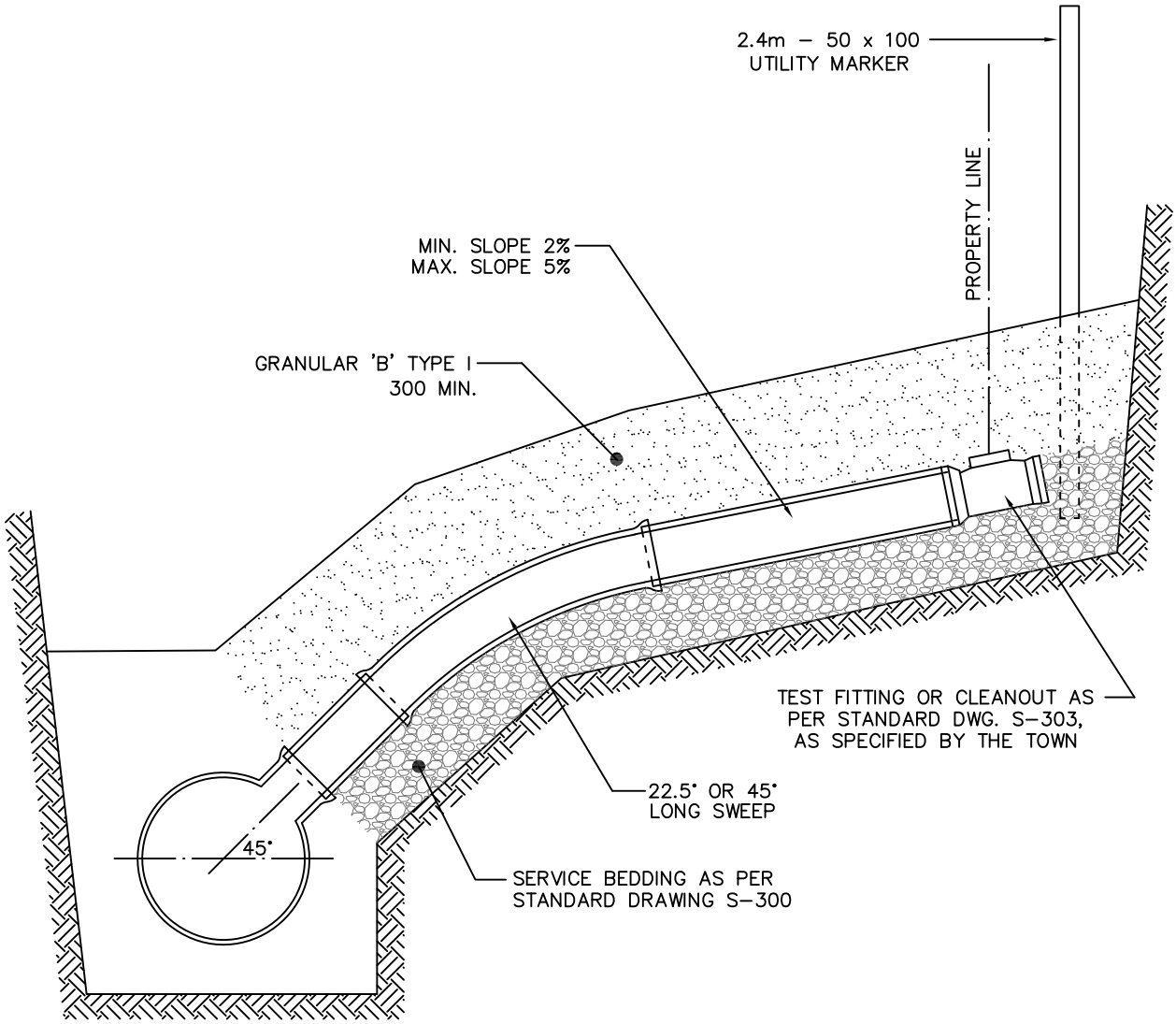
SEWER BEDDING AND BACKFILL DETAIL

DRAWING NO.: S-300



NOTES

1. CONNECTIONS SHALL BE MADE WITH PREFABRICATED TEES FOR NEW SEWERS AND STAINLESS STEEL SADDLES FOR EXISTING SEWERS.
2. MINIMUM SERVICE CONNECTION SIZES:
   125mm D.R.28 FOR SANITARY CONNECTIONS.
   150mm D.R.28 FOR STORM CONNECTIONS.
3. SERVICE CONNECTIONS SHALL BE SECURELY PLUGGED AT PROPERTY LINE WITH AN EXPANDING TYPE PLUG.
4. ALL TEST FITTINGS SHALL BE MARKED 'STORM' OR 'SANITARY'.
5. BEDDING AND BACKFILL SHALL BE IN ACCORDANCE WITH DRAWING S–300.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **SEPT. 2020**

DRAWING NO.: **S-301**

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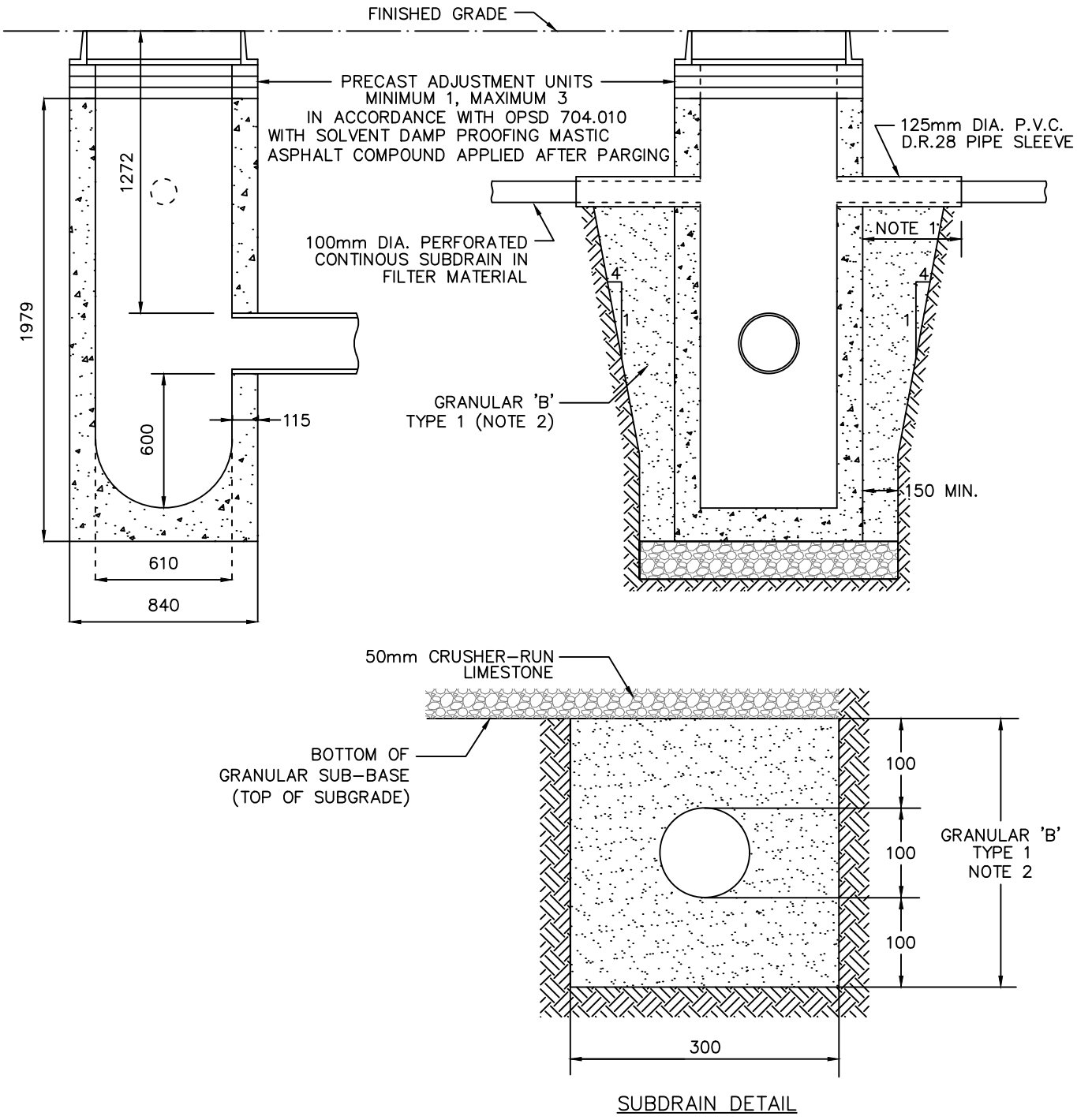
SEWER SERVICE CONNECTION DETAIL



SUBDRAIN DETAIL

NOTES

1. P.V.C. PIPE SLEEVE SHALL EXTEND BEYOND THE FROST TAPERS.
2. GRANULAR 'B' TYPE 1 AS PER OPSS 1010 WITH 100% PASSING THE 4.25mm SIEVE.
3. SUBDRAIN INVERT SHALL BE ABOVE THE OBVERT OF THE CATCHBASIN LEAD.
4. TOP OF SUBDRAIN SHALL BE 100mm BELOW THE BOTTOM OF THE GRANULAR SUB-BASE (TOP OF SUBGRADE).

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **SEPT 2020**

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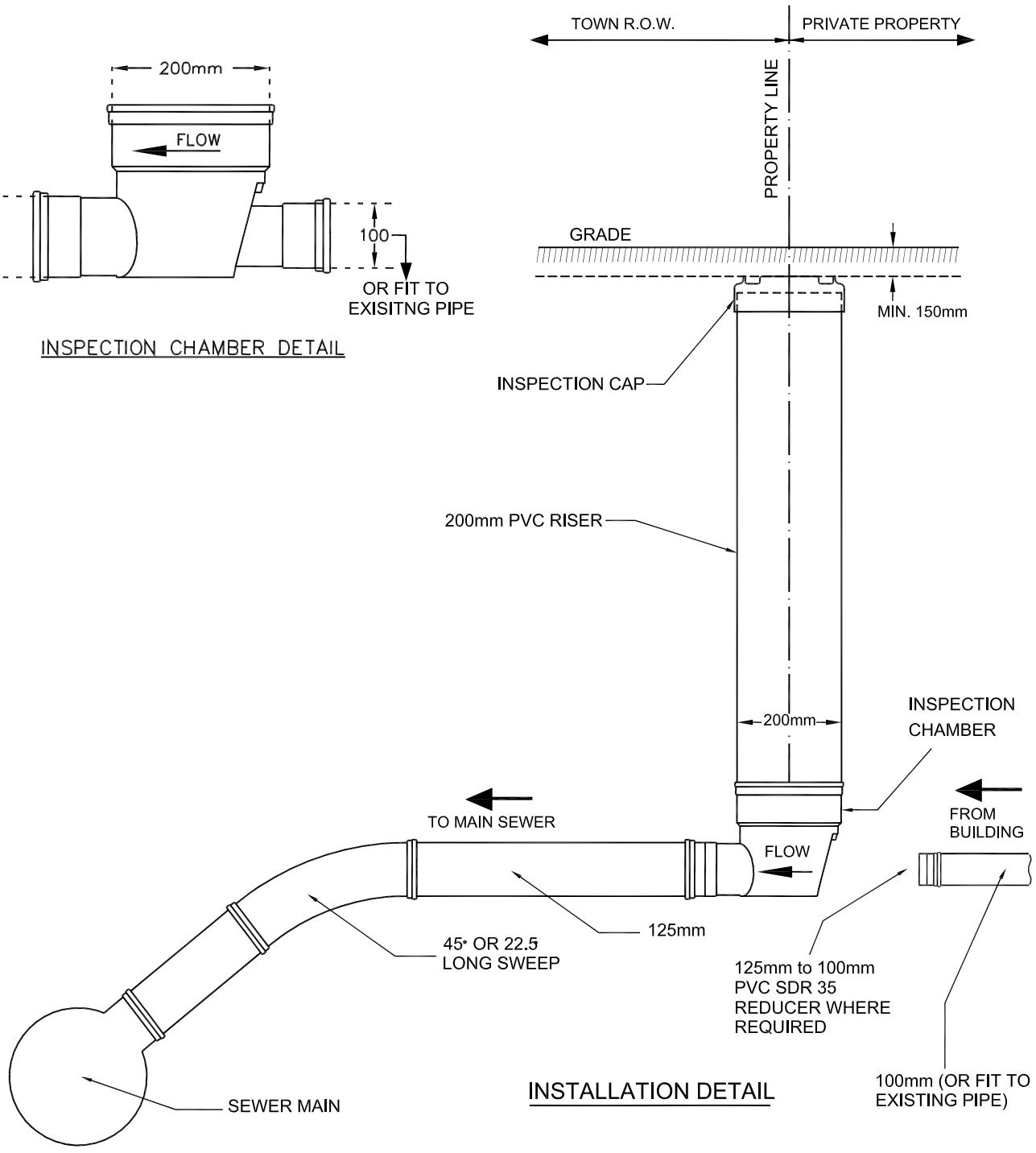
CATCHBASIN AND SUBDRAIN DETAIL

DRAWING NO.: **S-302**

INSPECTION CHAMBER DETAIL



INSTALLATION DETAIL

NOTES
1. SANITARY SEWER SERVICE SHALL BE INSTALLED IN ACCORDANCE WITH DRAWING S–301.
2. BEDDING AND BACKFILL SHALL BE IN ACCORDANCE WITH DRAWING S–300.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: Sept 2020

DRAWING NO.: S-303

AURORA
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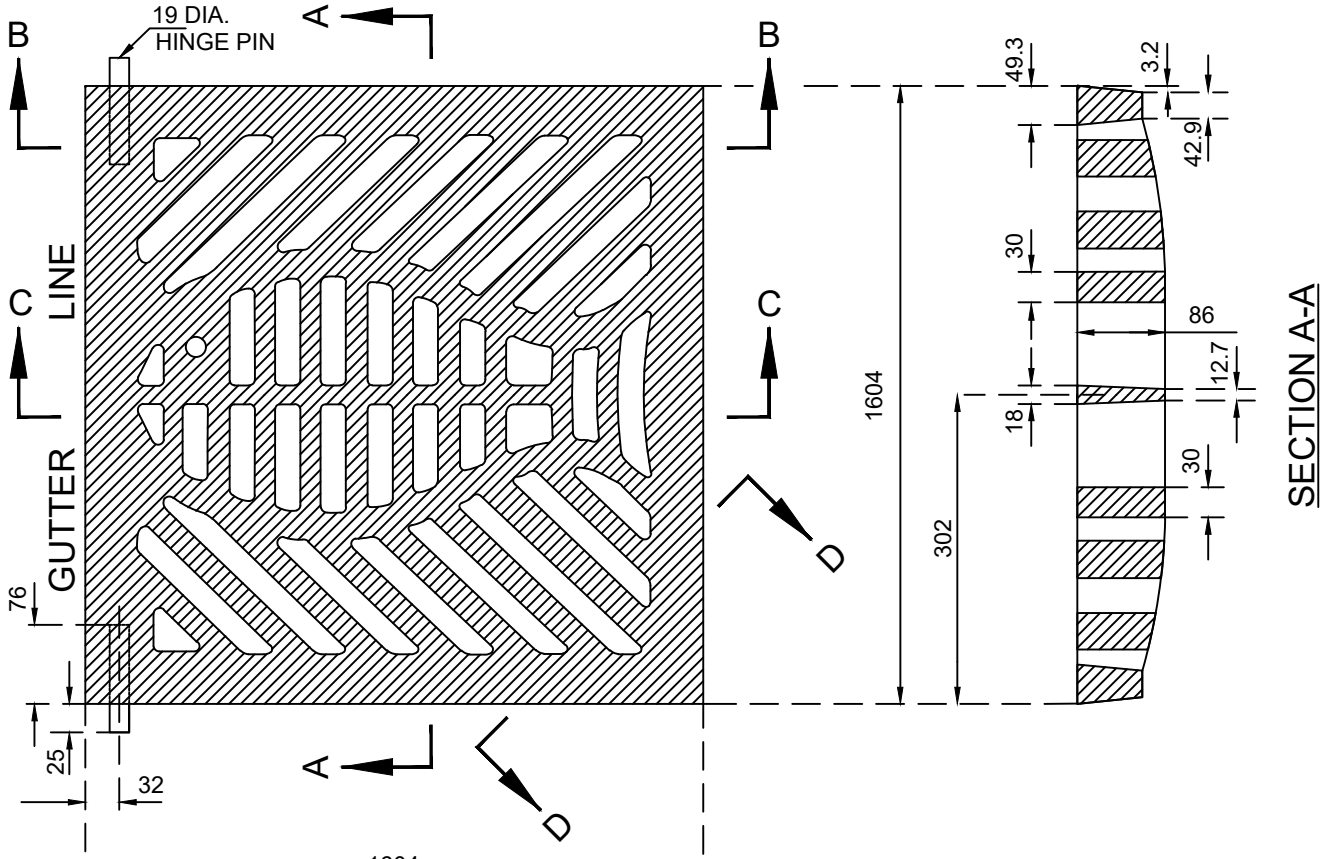
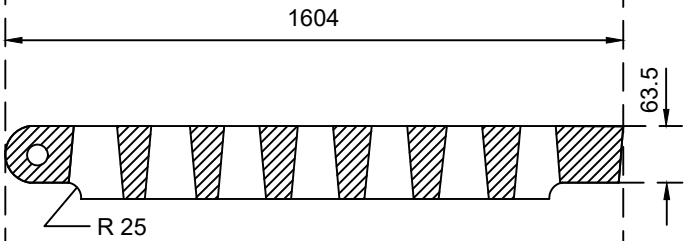
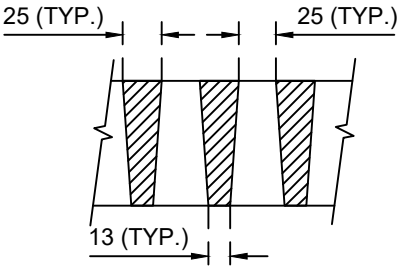
SANITARY SERVICE INSPECTION CHAMBER

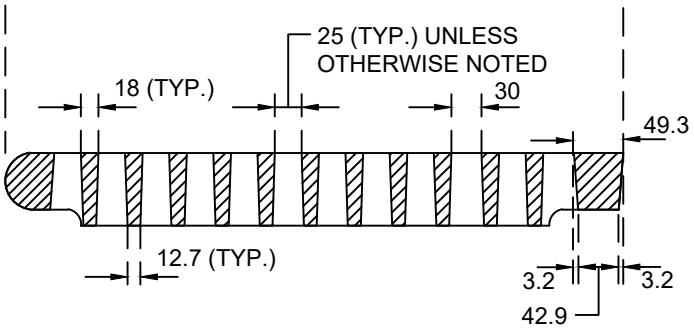




SECTION B-B



SECTION D-D



SECTION C-C

NOTES

1. GRATES SHALL BE HINGE-TYPE.
2. FRAMES SHALL BE OPSD 400.02.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **FEB. 2020**

DRAWING NO.: **S-304**

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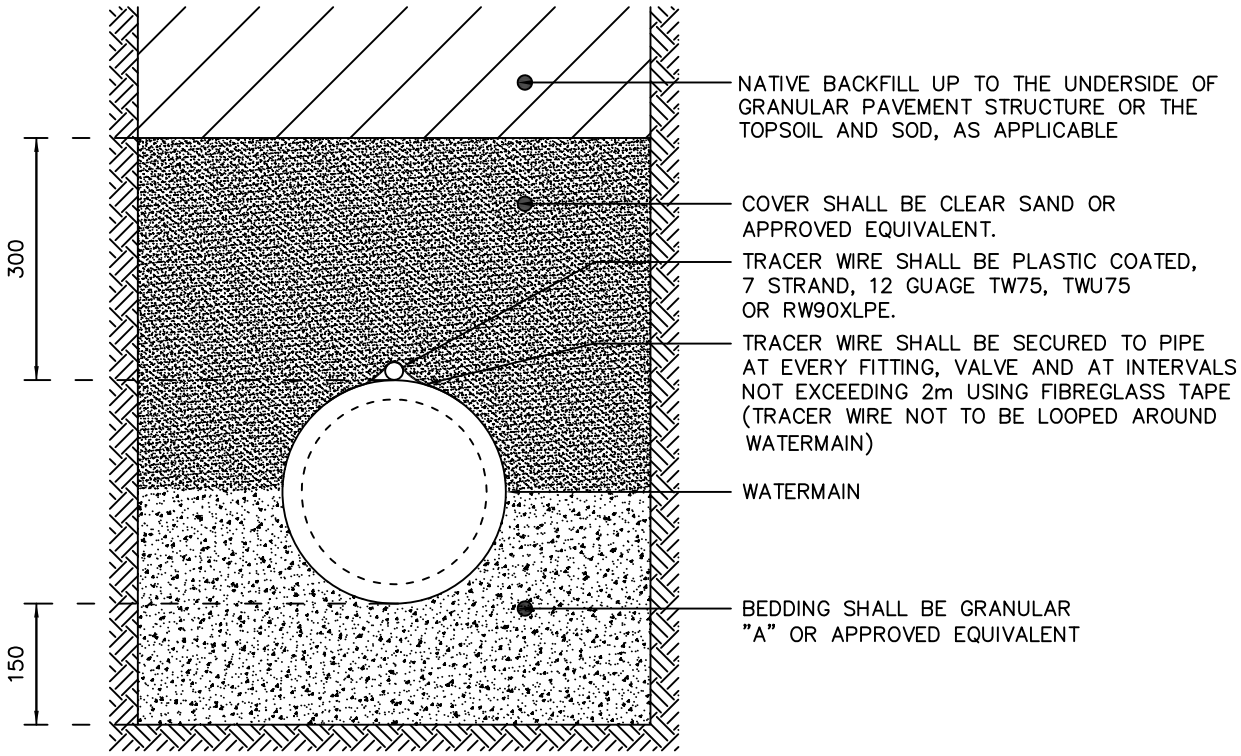
FISH PATTERN CATCHBASIN GRATE



NOTES

1. THE BEDDING MATERIAL SHALL BE HAND–SHAPED TO LINE AND GRADE TO PROVIDE UNIFORM LONGITUDINAL SUPPORT.
2. GRANULAR MATERIAL SHALL BE PLACED IN TRENCH IN 200mm LAYERS, LOOSE MEASUREMENT, AND COMPACTED TO 100% STANDARD PROCTOR MAXIMUM DRY DENSITY.
3. NATIVE MATERIAL SUITABLE FOR BACKFILL SHALL BE PLACED IN TRENCH IN 300mm LAYERS, LOOSE MEASUREMENT, AND COMPACTED TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY.
4. IN CASE OF OVER–EXCAVATION, THE OVER EXCAVATED AREA SHALL BE FILLED WITH APPROVED MATERIAL IN 200mm LAYERS, LOOSE MEASUREMENT, AND COMPACTED TO 100% STANDARD PROCTOR MAXIMUM DRY DENSITY.
5. IN POOR SOIL CONDITIONS, THE GEOTECHNICAL ENGINEER MAY VARY PIPE FOUNDATION TO SUIT.
6. GRANULAR MATERIAL SHALL BE IN ACCORDANCE WITH THE LATEST OPS SPECIFICATIONS.
7. MINIMUM TRENCH WIDTH SHALL BE PIPE OUTER DIAMETER PLUS 600mm. MAXIMUM TRENCH WIDTH SHALL BE OUTER DIAMETER PLUS 750mm.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **MAY 2023**

DRAWING NO.: **W-100**

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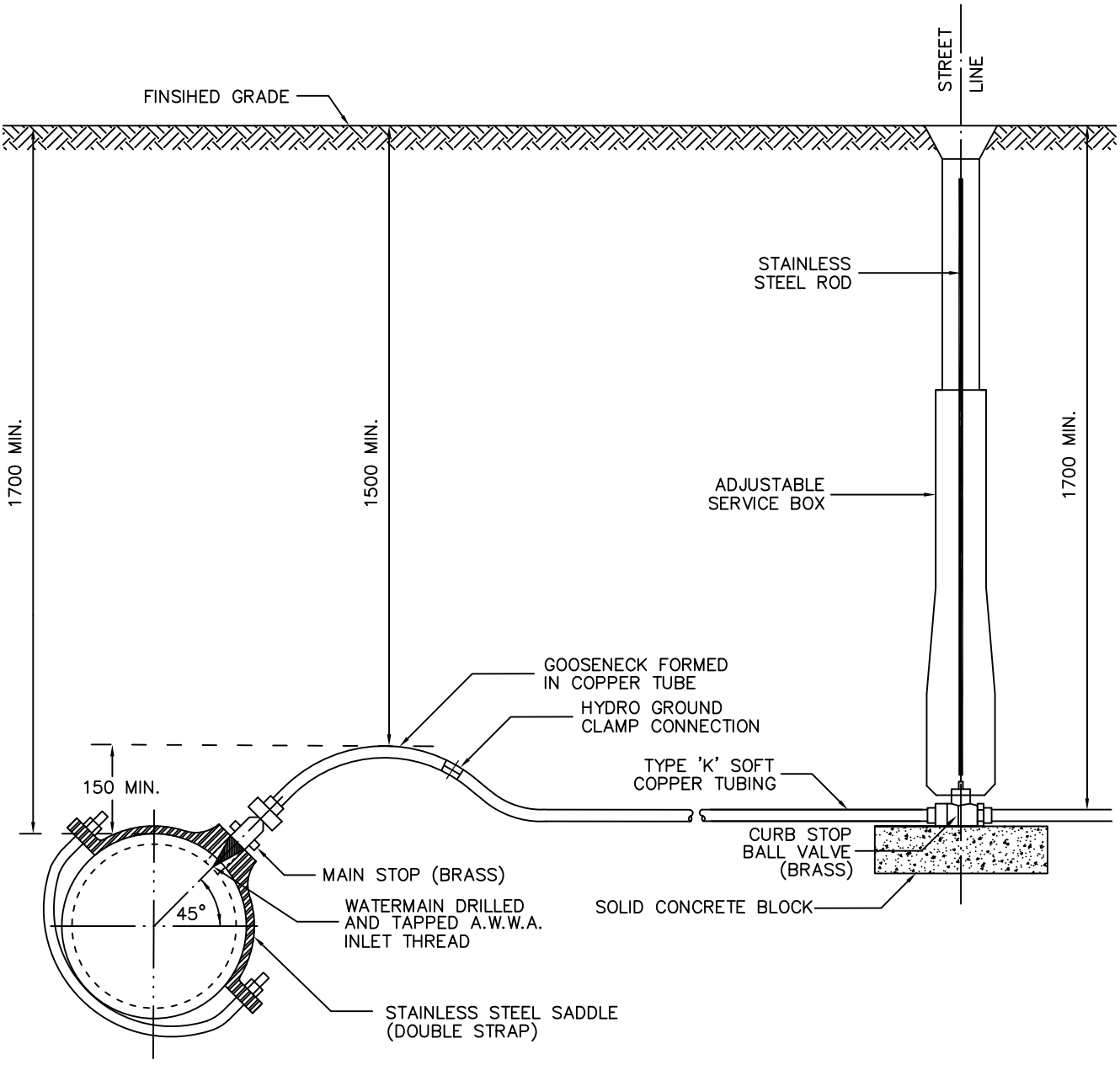
WATERMAIN AND WATER SERVICE BEDDING DETAIL



NOTES

1. MINIMUM DISTANCE BETWEEN MAINSTOPS ALONG WATERMAIN IS 1.0m
2. ALL WATER SERVICES TO BE INSTALLED AT 90 DEGREES TO THE WATERMAIN UNLESS OTHERWISE APPROVED.
3. DRY TAPPING IS PROHIBITED.
4. COPPER TUBING SHALL BE PROTECTED WITH PACKAGED ANODE AS PER SECTION F7.00 AND APPENDIX F.
5. A HYDRO GROUND CLAMP SHALL BE USED TO CONNECT THE ANODE TO THE COPER TUBING.
6. ANY JUNCTION MADE BETWEEN MAIN STOP AND CURB STOP SHALL BE MADE WITH APPROVED COUPLINGS.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: SEPT. 2020

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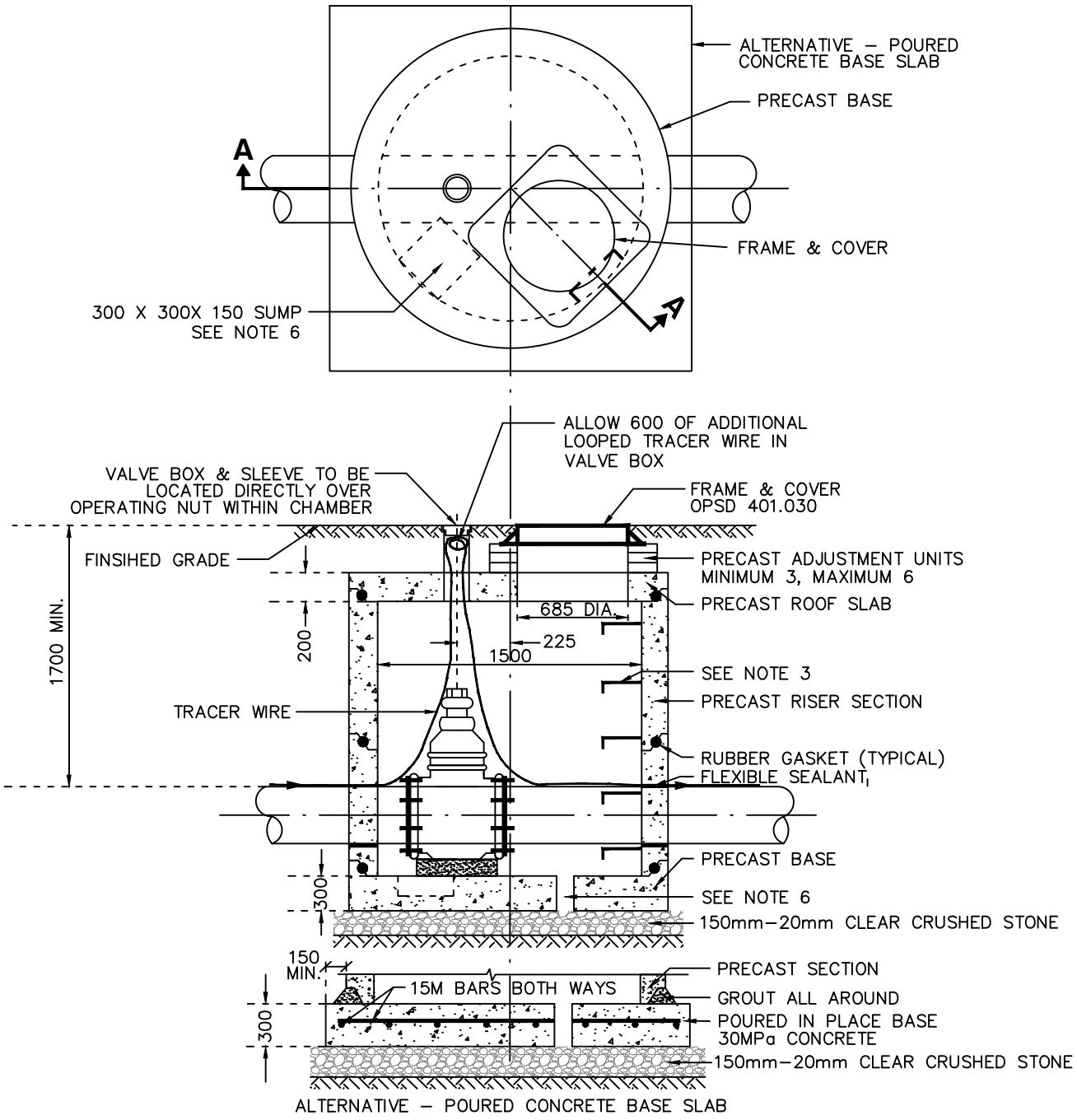
STANDARD WATER SERVICE CONNECTION 19mm AND 25mm DIAMETERS

DRAWING NO.: W-101



SECTION A–A

NOTES

1. PRECAST SECTIONS TO BE MANUFACTURED TO A.S.T.M. C–478 SPECIFICATIONS.
2. FILL ALL JOINTS & LIFT HOLES WITH 1:3 NON–SHRINK MORTAR MIX BEFORE BACKFILLING.
3. ALUMINIUM STEPS AS PER O.P.S.D. 405.010 AT 300mm C.C.
4. PRECAST ADJUSTMENT UNITS SHALL BE EXTERNALLY PARGED ALL AROUND.
5. VALVES & FITTINGS IN CHAMBERS SHALL BE PROTECTED FROM CORROSION BY PROTECTO CAPS ON EVERY BOLT.
6. ALL CHAMBERS SHALL BE BUILT TO CONTAIN A POSITIVE DRAINAGE SYSTEM, CONNECTING INTO THE STORM SEWER WITH A BACK–FLOW PREVENTOR. WHERE A STORM SEWER CONNECTION IS NOT POSSIBLE, THE CHAMBER SHALL INCLUDE A 300 X 300 X 150 SUMP.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: SEPT. 2020

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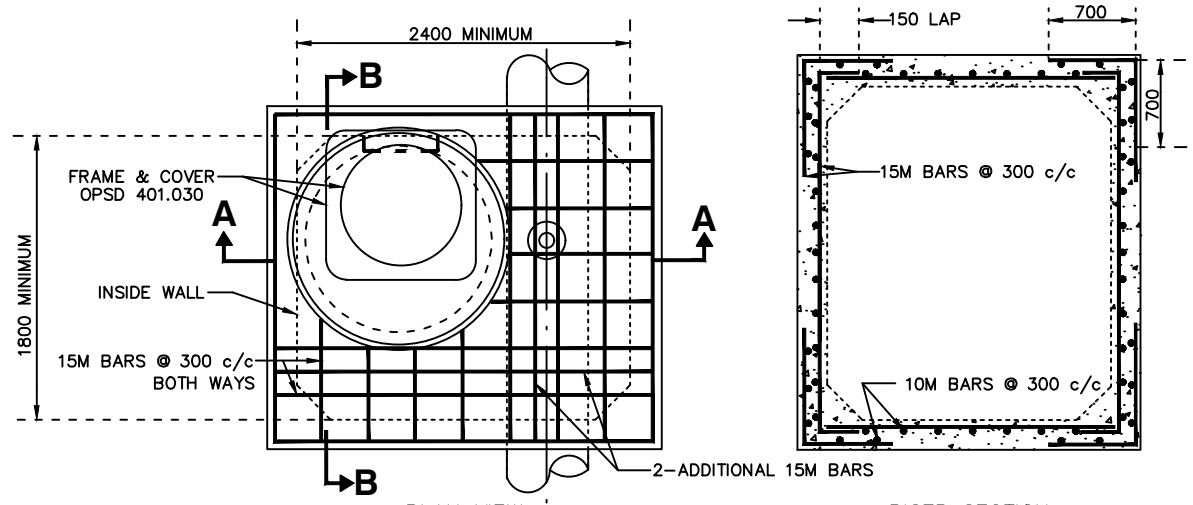
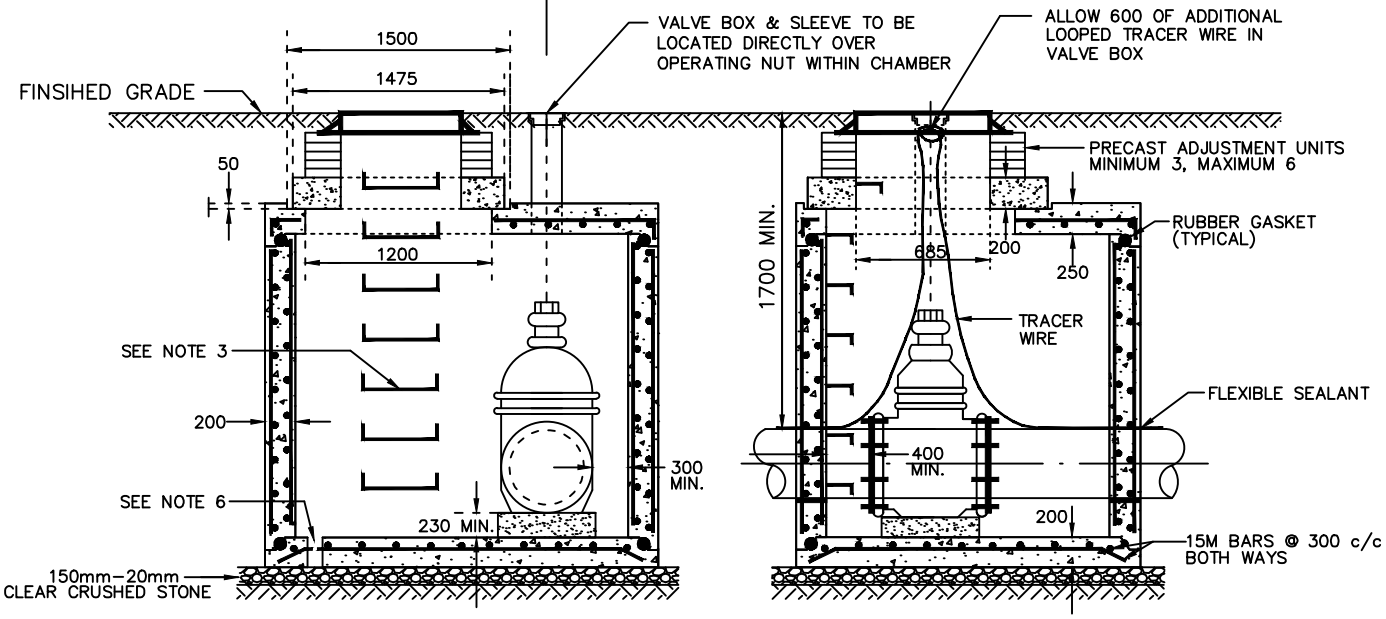
CIRCULAR PRECAST VALVE CHAMBER FOR 300mm WATERMAINS

DRAWING NO.: W-102





NOTES

1. CONCRETE STRENGTH TO BE 30 MPa. MINIMUM COVER TO REINFORCING STEEL TO BE 50mm.
2. REINFORCING STEEL IS TYPICAL ONLY. ACTUAL REINFORCEMENT AS PER SITE SPECIFIC REQUIREMENTS AND AS PER DESIGNER'S REQUIREMENTS.
3. ALUMINIUM STEPS AS PER O.P.S.D. 405.010 AT 300mm C.C FIRST STEP TO BE 75mm BELOW FRAME.
4. PRECAST ADJUSTMENT UNITS SHALL BE EXTERNALLY PARGED ALL AROUND.
5. VALVES & FITTINGS IN CHAMBERS SHALL BE PROTECTED FROM CORROSION BY PROTECTO CAPS ON EVERY BOLT.
6. ALL CHAMBERS SHALL BE BUILT TO CONTAIN A POSITIVE DRAINAGE SYSTEM, CONNECTING INTO THE STORM SEWER WITH A BACK-FLOW PREVENTOR. WHERE A STORM SEWER CONNECTION IS NOT POSSIBLE, THE CHAMBER SHALL INCLUDE A 300 X 300 X 150 SUMP.
7. POLYETHELENE BOND BREAKER TO BE USED BETWEEN CONCRETE AND FITTINGS.
8. VALVE CHAMBER TO BE SIZED TO MAINTAIN MINIMUM DISTANCES FROM INSIDE WALL TO VALVE FLANGES.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **SEPT. 2020**

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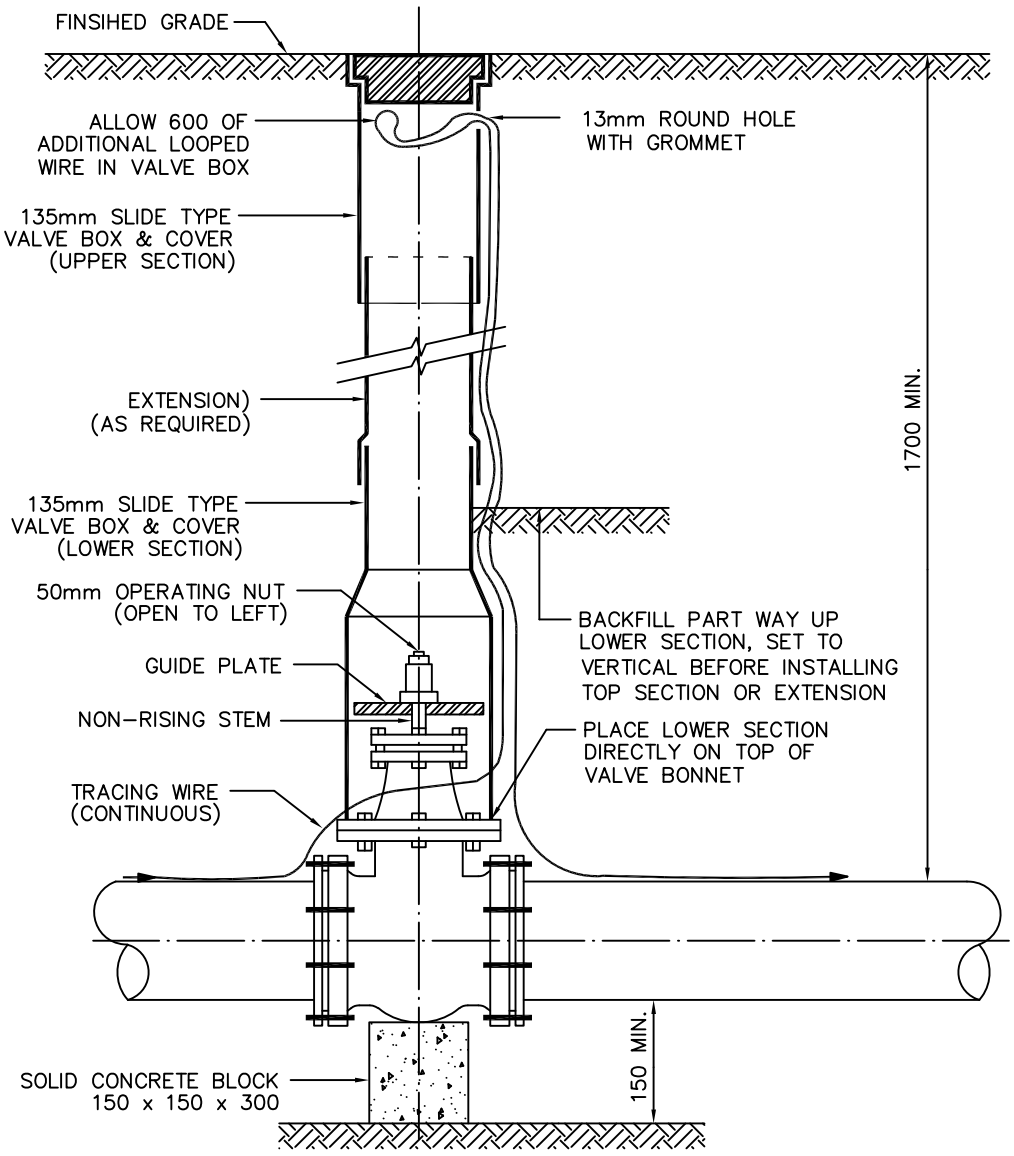
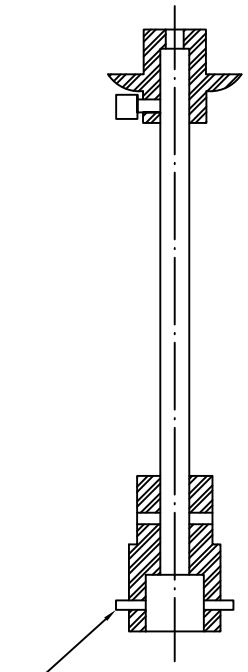
PRECAST VALVE CHAMBER FOR 350mm AND LARGER WATERMAINS

DRAWING NO.: **W-103**





EXTENSION STEM DETAIL

NOTES

1. VALVE BOX AND VALVE STEM EXTENSIONS SHALL ONLY BE USED IF REQUIRED.
2. WHEN THE DEPTH OF THE OPERATING NUT IS GREATER THAN 2.0m BELOW GRADE, AN EXTENSION STEM AND BOX SHALL BE USED
3. TRACER WIRE SHALL BE PLASTIC COATED, 7 STRAND, 12 GUAGE TW75, TWU75 OR RW90XLPE.
4. CORROSION PROTECTION SHALL BE IN ACCORDANCE WITH SECTIONS F4.00, F.700, AND APPENDIX F.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **SEPT. 2020**

DRAWING NO.: **W-104**

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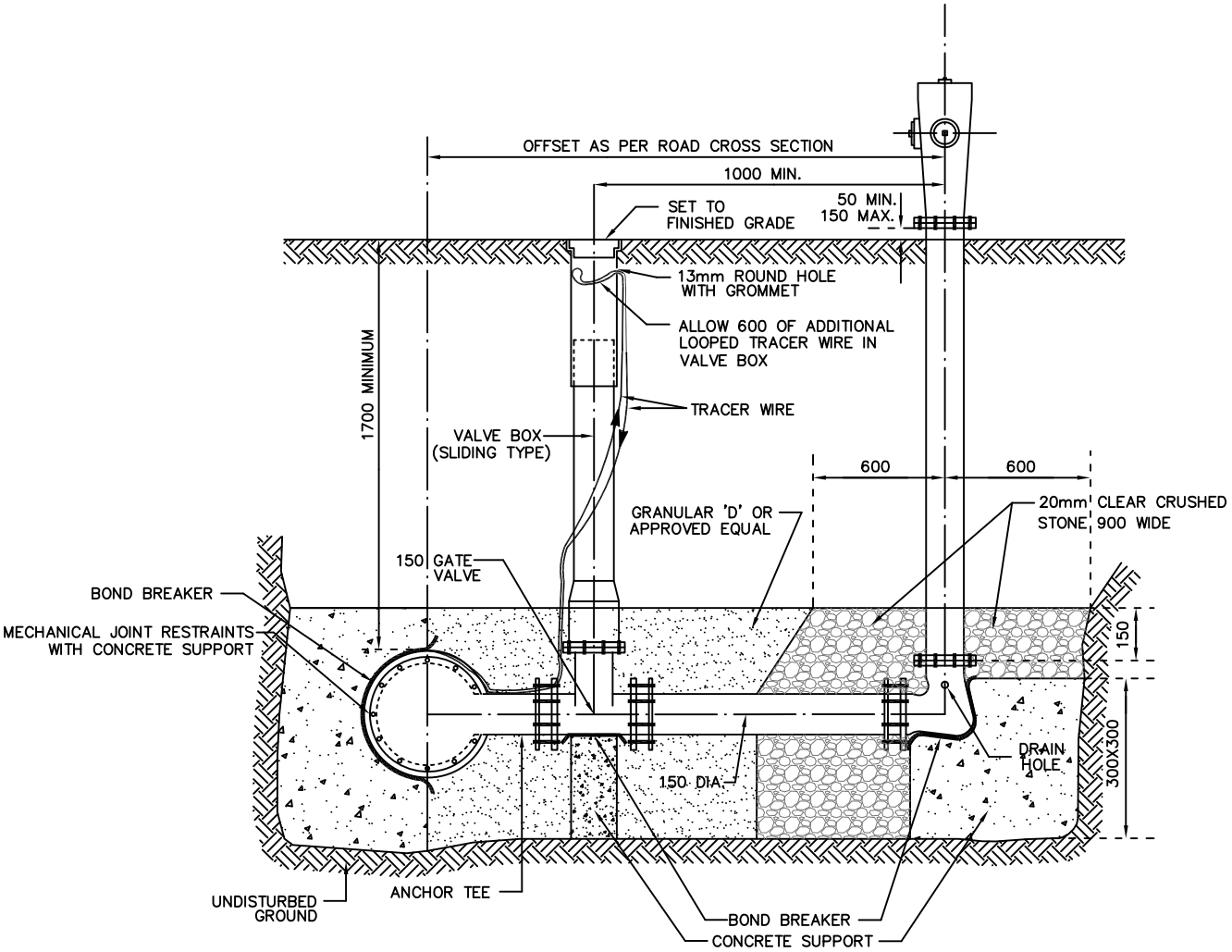
VALVE AND BOX INSTALLATION FOR 150mm, 200mm AND 250mm WATERMAINS



NOTES

1. ALL CONCRETE SHALL BE 20MPa MINIMUM.
2. ALL CONCRETE BLOCKING SHALL BE POURED AGAINST UNDISTURBED TRENCH WALL.
3. MECHANICAL JOINT RESTRAINTS SHALL BE USED IN ADDITION TO CONCRETE BLOCKING.
4. POLYETHYLENE BOND BREAKER SHALL BE USED BETWEEN CONCRETE AND FITTINGS.
5. STEEL TIE ROD AND/OR JOINT RESTRAINER GLANDS SHALL BE USED WHEN ANCHOR TEE IS NOT PRACTICAL.
6. DRAIN HOLES SHALL BE PLUGGED IN AREAS OF HIGH GROUND WATER LEVELS.
7. ONE PACKAGED ANODE SHALL BE USED ON EACH MECHANICAL FITTING FOR CORROSION PROTECTION AS PER SECTION F7.00 AND APPENDIX F.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: JUNE 2021

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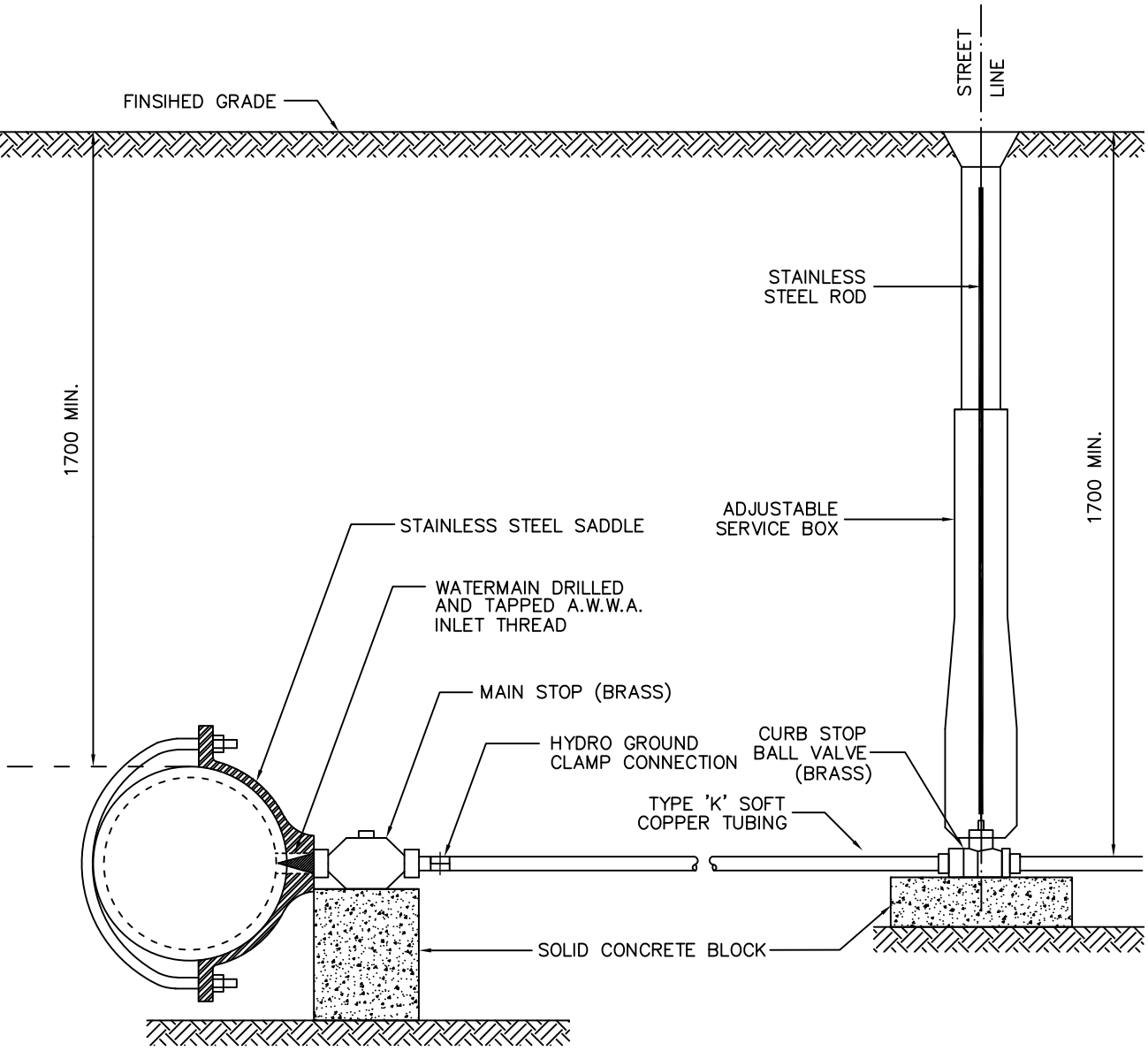
HYDRANT AND VALVE INSTALLATION

DRAWING NO.: W-105



NOTES

1. MINIMUM DISTANCE BETWEEN WATER SERVICES ALONG WATERMAIN IS 1.0m
2. ALL WATER SERVICES TO BE INSTALLED AT 90 DEGREES TO THE WATERMAIN UNLESS OTHERWISE APPROVED.
3. DRY TAPPING IS PROHIBITED.
4. COPPER TUBING SHALL BE PROTECTED WITH PACKAGED ANODE AS PER SECTION F7.00 AND APPENDIX F.
5. A HYDRO GROUND CLAMP SHALL BE USED TO CONNECT THE ANODE TO THE COPER TUBING.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: SEPT. 2020

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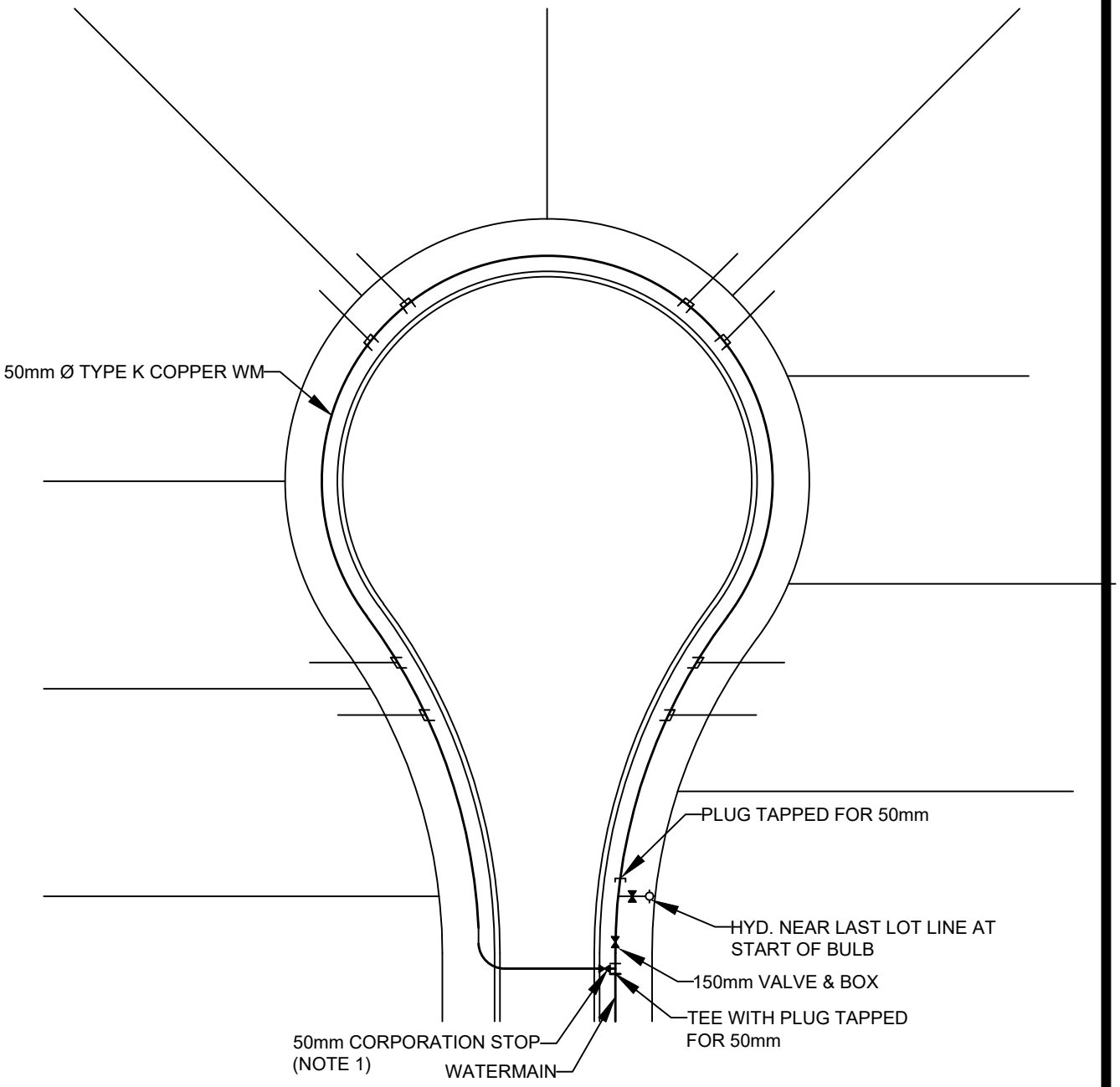
STANDARD WATER SERVICE CONNECTION 32mm, 40mm AND 50mm DIAMETERS

DRAWING NO.: W-106



NOTES:

1. VALVE AND BOX IS NOT TO BE LOCATED WITHIN TRAVELED PORTION OR ROAD.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: Sept 2020

DRAWING NO.: W-107

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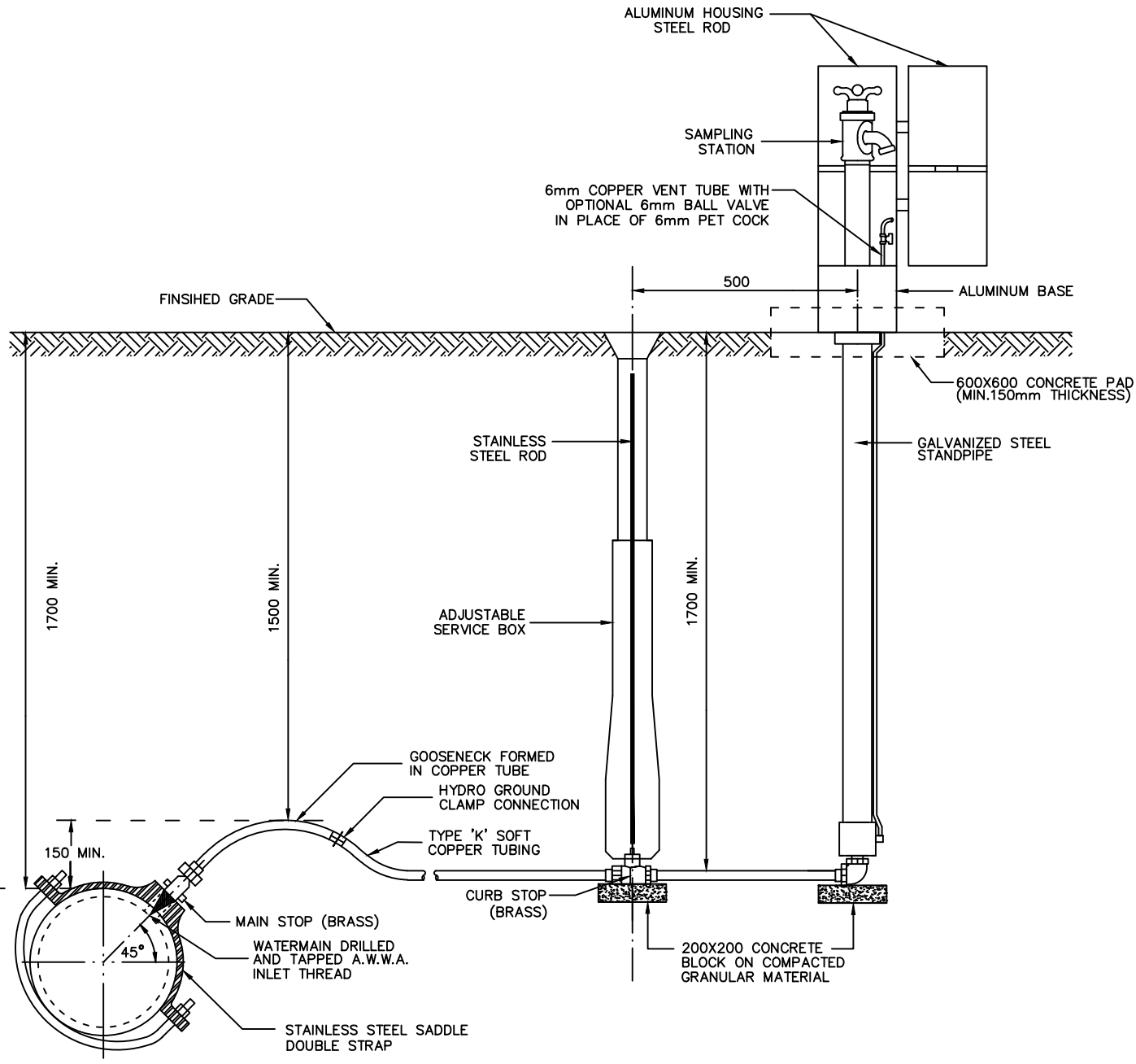
WATER CONFIGURATION FOR CUL DE SACS



NOTES

1. SAMPLING STATION TO BE FURNISHED WITH A 19mm FIP INLET AND A 19mm HOSE OF UNTHREADED NOZZLE.
2. ALL SAMPLING STATIONS SHALL BE ENCLOSED IN A LOCKABLE, NON-REMOVABLE, ALUMINUM-CAST HOUSING.
3. THE STATION SHALL REQUIRE NO KEY FOR OPERATION AND THE WATER WILL FLOW IN AN ALL BRASS WATERWAY.
4. ALL WORKING PARTS SHALL BE BRASS AND BE REMOVABLE FROM ABOVE GROUND WITH NO DIGGING. EXTERIOR PIPING SHALL BE GALVANIZED STEEL OR BRASS.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: SEPT 2020

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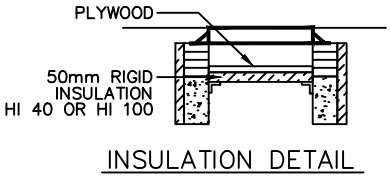
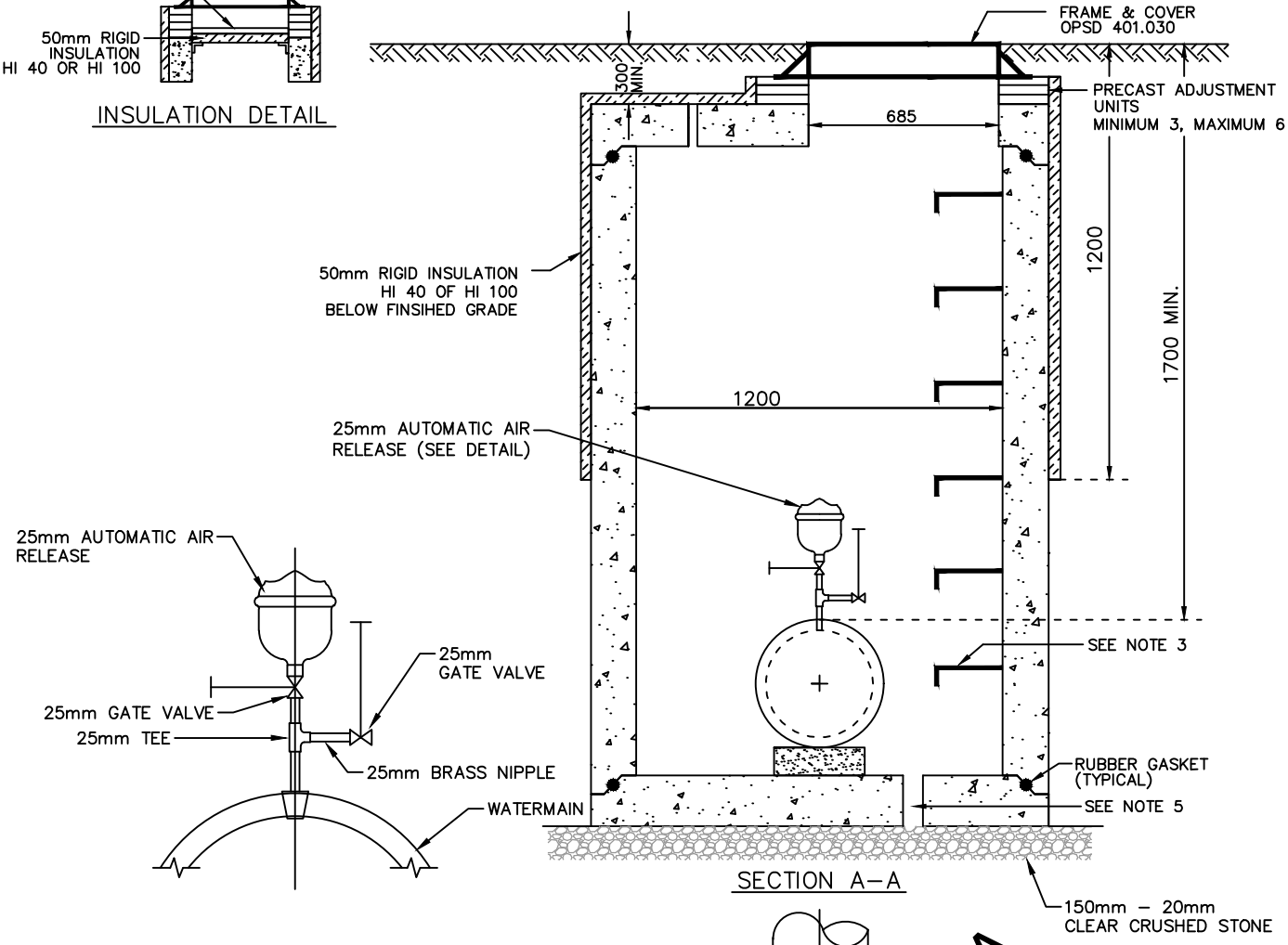
SAMPLING STATION

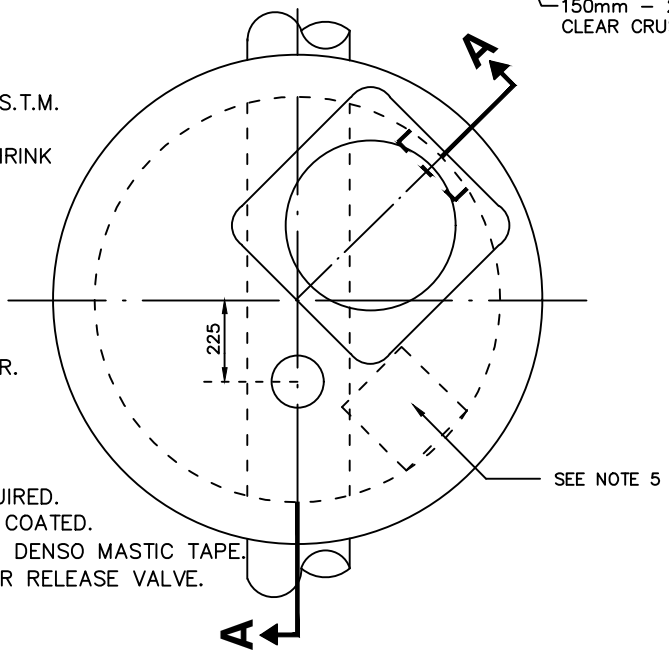
DRAWING NO.: W-108



INSULATION DETAIL



SECTION A–A



NOTES

1. PRECAST SECTIONS TO BE MANUFACTURED TO A.S.T.M. C–478 SPECIFICATIONS.
2. FILL ALL JOINTS & LIFT HOLES WITH 1:3 NON–SHRINK MORTAR MIX BEFORE BACKFILLING.
3. ALUMINIUM STEPS AS PER O.P.S.D. 405.01 AT 300mm c.c.
4. PRECAST ADJUSTMENT UNITS SHALL BE EXTERNALLY PARGED ALL AROUND.
5. ALL CHAMBERS SHALL BE BUILT TO CONTAIN A POSITIVE DRAINAGE SYSTEM, CONNECTING INTO THE STORM SEWER WITH A BACK–FLOW PRVENTOR. WHERE A STORM SEWER COMMECTION IS NOT POSSIBLE, THE CHAMBER SHALL INCLUDE A 300 X 300 X 150 SUMP.
6. AIR VALVES SHALL CONTAIN I.P.T. THREADED OUTLET WITH BRASS NIPPLES AS REQUIRED.
7. AIR RELEASE VALVE TO BE FUSION BOND EPOXY COATED.
8. ALL FITTINGS TO BE CORROSION PROTECTED WITH DENSO MASTIC TAPE.
9. SEE APPROVED MATERIAL LIST FOR APPROVED AIR RELEASE VALVE.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **SEPT. 2020**

DRAWING NO.: **W-109**

AURORA
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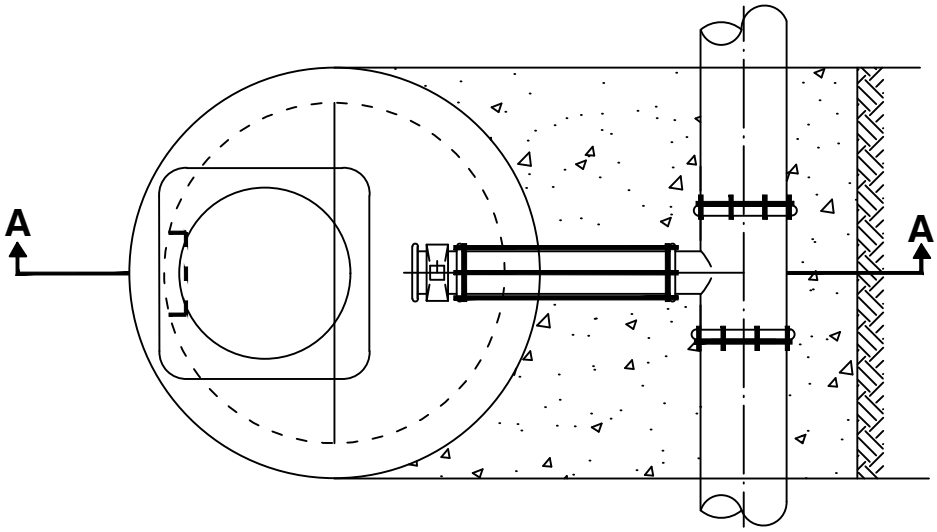
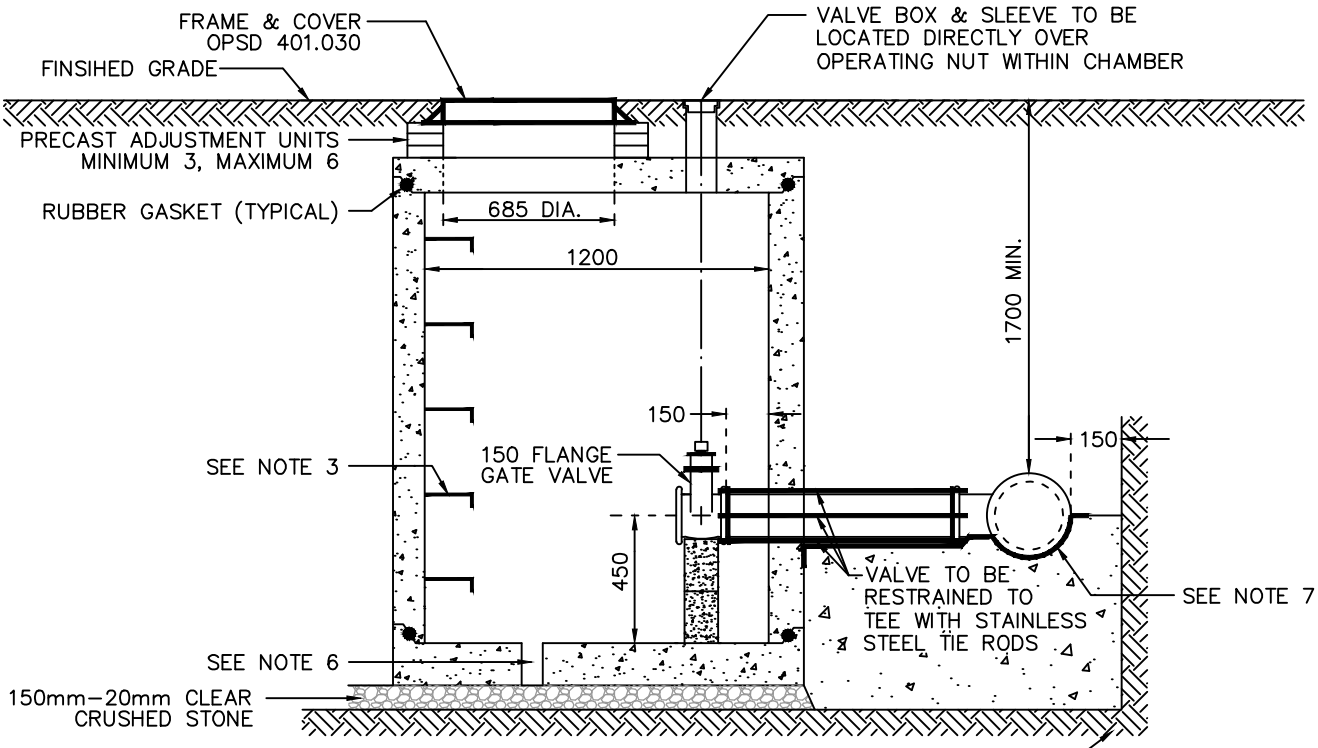
AIR VALVE AND CHAMBER





SECTION A-A

NOTES

1. PRECAST SECTIONS TO BE MANUFACTURED TO A.S.T.M. C-478 SPECIFICATIONS.
2. FILL ALL JOINTS & LIFT HOLES WITH 1:3 NON-SHRINK MORTAR MIX BEFORE BACKFILLING.
3. ALUMINIUM STEPS AS PER O.P.S.D. 405.010 AT 300mm C.C.
4. PRECAST ADJUSTMENT UNITS SHALL BE EXTERNALLY PARGED ALL AROUND.
5. VALVES & FITTINGS IN CHAMBERS SHALL BE PROTECTED FROM CORROSION BY PROTECTO CAPS ON EVERY BOLT.
6. ALL CHAMBERS SHALL BE BUILT TO CONTAIN A POSITIVE DRAINAGE SYSTEM, CONNECTING INTO THE STORM SEWER WITH A BACK-FLOW PREVENTER. WHERE PIPE A CONNECTION IS NOT POSSIBLE A 300X300X150mm SUMP IS REQUIRED.
7. POLYETHELENE BOND BREAKER TO BE USED BETWEEN CONCRETE AND FITTINGS.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: SEPT. 2020

AURORA
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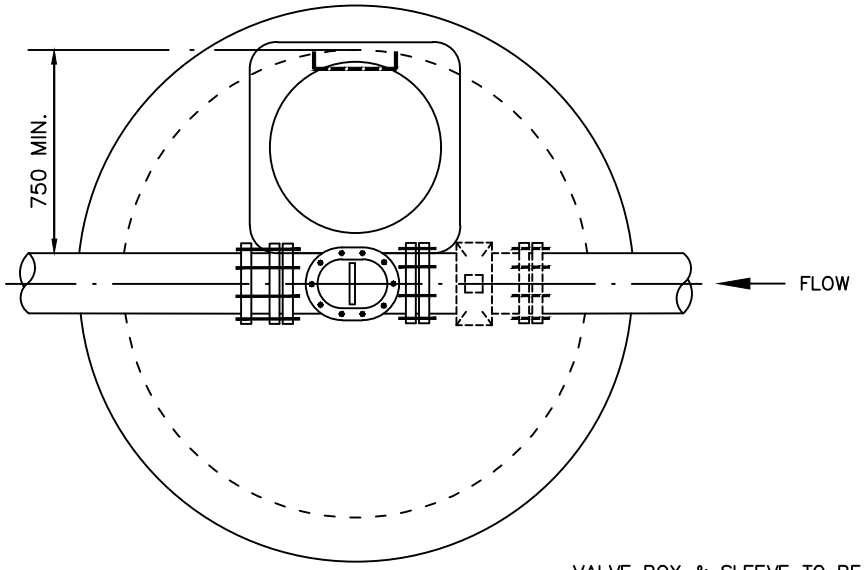
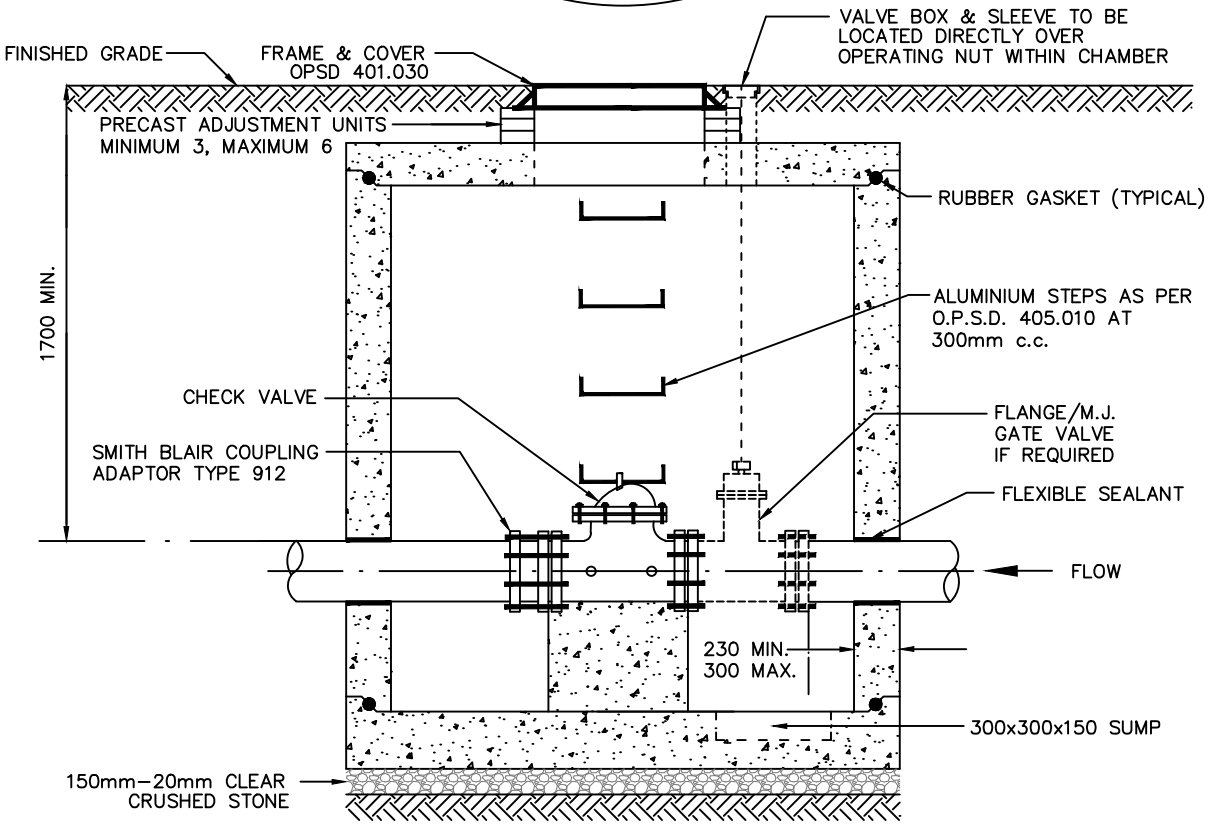
DRAIN VALVE AND CHAMBER

DRAWING NO.: W-110

CHECK VALVE CHAMBER SIZING	
VALVE SIZE	CHAMBER DIA.
150	1500
200	1500
250	1800
300	1800





NOTES

1. PRECAST SECTIONS TO BE MANUFACTURED TO A.S.T.M. C–478 SPECIFICATIONS.
2. FILL ALL JOINTS & LIFT HOLES WITH 1:3 NON–SHRINK MORTAR MIX BEFORE BACKFILLING.
3. PRECAST ADJUSTMENT UNITS SHALL BE EXTERNALLY PARGED ALL AROUND.
4. VALVES & FITTINGS IN CHAMBERS SHALL BE PROTECTED FROM CORROSION BY PROTECTO CAPS ON EVERY BOLT.
5. ALL CHAMBERS SHALL BE BUILT TO CONTAIN A POSITIVE DRAINAGE SYSTEM, CONNECTING INTO THE STORM SEWER WITH A BACK–FLOW PRVENTOR. WHERE A STORM SEWER CONNECTION IS NOT POSSIBLE, THE CHAMBER SHALL INCLUDE A 300 X 300 X 150 SUMP.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: SEPT.2020

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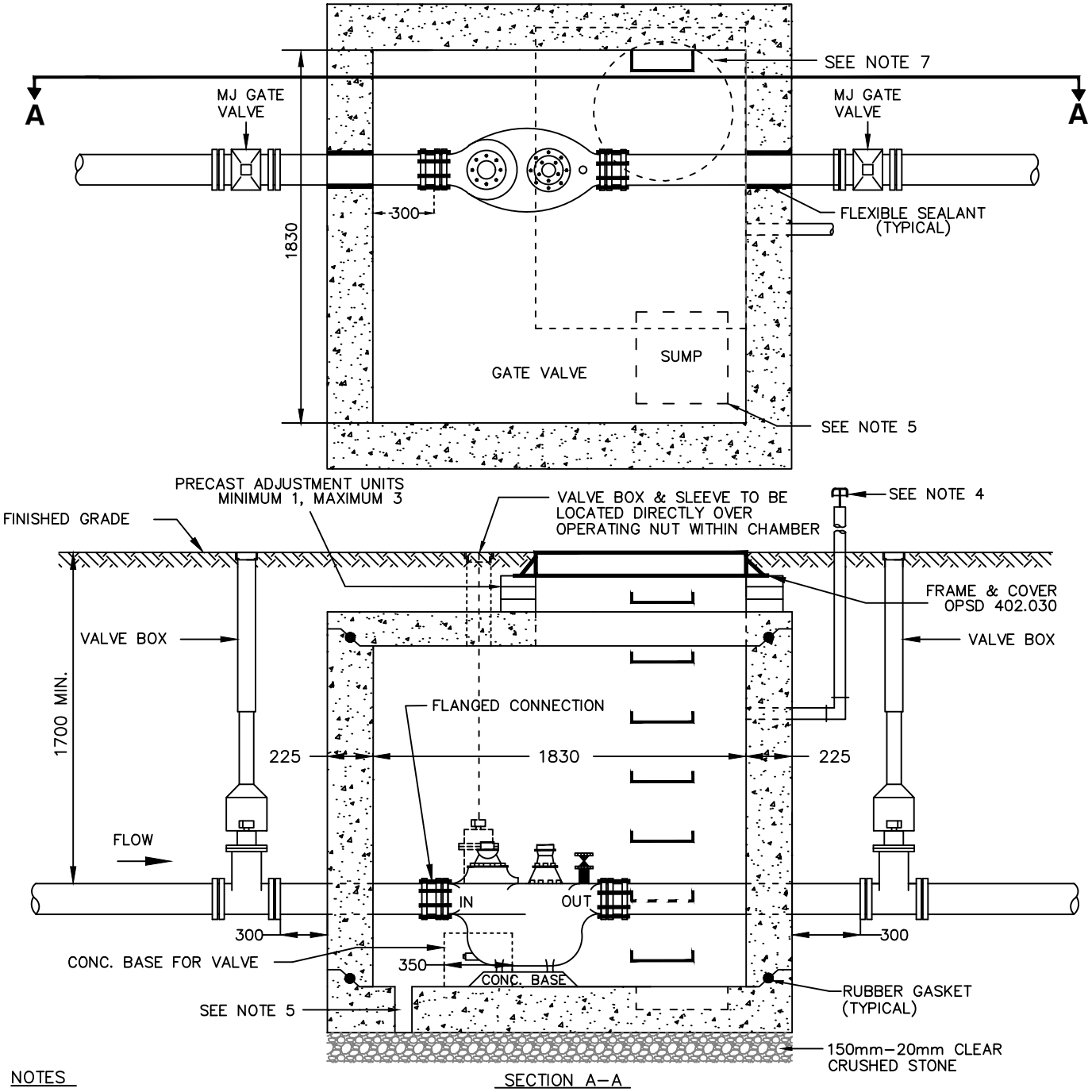
CHECK VALVE AND CHAMBER DETAIL

DRAWING NO.: W-111



SECTION A–A

NOTES

1. JOINTS IN CHAMBER SHALL BE TYTON.
2. 50mm CONDUIT TO BE INSTALLED FROM CHAMBER WALL TO A SUITABLE LOCATION.
3. REMOTE READER LOCATION SHALL BE IN ACCORDANCE WITH THE APPROVED SITE PLAN.
4. MECHANICAL JOINT RESTRAINER SYSTEM MAY BE USED IN LIEU OF CONCRETE THRUST BLOCKS.
5. ALL CHAMBERS SHALL BE BUILT TO CONTAIN A POSITIVE DRAINAGE SYSTEM, CONNECTING INTO THE STORM SEWER WITH A BACKFLOW PREVENTOR. WHERE A STORM SEWER CONNECTION IS NOT POSSIBLE, THE CHAMBER SHALL INCLUDE A 300 X 300 X 150 SUMP.
6. ALUMINIUM STEPS AS PER O.P.S.D. 405.010 AT 300mm c.c.
7. VALVES & FITTINGS IN CHAMBERS SHALL BE PROTECTED FROM CORROSION BY PROTECTO CAPS ON EVERY BOLT. BACKFLOW PREVENTORS INSTALLED INSIDE THE METER CHAMBER OR INSIDE A BUILDING SHALL HAVE A MINIMUM SEPARATION DISTANCE EQUIVALENT TO FOUR (4) TIMES THE PIPE DIAMETER DOWNSTREAM OF THE WATER METER.
8. ALL OTHER FITTINGS SUCH AS ELBOWS, TEE'S, REDUCERS, AND CHECK VAVES SHALL BE INSTALLED WITH A MINIMUM SEPARATION DISTANCE EQUIVALENT TO 2.5 TIMES THE PIPE DIAMETER ON EITHER SIDE OF THE WATER METER.
9. PRECAST ADJUSTMENT UNITS SHALL BE EXTERNALLY PARGED ALL AROUND.
10. WATER METER CHAMBER LIDS SHALL BE IN ACCORDANCE WITH OPSD 402.030.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: FEB. 2022

DRAWING NO.: W-112

AURORA
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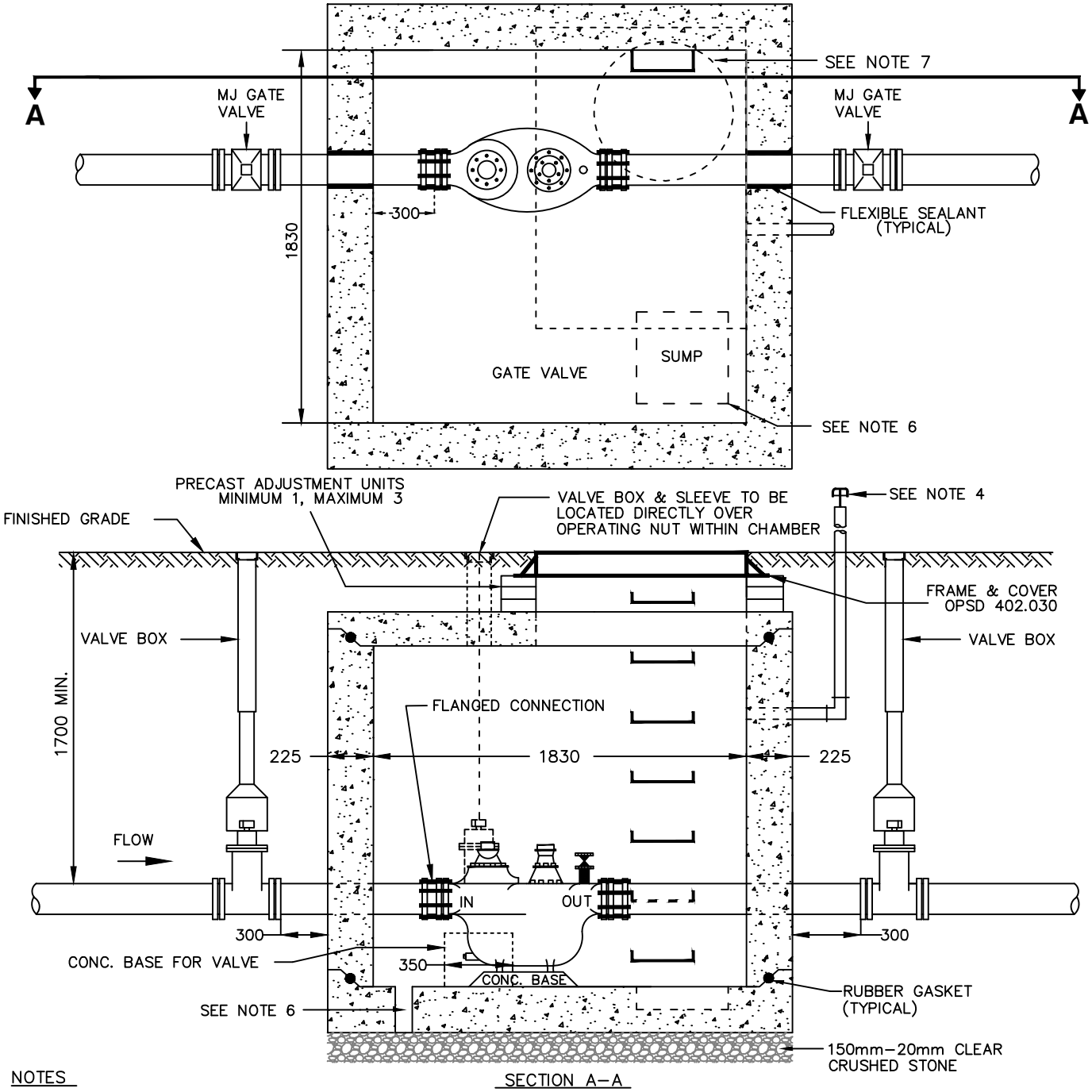
SENSUS OMNI™ + COMPOUND (C²) WATER METER CHAMBER DETAIL FOR DOMESTIC SERVICE 100mm, 150mm, 200mm, 250mm, AND 300mm



SECTION A–A

NOTES

1. JOINTS IN CHAMBER SHALL BE TYTON.
2. 50mm CONDUIT TO BE INSTALLED FROM CHAMBER WALL TO A SUITABLE LOCATION.
3. SENSUS FIRELINE METER SHALL BE USED FOR PRIVATE HYDRANTS ON A BULK METER SYSTEM.
4. REMOTE READER LOCATION SHALL BE IN ACCORDANCE WITH THE APPROVED SITE PLAN.
5. MECHANICAL JOINT RESTRAINER SYSTEM MAY BE USED IN LIEU OF CONCRETE THRUST BLOCKS.
6. ALL CHAMBERS SHALL BE BUILT TO CONTAIN A POSITIVE DRAINAGE SYSTEM, CONNECTING INTO THE STORM SEWER WITH A BACKFLOW PREVENTOR. WHERE A STORM SEWER CONNECTION IS NOT POSSIBLE, THE CHAMBER SHALL INCLUDE A 300 X 300 X 150 SUMP.
7. ALUMINIUM STEPS AS PER O.P.S.D. 405.010 AT 300mm c.c.
8. VALVES & FITTINGS IN CHAMBERS SHALL BE PROTECTED FROM CORROSION BY PROTECTO CAPS ON EVERY BOLT. BACKFLOW PREVENTORS INSTALLED INSIDE THE METER CHAMBER OR INSIDE A BUILDING SHALL HAVE A MINIMUM SEPARATION DISTANCE EQUIVALENT TO FOUR (4) TIMES THE PIPE DIAMETER DOWNSTREAM OF THE WATER METER.
9. ALL OTHER FITTINGS SUCH AS ELBOWS, TEE'S, REDUCERS, AND CHECK VAVES SHALL BE INSTALLED WITH A MINIMUM SEPARATION DISTANCE EQUIVALENT TO 2.5 TIMES THE PIPE DIAMETER ON EITHER SIDE OF THE WATER METER.
10. PRECAST ADJUSTMENT UNITS SHALL BE EXTERNALLY PARGED ALL AROUND.
11. WATER METER CHAMBER LIDS SHALL BE IN ACCORDANCE WITH OPSD 402.030.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

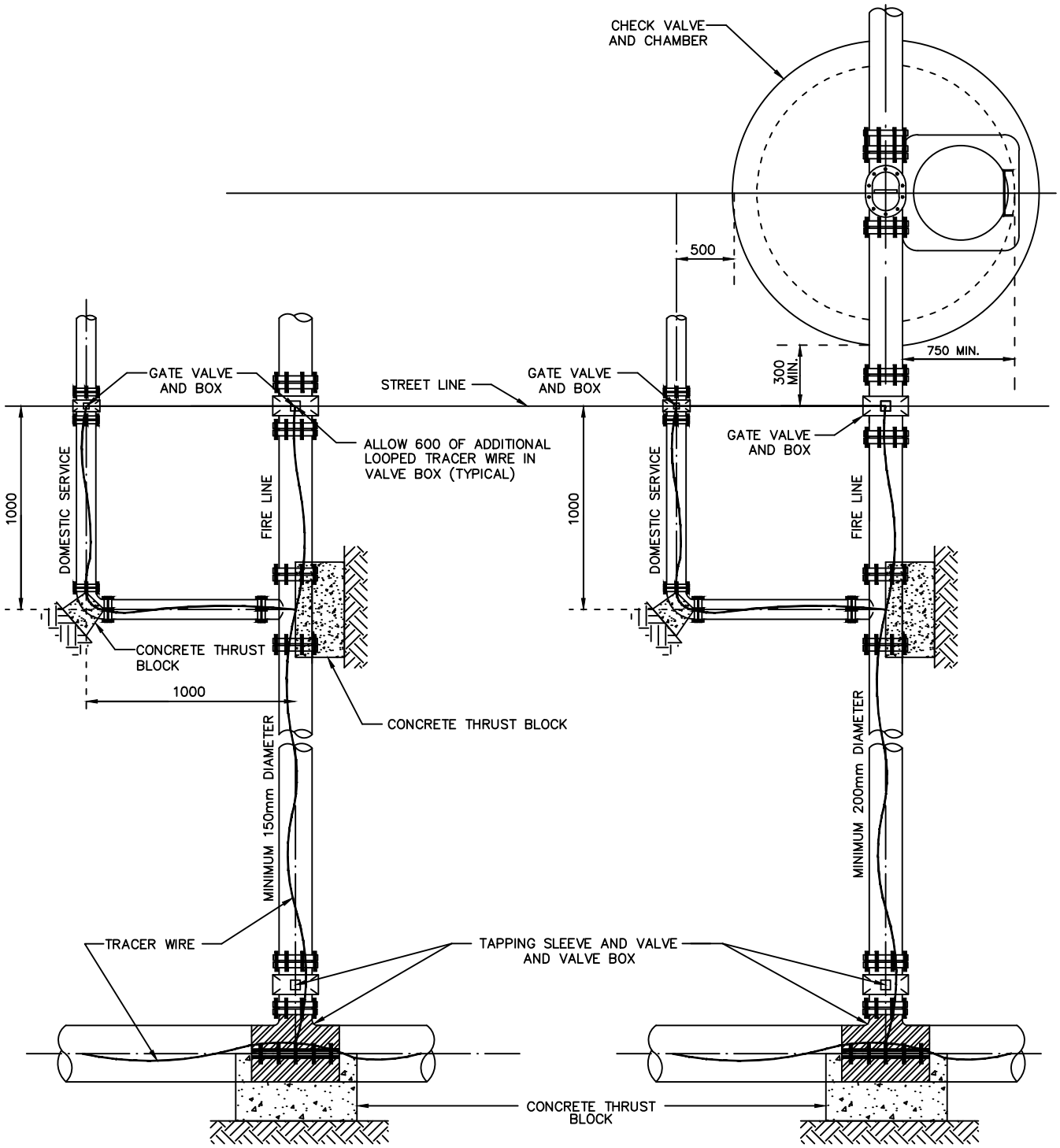
SCALE: N.T.S

REVISION: FEB. 2022

DRAWING NO.: W-112A

AURORA
You're in Good Company

SENSUS OMNI™+ FIRELINE® (F^2) WATER METER CHAMBER DETAIL FOR FIRE RATED METER 100mm, 150mm, 200mm, 250mm, AND 300mm



CONNECTION WITH NO EXTERNAL HYDRANTS

CONNECTION WITH EXTERNAL HYDRANTS

NOTES

1. CHECK VALVE AND CHAMBER TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W–112.
2. VALVE AND BOX TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W–111.
3. STANDARD FOR SERVICES GREATER THAN 5.0m IN LENGTH.
4. SERVICES LESS THAN 5.0m IN LENGTH REQUIRE SEPARATE DOMESTIC SERVICE AND FIRE LINE CONNECTIONS.
5. VALVES AND CHECK VALVE CHAMBERS SHALL NOT BE PERMITTED IN DRIVEWAYS.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: SEPT. 2020

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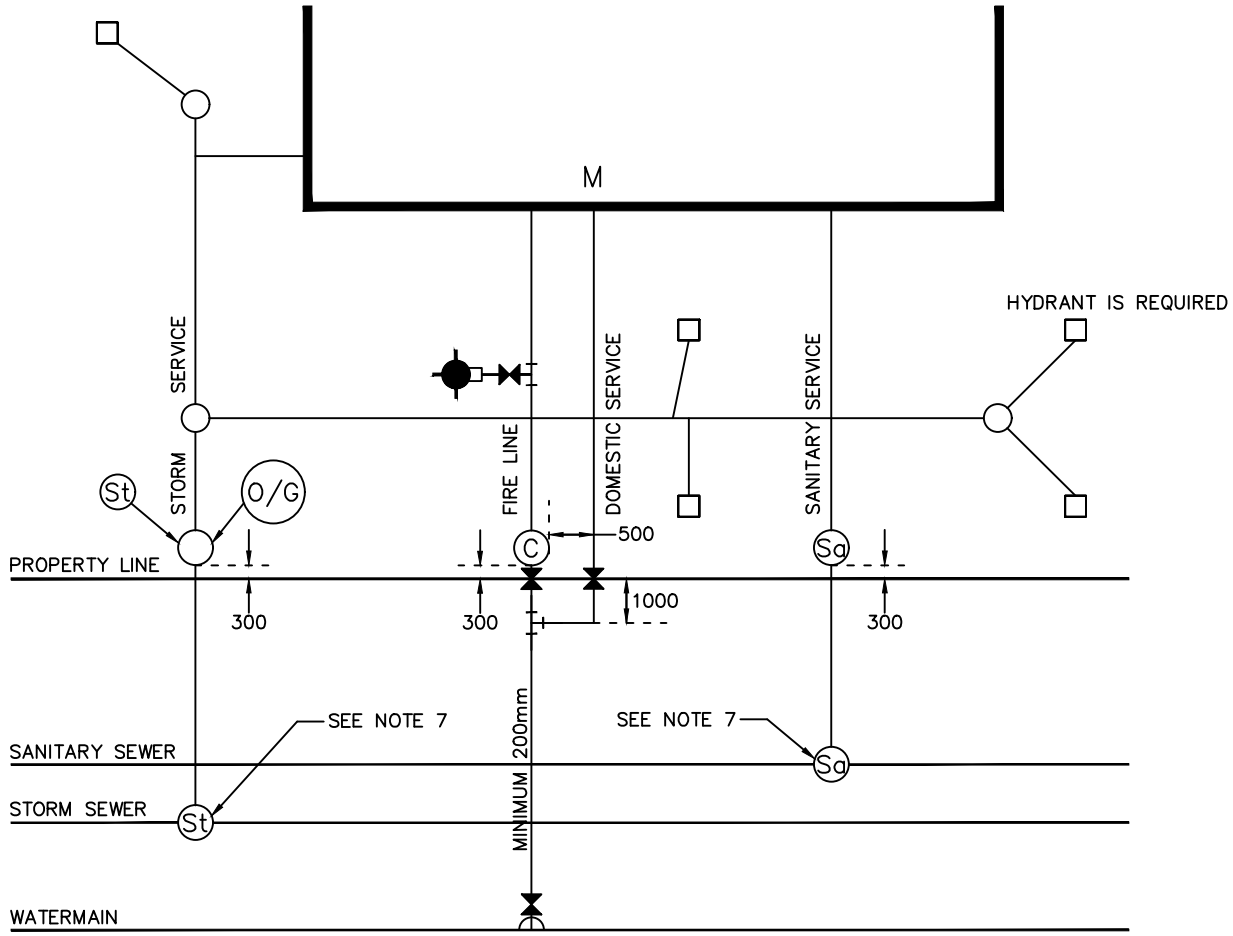
COMBINED FIRE AND DOMESTIC WATER CONNECTIONS

DRAWING NO.: W-113



LEGEND

- VALVE AND BOX
- CHECK VALVE IN CHAMBER
- TAPPING SLEEVE AND VALVE AND BOX
- MECHANICAL TEE
- M — WATER METER
- FIRE HYDRANT c/w VALVE AND BOX
- DIRECTION OF PUMPER NOZZLE
- Sa — SANITARY SEWER INSPECTION MAINTENANCE HOLE
- St — STORM SEWER INSPECTION MAINTENANCE HOLE
- O/G — OIL/GRIT SEPARATOR
- CATCHBASIN

NOTES

1. WATER SERVICES TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W–107.
2. CHECK VALVE AND CHAMBER TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W–112.
3. VALVE AND BOX TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W–102, W–103 & W–104.
4. STANDARD FOR SERVICES GREATER THAN 5.0m IN LENGTH.
5. SERVICES LESS THAN 5.0m IN LENGTH REQUIRE SEPARATE DOMESTIC SERVICE AND FIRE LINE CONNECTIONS.
6. VALVES AND CHECK VALVES SHALL NOT BE PERMITTED IN DRIVEWAYS.
7. MAINTENANCE HOLE REQUIRED ON THE MAINLINE SEWER WHERE THE SERVICE DIAMETER IS GREATER THAN OR EQUAL TO 50% OF THE DIAMETER OF THE MAINLINE SEWER.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

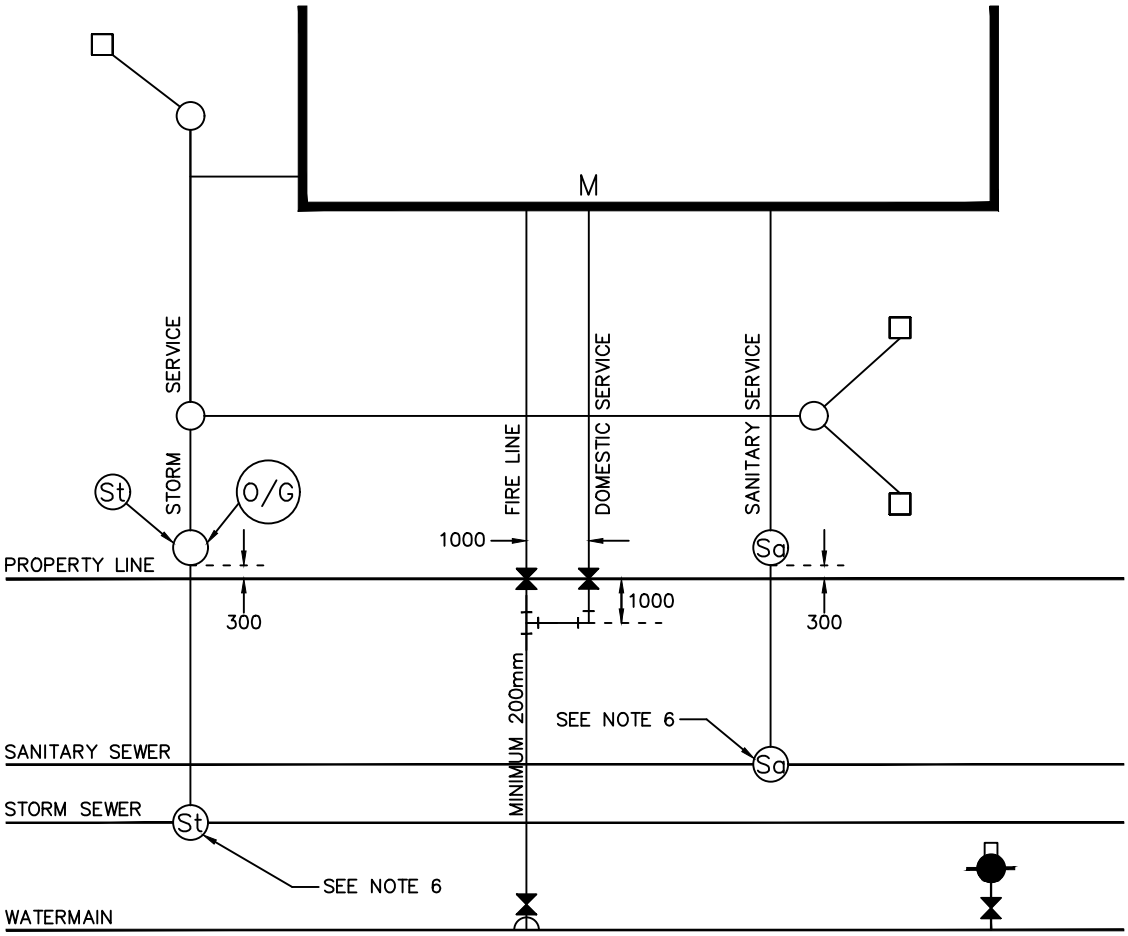
SCALE: N.T.S

REVISION: SEPT. 2020

AURORA
You're in Good Company

SINGLE BUILDING COMMERCIAL & INDUSTRIAL LOT SERVICING WITH PRIVATE HYDRANTS

DRAWING NO.: W-114



LEGEND

- VALVE AND BOX
- TAPPING SLEEVE AND VALVE AND BOX
- MECHANICAL TEE
- M — WATER METER
- CATCHBASIN
- FIRE HYDRANT c/w VALVE AND BOX
- DIRECTION OF PUMPER NOZZLE
- Sa — SANITARY SEWER SAMPLING MAINTENANCE HOLE
- St — STORM SEWER SAMPLING MAINTENANCE HOLE
- O/G — OIL/GRIT SEPARATOR
- NON-SAMPLING MAINTENANCE HOLE

NOTES

1. WATER SERVICES TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W-107.
2. VALVE AND BOX TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W-102, W-103 & W-104.
3. STANDARD FOR SERVICES GREATER THAN 5.0m IN LENGTH.
4. SERVICES LESS THAN 5.0m IN LENGTH REQUIRE SEPARATE DOMESTIC SERVICE AND FIRE LINE CONNECTIONS.
5. VALVES SHALL NOT BE PERMITTED IN DRIVEWAYS.
6. MAINTENANCE HOLE REQUIRED ON THE MAINLINE SEWER WHERE THE SERVICE DIAMETER IS GREATER THAN OR EQUAL TO 50% OF THE DIAMETER OF THE MAINLINE SEWER.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

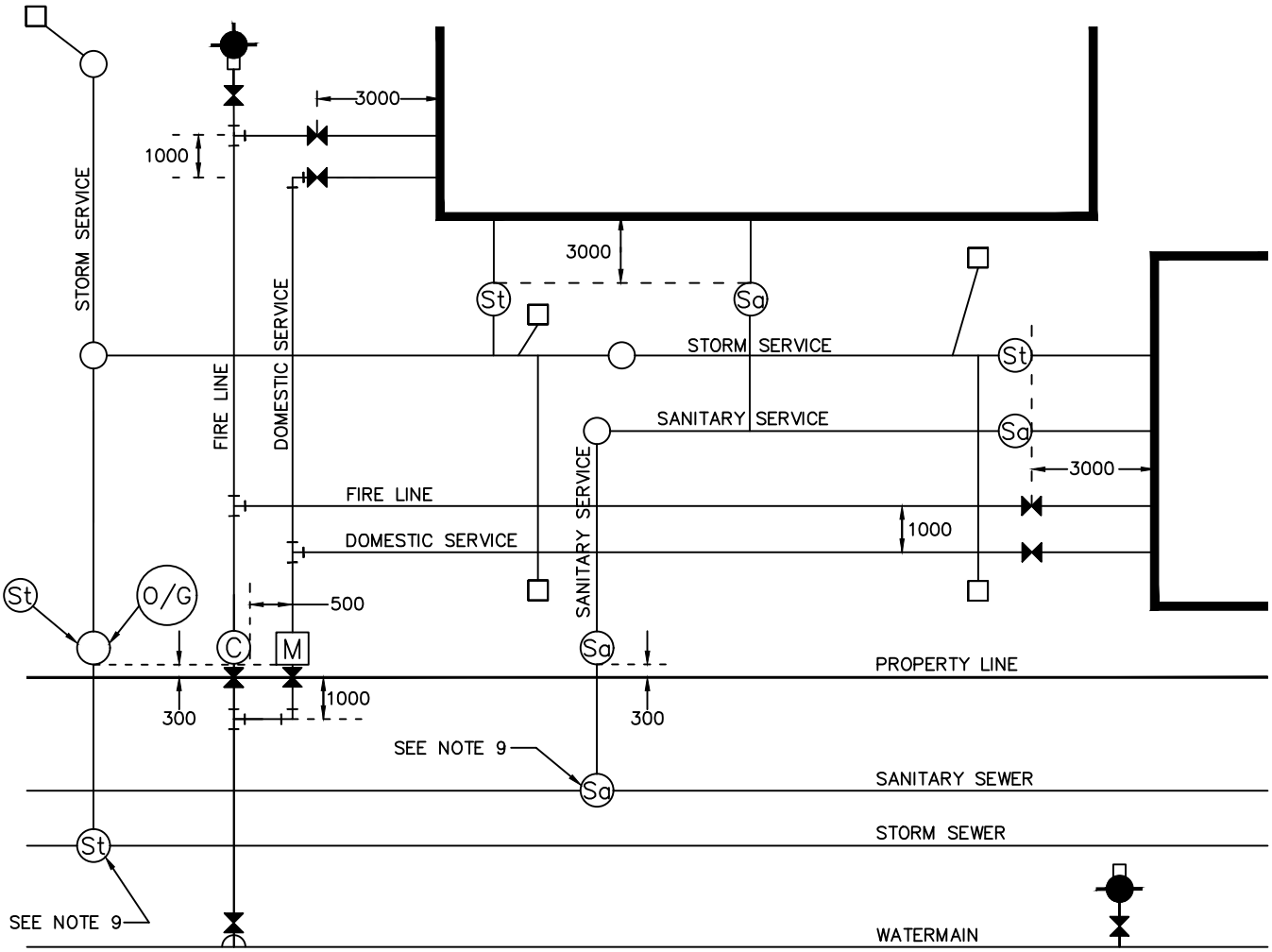
SCALE: N.T.S

REVISION: SEPT. 2020

DRAWING NO.: W-115

AURORA
You're in Good Company

SINGLE BUILDING COMMERCIAL & INDUSTRIAL LOT SERVICING WITHOUT PRIVATE HYDRANTS



LEGEND

- VALVE AND BOX
- (C) CHECK VALVE IN CHAMBER
- TAPPING SLEEVE AND VALVE AND BOX
- MECHANICAL TEE
- [M] WATER METER IN CHAMBER
- FIRE HYDRANT c/w VALVE AND BOX
  DIRECTION OF PUMPER NOZZLE
- (Sa) SANITARY SEWER SAMPLING MAINTENANCE HOLE
- (St) STORM SEWER SAMPLING MAINTENANCE HOLE
- (O/G) OIL/GRIT SEPARATOR
- □ CATCHBASIN
- ○ NON-SAMPLING MAINTENANCE HOLE

NOTES

1. WATER SERVICES TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W-107.
2. CHECK VALVE AND CHAMBER TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W-112.
3. VALVE AND BOX TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W-102, W-103 & W-104.
4. METER AND CHAMBER TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W-113.
5. STANDARD FOR SERVICES GREATER THAN 5.0m IN LENGTH.
6. SERVICES LESS THAN 5.0m IN LENGTH REQUIRE SEPARATE DOMESTIC SERVICE AND FIRE LINE CONNECTIONS.
7. VALVES AND CHECK VALVES SHALL NOT BE PERMITTED IN DRIVEWAYS.
8. IF THERE ARE NO EXTERIOR HYDRANTS TO BE CONNECTED TO FIRE LINES, THEN THE CHECK VALVE AND CHAMBER MAY BE DELETED.
9. MAINTENANCE HOLE REQUIRED ON THE MAINLINE SEWER WHERE THE SERVICE DIAMETER IS GREATER THAN OR EQUAL TO 50% OF THE DIAMETER OF THE MAINLINE SEWER.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

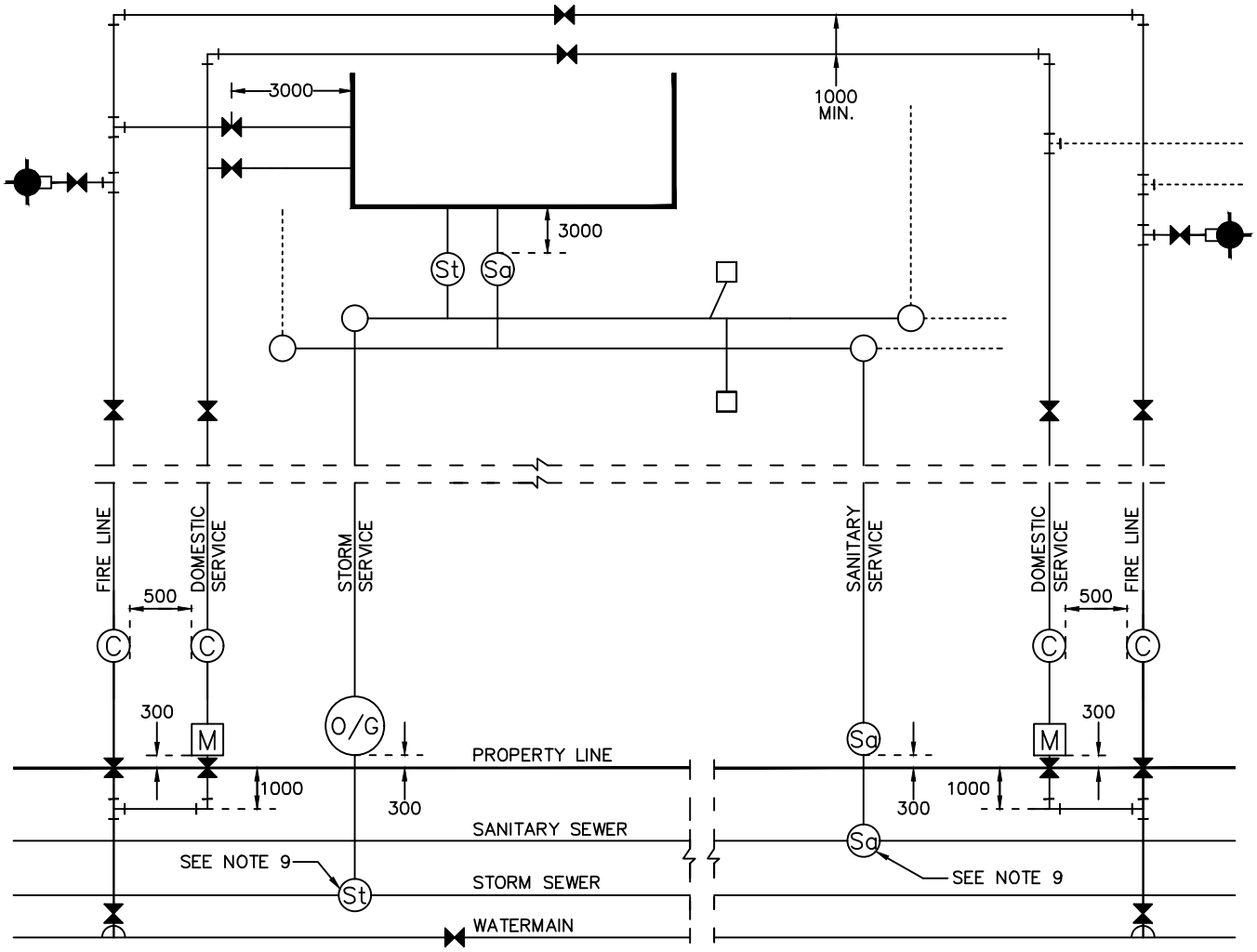
SCALE: N.T.S

REVISION: SEPT. 2020

DRAWING NO.: W-116

AURORA
You're in Good Company

MULTIPLE BUILDING COMMERCIAL & INDUSTRIAL LOT SERVICING WITH SINGLE WATER CONNECTION



LEGEND

- VALVE AND BOX
- CHECK VALVE IN CHAMBER
- TAPPING SLEEVE AND VALVE AND BOX
- MECHANICAL TEE
- NON–SAMPLING MAINTENANCE HOLE
- FIRE HYDRANT c/w VALVE AND BOX
- DIRECTION OF PUMPER NOZZLE
- Sa — SANITARY SEWER SAMPLING MAINTENANCE HOLE
- St — STORM SEWER SAMPLING MAINTENANCE HOLE
- O/G — OIL/GRIT SEPARATOR
- CATCHBASIN
- M — METER IN CHAMBER

NOTES

1. WATER SERVICES TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W–107.
2. CHECK VALVE AND CHAMBER TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W–112.
3. VALVE AND BOX TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W–102, W–103 & W–104.
4. METER AND CHAMBER TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W–113.
5. STANDARD FOR SERVICES GREATER THAN 5.0m IN LENGTH.
6. SERVICES LESS THAN 5.0m IN LENGTH REQUIRE SEPARATE DOMESTIC SERVICE AND FIRE LINE CONNECTIONS.
7. VALVES, CHECK VALVES AND METER CHAMBERS SHALL NOT BE PERMITTED IN DRIVEWAYS.
8. IF THERE ARE NO EXTERIOR HYDRANTS TO BE CONNECTED TO FIRE LINES, THEN THE CHECK VALVE AND CHAMBER MAY BE DELETED.
9. MAINTENANCE HOLE REQUIRED ON THE MAINLINE SEWER WHERE THE SERVICE DIAMETER IS GREATER THAN OR EQUAL TO 50% OF THE DIAMETER OF THE MAINLINE SEWER.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

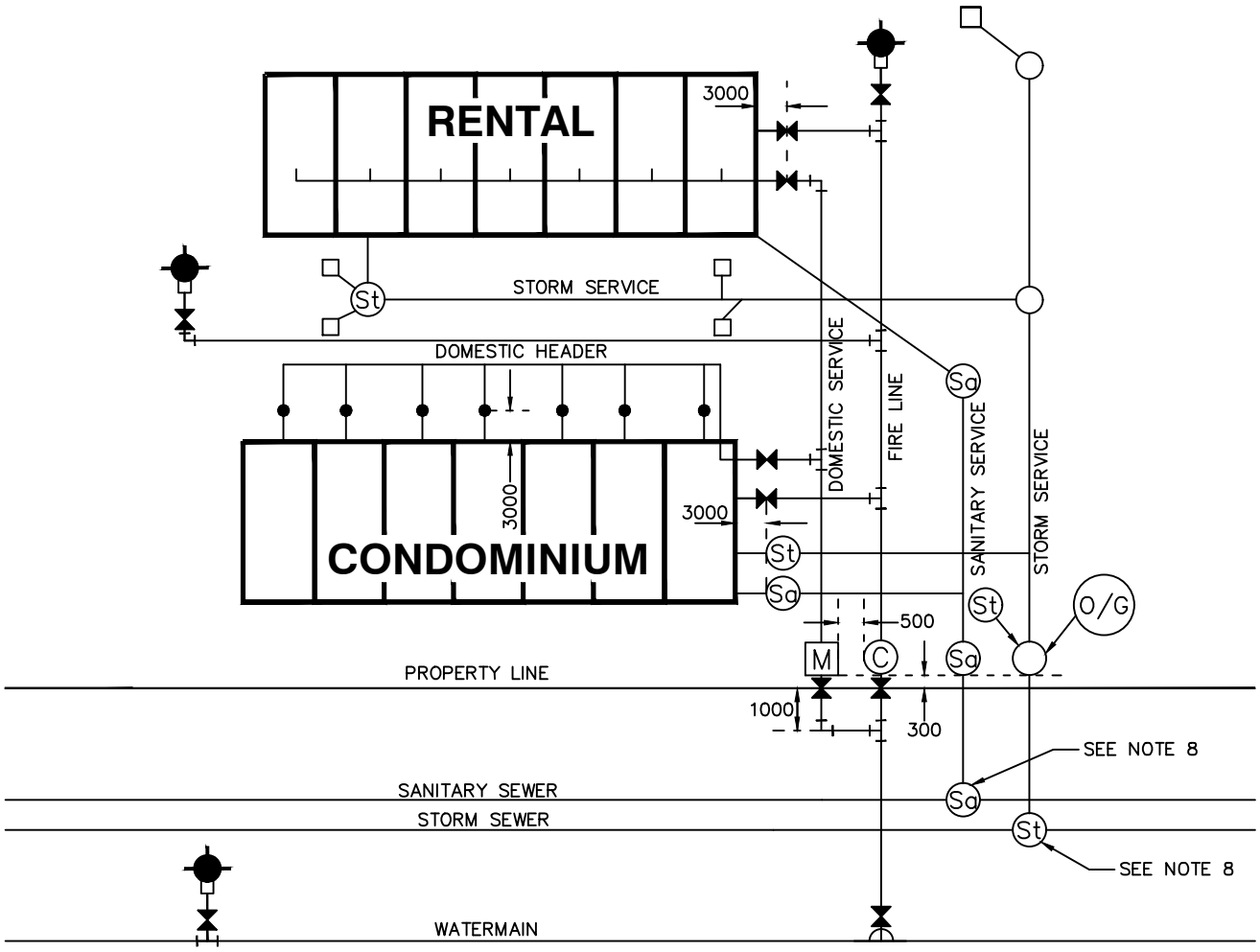
SCALE: N.T.S

REVISION: SEPT. 2020

AURORA
You're in Good Company

MULTIPLE BUILDING COMMERCIAL & INDUSTRIAL LOT SERVICING WITH TWO WATER CONNECTIONS

DRAWING NO.: W-117



LEGEND

- VALVE AND BOX
- (C) CHECK VALVE IN CHAMBER
- TAPPING SLEEVE AND VALVE AND BOX
- [M] WATER METER IN CHAMBER
- NON-SAMPLING MAINTENANCE HOLE
- CURB STOP
- FIRE HYDRANT c/w VALVE AND BOX
- DIRECTION OF PUMPER NOZZLE
- (Sa) SANITARY SEWER SAMPLING MAINTENANCE HOLE
- (St) STORM SEWER SAMPLING MAINTENANCE HOLE
- (O/G) OIL/GRIT SEPARATOR
- CATCHBASIN

NOTES

1. WATER SERVICES TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W-107.
2. CHECK VALVE AND CHAMBER TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W-112.
3. VALVE AND BOX TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W-102. W-103 & W-104
4. METER AND CHAMBER TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W-113.
5. STANDARD FOR SERVICES GREATER THAN 5.0m IN LENGTH.
6. SERVICES LESS THAN 5.0m IN LENGTH REQUIRE SEPARATE DOMESTIC SERVICE AND FIRE LINE CONNECTIONS.
7. VALVES AND CHECK VALVES SHALL NOT BE PERMITTED IN DRIVEWAYS.
8. MAINTENANCE HOLE REQUIRED ON THE MAINLINE SEWER WHERE THE SERVICE DIAMETER IS GREATER THAN OR EQUAL TO 50% OF THE DIAMETER OF THE MAINLINE SEWER.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

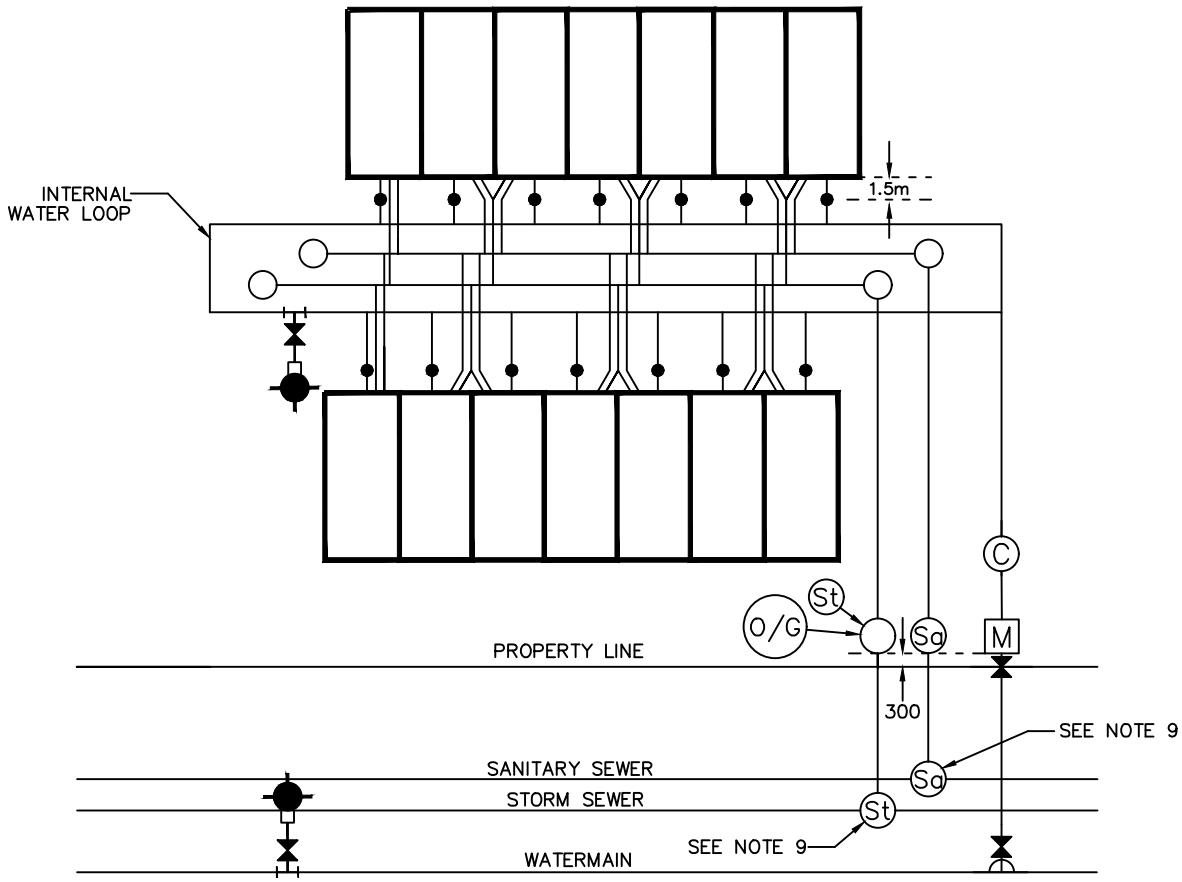
SCALE: **N.T.S**

REVISION: **SEPT. 2020**

DRAWING NO.: **W-118**

AURORA
You're in Good Company

MULTIPLE UNIT INDUSTRIAL/COMMERCIAL LOT SERVICING



LEGEND

- VALVE AND BOX
- (C) CHECK VALVE IN CHAMBER
- TAPPING SLEEVE AND VALVE AND BOX
- [M] METER IN CHAMBER
- ● CURB STOP
- FIRE HYDRANT c/w VALVE AND BOX
  DIRECTION OF PUMPER NOZZLE
- (Sa) SANITARY SEWER SAMPLING MAINTENANCE HOLE
- (St) STORM SEWER SAMPLING MAINTENANCE HOLE
- (O/G) OIL/GRIT SEPARATOR
- ○ NON-SAMPLING MAINTENANCE HOLE

NOTES

1. WATER SERVICES TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W-107.
2. CHECK VALVE AND CHAMBER TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W-112.
3. VALVE AND BOX TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W-102, W-103 & W-104.
4. METER AND CHAMBER TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING W-113.
5. STANDARD FOR SERVICES GREATER THAN 5.0m IN LENGTH.
6. SERVICES LESS THAN 5.0m IN LENGTH REQUIRE SEPARATE DOMESTIC SERVICE AND FIRE LINE CONNECTIONS.
7. VALVES AND CHECK VALVES SHALL NOT BE PERMITTED IN DRIVEWAYS.
8. INDIVIDUAL UNIT SERVICING TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING M-411.
9. MAINTENANCE HOLE REQUIRED ON THE MAINLINE SEWER WHERE THE SERVICE DIAMETER IS GREATER THAN OR EQUAL TO 50% OF THE DIAMETER OF THE MAINLINE SEWER.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

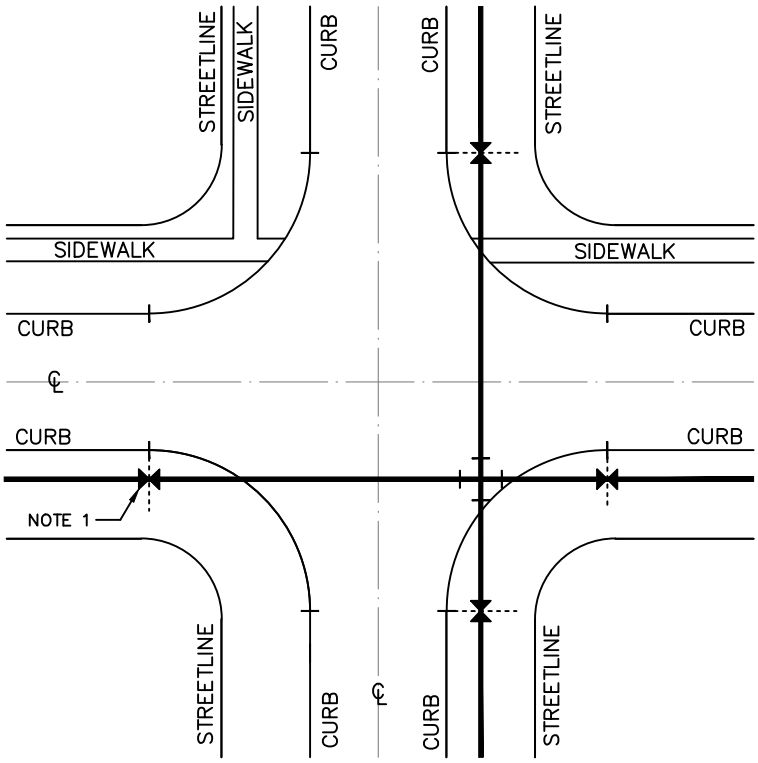
SCALE: N.T.S

REVISION: SEPT. 2020

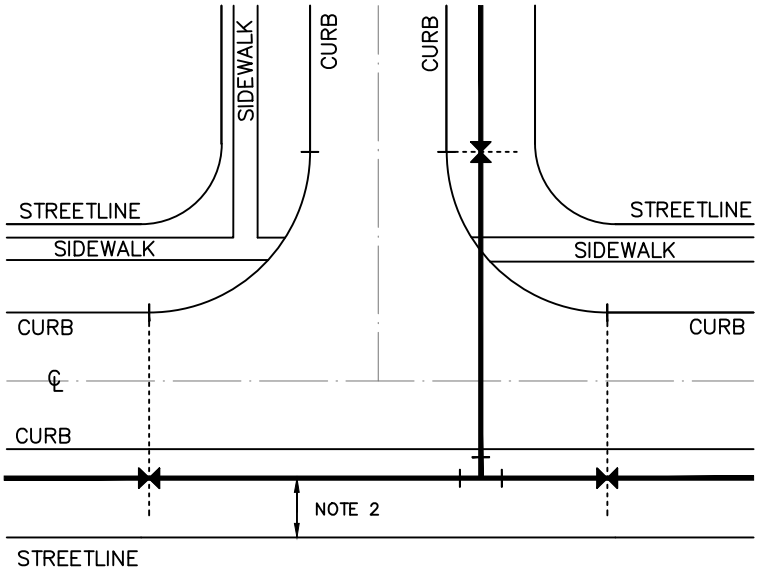
AURORA
You're in Good Company

TOWNHOUSE CONDOMINIUM SERVICING

DRAWING NO.: W-119



FOUR-WAY INTERSECTION



THREE-WAY INTERSECTION

NOTES:

1. VALVES SHALL BE LOCATED AT THE BEGINNING OR END OF CURB RADII.
2. WATERMAIN OFFSET FROM STREETLINE AS SPECIFIED ON TOWN OF AURORA TYPICAL CROSS SECTION DETAILS.
3. 150mm, 200mm & 250mm WATERMAINS SHALL BE FITTED WITH VALVE AND BOX ASSEMBLIES.
4. 300mm AND LARGER WATERMAINS SHALL BE FITTED WITH VALVE AND CHAMBER ASSEMBLIES.

ALL DIMENSIONS ARE EXPRESSED IN METRES (m) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **SEPT. 2020**

DRAWING NO.: **W-120**

AURORA
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WATER VALVE LOCATIONS AT INTERSECTIONS

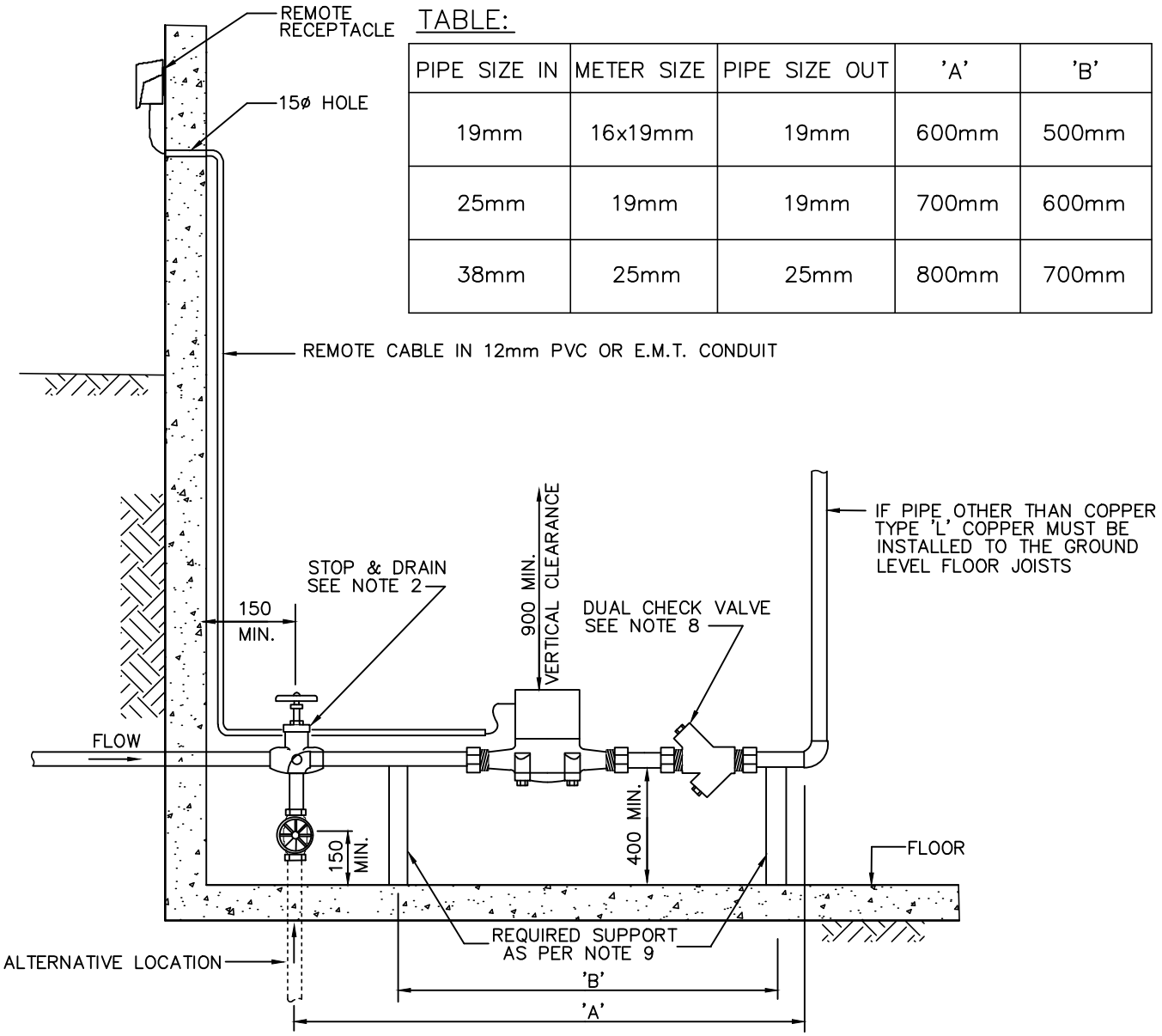

TABLE:

PIPE SIZE IN	METER SIZE	PIPE SIZE OUT	'A'	'B'
19mm	16x19mm	19mm	600mm	500mm
25mm	19mm	19mm	700mm	600mm
38mm	25mm	25mm	800mm	700mm

NOTES:

1. 175mm MINIMUM CLEARANCE BETWEEN WALL AND C/L OF PIPE AND 75mm CLEARANCE BETWEEN WALL AND METER.
2. STOP AND DRAIN TO BE THE SAME SIZE AS INCOMING PIPE.
3. IF HOT WATER TANK IS WITHIN 3.0m OF METER. THEN A CHECK VALVE IS REQUIRED BETWEEN METER AND HOT WATER TANK.
4. ALL COPPER PIPING AFTER THE STOP AND DRAIN SHALL BE TYPE 'L' COPPER.
   PIPING FOR METER TO BE RUN HORIZONTALLY AND METER TO BE INSTALLED ON HORIZONTAL PIPING ONLY.
5. WHERE THE INCOMING PIPE IS OTHER THAN COPPER, 500mm OF HORIZONTAL TYPE 'L' COPPER PIPE (AS PER ABOVE TABLE).
6. METER SIZE TO BE ONE PIPE SIZE SMALLER THAN INCOMING SERVICE SIZE.
7. METERS MUST NOT BE LOCATED BEHIND FURNACES, WATER TANKS, ETC.
8. WHERE REQUIRED, DUAL CHECK VALVE BACKFLOW PREVENTER IS TO BE INSTALLED DOWNSTREAM OF METER.
9. IF PLUMBING RISER/WATER SERVICE IS PLASTIC, SUPPORTS SHALL BE REQUIRED FOR METER ASSEMBLY AREA. TO AVOID INSTALLING SUPPORTS, RISER SHALL BE COPPER AND ATTACHED TO LOWER FLOOR LEVEL JOISTS.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: JAN. 2022

DRAWING NO.: W-121

AURORA
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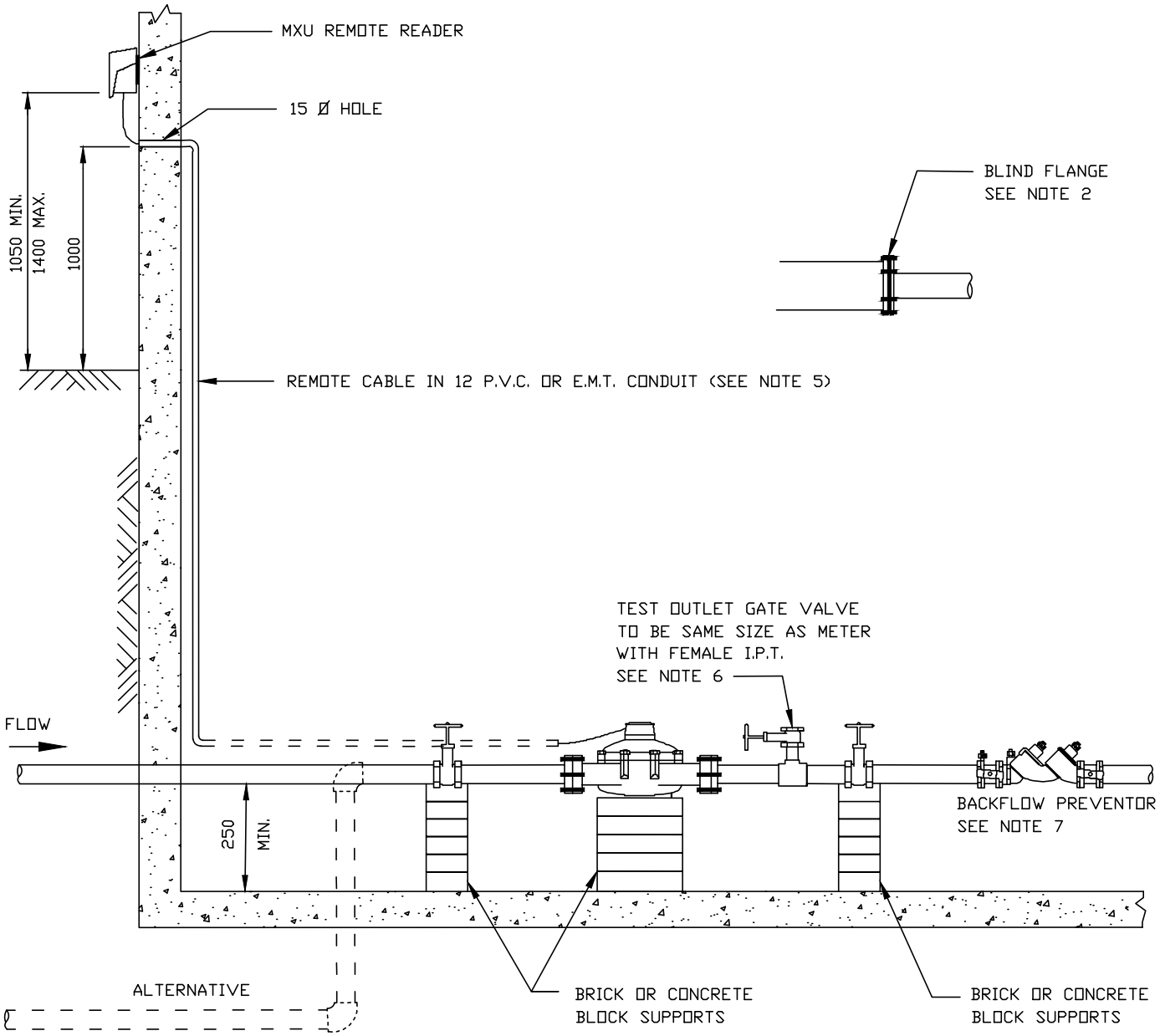
WATER METER INSTALLATION DETAIL IN BUILDING 19mm, 25mm



NOTES:

1. 300mm MINIMUM CLEARANCE BETWEEN WALL AND > OF PIPE.
2. 100mm OR LARGER SERVICE MAY BE REDUCED BY USING A TAPPING FLANGE.
3. IF HOT WATER TANK IS WITHIN 3.0m OF METER, THEN A CHECK VALVE IS REQUIRED BETWEEN METER AND HOT WATER TANK.
4. WHERE METER ROOM IS NOT ADJACENT TO AN OUTSIDE WALL OR IS BELOW EXTERIOR FINISHED GRADE, CONTRACTOR/ APPLICANT SHALL PROVIDE A CONTINUOUS E.M.T. CONDUIT COMPLETE WITH NYLON FISH LINE FROM METER ROOM TO 1000mm ABOVE EXTERIOR FINISHED GRADE.
5. TEST OUTLET SHALL BE LOCATED BETWEEN THE OUTLET SIDE OF THE METER AND THE OUTLET SIDE ISOLATION VALVE.
6. WHERE REQUIRED, BACKFLOW PREVENTOR SHALL BE INSTALLED AFTER THE WATER METER. BACKFLOW PREVENTORS INSTALLED INSIDE THE METER CHAMBER OR INSIDE A BUILDING SHALL HAVE A MINIMUM SEPARATION DISTANCE EQUIVALENT TO FOUR (4) TIMES THE PIPE DIAMETER DOWNSTREAM OF THE WATER METER.
7. PRODUCT SHALL BE OMNI COMPOUND (C2) WATER METERS MANUFACTURED BY SENSUS.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: FEB. 2022

DRAWING NO.: W-122

AURORA
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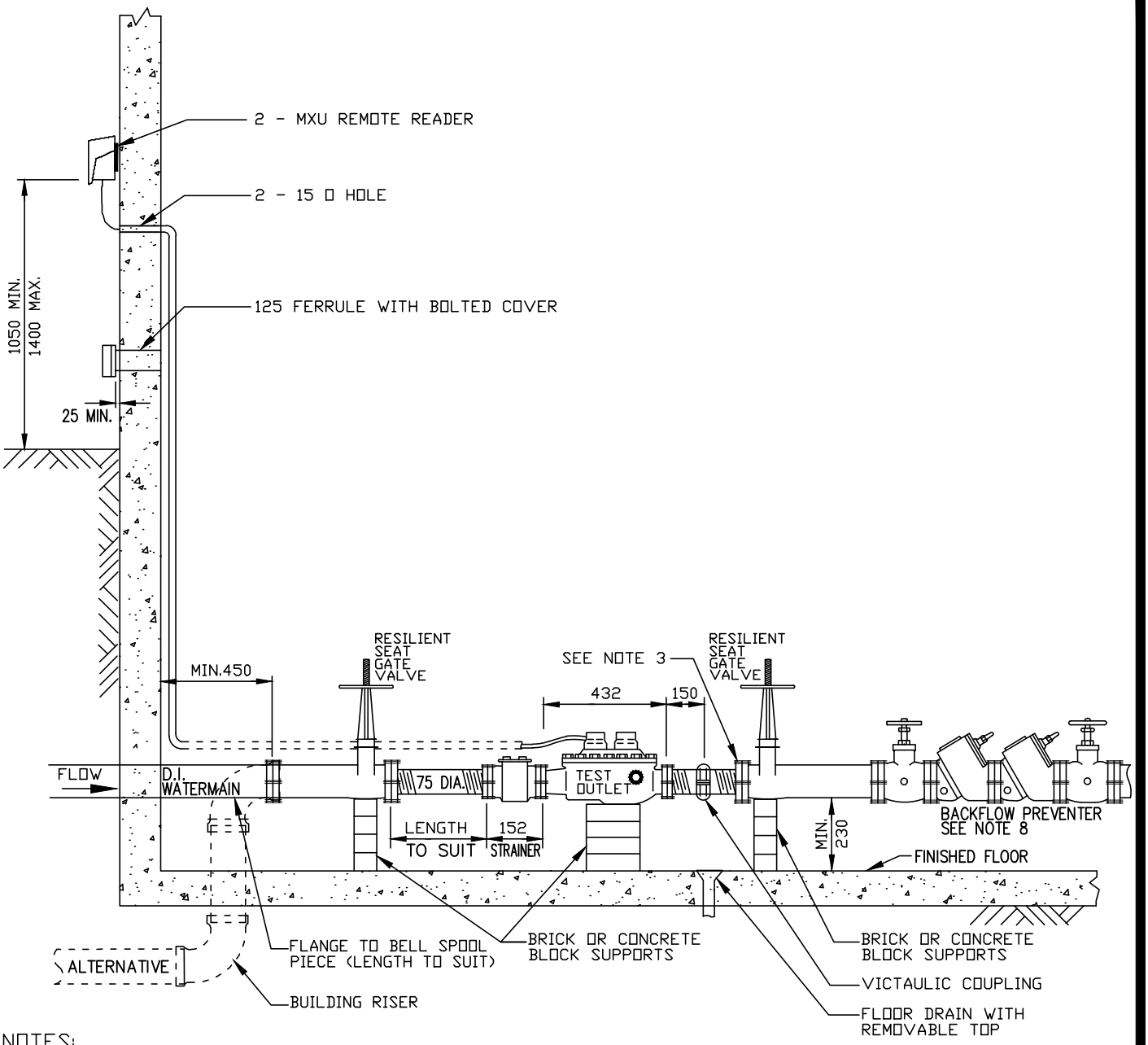
SENSUS OMNI™ + COMPOUND (C^2) WATER METER INSTALLATION DETAIL IN BUILDING
38mm, 50mm



NOTES:

1. PROVISION IS TO BE MADE FOR THE DISPOSAL OF WATER USED FOR IN-PLACE TESTING OF OMNI COMPOUND WATER METER EITHER THROUGH FLOOR DRAIN OR THE 125mm FERRULE.
2. IF HOT WATER TANK IS WITHIN 3.0m OF METER, THEN A CHECK VALVE IS REQUIRED BETWEEN METER AND HOT WATER TANK.
3. FLANGED ENDS COMPLETE WITH TAPPED BLIND FLANGE.
4. WHERE METER ROOM IS NOT ADJACENT TO AN OUTSIDE WALL OR IS BELOW EXTERIOR FINISHED GRADE, CONTRACTOR/ APPLICANT SHALL PROVIDE A CONTINUOUS 12mm E.M.T. CONDUIT COMPLETE WITH NYLON FISH LINE FROM METER ROOM TO 1000mm ABOVE EXTERIOR FINISHED GRADE.
5. MIN. 300mm CLEARANCE BETWEEN WALL AND EDGE OF METER.
6. METER SHALL BE ACCESSIBLE AT ALL TIMES.
7. WHERE REQUIRED, BACKFLOW PREVENTOR SHALL BE INSTALLED AFTER THE WATER METER. BACKFLOW PREVENTORS INSTALLED INSIDE THE METER CHAMBER OR INSIDE A BUILDING SHALL HAVE A MINIMUM SEPARATION DISTANCE EQUIVALENT TO FOUR (4) TIMES THE PIPE DIAMETER DOWNSTREAM OF THE WATER METER.
8. ALL OTHER FITTINGS SUCH AS ELBOWS, TEE'S, REDUCERS, AND CHECK VAVES SHALL BE INSTALLED WITH A MINIMUM SEPARATION DISTANCE EQUIVALENT TO 2.5 TIMES THE PIPE DIAMETER ON EITHER SIDE OF THE WATER METER.
9. PRODUCT SHALL BE OMNI COMPOUND (C2) WATER METERS MANUFACTURED BY SENSUS.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: FEB. 2022

DRAWING NO.: W-123

AURORA
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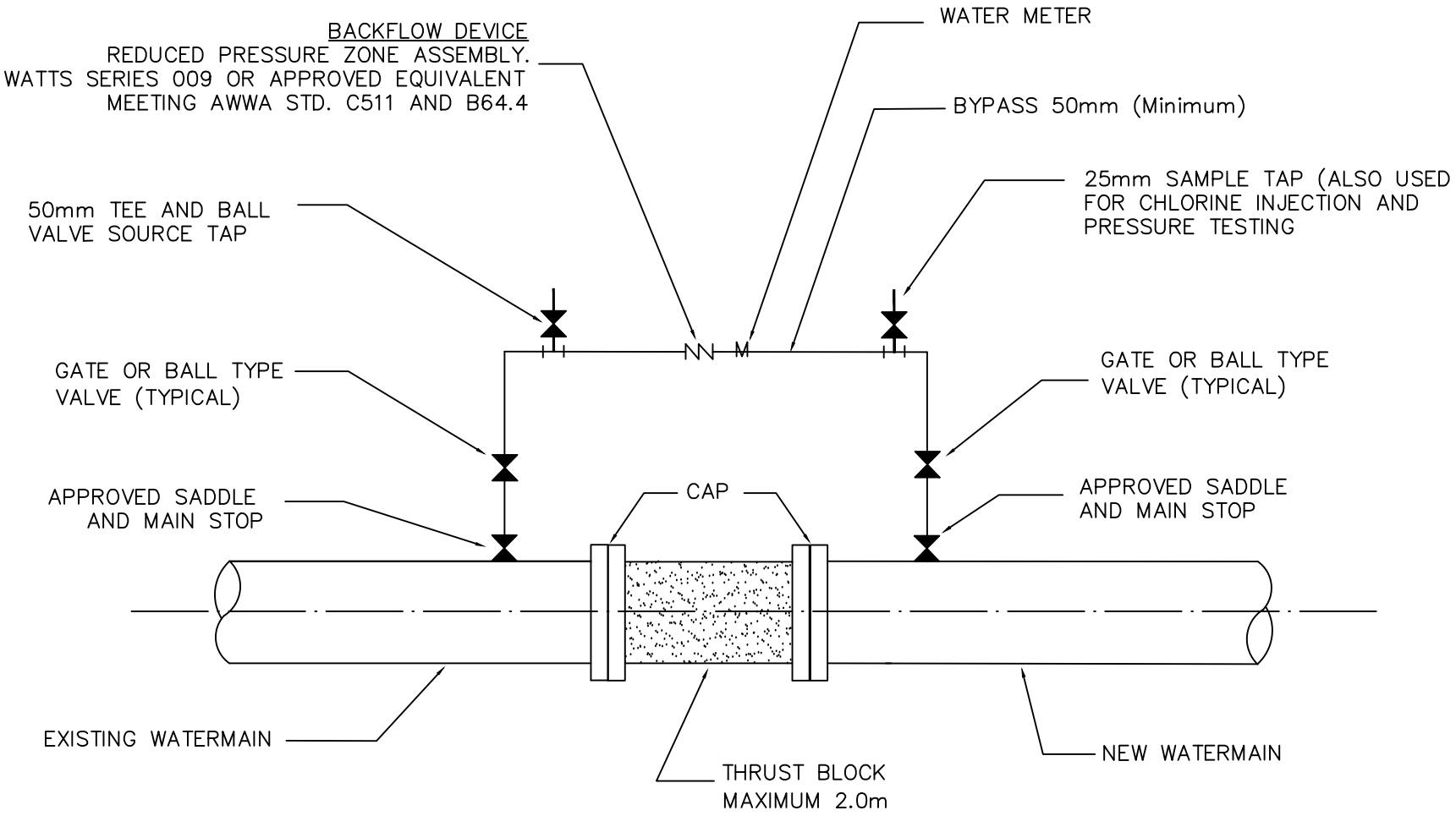
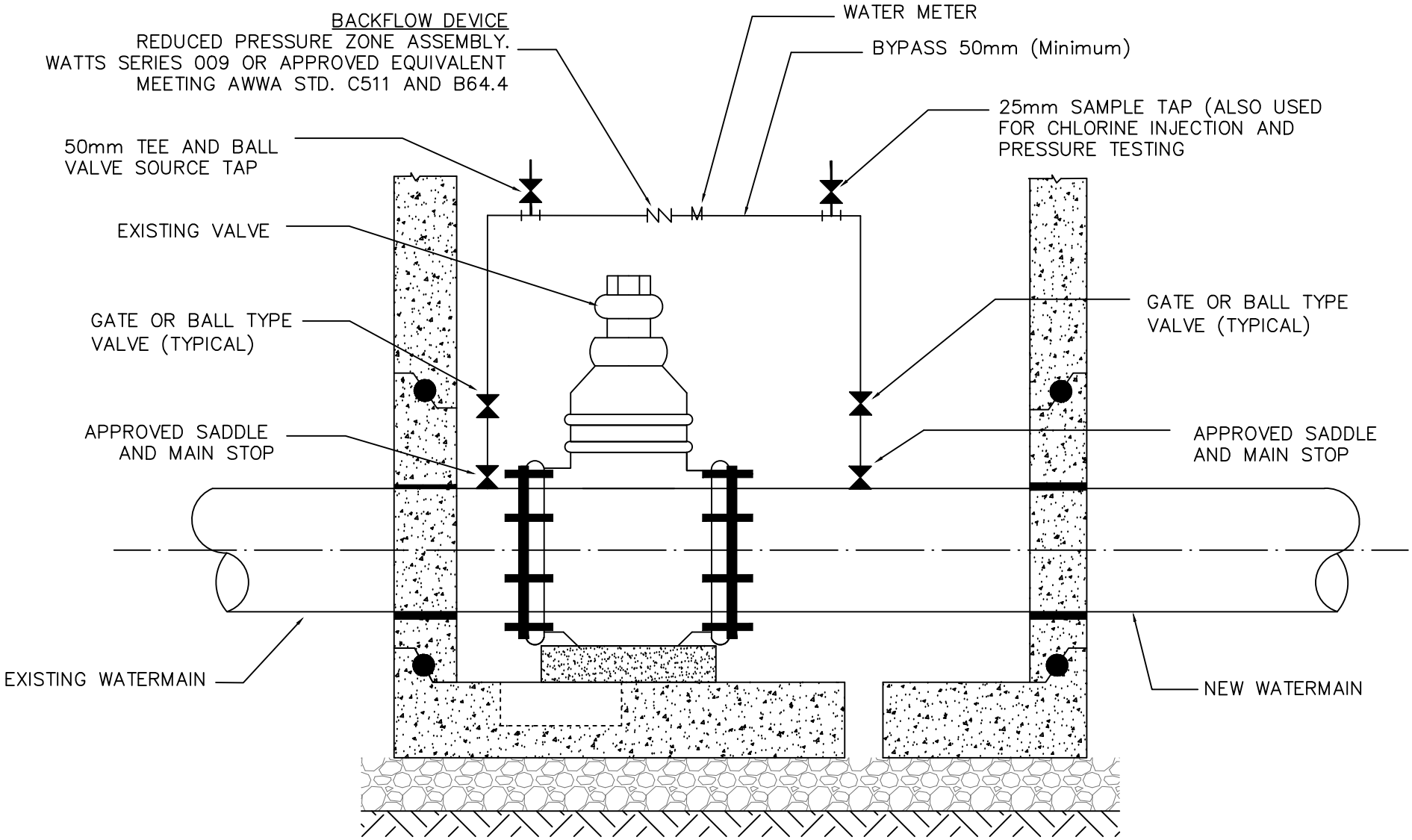
SENSUS OMNI™ + COMPOUND (C^2) WATER METER INSTALLATION DETAIL IN BUILDING 75mm, 100mm



TOWN OF AURORA	APPROVED:	SCALE: N.T.S
AURORA You're in Good Company	**ISOLATION OF EXISTING AND NEW WATERMAINS**	REVISION: JAN. 2013
		DRAWING NO.: **W-124**



TOWN OF AURORA

APPROVED:

AURORA
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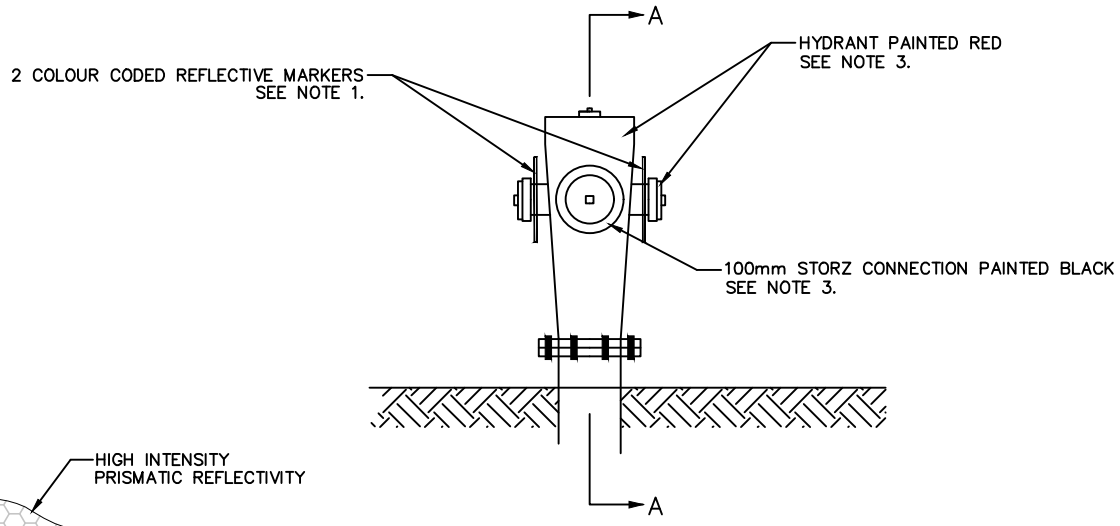
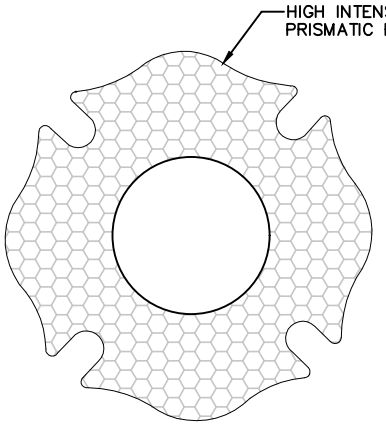
CONNECTION AT EXISTING VALVE
300mm OR GREATER WATERMAIN

SCALE: N.T.S

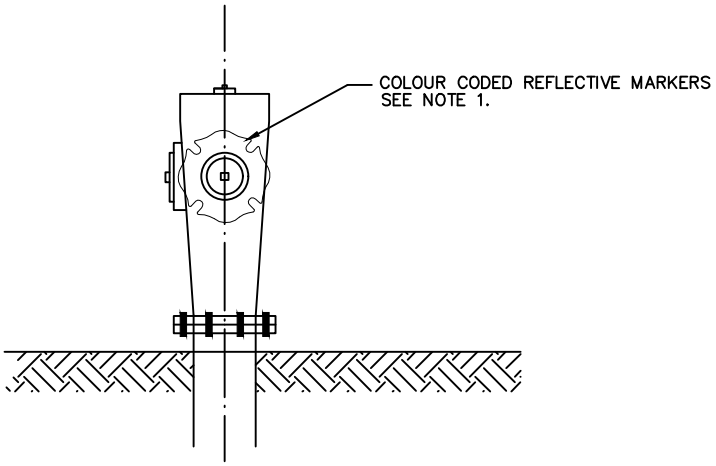
REVISION: SEPT. 2020

DRAWING NO.: W-125





REFLECTIVE MARKER



SECTION A–A

NOTES

1. MARKER TO BE COLOUR COORDINATED TO HYDRANT FLOW RATE PER:
   - –CLASS AA, BLUE MARKER FOR FLOWS – 5,500 L/MIN. (1210 IMPERIAL GPM) OR GREATER;
   - –CLASS A, GREEN MARKER FOR FLOWS – 4,500 L/MIN. TO 5,500 L/MIN (1,189 TO 1,453 IMPERIAL GPM);
   - –CLASS B, ORANGE MARKER FOR FLOWS – 2,250 L/MIN. TO 4,500 L/MIN (500 TO 999 IMPERIAL GPM).
2. HYDRANT FLOW RATE LESSER THAN 2,250 L/MIN. IS NOT ACCEPTABLE.
3. HYDRANT TO BE PAINTED RED INCLUDING 65mm PORTS. RED PAINT TO BE EITHER:
   - – SHERWIN WILLIAMS #B65 400 SERIES DFT @ 2–4 MILS WITH SHERWIN WILLIAMS MACROPOXY 646 FAST CURE; OR
   - – SICO CORROSTOP ULTRA BRIGHT RED #635720; OR
   - – DULUX A0278 METAL CLAD HIGH GLOSS POLYURETHANE ALKYD ANTI–RUST DURABLE HIGH GLOSS FINISH
4. 100mm STORZ CONNECTION TO BE PAINTED BLACK.
5. MARKERS TO BE FIRE SERVICE MALTESE CROSS SHAPE WITH HIGH INTENSITY PRISMATIC REFLECTIVE FILM.

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES (mm) UNLESS OTHERWISE NOTED.

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **SEPT. 2020**

AURORA
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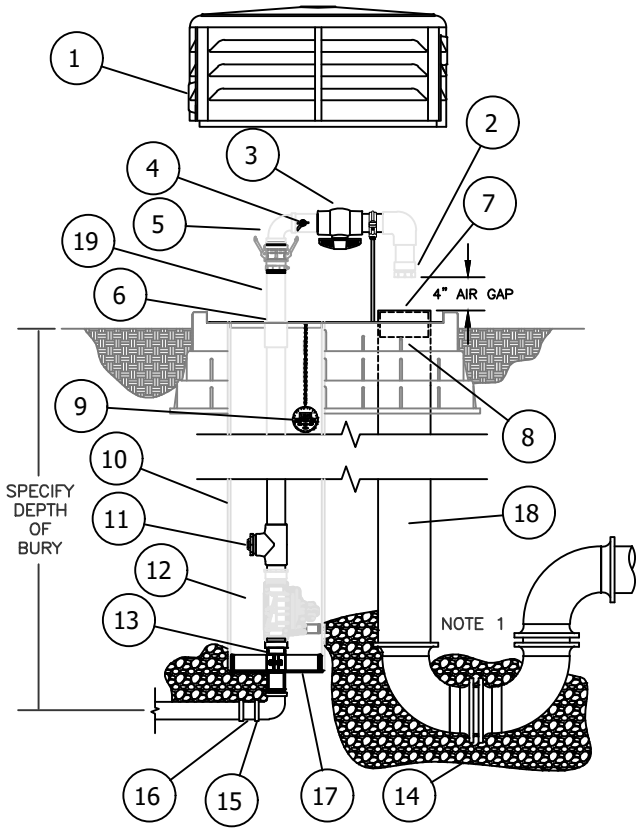
COLOUR CODING OF HYDRANTS

DRAWING NO.: **W-126**



ITEM	ITEM/DESCRIPTION	OPTIONAL	BY OTHERS
1	UV RESISTANT LOCKABLE LID		
2	DIFFUSER/ TRAP		
3	2" PVC BALL VALVE		
4.	SAMPLING POINT		
5.	2" STAINLESS STEEL QUICK DISCONNECT		
6.	REMOVABLE ACCESS POINT		
7.	DECHLOR BASKET		
8.	6" SEWER PIPE CONNECTION		
9.	CONTROLLER		
10.	SDR 35 PVC PIPE		
11.	AUTOMATIC DRAIN		
12.	2" AUTOMATIC VALVE		
13.	O-RING CONNECTOR		
14.	1" CLEAN ROCK		
15.	2" S.S FIP INLET		
16.	2" MIP X COMPRESSION ADAPTOR		
17.	DEBRIS PLATE		
18.	6" PVC SEWER PIPE AND P TRAP		
19.	SCHEDULE 80 PVC PIPE		

AUTOMATIC FLUSHING DEVICE SHALL HAVE A 2" STAINLESS STEEL FIP INLET THAT WILL LEAD VERTICALLY TO THE BOTTOM OF A 2" AUTOMATIC FLUSHING VALVE. THE FLUSHING VALVE SHALL CONTROL THE FLOW OF WATER THROUGH THE HYDRANT AND ITS DIAPHRAGM WITH THE EXTENSION AND RETRACTION OF A DC LATCHING SOLENOID AND HAVE A 150 PSI RATING. EACH UNIT SHALL BE FURNISHED WITH A STAND-ALONE VALVE CONTROLLER. THE VALVE CONTROLLER WILL NOT REQUIRE A SECOND HAND-HELD DEVICE FOR PROGRAMMING. CONTROLLER MUST HAVE MINIMUM OF 12 POSSIBLE FLUSHING CYCLES PER DAY. CONTROLLER SHALL BE SUBMERSIBLE TO 12 FEET, OPERATE WITH A 9 VOLT BATTERY, AND HAVE RESIN-SEALED ELECTRICAL COMPONENTS. THE SOLENOID SHALL HAVE NO LOOSE PARTS WHEN REMOVED FROM THE EACH UNIT SHALL HAVE A ALL STAINLESS STEEL SAMPLING POINT. REMOVAL OF THE 2" VALVE SHALL BE POSSIBLE VIA AN O-RING CONNECTOR LOCATED BENEATH THE VALVE AFTER THE ABOVE GROUND DISCONNECTION OF THE STAINLESS STEEL ACCESS PLATE. VALVE ASSEMBLY SHALL BE HOUSED IN A PVC ENCLOSURE AND EACH UNIT SHALL BE SELF-DRAINING, NON-FREEZING. ALL ABOVE-GROUND COMPONENTS SHALL BE CONTAINED WITHIN A UV-RESISTANT LOCKING COVER.

UNIT MODEL # SHALL BE 9800 AS MANUFACTERED BY KUPFERLE FOUNDRY COMPANY, ST. LOUIS MO (1-800-231-3990), OR APPROVED EQUAL.

NOTE:

1. FLUSH WATER LINES FREE OF DEBRIS BEFORE INSTALLATION.
2. KUPFERLE RECOMMENDS THE INSTALLATION OF A 6" DWV P TRAP.

TOWN OF AURORA

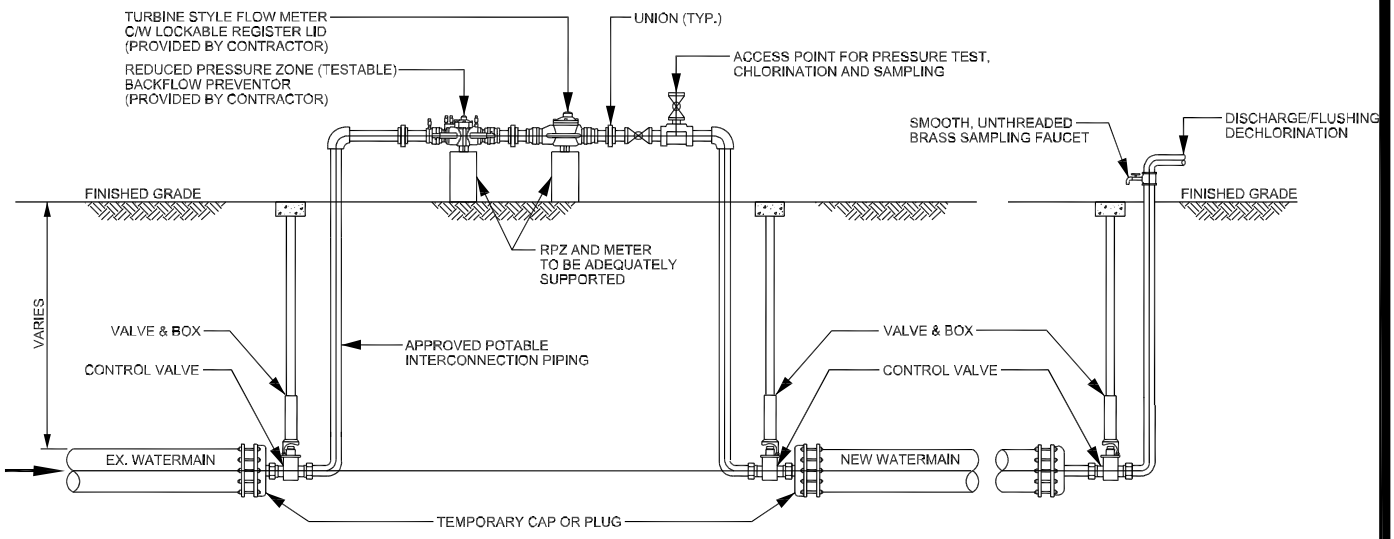
APPROVED:

SCALE: **N.T.S**

REVISION: SEPT 2020

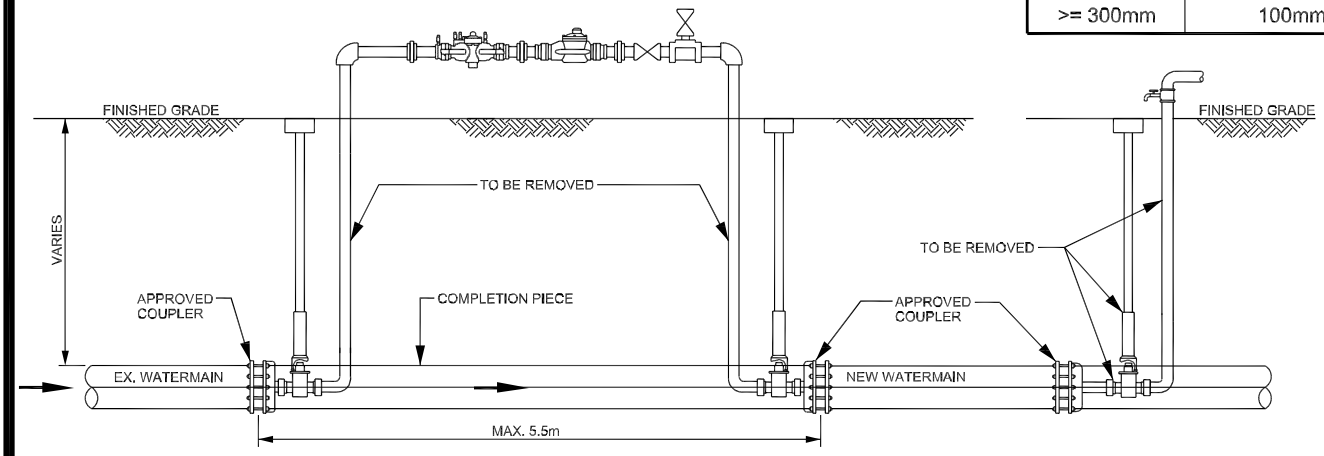
AUTOMATIC FLUSHING DEVICE

DRAWING NO.: W-127



BACKFLOW PREVENTION VALVE AND FLOW METER ASSEMBLY

INTERCONNECTION	
WM SIZE	MINIMUM CONNECTION SIZE
< 300mm	50mm
>= 300mm	100mm



WATERMAIN COMPLETION ASSEMBLY

NOTE

1. THE REDUCED PRESSURE ZONE BACKFLOW PREVENTER (RPZ) MUST BE PROVIDED BY THE CONTRACTOR AND TESTED AS PER CSA B64-10. THE TESTING LOGS MUST BE ON SITE AND AVAILABLE FOR REVIEW BY THE AGENCY AT ANYTIME.

2. THE BACKFLOW PREVENTION VALVE AND FLOW METER ASSEMBLY SHALL BE DISCONNECTED DURING WATERMAIN PRESSURE TESTS.

3. THE FINAL CONNECTION OF THE WATERMAIN SHALL BE COMPLETED ONLY AFTER AUTHORIZATION BY TOWN OF AURORA.

4. THE WATERMAIN SHALL BE DRAINED BY CONTROLLED MEANS AND TEMPORARY CAP OR PLUGS INSTALLED AS REQUIRED. SUFFICIENT TRENCH DEWATERING CAPACITY SHALL BE USED WHEN THE EXISTING AND NEW WATERMAINS ARE DRAINED PRIOR TO THE FINAL CONNECTION TO ENSURE NO BACKFLOW OF TRENCH WATER INTO EITHER WATERMAIN.

5. THE WATERMAIN SHALL BE CUT BACK TO REMOVE THE TAPPING POINTS OF THE BACKFLOW PREVENTION VALVE ASSEMBLY. ENSURE COMPLETION PIECE IS LESS THAN 5.5m AND DISINFECTED ACCORDING TO AWWA 651-05.

6. ONLY MUNICIPAL STAFF SHALL OPERATE MUNICIPALITY OWNED VALVES.

7. ALL NEW PIPING AND APPURTENANCES PLACED IN THE CONNECTION SHALL BE THOROUGHLY DISINFECTED WITH 1%-5% SOLUTION OF SODIUM HYPOCHLORITE (ANSI/NSF60 CERTIFIED) IN ACCORDANCE WITH AWWA C651.

8. A PHYSICAL SEPARATION MUST BE MAINTAINED AT ALL CONNECTION POINTS OF NEW WATERMAINS TO THE EXISTING SYSTEMS UNTIL BACTERIOLOGICAL TESTS HAVE PASSED. A SAMPLING TAP MUST BE PROVIDED AT THE END OF EACH BRANCH OR STUB.

9. THIS DETAIL IS FOR SCHEMATIC INFORMATION ONLY. THE ACTUAL CONFIGURATION USED MUST SATISFY THE INTENT OF THIS DRAWING

10. FREEZING PROTECTION MUST BE PROVIDED WHEN APPLICABLE. INSULATION IS REQUIRED BETWEEN THE FROST BOX AND GROUND TO PREVENT ADHERENCE TO THE GROUND.

11. ALL TEMPORARY CAPS SHALL BE EITHER RESTRAINED OR APPROVED ALTERNATIVE. ALL RESTRAINED JOINTS SHALL BE IN ACCORDANCE WITH THE PIPE MANUFACTURER'S SPECIFICATIONS.

12. RPZ AND FLOW METER TO BE LOCATED IN THE BOULEVARD.

TOWN OF AURORA

APPROVED:

SCALE: N.T.S

REVISION: Sept 2020

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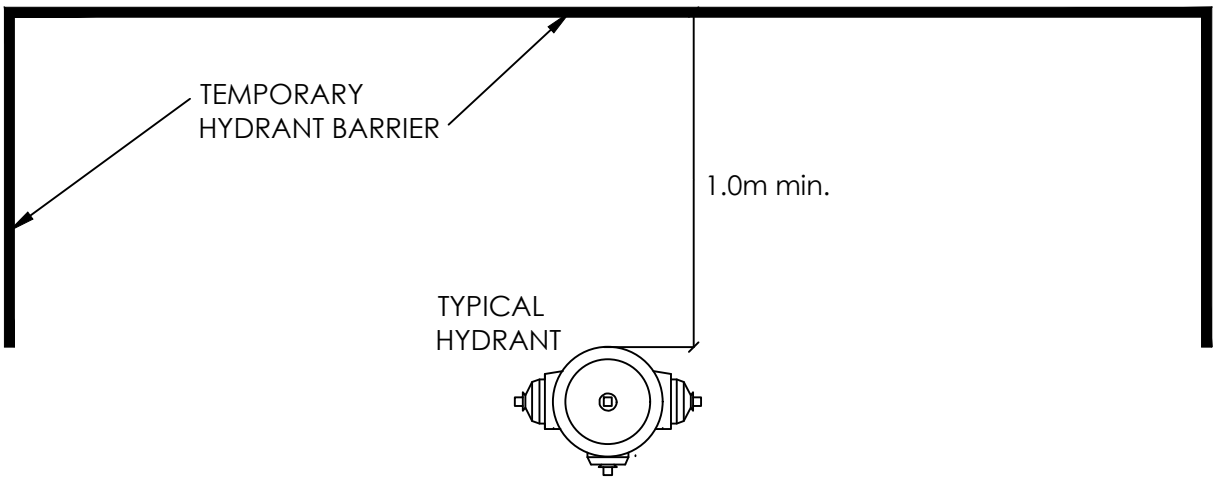
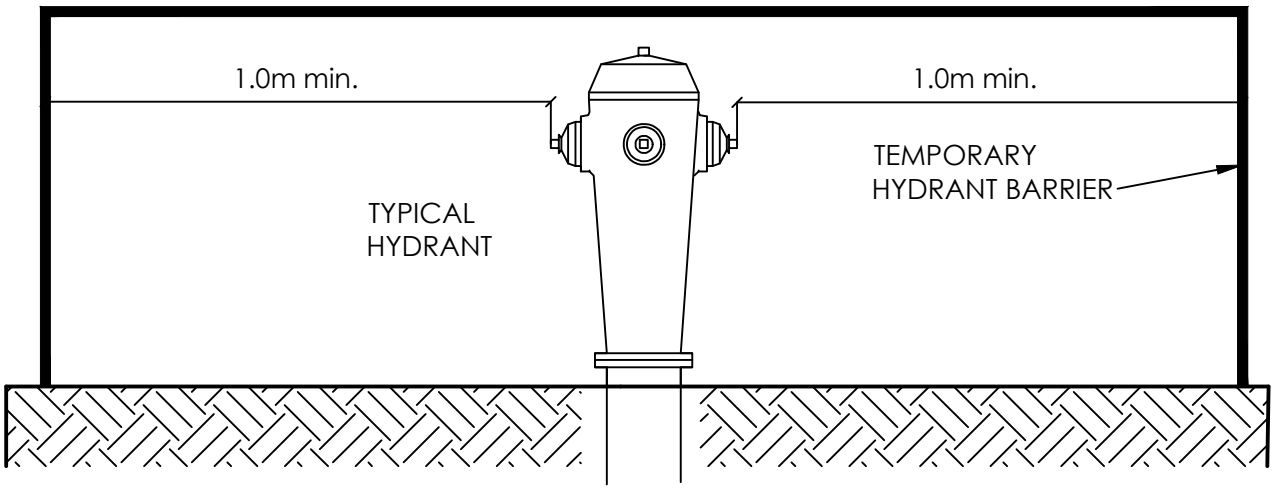
TEMPORARY WATERMAIN CONNECTION DETAIL FROM WATERMAIN

DRAWING NO.: W-128



PLAN VIEW



ELEVATION VIEW

NOTES:

1. A MINIMUM OF 1.0m SEPARATION IS REQUIRED BETWEEN THE TEMPORARY BARRIER AND THE OUTSIDE EDGE OF HYDRANT FLANGES.
2. ALL BARRIER MATERIALS ARE TO BE FREE OF SCREWS, NAILS, OR SHARP EDGES.
3. NO CONSTRUCTION MATERIALS OR EQUIPMENT IS TO BE LOCATED IN FRONT OF THE HYDRANT OR BARRIER.
4. THE BARRIER IS TO BE SECURELY FASTENED TO THE GROUND TO RESTRICT MOVEMENT.
5. REPAIRS OR RECTIFICATIONS TO THE BARRIER ARE TO BE PERFORMED IMMEDIATELY UPON NOTICE FROM THE FIRE DEPARTMENT, TOWN STAFF, OR TOWN REPRESENTATIVES.

TOWN OF AURORA

APPROVED:

SCALE: **N.T.S**

REVISION: **OCT. 2020**

DRAWING NO.: **W-129**

AURORA
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TEMPORARY HYDRANT PROTECTION BARRIER

Appendix E York Region

Inflow and Infiltration Reduction Standard for Sewers Servicing New Development

Sanitary Sewer System Inspection, Testing, and Acceptance Guideline

Appendix E York Region 'Inflow and Infiltration Reduction Standard for Sewers Servicing New Development' and 'Sanitary Sewer System Inspection, Testing, and Acceptance Guideline'

The latest versions of the documents can be retrieved from York Region's website using the following links:

Inflow and Infiltration Reduction Standard for Sewers Servicing New Developments

Sanitary Sewer System Inspection, Testing, and Acceptance Guideline

Appendix F Approved Materials List

Appendix F Approved Materials List

The Town of Aurora utilizes its own standard drawings, standard drawings from other jurisdictions and Ontario Provincial Standard Drawings, either as presented or in modified form.

Approved Watermain Material and Manufacturer's Product List

All materials and chemicals required for water infrastructure repairs, replacements, and new installations, that come into contact with drinking water, shall meet AWWA/NSF/ANSI requirements, refer to Town's Drinking Water Permit and Licence. The Drinking Water Permit and Licence must be requested from the Operations Department, Drinking Water Division.

Product	Comments	Manufacturer and Model
Pipe	Ductile iron manufactured to AWWA C151/A21.51, CL-52 with cement lining to AWWA C104/A21/4 (No bituminous lining or pressure class pipe). 450 mm dia. and larger	Canada Pipe
	Polyvinyl chloride manufactured to AWWA C900, Class 150 SDR 18. 400mm dia. and smaller	Diamond Plastics Corp. IPEX Inc. Rehall Industries Inc. Royal Pipe Co.
	Molecularly oriented polyvinyl chloride (PVCO) manufactured to ASTM F1483, AWWA C909 and CSA B137.3.1. 100mm to 750mm dia.	IPEX Inc. – Bionax
Pipe and Service	Copper, ASTM B88, Type "K" - soft copper water service up to 50mm.	
Fittings	Shall be only ductile iron cement lined, conforming to the requirements of AWWA C110/C111/A21.10	Bibby Waterworks Corp. STAR Pipe Products SIGMA Class 350
Gate Valves	Valves 75 mm and up shall be gate valves conforming to the requirements of AWWA C509 (resiliant wedge type only/no double disk); includes tapping valves	Mueller – NRS, Resilient Wedge A-2360 CLOW – R/W – F6100 AVK – Resilient Seat
Glands, Plugs, Caps	Manufacturer to CSA B131.9 and CSA B131.10	

Product	Comments	Manufacturer and Model
Joint Retainer Glands	Shall be used as requested to increase the strength of mechanical joints	Clow Canada, Series 400, 1300, 1350 EBAA Iron Inc. – Series 1100, 1600, 2000, 2100, 2500, 2800 Romac Industries Inc. – Grip Ring Sigma – PV-Lok Star Pipe Products – All Grip Uni-Flange – Series 400, 1300, 1350, 1360
Watermeter	Sensus S.R./ECR complete with exterior Touchread Pad, calibrated in cubic metres 1 m^3 read	Sensus
Hydrants	Conforming to the requirements of AWWA C502, base to be a 150 mm mechanical joint dry barrel, Storz nozzle, red body, and black caps. New hydrants shall match existing hydrants in the area. Height adjustments at ground level.	Mueller Canada Inc. - Century CLOW – McAvity M-67 AVK #2780
Main Stops	Plug valve type, AWWA C800-89, compression joint	Cambridge Brass - Series 102 Ford Meter Box Co. - F1000-G Mueller Canada Inc. - H15008
Tapping Sleeve	On PVC pipe, use stainless steel only. On D.I. pipes any of the listed materials may be used	Ford Meter Box – Style FAST SS Mueller – H-615, All Stainless Steel Robar Industries Ltd. - 6606SS Romac Ind. – Model SST304, FTS420 Smith Blair – 622 and 663 SS

Product	Comments	Manufacturer and Model
Curb Stops	Ball valves only – compression joints AWWA C800-89	Cambridge Brass – Century Ford Meter Box Company – B44G Mueller Canada – Oriseal
Valve Boxes	Shall be slide type 125 mm diameter with 0.60 m adjustment	Bibby Waterworks Domestic Foundry Ltd. Mueller Canada Inc.
Service Boxes	#D-1 size No. 8 c/w stainless steel rods and pin.	Bibby Waterworks Clow 9DI Mueller Canada A726-28
Chambers	Pre-cast Section to be manufactured to ASTM C-378	
Frames and Covers	Cast iron conforming to ASTM A48, Class 30. 3 piece with centre plug or plain sanitary cover with no markings for chambers with offset valve box access	Bibby Waterworks Domestic Foundry Ltd. McCoy Foundry Co. Mueller Canada Inc.
Couplings (service)	Compression type AWWA C800-89	Cambridge Brass Service 118 Ford Meter Box Company C44G Mueller Canada Inc.
Couplings (mains)	Must meet all AWWA C219 requirements. Centre sleeves and end rings must be DI and meet AWWA C219 requirements Centre sleeves and end rings shall be shop coated Bolts and nuts must be high strength (>#6), low alloy steel to AWWA C111-85 requirements	Ford Meter Box -– Style FC1, FC2A Robar Industries – Style 1408 Rockwell – Style 441 Romac Industries – Style 501 Viking Johnson Ltd. – Maxi-fit Universal Coupling (50 mm to 300 mm – Rilsan Coated)

Product	**Comments**	**Manufacturer and Model**
Corrosion Protection Note: The use of 1 of the 3 systems or any combination thereof is accepted.		
Zinc Cap (Watermain Fittings)	Installed on every bolt	Protecto Caps Sac Nuts
Zinc Collars (Services)	Install four (4) collars per service	Protecto Collars
Zinc Packaged Anodes (Watermain Fittings)	Cad weld one (1) Anode per fitting	Corexco Rustrol Bren Technologies
Zinc Packaged Anodes (Watermain Fittings)	Attach one (1) Anode per service via hydro contact clamp fitting	Erico Bren Technologies
Anti-Corrosion Wraps and Coatings (Watermain)	Entire fitting to be treated and covered	Denso Systems PetroGuard Systems Royston Bren Technologies Longwrap Petrolatum Systems
Tracing Wire	12 gauge, stranded, plastic coated copper wire, T.W.U. 75C, 600V	

Approved Sewer Material and Manufacturer's Product List

Product	**Comments**	**Manufacturer and Model**
Concrete Pipe	300 mm diameter and larger – reinforced, minimum Class 65-D, manufactured to CSA Specification A257.2	Loc-Pipe Waterloo Concrete Prod. Ltd. Centennial LaFarge Munroe
PVC Pipe	Sanitary sewers – DR35 manufactured to CSA Specification B182.2 (green in colour) Storm lines up to 450 mm diameter ribbed pipe manufactured to CSA Specification B182.4 (any colour but green)	Diamond Plastic Pipe IPEX Inc. Loc-Pipe Rehau Industries Inc. Royal Pipe Co.
PVCO Pipe	Molecularly oriented polyvinyl chloride (PVCO) manufactured to ASTM F1483, AWWA C909 and CSA B137.3.1. 100mm to 750mm dia.	IPEX Inc. – Bionax
Fittings	Pre-manufactured and compatible with the type and class of pipe	Same as pipe
Services	PVC – DR28, manufactured to CSA Specification B182.1	Same as pipe
Maintenance Holes and Catchbasins	Pre-cast concrete conforming to ASTM-C478	Con Cast Pipe Duracon Lafarge Ind. Loc-Pipe Monroe Concrete Waterloo Concrete Prod. Ltd.
Adjustment Rings	Pre-cast concrete conforming to ASTM-C478	
Frames, Covers and Grates	Gray iron castings or Ductile Iron castings conforming to ASTM-A48 Class No. 30B or ASTM-A536	Bibby Waterworks Corp. Domestic Foundry Ltd. McCoy Foundry Co.

Product	**Comments**	**Manufacturer and Model**
	Sanitary –"Closed" Type Marked "Sanitary" or “Closed” Solid No Pickhole Manhole Cover (Product No. MC401010408 manufactured by EJ Group Inc.) Storm – "Open" Type Marked "Storm"	Mueller Canada Inc. EJ Group Inc.
Maintenance Hole Steps	Hollow aluminum steps conforming to CSA Specification HA.5-M	
Safety Platforms	Aluminium platform with self-locking hinge.	
Inlet Control Devices	PVC plug or frame style	IPEX

Approved Oil and Grit Separators

Product	Comments	Manufacturer and Model
Oil and Grit Separators – Pre-cast Concrete	E.T.V. Canada verification required Meet “enhanced” total suspended solids removal per M.E.C.P. / T.R.C.A. / L.S.R.C.A.	Imbrium Systems Inc. – Stormsceptor concrete models

Approved Street Lighting Material and Manufacturer's Product List

Product	Comments	**Product**
Streetlights – Poles	Spun Concrete	
	Residential – Class 'A', 9.1 m pole height, Saluki Bronze or Carpathian Bronze or approved equivalent per StressCrete E-300-APO-G-S90 S/F FC (Brown)	Saluki Bronze or Carpathian Bronze or approved equivalent per StressCrete E-300-APO-G-S90 S/F FC (Brown)
	Industrial – Class 'B', 9.1 m pole height	StressCrete 300-BPR-G-M00 S/F 120 or approved equivalent
	Walkway – 6.4 m pole height	Saluki Bronze, StressCrete No. E21-APO-G-S90 C/W 140-25/35 or approved equivalent
Streetlights – Pole Brackets	Compatible in materials, connections and colour with specified light pole	
	Residential – 1.8 m decorative scroll arm bracket	StressCrete 170, Powerlite AS5SEBK, or Cooper SCA5001BK
	Industrial – 1.8 m polished aluminum elliptical are bracket	Powerlite REGMA
Streetlights – Luminaires	All shall be Light Emitting Diode (L.E.D.) technology All shall be Fully Cut Off and classified as Dark Sky Friendly as determined by International Dark Sky Association Fixture and arm colour to match pole (bronze) Maximum 4000 K heat temperature specification for arterial and major collector roads Maximum 3000 K heat temperature for all others including walkways	Philips Lumec's L4OU "coach style" L.E.D. luminaire Cree XSP "cobra head style" L.E.D. luminaire Walkways – L.E.D. "Shoe box" style luminaire subject to Town approval
Streetlights – Power Pedestal	Short profile (690 mm), dark green in colour	Pedestal Solutions, No. SLS1, 240 volt

Streetlights – Power Pedestal Base	Pre-cast concrete	Utilicon UP1420

Appendix G Functional Internal Traffic Study (F.I.T.S.) Guideline

Appendix G Functional Internal Traffic Study (F.I.T.S.) Guideline

A F.I.T. Study is required for all draft plan submissions. The F.I.T. Study should be accompanied by a Transportation Impact Study (T.I.S.), where required. A T.I.S. is to comply with Region of York guidelines. The information presented below is a check list which is to be followed during the subdivision review process. The transportation and traffic review process is to examine the details of such submissions and evaluates these details against the applicable standards.

The following items help to determine the roadway network types and classifications and ensures that the critical design elements of the road network are confirmed. The list is further complimented by items which deal with the provision of adequate parking, proper access for major attractors and generators, and formation of a satisfactory traffic control plan. Where applicable, additional items should be added that include traffic calming measures and active transportation measures.

Associated with each item are specific criteria which require measurement, calculation and/or demonstration of adherence to standards and operating parameters. It is recognized that not all items may be applicable to all applications.

Items identified with an asterisk (*) indicate that this item must be completed at the initial stages of any Draft Plan submissions. Other items may be deferred, subject to the Town's concurrence, but it must be emphasized that a proper geometric and standards fit must occur. Otherwise a significant number of conditions and red lining of plans may occur.

F.I.T.S. Components

1. Road Network Layout and Design Volumes *

   The built-out traffic flows are to be determined on each internal road for the typical weekday and/or weekend peak hours. In addition, if the development application contains a collector road which forms an intersection with another collector road or any type of road bounding an arterial road, the typical peak hour turning volumes must be identified. It is imperative that any associated exclusive turning lanes, particularly left turns are provided with their ultimate storage and taper length dimensions. It is understood that collector roads at intersections with other collector roads and arterial roads may require a right-of-way widening to permit the introduction of necessary vehicle turning lanes. All projected traffic volumes are to be consistent with projections in a T.I.S., where a T.I.S. is required.

2. Internal Road Classification and Right-of-Way *

   Standards are available from accredited associations identifying the acceptable range of traffic flows that a type of road can satisfactorily accommodate, either in a 24-hour period or during the roadway peak hours. The road type and classification being considered must be capable of serving the traffic flow demand within the identified level and comply with the Town's Official Plan and Transportation Master Plan.

3. Horizontal and Vertical Geometry *

   Acceptable standards pertaining to horizontal curves, vertical curves, intersection angles and Safe Vehicle Stopping and turning decision criteria are contained in Manuals available from the Ontario Ministry of Transportation, the Transportation Association of Canada and Institute of Transportation Engineers. All road elements are to be evaluated and made to conform to the applicable criteria.

4. Intersection Spacing *

   Standards are available from accredited associations (and also available from York Region) that identify the minimum spacing of intersections from each other. The development application must meet these minimum standards.

5. Intersection Warrants – Turning Lanes, Traffic Signals, Roundabouts *

   The forecast demand volumes and the forecast intersection turning movements will dictate the appropriate traffic control device as well as the intersection lane configuration. The forecast demand volumes will be used to calculate required storage lengths for any turning lanes. If a traffic signal is to be considered, then a signal warrant analysis must be conducted that follows the O.T.M. A roundabout can be considered as an alternative to an intersection controlled by a traffic signal or all-way stop. A functional plan is to be provided.

6. Street Elbows *

   Certain internal local roads may have centre line radii greater than 90 degrees in order to continue the lot fabric. At these locations, pavement width analysis must be conducted to ensure that opposing design vehicles (design vehicle to be determined by the Town) can negotiate the manoeuvre with no impacts. In addition, individual driveways must be located such that the road manoeuvring area and sidewalk is not compromised. Formation of land use patterns incorporating such street elbows are not encouraged.

7. Rear Laneways *

   The laneway layout and operation must be thoroughly addressed. This includes pavement widths, shoulder treatments, garage (building) setbacks (including ability to manoeuvre an automobile into and out of the garage), automobile, emergency vehicle and garbage truck circulation and turning movement capability. The assessment must be undertaken along a typical cross-section of the laneway as well as at each intersection or bend formed by a laneway. Bends in laneways are discouraged.

8. Temporary Turnarounds and Cul-de-Sacs *

   Any proposed temporary turn around or cul-de-sac must be capable of satisfactorily accommodating service and emergency vehicle turning capability.

9. On Street Parking *

   The location of on-street parking must be done in a consultative manner with all disciplines involved in the preparation of the development application. The location of on-street parking will be guided by many factors including adjacent land uses, roadway geometrics and traffic demand flows. It is expected that there will be no parking in laneways. It is expected that parking will only be permitted on one side of local roads. It is expected that parking will be introduced in a sensitive manner on collector roads. Additional pavement on collector roads must not encourage speeding or diminish the operation of future transit. Consideration of parking bays (indent parking) with protected intersection conditions minimizing pedestrian walking distances are considered appropriate.

   The development application must demonstrate through scaled plans that the required parking supply for residents and visitors can be achieved. On street parking must respect vehicle sight line requirements, parking space width and length, emergency vehicle needs, snow storage and intersection setbacks. No portion of a vehicle parked in a driveway can protrude onto the curb.

10. Traffic Calming

    All roadway cross-sections must consider pavement widths that are conducive to reducing vehicle speeds. On street parking should be strategically placed such that the additional pavement does not encourage greater vehicle speeds. If necessary, traffic calming devices can be considered excluding speed bumps or other devices that are not acceptable to transit or emergency service vehicles. Should further traffic calming features be desired the traffic tables, medians and boulevard treatments can be considered. All proposed traffic calming is to be consistent with the Canadian Guide to Neighbourhood Traffic Calming.

11. Headlight Screening

"Window Streets" or other internal roads may parallel a bounding arterial road. Vehicle headlight movements must be examined on the local road and preventative measures must be brought forth which prevent headlight glare from reaching the eye level of drivers on the bounding arterial road.

12. Service and Emergency Vehicle Circulation

All internal roads including any laneways must demonstrate that the available driving surface is capable of efficiently accommodating the free flow movement of emergency and service vehicles.

13. Emergency Vehicle Access

Where a subdivision proposes only one vehicular access, a secondary emergency vehicle access is to be considered in consultation with Town staff.

14. Curb Radii

Curb radii can be introduced which reduce vehicle speeds and benefit pedestrians. The curb radii must demonstrate to scale that sufficient capacity is provided for vehicle turning demands and that all service and emergency vehicles can efficiently negotiate turns.

15. Corner Daylighting

The ability to minimize the required space providing the necessary clear sight line distances for vehicle turning and stopping can be accomplished through corner daylightings. Each intersection must be examined to verify that the clear vehicle sight lines are available. Any special circumstances must be justified.

16. Pedestrian and A.O.D.A. Accommodation

Sidewalks must be available to serve primary pedestrian flows. At curb locations grading must be provided to accommodate wheelchair movements and meet the Region of York's A.O.D.A. requirements.

17. Surface Treatments

As part of traffic calming at intersections and in an effort to accommodate major pedestrian flows, consideration can be given to providing alternative surface treatments. These surface treatments are meant to give textural and noise signals to drivers that increased awareness is necessary.

18. Roundabouts

Any proposed roundabout must be designed to meet forecast traffic demands as well as the turning paths required for all municipal services including transit and emergency vehicles. Larger vehicles such as moving trucks should also be examined. Pedestrian crosswalks must be properly located to provide maximum visibility to all users and comply with the O.T.M.

19. Driveway Locations

Driveways to individual uses must respect the adjacent traffic flow demands and resultant intersection lane configuration requirements. The driveway location must minimize impacts on the role and function of adjacent boundary lanes particularly turning lanes. At internal collector to collector road or collector to arterial road intersections, consideration should be given to a land use form that is served by rear laneways thereby reducing the impact on intersection lane functions.

20. Sidewalks

The placement of sidewalks must conform to Municipal guidelines and the Region of York A.O.D.A. requirements. Sidewalks shall not be located across residential lot frontages less than 11 m in width to increase driveway parking capacity on smaller lots. Continuity and connectivity are imperative to providing an environment which encourages walking. Special pedestrian crossings outside of intersection locations must be examined in detail and the justification for pedestrian actuated controls brought forward that comply with the O.T.M.

21. Bicycle Paths, Bicycle Lanes and Multiuse Paths

Bicycle paths and lanes must be in conformity with Municipal goals and objectives. Those bicycle routes whether lanes, paths or multiuse paths must be clearly identified, and the appropriate geometric standards incorporated into the roadway cross-sections or where bicycles cross a roadway.

22. Transit Route Pattern

Where so directed by the Town, the primary route pattern to serve the development application will be identified and the following related items are to be addressed.

23. Bus Stop and Pedestrian Pad

Major bus stop locations along each route will be identified. At these locations the necessary concrete pad to serve boarding and de-boarding passengers will be identified and included in the development application.

24. Development Integration

    Opportunities should be examined at significant locations where adjacent land uses can provide an integration opportunity with transit. This could range from integrated shelter/building conditions to a minor pick up and drop off area in the vicinity of the bus stop.

25. Major Public Generators & Attractors * – Driveway and Entrance Locations

    Within the development application there could be uses such as public schools, high schools and community centres, parks, etc. These land uses generate unique vehicle circulation and parking demands. The vehicle flow demands should be examined in the context of planning driveway and entrance locations which minimize impacts on bounding intersections and major pedestrian flows.

26. Major Public Generators & Attractors * – On Street Parking Assessment

    Many of these generators are also located next to parks. The bounding road network should be examined to determine if on-street parking can serve multiple parking demands. How the on-street parking is incorporated with the roadway cross-section should be examined in detail. The intent is not to increase the asphalt surface area in a continuous manner which leads to increased vehicle speeds.

27. Major Public Generators & Attractors * – Traffic Control Plan for Entrances Providing Direct Access

    The appropriate traffic control device plan which directly serves these uses must be brought forth. The accommodation of pedestrian flows must also be identified.

28. Traffic Control and Pavement Marking Plan

    The development application must provide the definition and location of all traffic control, pavement marking and parking control signage to be installed in accordance with the Ontario Traffic Manual and related specifications.

Appendix H Checklists

Appendix H Checklists

Appendix H1 Completion Checklist

Appendix H2 Assumption Checklist

Town of Aurora			APPENDIX H1 - COMPLETION CHECKLIST - SUBDIVISIONS
Development:			
Developer:			
Sub-contractors:			
Engineering Consultant:			
Town File numbers:	19T(W) -		65M-
Guaranteed Maintenance Period:	24 months (minimum)	Anticipated start:	
Checklist Updated:		Date:	BY:
Account Numbers:			Town #

ITEM	OK	Aspect	Provide To / Inspected By	Sign Off Initials	Date	Comments
WATERMAIN						
1	!	Valves checked & operational	ENGINEERING & WATER OPERATIONS			
2	!	Hydrants painted	ENGINEERING & WATER OPERATIONS			
3	!	Fire hydrant protection in place and acceptable to the Fire Chief	ENGINEERING & FIRE CHIEF			
4	!	Fire Flow tests prior to Building Permit	ENGINEERING & FIRE CHIEF			
5	!	Sampling stations inspected	ENGINEERING & WATER OPERATIONS			
SANITARY SEWER						
6	!	Manholes inspected	ENGINEERING & DEVELOPER / CONSULTANT			
7	!	Flush sewers and provide report (as required)	ENGINEERING & DEVELOPER / CONSULTANT			
8	!	Flush sewers and CCTV inspection - Provide Report	ENGINEERING & DEVELOPER / CONSULTANT			
9	!	Mandrel and pressure testing of all flexible mainline sewers - Provide Report	ENGINEERING & DEVELOPER / CONSULTANT			
10	!	Compliance with Servicing Incentive Program (SIP)	ENGINEERING & DEVELOPER / CONSULTANT			
STORM SEWER						
11	!	Manholes inspected	ENGINEERING & DEVELOPER / CONSULTANT			
12	!	CB / DI / RLCB inspected	ENGINEERING & DEVELOPER / CONSULTANT			
13	!	Flush sewers (as required) - Provide Report	ENGINEERING & DEVELOPER / CONSULTANT			
14	!	Flush & CCTV inspection for RLCB leads - Provide Report	ENGINEERING & DEVELOPER / CONSULTANT			
15	!	Infiltration/exfiltration/low pressure testing report (if required because of ground conditions)	ENGINEERING & DEVELOPER / CONSULTANT			
16	!	Mandrel and pressure testing of all flexible mainline sewers - Provide Report	ENGINEERING & DEVELOPER / CONSULTANT			

		Town of Aurora				APPENDIX H1 - COMPLETION CHECKLIST - SUBDIVISIONS
STORMWATER MANAGEMENT FACILITIES						
17	!	Engineer Certificate letter and As-Built Drawings confirming Stormwater Management facility is constructed and continues function as designed	DEVELOPMENT REVIEW ENGINEER			
18	!	Preliminary Maintenance and Operations Manual accepted	DEVELOPMENT REVIEW ENGINEER			
19	!	Ministry of Environment C of A or ECA	DEVELOPMENT REVIEW ENGINEER			
20	!	Travelled surfaces, slopes inspected	ENGINEERING & DEVELOPER / CONSULTANT			
21	!	Safety devices including fences/handrails inspected	ENGINEERING & DEVELOPER / CONSULTANT			
22	!	Structures inspected	ENGINEERING & DEVELOPER / CONSULTANT			
23	!	Gates inspected	ENGINEERING & DEVELOPER / CONSULTANT			
24	!	Vegetated ground cover and landscaping completed	PARKS			
LOT GRADING						
25	!	Certificates provided for occupied lots	ENGINEERING & DEVELOPER / CONSULTANT			
26	!	Roof downspout arrangement confirmed	ENGINEERING & DEVELOPER / CONSULTANT			
27	!	Pre-Sod and Post-Sod Lot Grading Inspection	ENGINEERING & DEVELOPER / CONSULTANT			

		Town of Aurora				APPENDIX H1 - COMPLETION CHECKLIST - SUBDIVISIONS
ROADS & SURFACE WORKS						
28	!	Retaining walls Inspection and report	ENGINEERING & DEVELOPER / CONSULTANT			
29	!	Bridge inspection as per Ministry of Transportation - Ontario Structure Inspection Manual and Form	ENGINEERING & DEVELOPER / CONSULTANT			
30	!	Unassumed Roads signs in place	ENGINEERING & DEVELOPER / CONSULTANT			
31	!	All regulatory and street signs inspected	ENGINEERING & DEVELOPER / CONSULTANT			
32	!	Sidewalks inspected	ENGINEERING & DEVELOPER / CONSULTANT			
33	!	Canada Post mailbox pads inspected (as applicable)	ENGINEERING & DEVELOPER / CONSULTANT			
34	!	First stage curbs inspected	ENGINEERING & DEVELOPER / CONSULTANT			
35	!	Surface course asphalt inspected	ENGINEERING & DEVELOPER / CONSULTANT			
36	!	Boulevards inspected (utilities and sod)	ENGINEERING & DEVELOPER / CONSULTANT			
37	!	Road structural adequacy confirmed (prior to placing surface course asphalt)	ENGINEERING & DEVELOPER / CONSULTANT			
38	!	Line painting of surface course asphalt inspected	ENGINEERING & DEVELOPER / CONSULTANT			
39	!	Emergency Access Prior to Building Permit	ENGINEERING & FIRE CHIEF			
40	!	Decorative crosswalks inspected	ENGINEERING & DEVELOPER / CONSULTANT			
WALKWAYS (civil works only)						
41	!	Walkways inspected	ENGINEERING & DEVELOPER / CONSULTANT			
42	!	Drainage inspected	ENGINEERING & DEVELOPER / CONSULTANT			
STREET LIGHTING						
43	!	Street lights and poles inspected	ENGINEERING & DEVELOPER / CONSULTANT			
44	!	Check and confirm street lights are operational	ENGINEERING & DEVELOPER / CONSULTANT			
TRAFFIC SIGNALS						
45	!	Check and confirm traffic signals are operational	ENGINEERING & DEVELOPER / CONSULTANT			

		Town of Aurora				APPENDIX H1 - COMPLETION CHECKLIST - SUBDIVISIONS
CONFIRMATION, VERIFICATION AND CERTIFICATES						
46	!	Updated construction schedule as applicable indicating deficiency repairs and work deferrals	ENGINEERING			
47	!	Supply digital copies of all Operation Manuals, Testing & Inspection Reports.	ENGINEERING & DEVELOPER / CONSULTANT			
48	!	OLS Certificate	ENGINEERING & DEVELOPER / CONSULTANT			
49	!	Benchmark installed in acordance with MNRF cosine standard or Town approved cash in lieu request from the developer submitted via letter/email to the Town (Development Coordinator)	ENGINEERING & DEVELOPER / CONSULTANT			
50	!	Certificate Letter from development Engineer certifying that works have been constructed as designed.	ENGINEERING & DEVELOPER / CONSULTANT			
51	!	Constructed to design - Certificate letter from Acoustical Consultant	ENGINEERING & DEVELOPER / CONSULTANT			
52	!	Precast, steel and other shop drawings as required	ENGINEERING & DEVELOPER / CONSULTANT			
53	!	Approved As-Built information, Civil Drawings (Digital and Physical copy)	ENGINEERING & DEVELOPER / CONSULTANT			
54	!	Approved As-built information, Street Lighting	ENGINEERING & DEVELOPER / CONSULTANT			
55	!	Approved As-constructed Design Sheets and Data Tables	DEVELOPMENT REVIEW ENGINEER			
56	!	Statutory Declaration provided by Developer	ENGINEERING			
57	!	Statutory Declaration provided by Contractor	ENGINEERING			
58	!	Notice of Substantial Completion provided. Advertisements made in the daily commercial news.	ENGINEERING			
CLEARANCES						
59	!	Ministry of Environment C of A or ECA	DEVELOPMENT REVIEW ENGINEER			
60	!	Digital Draft PSAB information provided to Town as per Public Works and Finance requirements	ENGINEERING & DEVELOPER / CONSULTANT			
61	!	Letter of Credit Reduction as required	ENGINEERING			
62	!	Other issues outstanding	ALL			

Town of Aurora

APPENDIX H2
ASSUMPTION CHECKLIST - SUBDIVISIONS

Development:		
Developer:		
Engineering Consultant:		
Town File numbers:		
Completion Certificate Date:	Start:	End:
Warranty Period:	24 months (minimum)	
Checklist Last Updated in RED:	Date:	BY:
Account Numbers:		Town #

ITEM	OK	Aspect	Provide To / Inspected By	Sign Off Initials	Date	Comments
WATERMAIN						
1	!	Valves and valve chambers checked & operational	ENGINEERING & WATER OPERATIONS			
2	!	Hydrants checked and Decal installed as per the final fire flow test results	ENGINEERING & WATER OPERATIONS			
3	!	Curb stops checked & operational (as applicable)	ENGINEERING & WATER OPERATIONS			
4	!	Conductivity confirmed	ENGINEERING & WATER OPERATIONS			
5	!	Hydrant fire flow test results provided after Occupancy/End of Maintenance	ENGINEERING AND FIRE CHIEF			
6	!	Sampling stations inspected	ENGINEERING & WATER OPERATIONS			
SANITARY SEWER						
7	!	CCTV inspection, reports and tapes complete with flushing as required	ENGINEERING & DEVELOPER / CONSULTANT			
8	!	CCTV inspection for services as directed by the Town	ENGINEERING & DEVELOPER / CONSULTANT			
9	!	Manholes inspected (after flushing)	ENGINEERING & DEVELOPER / CONSULTANT			
10	!	Compliance with Servicing Incentive Program (SIP)	ENGINEERING & DEVELOPER / CONSULTANT			
STORM SEWER						
11	!	CCTV/visual (if accessible) inspection, reports and tapes complete with flushing as required	ENGINEERING & DEVELOPER / CONSULTANT			
12	!	CCTV inspection for services as directed by the Town	ENGINEERING & DEVELOPER / CONSULTANT			
13	!	Manholes inspected (after flushing)	ENGINEERING & DEVELOPER / CONSULTANT			
14	!	CB / DI / RLCB inspected (after flushing)	ENGINEERING & DEVELOPER / CONSULTANT			

		Town of Aurora				**APPENDIX H2 ASSUMPTION CHECKLIST - SUBDIVISIONS**
STORMWATER MANAGEMENT FACILITIES						
15	!	Certificate letter from Development Engineer confirming silt removal and volumes	DEVELOPMENT REVIEW ENGINEER			
16	!	Final Maintenance and Operation Manual accepted	DEVELOPMENT REVIEW ENGINEER			
17	!	Travelled surfaces & slopes inspected	ENGINEERING & DEVELOPER / CONSULTANT			
18	!	Safety devices (including fences/handrail) inspected	ENGINEERING & DEVELOPER / CONSULTANT			
19	!	Structures inspected	ENGINEERING & DEVELOPER / CONSULTANT			
20	!	Vegetated ground cover and landscaping completed	PARKS			
21	!	Walkways inspected	ENGINEERING & DEVELOPER / CONSULTANT			
22	!	Gates inspected	ENGINEERING & DEVELOPER / CONSULTANT			
ROADS & SURFACE WORKS						
23	!	Sidewalks inspected	ENGINEERING & DEVELOPER / CONSULTANT			
24	!	Canada Post mailbox pads inspected	ENGINEERING & DEVELOPER / CONSULTANT			
25	!	Second stage curbs inspected	ENGINEERING & DEVELOPER / CONSULTANT			
26	!	Surface course asphalt inspected and certificate provided for repairs, cracks and structural integrity	ENGINEERING & DEVELOPER / CONSULTANT			
27	!	Line painting inspected	ENGINEERING & DEVELOPER / CONSULTANT			
28	!	All regulatory and street signs inspected as compareed to the signed drawing set	ENGINEERING & DEVELOPER / CONSULTANT			
29	!	Decorative crosswalks inspected	ENGINEERING & DEVELOPER / CONSULTANT			
30	!	Retaining walls re-inspection and report	ENGINEERING & DEVELOPER / CONSULTANT			
31	!	Bridge re-inspection as per Ministry of Transportation - Ontario Structure Inspection Manual and Form	ENGINEERING & DEVELOPER / CONSULTANT			
32	!	Boulevards inspected (utilities and sod)	ENGINEERING & DEVELOPER / CONSULTANT			
32	!	Boulevards complete for undeveloped lots (utilities and sod), cash allowances provided to Town as required	ENGINEERING & DEVELOPER / CONSULTANT			
33	!	Emergency Access - Final Review	ENGINEERING /FIRE CHIEF			

		Town of Aurora	**APPENDIX H2 ASSUMPTION CHECKLIST - SUBDIVISIONS**			
WALKWAYS (civil works only)						
34	!	Walkways inspected	ENGINEERING & DEVELOPER / CONSULTANT			
35	!	Drainage inspected	ENGINEERING & DEVELOPER / CONSULTANT			
STREET LIGHTING						
36	!	Street lights and poles inspection and Certification	ENGINEERING & DEVELOPER / CONSULTANT			
37	!	Street lights checked and operational	ENGINEERING & DEVELOPER / CONSULTANT			
38	!	Warranties obtained for all LED street lights in the subdivision	ENGINEERING & ROAD OPERATIONS			
TRAFFIC SIGNALS						
39	!	Traffic signals checked and operational	ENGINEERING & DEVELOPER / CONSULTANT			
CLEARANCE, CONFIRMATION, VERIFICATION AND CERTIFICATES						
40	!	Other issues outstanding	ENGINEERING & DEVELOPER / CONSULTANT			
41	!	Letter of Credit Release	ENGINEERING			
42	!	Guaranteed maintenance period has elapsed	ENGINEERING			
43	!	Warranties referred to in Subdivision Agreement (e.g. warranties for retaining walls, SIP Program, and/or LED street lights) have been delivered to the Town as applicable	ENGINEERING & DEVELOPER / CONSULTANT			
44	!	Statutory Declaration provided by Developer	ENGINEERING & DEVELOPER / CONSULTANT			
45	!	Notices provided as per the constructions liens act. Advertisements made in the daily commercial news.	ENGINEERING & DEVELOPER / CONSULTANT			
46	!	Benchmark installed and OLS Certificate	ENGINEERING & DEVELOPER / CONSULTANT			
47	!	Town departments notified of anticipated assumption date	ENGINEERING			
TANGIBLE ASSETS (Finance, Public Works and Leisure)						
48	!	Final Digital PSAB information provided to Town as per Public Works and Finance requirements	ENGINEERING & DEVELOPER / CONSULTANT			
49	!	Verified As-built information, Civil (Digital)	ENGINEERING			
50	!	Verified As-built information, Street Lighting (Digital)	ENGINEERING			
51	!	Verified As-built Design Sheets, coordinate tables	DEVELOPMENT REVIEW ENGINEER			
52	!	Supply digital copies of all Operation Manuals, Testing & Inspection Reports.	DEVELOPMENT REVIEW ENGINEER			
53	!	Certificate letter from Acoustical Consultant	ENGINEERING & DEVELOPER / CONSULTANT			
54	!	Certificate letter from Development Engineer	ENGINEERING & DEVELOPER / CONSULTANT			

Appendix I Watermain Disinfection Procedure

Last Updated: **August 2023**

Topic:	Town of Aurora Drinking Water Distribution System – Watermain Disinfection Procedure	**Affects:**	Certified Water Operators, Top Management, Drinking Water System Owner, Engineering
Section:	DWQMS PRO - 026	**Replaces:**	August 6, 2021
Version:	V8	**Revision Date:**	February 17, 2023
Effective Date:	February 17 2023	**Proposed Revision Date:**	December 31, 2024
Prepared By:	Iustina Voinea, Program Coordinator Water, Wastewater, Stormwater	**Approval Authority:**	Luigi Colangelo, Manager

1 Scope

This procedure covers the cleaning, disinfection, hydrostatic testing and sampling of watermains. The Ministry of Environment, Conservation and Parks' Watermain Disinfection Procedure along with this procedure apply to all new watermains including above ground by-pass (temporary) watermains and relined watermains.

The purpose of this procedure is not to reiterate all MECP Watermain Disinfection Procedure's requirements, but to provide information on Town's needs regarding the work to be completed, records and documentation to be submitted.

This procedure shall be used in conjunction with Town's Design Criteria Manual for Engineering Plans.

The Engineer is required to complete and submit the appropriate Form(s) 1/2/3 and all related documents to the Town for review and comment prior to watermain being commissioned. Upon acceptance, the submission will be recommended to the Director of Operations for approval. The approved form will be provided to the Engineer to start the watermain commissioning process.
The forms required under the Drinking Water Works Permit (DWWP) are:

• Form 1: Record of Watermains Authorized as Future Alteration

• Form 2: Record of Minor Modification or Replacements to the Drinking Water System

• Form 3: Record of Addition, Modification or Replacement of Equipment Discharging a Contaminant of Concern to the Atmosphere

2 Definitions

Town Shall be the Director, or Manager, or Supervisor, Water/Wastewater, or Manager of Engineering Services or Technical Assistants or an Engineering company retained by the Town.

Town Inspector Shall be an employee assigned by Town or Company engaged by Town to perform inspection services.

Town Operator Shall be an Operational Services Department employee, Certified Water Operator under Ontario Regulation 128/04.

Engineer Shall be an Engineering company retained by a Developer, or an Engineering company retained by the Town or Engineering Technical Assistants.

Development Owner Shall be a company or individual who has signed the subdivision agreement.

Workforce Shall be specialized watermain disinfection Contractor whose personnel meets current MECP licensing requirements and holds a minimum a Class 1 Drinking Water Certification (O.Reg. 128/04).

Disinfectants Shall be Calcium or Sodium Hypochlorite that meets or exceeds AWWA Standard B300 and NSF 60.

Neutralizing Shall be Sodium Thiosulfate that meets or exceed AWWA Standard C651 and NSF60.

Microbiological samples Water samples taken and tested for Escherichia Coli, Total Coliforms, Background Count and Heterotrophic Plate Counts.

3 References

These procedures are based on and should be used in conjunction with:

- MECP Watermain Disinfection Procedure
- Town of Aurora Design Criteria Manual for Engineering Plans (DCMEP)

- Ontario Provincial Specifications (OPS)
- American Waterworks Association (AWWA) standards C651
- CSA Standards B64.10 and B64.10.1
- Ontario Safe Drinking Water Act (OSDWA)
- O.Reg. 169/03
- O.Reg. 170/03
- NSF/ANSI/CAN 60
- O.Reg. 128/03

4 Preconstruction meeting

The Engineer must arrange a mandatory preconstruction meeting with all parties including:

• Engineering Department

• Water Division

• Developer

• Contractor(s)

• Engineer(s)

5 Disinfection

5.1 General Requirements

Keep pipes clean and dry. Take precautions to protect the interiors of pipes, fittings, and valves against contamination. Cap all openings with watertight plugs/seals. Remove plugs only when making connections. Complete joints of all pipes in trenches before any stoppage of work, i.e. at the end of the workday. Pipes shall not be laid in water.

The new watermain shall be connected to the existing system at a maximum of only one location where there is a suitable isolation valve unless otherwise accepted by Town Public Works. Other required connections to the system shall be stopped short and capped.

5.2 Commissioning/Disinfection Proposal

The Engineer or authorized agent shall submit a Commissioning/Disinfection Proposal plan and required documents to the Town's Water Division Supervisor including:

- Watermain Disinfection Checklist for Contractors & Subcontractors (to include all steps required by the MECP Watermain Disinfection Procedure, records to be kept and submissions to Town)
- A copy of the MECP issued water operator licences from the commissioning contractor for all operators who will be taking part in watermain commissioning activities.
- Backflow prevention inspection report
- Swabbing
- Hydrostatic pressure testing
- Disinfection Proposal plan
- Dechlorination plan
- Sampling plan
- Location of Connections and date/time

5.3 Supervision, Testing and Records

The Engineer shall witness all cleaning, disinfection, hydrostatic testing and sampling activities. The workforce carrying out the cleaning and disinfection in conjunction with the Engineer is to take and record measurements. All records required by this procedure and by MECP Watermain Disinfection Procedure shall be submitted to the Supervisor, Water Wastewater.

During flushing, swabbing, removal of super-chlorinated water or disinfection a certified Town Operator shall be onsite to operate the isolation valve. The Engineer is to notify the Town three (3) working days in advance to make arrangements for the operation of an isolation valve.

5.4 Testing procedure

Chlorine residual shall be tested with an electronic tester such as a Hach Pocket Colorimeter or equivalent.

5.5 Watermain Connections

The Town outlines two procedures for connecting watermains to the Town's Drinking Water System in dependence of the geographical, physical location of the project, and Town preference. The procedure to be followed will be dictated by the Town.

As per MECP Watermain Disinfection Procedure, backflow prevention is required for new watermains.

a) Commissioning Watermains in a New Development that is Physically Separated

All commissioning and disinfection of new watermains and temporary watermains should be completed in accordance with the most recent version of the Ministry of the Environment, Conservation and Parks (MECP) Watermain Disinfection Procedure and American Water Works Association (AWWA) Standard C651.

This procedure applies to new watermains that are physically isolated from the Town's drinking water system including aboveground by-pass watermains and relined watermains. Refer to Drawing # W-125 attached.

b) Commissioning Watermains Connected to Existing Watermains and Isolated by a Valve

This procedure will typically apply to the replacement of a watermain that is connected to an existing watermain and isolated by a valve, in an existing development where it is not possible to physically isolate the new watermain. Refer to Drawing # W-126 attached.

5.6 Water Sample Location Drawings

One set of Watermain Distribution Drawings for the site with clearly marked Water Sample Locations, shall be submitted to Operational Services Department for approval, a minimum of 2 two weeks prior to disinfection. Where needed consideration shall be given to sectioning off areas as required.

All new watermains including all stubs and commercial services to be tested shall be highlighted and supply points indicated. All sample points should be copper and brought to the surface complete with a valve. Pressure test boundaries are to be the same as the valve off sections indicated on the Water Sample Location drawing, unless otherwise approved by the Town.

5.7 Loading of Watermain

(AWWA C651, MECP Watermain Disinfection Procedure)

All potable water obtained from the Town's water distribution system and used for the commissioning procedure shall first pass through a by-pass, water meter and a backflow prevention device.

The new watermain shall be loaded via a by-pass around the isolation valve. The by-pass shall be fitted with an approved, field tested reduced pressure principle backflow preventer and used only for drinking water supply, unless otherwise noted or authorized by the Town. The BFP device shall be tested and certified by a licensed Cross Connection Control Specialist (CCCS) on the day of installation. Copies of CCCS test reports must be provided to the Town as soon as available. Backflow preventers shall not be removed until completion of the commissioning project and without first notifying the Town.

The minimum size of by-pass shall be 50 mm diameter. All materials for the by-pass are subject to approval by the Town. For further details of the installation of the by-pass and backflow preventer, refer to MECP Watermain Disinfection Procedure (QMS-PRO-010 Appendix A - MECP-watermain-disinfection-procedure-August-1-2020) and Town's Drawings # W-124, W-125, W-128 included at the end of this document.

The by-pass shall be removed once all testing is completed and accepted by the Town.

- For direct bury installations the saddles shall be removed and repair clamps installed in their place.
- For chamber installations, the main stops shall be removed and the by-pass opening sealed in an approved manner.

All site plan agreement applications which propose service connections 100 mm in diameter or larger shall include pressure testing and disinfection and sampling as per standards defined herein and MECP Watermain Disinfection Procedure.

The Town operator shall operate the isolation valve once they have ensured there is flow to the discharge. All direct bury test points within Municipal Right of Way are to be removed and a repair clamp installed in its place once all testing has been completed and accepted.

5.8 Swabbing

(AWWA C651) All watermains shall be loaded prior to the commencement of swabbing. All swabs that are inserted into the watermain and retrieved, either during construction or after, must be witnessed, numbered and recorded by the Engineer overseeing the project.

The swab shall be new and with a length equal to twice the diameter of the watermain. All stubs shall be provided with a temporary flushing hydrant to allow for the removal of the swabs. Open risers will only be permitted by the Town when watermain sizing is such that the appropriate sized swab cannot be physically removed through a hydrant

branch line. The operation of the isolation valve shall be performed by the Town Operators. Refer to Table 2: By-pass Requirements for swabbing and flushing of new watermains.

5.9 Flush to Remove Turbidity

(AWWA C651) The watermain shall be flushed to remove remaining air pockets and foreign matter from the watermain via the by-pass.

The watermain is to be flushed through each hydrant for 5 to 10 minutes until the watermain achieves and sustains a turbidity of less than 1 NTU, or is no higher than that of the existing distribution system. The turbidity testing will be performed by the Workforce and witnessed by the Engineer overseeing the project. Refer to Table 2: By-pass Requirements for swabbing and flushing of new Watermains.

The pH shall be checked, and results shall be between 7-8.5 or similar to the sample result from the municipal source.

Records of flushing, turbidity and pH measurements shall be submitted to the Town.

5.10 Hydrostatic Testing

Hydrostatic Pressure Test and Hydrostatic Leakage Test shall be done in accordance with AWWA C651 to ensure the main meets Town's allowable leakage rate. Hydrostatic pressure tests shall not be undertaken until satisfactory results form Microbiological sampling are received.

The hydrostatic testing shall be conducted with potable water.

The watermain shall be pressurized to 1035 kpa (150 psi) and maintained for two (2) hours. The test section shall not exceed any of the isolated sections as indicated on the sample drawings. If the test pressure drops significantly, the test section shall be isolated to a manageable area.

At the end of the two (2) hour test period, the volume of water used to maintain the 1035 kpa pressure is to be recorded and compared against the allowable leakage.

Leakage is defined as the quantity of water that must be supplied into the new pipe or any valved section thereof to maintain pressure within 5 psi of the specified test pressure, after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop in pressure in a test section over a period of time.

The leakage is to be measured by the workforce and recorded by the Engineer. No pipe installation shall be accepted if the leakage is greater than that determined by the formula:

- The allowable leakage is 1L per mm of pipe diameter per km of pipe per day
- Allowable Leakage per Hour (l) = 1.0 L * diameter (mm)*length (km) / 24

For High Density Polyethylene (HDPE) pipe, the test section shall not include any other samples points. A 3 to 4 hour deformation period, maintaining a 1035 kpa pressure shall be required immediately prior to the hydrostatic testing. The acceptance leakage for HDPE is as per OPSS 701.07.22.02.

If the test is successful, the system shall be left in isolation for 24 hours before taking final samples. If the test is not successful the leak shall be found, repaired and the hydrostatic test conducted again until it is successful.

5.11 Disinfecting Watermain (new or relined)

(AWWA C651) The disinfection of the watermain shall be done as per MECP - Watermain disinfection procedure and AWWA C-651 Disinfecting Water Mains.

The method of disinfection to be used is the continuous feed method, such that water from the existing distribution system shall be allowed to flow at a controlled rate into the new watermain through the by-pass. The isolation valve shall remain closed during this process. The chlorine is to be injected into the system through the by-pass injection point. The chlorine solution is to be thoroughly mixed prior to pumping it into the system and have a minimum concentration of 25mg/l throughout the system and shall not exceed 100mg/l. Chlorine solution is to be flowed through each hydrant and blow-off. The high chlorine residual is to be measured by the Workforce at each sample location and witnessed by the Engineer overseeing the project.

Once the desired level of chlorine has been achieved, the remaining Chlorine solution within the tank is to be neutralized and disposed off.

The high chlorine shall be isolated in the watermain for a minimum of twenty four (24) hours but not exceeding 72 hours.

After the required contact time, the chlorine residual shall be taken at each sample location by the workforce and witnessed by the Engineer. If the decrease in chlorine concentration is equal or less than 40% of the original concentration and up to a maximum of 50 mg/L, the disinfection of the watermain is acceptable. Chlorinated water is ready to be discharged, see section 13 of this procedure. In the event that the

Chlorine residual does not meet the above requirement, the system shall be discharged, swabbed if necessary and the disinfection procedure must be repeated.

Where copper pipe is used as a watermain, disinfection shall be performed using the continuous feed method, with an initial chlorine concentration of ≥ 50 mg/L and a minimum 24-hour contact time. Due to the chlorine demand exerted by the copper, the maximum allowable decrease requirement does not apply, and the effectiveness of the disinfection process shall be demonstrated by the Microbiological Sampling.

Records of the duration of disinfection, the initial dose and remaining chlorine residual at the end of the contact time, the decrease of chlorine residual and the passing results shall be provided to Town.

For relined existing watermain the return to service will be allowed prior to receiving acceptable Microbiological sample test results if **all** the following conditions are met:

- the local Medical Officer of Health is consulted prior to the commencement of the project and their advice is documented and followed;
- watermain is physically isolated from the remainder of the system through Backflow prevention; and
- Flushing of the watermain has been completed and secondary disinfection has been restored. The disinfectant concentration at the point of Flushing reaches at least 1.0 mg/L combined chlorine. If these disinfectant concentrations cannot be achieved, Flushing shall continue until the disinfectant concentration at the point of Flushing is representative of the system residual in the break area.

5.12 Removal and Disposal of Super Chlorinates Water

(AWWA C651) The watermain shall be flushed to remove super-chlorinated water via the by-pass. If this is unsuccessful, a discharge shall be set up by the workforce to remove the super chlorinated water prior to the Town Operators opening the isolation valve. The watermain shall be valved in such a manner that the direction of the flow is known to promote the expedient and complete removal of the super chlorinated water. The super chlorinated water shall be flushed from the main through all hydrants and sample points until the chlorine residual matches that of the existing distribution system (supply location). The chlorine residual shall be checked at each sample point by the Workforce, and witnessed by the Engineer.

For the disposal of the super chlorinated water, the Engineer shall ensure throughout the disposal process that the chlorine residual in the neutralized water does not exceed 0.002mg/l.

Dechlorination of discharged water is required for any water that is directed into surface water or if the discharge into the natural environment causes or is likely to cause an adverse effect, as per Condition 10 of Schedule B of the Municipal Drinking Water Licence.

The potable water from municipal water mains is deemed to be a Class II spill for the purposes of O. Reg. 675/98 (Classification and Exemption of Spills and Reporting of Discharges) made under the Environmental Protection Act. Discharges of flushed water are also regulated under Condition 1.2 of Schedule C of the Municipal Drinking Water Licences. Super chlorinated water shall not be discharged to storm sewers or watercourses unless the residual is reduced to that level. Neutralizing chemicals shall be as per AWWA C651.9 Sec.6 and NSF/ANSI/CAN 60.

5.13 Microbiological Sampling

The sapling shall be done as per MECP - Watermain disinfection procedure and AWWA C-651 Disinfecting Water Mains.

The fresh water supply shall be left isolated within the system for a minimum of twenty four (24) hours. For above ground by-pass watermains, the isolation period can be shortened to sixteen (16) hours.

A Town Operator shall be on site to operate the isolation valve or by-pass valve. The Workforce shall be responsible to take microbiological samples at each sample location and deliver it to the York Durham Lab. All costs of all microbiological sampling shall be the responsibility of the Development Owner. The isolation valve shall remain closed throughout this procedure. Refer to Table 1: New Watermain Acceptance Criteria – Microbiological Testing.

5.14 Microbiological Sample Results

Developers /Contractors are to email the sampling results to the Town once they receive the results from the laboratory.

If sample results do not meet requirements set in Table 1 below, the failed section must flushed and resampled. The Town may order the Developer/Contractor to do additional swabbing and/or re-chlorination to achieve passing results.

Table 1-: New Watermain Acceptance Criteria – Microbiological Testing

Test Procedure	Acceptance Value
Total Coliforms	Not Detectable (CFU)
E.coli (Escherichia coli)	Not Detectable (CFU)
Heterotrophic Plate Count	100 (CFU/mL)
Background Count	50 (CFU/mL)

Notes:

1. At Towns discretion, the acceptance value for Heterotrophic Plate Count shall be equal to or lower than the sample result from the municipal source

2. CFU = colony forming unit

6 Commissioning

The Engineer must arrange a mandatory meeting prior to the commissioning stage with the following in attendance:

• Engineering Department

• Water Division

• Developer

• Contractor(s)

• Engineer(s)

7 Final Connections to Existing Mains and Acceptance

(AWWA C651) If there are additional connections to be made to the existing system, the work shall be done in accordance with AWWA standards. Water mains and appurtenances must be completely installed, flushed, disinfected, and satisfactory microbiological sample results received prior to permanent connections being made to the active distribution system.

Final connection must be made within 30 days of receiving passing samples or re-sampling will be required, at the discretion of Town ORO.

Fittings and valve(s) required for the connection shall be spray disinfected or swabbed with a minimum 1-5 % solution of chlorine just prior to being installed.

The disinfection shall be done by the Workforce. Town's operator shall witness the installation of the Connection to ensure sanitary construction practices are followed and proper disinfection is performed. The Engineer shall conduct a visual examination of the pressurized system prior to burial to ensure that there are no visible leaks. Once the connection is made, the Town Operators shall flush the system and record the chlorine residual.

Table 2-: By-pass Requirements for Swabbing and Flushing of New Watermains

Pipe Diameter (mm)	Flow required to produce 0.76 m/s (approx.) velocity in main (litres/s)	Number of Taps on Pipe Size of taps 50 (mm)	Number of open 64mm Hydrant Outlets
100	6.3		1
150	12.6	1	1
200	25.2	1	1
250	37.9	2	1
300	56.8	2	2
400	109.9	4	2

*Note: Should space limitations not allow for a 50mm tap to be installed, 25mm or 38mm taps could be installed, upon Town's approval.

8 Mandatory Submission

Prior to final connections, all documentation specified in this document as part of new watermain commissioning shall be submitted to the town. The documentation shall provide, at minimum, the required information by the MECP Watermain Disinfection Procedure.

- Watermain Disinfection Checklist for Contractors & Subcontractors
- Backflow (RP), Test inspection Report
- Contractor/Subcontractor Site Summary
- Watermain Disinfection Plan – Disinfection Criteria
- Watermain Disinfection Plan – Disinfection Site Map/Sketch
- Watermain Disinfection Plan– Swabbing Plan/Sketch
- Disinfection Records
- Dechlorination/Discharge Logs/Sampling records
- Connection plan, followed by connection records

9 Associated Forms/ Procedures/ Work Instructions

AWWA C-651 Disinfecting Water Mains

MECP - Watermain Disinfection Procedure

ATTACHMENTS:

Drawing # W-124, Isolation of Existing and New Watermains

Drawing # W-125, Connection at Existing Valve 300mm or Greater Watermain

Drawing #W-128 Temporary Watermain Connection Detail from Watermain

10 Revision History

Date	Revision #	Reason for Revision
June 18, 2013-V1		Procedure Issued
Nov 13, 2013-V2	1	Page 2, Town Operator-Workforce Reg. 435/93 to 128/04
Feb 3, 2015-V3	2	Page 6, #11
Feb 17 , 2017-V4	3	Table 1; Notes
Aug 29, 2018-V5	4	Sections updated: Scope; References; 3, 4; 5; 7; 12
July 12, 2019-V5	6	Scope, Definitions, References, 7, 8, 9, 10, 11
August 9, 2021, 2021-v6	7	Manager and Director titles throughout the document, Sections 3, 8, 10, 12, 13, 15 and 16
February 17, 2023-V8	7	All document