Town of Whitecourt

Municipal Design Standards

Date:
November 2020

Revision Log

Revision #	Revised By	Date	Issue / Revision Description

Report Prepared By: _____

Report Reviewed By: _____

Disclaimer

These municipal engineering standards are subject to periodic update. The most current version of these standards will be posted to the Town's website at www.whitecourt.ca Users of these standards for work in Whitecourt are required to download the latest version prior to proceeding with project design.

Contact

For general inquiries or to suggest revisions to this document, please forward a completed copy of Appendix B-4 to planning@whitecourt.ca.

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1. General

1.1 Definitions

In these Standards, unless the context otherwise indicates, the following definitions shall apply:

1.1.1 "Change Authorization" means a written communication issued by the Town Engineer authorizing a departure from these Standards in accordance with Section 1.7 of these Standards.

1.1.2 "Town" shall mean to the Town of Whitecourt.

1.1.3 "Town Engineer" shall mean the professional engineer, or designated representative, authorized by the Town to oversee all approvals and execution of these design standards on behalf of the municipality.

1.1.4 "Contractor" shall mean the person, firm, or corporation that undertakes the installation of municipal infrastructure on behalf of the Developer or the Town.

1.1.5 "Design" shall mean the designs, reports, studies, engineering drawings, technical specifications, and associated documents, including the execution and implementation of such, pertaining to a Development, Subdivision, or other municipal improvement within the Town of Whitecourt.

1.1.6 "Designer" or "Consultant" shall mean the professional engineer responsible for the design, layout and supervision of installation, recording of as-built information, and performing these duties in connection with the provision of municipal infrastructure as set out in these design standards. Where applicable throughout these Standards, this term may refer to or include the Landscape Architect.

1.1.7 "Developer" shall mean the person, firm, or corporation named within an Area Structure Plan, Development Agreement, subdivision or development approval whether as the owner or an agent for the owner of the land included therein.

1.1.8 "Development" shall mean the land area to be developed.

1.1.9 "Engineering Drawings" shall mean the detailed engineering drawings and specifications prepared by the Consultant for the municipal infrastructure to be constructed within the development area.

1.1.10 "Municipal Infrastructure" includes roads, utility works, landscaping, and other surface or underground improvements to be owned and/or operated by the Town.

1.1.11 "Standards" refers to the latest version of these municipal engineering standards in their entire scope, as further defined in Section 1.3.

1.1.12 "Subdivision" shall mean the particular subdivision stage of the development that is proposed for construction.

1.2 Objective

1.2.1 The objective of these Standards is to provide a clear guiding framework for designers and developers in the design of municipal infrastructure in the Town of Whitecourt. These standards are intended to ensure that new municipal infrastructure is acceptable to the Town with regard to overall quality, safety and environmental considerations, functionality, operation and maintenance requirements, and life cycle costs. The developer and consultant are responsible for ensuring that municipal infrastructure is designed and constructed to achieve the Town's objectives in this regard.

1.3 Scope

1.3.1 These Standards apply to the design and installation of all municipal infrastructure within the Town of Whitecourt.

1.3.2 These Standards do not cover the detailed design or installation of street lighting, power, gas, telecommunication, or other 3rd party utilities, but do include the general Town requirements as it relates to their infrastructure as well as the requirement to coordinate with these various companies.

1.3.3 The Engineering Standard Drawings, and all other appendices, shall form a part of these Standards. Engineering Standard Drawings can be found in Appendix A of these Standards.

1.4 Interpretation

1.4.1 The Town reserves the right to make the final decision regarding the interpretation of the intent of these Standards.

1.4.2 These standards are not specifications and should not be treated as such.

1.5 Use of These Standards

1.5.1 These Standards define the minimum acceptable requirements to be satisfied in the planning, design, and construction of municipal infrastructure within the Town of Whitecourt. The Town reserves the right to impose more stringent planning, design, and/or construction criteria as appropriate.

1.5.2 The Town's acceptance of the design covers only compliance of the design with respect to these Standards and is not a warranty of the design.

1.5.3 Notwithstanding the requirements of these Standards, the Developer and Consultant shall remain fully responsible for the Design.

1.5.4 Where a departure from these Standards might achieve a better design with regard to infrastructure quality, safety and environmental considerations, functionality, operation and maintenance requirements, or life cycle costs, the Consultant is encouraged to present a change proposal to the Town in accordance with Section 1.7 of this section.

1.6 Revisions to these Standards

1.6.1 The Town reserves the right to alter, revise, or update the Standards from time to time based on new or improved knowledge or innovations. Any such changes will be established following reasonable notice to designers and developers.

1.7 Proposed Changes and Items Not Covered

1.7.1 Where the Designer is inclined to use a Design which differs from these Standards or which is not covered by these Standards, the Designer may apply to the Town to review the Design.

1.7.2 The Town will review requests to revise these Standards, provided such requests are submitted using the Standards Revision Request Form attached in Appendix B. The revision request process is described in more detail on the second page of the form.

1.7.3 The Town will review such change proposals on a case-by-case basis.

1.7.4 The Designer must provide a detailed proposal describing the Design to the Town for review. The proposal must be prepared, signed, and sealed by a professional engineer, landscape architect, architect, or other industry professional, as applicable to the Design.

1.7.5 The proposal shall include sufficient detail regarding the proposed method or material to be used in the Design, including justification with respect to the impact on infrastructure quality, safety and environmental considerations, functionality, operation and maintenance requirements, and life cycle costs. The Town may request additional information as required to make an informed decision regarding the proposed design.

1.7.6 No departure from these Standards shall be permitted except with written authorization of the Town Engineer. A change authorization shall be issued recording any such revision.

1.7.7 A Change Authorization is only valid for the Development or Subdivision under consideration.

1.7.8 Notwithstanding review and acceptance of any such proposal by the Town Engineer, the Developer and Consultant shall remain fully responsible for the Design.

1.8 Requirements by Other Authorities

1.8.1 It is the responsibility of the designer to ensure the design conforms to all applicable statutes, laws, bylaws, regulations, ordinances, orders, directives, permits, licenses and requirements of governmental or other public authorities having jurisdiction, and all amendments thereto.

1.8.2 Wherever the standards of other authorities are referred to in these Standards, the current edition of such standards shall apply.

1.8.3 Where two or more applicable standards govern the design, the more restrictive shall apply.

1.9 Area Structure Plan – Detailed Requirements

The technical report for an Area Structure Plan must include all information outlined in the Town's Municipal Development Plan and as follows:

1.9.1 All area structure plans must describe:

The sequence of development proposed for the area;
The land uses proposed for the area, either generally or with respect to specific parts of the area;
The density of population proposed for the area either generally or with respect to specific parts of the area, and;
The general location of major transportation routes and public utilities.

1.9.2 The technical report may be required to include the following information regarding proposed municipal infrastructure under the Area Structure Plan:

1.9.2.1 Transportation Systems

a.) Land use and expected trip generation;
b.) A Transportation Impact Assessment (TIA), signed and sealed by professional engineer, must be included for all developments that will result in greater than 100 peak hour trips generated;
c.) Conceptual plan showing the location of all roads within the development;
d.) Classification of all proposed roads (i.e. arterial, collector, or local);
e.) Identification of truck routes and dangerous goods routes;
f.) Identification of all intersections which may require signals and the trigger points where these shall be required;
g.) Assessment of any special crossing requirements for vehicular, rail, and pedestrian traffic;
h.) Alignment of proposed pedestrian, bicycle corridors, circulation routes and other active modes of transportation. This includes multi-use trail systems.
i.) Alignment of any proposed transit routes;
j.) Detailed description of the phasing of the development noting trigger points when transportation facilities or upgrades shall be required;
k.) Description of any impacts of the proposed development on existing infrastructure and any proposed measures intended to offset negative impacts on such existing infrastructure; and
l.) Description of any noise impacts to the proposed development from arterial roads and any proposed measures intended to mitigate such impacts.

The Town may request additional analysis for area structure plans featuring high traffic generation land uses and developments within areas of the Town with limited capacity for increased traffic volumes.

1.9.2.2 Water Distribution Systems

a.) Land use, expected peak demands, and fire flow requirements;
b.) Conceptual servicing plan showing the approximate location and sizing of major water mains, and any other significant water distribution facilities;
c.) Definition of the pressure zone to be used for the development with delineation of pressure zone limits where more than one pressure zone may apply to the development;
d.) Detailed description of the phasing of the development noting trigger points when water distribution facilities or upgrades shall be required; and
e.) Description of any impacts of the proposed development on existing infrastructure and any proposed measures intended to offset negative impacts, including capacity limitations, on such existing infrastructure.

The Town may request that the technical report include a computer network analysis for the proposed water distribution system.

1.9.2.3 Wastewater Collection Systems

a.) Land use and sewage generation rates;
b.) Expected peak flows and design flows;
c.) Conceptual servicing plan showing the approximate location and sizing of major sewer mains, lift stations, and any other significant wastewater collection system infrastructure;
d.) Detailed description of the phasing of the development noting trigger points when wastewater facilities or upgrades shall be required; and.
e.) Description of any impacts of the proposed development on downstream infrastructure and any proposed measures intended to offset negative impacts, including capacity limitations, on such downstream infrastructure.

The Town may request that the technical report include a computer analysis for the proposed wastewater collection system.

1.9.2.4 Stormwater Management Systems

a.) Definition of the general catchment areas;
b.) Pre-development peak runoff flows and volumes, including all inflow and outflow points in the area;
c.) Post-development rate shall be controlled to pre-development values, or no greater than 2.5 L /sec/ha;
d.) Conceptual overland drainage plan illustrating flow routes and trapped low points within the proposed Development and clearly demonstrating the continuity of flow from upstream developments through the Development;
e.) Conceptual servicing plan showing the approximate location and sizing of major sewer mains, stormwater management facilities, storm outfalls, and any other significant stormwater management system infrastructure;
f.) Approximate alignment of proposed trunk sewers;
g.) Approximate location of storm ponds and corresponding storage volumes;
h.) Proposed connection locations to downstream major and minor drainage systems, including proposed release characteristics at each connection compared to pre- development characteristics;
i.) If the site is near any river, creek, watercourse, or wetland, a plan of the floodplain and a letter providing recommendations to limit the risk of flooding must be included;
j.) Detailed description of the phasing of the development such that the identified peak release rates are not exceeded at any time. This should include trigger points at which various stormwater facilities or upgrades shall be required;
k.) Description of any impacts of the proposed development on downstream infrastructure and any proposed measures intended to offset negative impacts, including capacity limitations, on such downstream infrastructure; and
l.) A map or detailed description of the major drainage system flow route from the development boundary to the major drainage system outlet. Such outlets are typically considered as the nearest water body or natural channel where storm runoff from the development would discharge.

The Town may request that the technical report include a computer analysis for the proposed stormwater management system.

1.9.2.5 Landscaping/Open Space Design

a.) Conceptual landscape plan for the Development;
b.) Location and route for any trail systems through the Development;
c.) Location and conceptual details of entryway features; and
d.) Approximate location and details of any proposed fencing, berming retaining walls, decorative pavements, or other significant landscaping features that may reduce conflicts between residential and proposed new land use.
e.) Retention of existing vegetation.
f.) Identification of parks, schools and recreation facilities.
g.) Provision for future linkages with existing developments.
h.) Integration of land use with existing natural environment.
i.) Identify locations of proposed environmental reserve (ER) and/or municipal reserve (MR).
j.) Integration of stormwater management facility with the open space plan including plantings, seeding and access for maintenance.

1.10 Development/Servicing Agreement Requirements

All new infrastructure that will come under the ownership of the Town will require a Development and/or Servicing Agreement. To commence preparation of a Development/Servicing Agreement, the Developer must have an approved subdivision/development permit for the proposed area, an approved engineering design, and full cost estimates for the proposed infrastructure to come under the ownership of the Town.

The Town reserves the right to require the Developer to construct or pay for an improvement with an excess capacity to accommodate future developments that may connect to the system. In these situations, the Town may endeavour to provide for reimbursement to the Developer of the cost incurred, or payment made in respect of the excess capacity, together with reasonable interest at the time of future connection to the constructed system(s). The Town shall only be responsible to the Developer for any excess capacity reimbursement actually collected by it, and the Town does not guarantee such collection.

The Developer shall be responsible to pay any excess capacity reimbursements for any previously installed oversizing or constructed infrastructure that benefits their proposed development area.

Information required for these development/servicing agreements may include:

1.10.1.1 Geotechnical Report

The geotechnical report for the subdivision shall contain all required review and analysis to meet the requirements of the applicable sections of these Standards. The report shall include, but may not necessarily be limited to, the following information:

a.) Summary of the field drilling program;
b.) Summary of laboratory testing;
c.) Site description with details regarding the surface, subsurface, and groundwater conditions, and frost action;
d.) Soil alkalinity and resistivity test results with recommendations regarding the type of concrete to be used and any corrosion protection that might be required;
e.) Identification of areas with high groundwater tables;
f.) Estimated weeping tile flow rates;
g.) Recommendations for pavement structure construction based on geotechnical conditions. This must include information regarding CBR values, design traffic loading volumes, and pavement design life;
h.) Recommendations for any necessary berm construction;
i.) Recommendations for stormwater management facility construction;
j.) Recommendations with respect to any geotechnical conditions in the area that impact design, construction, and/or maintenance of the proposed municipal infrastructure;
k.) Identification of areas requiring special design/construction considerations;
l.) Delineation of any contaminated sites within the area with recommended procedures for any site remediation to be completed, including copies of any contaminated site assessments;
m.) Top of bank setbacks for areas adjacent to creeks, watercourses, or ravines; and
n.) Slope stability analysis and requirements for stabilization.

These must be reflected on the drawings may be required to be registered as caveats on applicable land titles.

1.10.1.2 Transportation System

a.) Calculated trip generation rates and identification of the ultimate number of dwelling units served at each road link and intersection;
b.) Identification of truck routes and dangerous goods routes and description of any special measures in the Design to address these routes;
c.) Identification of all intersections to be signalized, with proposed timings and identification of intersections which may require signals in the future and the trigger points where these shall be required;
d.) Description of any special crossing designs for vehicular, rail, wildlife, and pedestrian traffic;
e.) Identification and discussion of transit routes and proposed transit stop locations through the Subdivision;

f.) Description of any impacts of the Subdivision on existing infrastructure and any measures to be completed to offset the negative impacts on such existing infrastructure;
g.) Description of the pavement design;
h.) Description and details regarding any temporary roadways or accesses required for regular and emergency traffic during the construction and phasing of the development;
i.) Description and details on any traffic calming measures;
j.) Noise Impact Assessment, signed and sealed by a professional engineer, where applicable;
k.) Description and details on any noise attenuation infrastructure;
l.) Description of any special materials or methods required for construction; and
m.) Description of quality control testing and inspection to be instituted during and following construction.

1.10.1.3 Water Distribution System

a.) Population calculations;
b.) Average and peak demand calculations;
c.) Hydrant flow test results;
d.) Fire flow calculations and a water network analysis which demonstrates that necessary fire flows will be maintained throughout all stages of the Development;
e.) Detailed hydraulic calculations;
f.) Description of pressure zone(s) and any required pressure relief infrastructure;
g.) Criteria and results summaries for any computer simulation models;
h.) Pipe design calculations;
i.) Description of any special materials or methods required for construction; and
j.) Description of quality control testing and inspection to be instituted during and following construction.

1.10.1.4 Wastewater Collection System

a.) Population calculations;
b.) Average and peak flow calculations;
c.) Inflow/infiltration calculations;
d.) Detailed hydraulic calculations;
e.) Description and details of any required lift stations and force mains;
f.) Criteria and results summaries from any computer simulation models;
g.) Pipe design calculations;
h.) Description of any special materials or methods required for construction; and
i.) Description of quality control testing and inspection to be instituted during and following construction.

1.10.1.5 Stormwater Management System

a.) Design flow calculations for minor and major systems;
b.) Description of the stormwater management system demonstrating that peak release rates from the development are below defined limits;
c.) Detailed hydraulic calculations;
d.) Description and details of any required lift stations and force mains;
e.) Criteria and results summaries from any computer simulation models;
f.) Pipe design calculations;
g.) Analysis of the capacity and characteristics of the downstream receiving drainage course and identification of any measures to be completed to prevent downstream flooding and/or for erosion and sediment control;
h.) Details and calculations for major system conveyance infrastructure;
i.) Expected flow depths and velocities for critical locations within the development's stormwater management system (i.e. major system conveyance infrastructure, inlets, outlets, overflows, and outfalls);
j.) Lot grading plan and landscape design as related to the drainage plan;
k.) Details regarding any interim stormwater management system infrastructure and protective measures required, including sediment and erosion controls, during the construction and phasing of the Development;

l.) Detailed description of the design of any stormwater management facilities including details on extent, depth, volume, and duration of ponding in stormwater management facilities, orifice sizing, and trapped low points including a description of how the storage provided by such corresponds to the requirements of the drainage plan for the Development;
m.) Stormwater quality control BMP infrastructure design calculations;
n.) Storm outfall design details;
o.) Description of any special materials or methods required for construction; and
p.) Description of quality control testing and inspection to be instituted during and following construction.

1.10.1.6 Public Lands

a.) Identify parks, schools and recreation facilities.
b.) Identify MR lands, ER lands, buffer strips and walkways.
c.) Consideration for recreation facilities.

All road, utilities and or drainage rights of way, easements, reserves, and/or public utility lots required shall be noted and registered at land titles.

1.10.1.7 Erosion and Sediment Control Plan

a.) An erosion and sediment control plan may be required to define all procedures to be undertaken to control such during construction.
b.) All water discharged, by gravity flow or pumping, to a watercourse or to storm sewer conveyance infrastructure must be filtered or treated in accordance with suitable best management practices (BMPs) prior to release.
c.) The plan should detail the BMPs to be employed, including both temporary and permanent measures.
d.) The Developer shall be responsible for ensuring the erosion and sediment control plan is fully implemented during construction and meets all current regulations and best practices.

1.11 Design Review Process

1.11.1 The full design complete with all necessary supporting documentation, must be provided to the Town for review following subdivision/development approval and prior to subdivision registration.

1.11.2 The Development/Servicing Agreement may not be issued until all required submissions have been reviewed and accepted by the Town.

1.11.3 Incomplete submissions, submissions with excessive errors, or submissions lacking appropriate authentication or endorsement, as determined by the Town, may be rejected and returned by the Town without review.

1.11.4 If the design submission process requires in excess of 3 Town reviews, the Town reserves the right to charge the Developer for any further reviews required to obtain an approved engineering design. Any charges for additional reviews shall be paid in full prior the Town undertaking the review.

1.11.5 The Developer will be required to pay for any 3rd party specialists required by the Town to review any components of the submitted design outside of the Town's expertise.

1.11.6 Review by the Town is for the sole purpose of ascertaining conformance with the Municipal Engineering Standards (current edition). This review shall not constitute the Town's approval of the Design, nor relieve the Designer of responsibility for errors or omissions in the submittal or of responsibility for meeting all requirements of the Standards.

1.11.7 The Designer shall make any changes to the submission which the Town may require, consistent with the Municipal Engineering Standards, and resubmit unless otherwise directed by the Town. When resubmitting, the Designer shall notify the Town in writing of any revisions made by the Designer other than those requested by the Town, in the Town's previous review.

1.11.8 The Developer shall not proceed with construction until the Town has approved the full design and executed a Development/Servicing Agreement for the Subdivision.

1.12 Design Revisions After Approval Issued

1.12.1 If, for any reason, it becomes necessary to revise the Design after the Town approval has been issued, the Designer shall obtain the Town's acceptance of such revision prior to construction proceeding in accordance with the revision. An Appendix B-3 form is to be filled out in full and submitted to the Town for review.

1.12.2 Construction of the proposed revision shall not proceed until the Town has issued written acceptance of the revision.

1.13 Easements

1.13.1 The Developer shall be responsible for securing all the necessary easements and rights of ways for any constructed utilities and infrastructure not located within a road right-of-way or utility lot.

1.13.2 All permanent easements shall be registered no later than at time of registration of subdivision.

1.14 Crossing Agreements

1.14.1 Where a crossing of gas or oil pipelines, power transmission lines, railway, or other private utility is required by a Design, the Developer shall be responsible for securing and coordinating the crossing agreement and all associated approvals with the necessary authorities.

1.14.2 The Developer shall be responsible to comply with all terms and conditions of any crossing agreement and associated approvals.

1.14.3 Prior to application to the Town for a construction completion certificate for municipal infrastructure subject to a crossing agreement, the Developer shall apply to the Town and the crossing agreement authority to have the crossing agreement transferred to the Town's name. The construction completion certificate shall not be issued until all applicable crossing agreements are transferred to the Town.

1.15 Control Markers and Legal Pins

1.15.1 Existing Control Markers

a.) Every effort shall be made to protect existing markers.
b.) The Developer shall be responsible for replacing any markers which are disturbed, destroyed, or missing, at the Developer's sole expense. Markers are to be replaced only by a licensed legal surveyor.

1.15.2 Alberta Survey Control Markers

a.) The Developer shall provide additional markers as required for the Development.
b.) Markers shall have a maximum spacing of 500 m with a minimum of two other markers within clear view.

1.15.3 Legal Pins

a.) The Developer shall hire a licensed legal surveyor to install legal pins through the Development.
b.) Legal pins shall be installed prior to installation of buried utilities.
c.) The Developer shall be responsible for replacing any markers or legal pins which are disturbed, destroyed, or missing. Legal pins are to be replaced only by a licensed legal surveyor, at the Developer's sole expense. The Town will not issue the Final Acceptance Certificate until this is completed.

1.16 Construction

1.16.1 A copy of all Town approved construction drawings, construction specifications, and applicable supporting documentation shall be maintained at the construction site during construction.

1.16.2 It is the responsibility of the Developer and Consultant to ensure that all utility locates, approvals, and coordination with utility providers is complete prior to construction.

1.16.3 It is the responsibility of the Developer and Consultant to ensure proper notification is given to the Town prior to construction.

1.16.4 Underground utilities shall not be permitted to operate as part of their respective existing utility systems until such utilities have been inspected and tested by the Contractor under witness of the Consultant, and accepted by the Town in writing. Only the Town may operate existing utility systems.

1.16.5 The Consultant shall be responsible for the layout and inspection of all municipal infrastructure to ensure conformance with the approved detailed engineering drawings, plans and specifications. The Consultant or their authorized representative shall conduct on-site regular inspections during construction and shall have an active presence during critical or sensitive times.

1.16.6 In addition to construction observation carried out by the Consultant, the Town will periodically review the work. Should the Town note any method or material being employed that is contrary to the accepted Design, the Town shall bring such to the attention of the Consultant. If remedial action is not taken to the satisfaction of the Town, the Town will issue a stop work order.

1.16.7 It shall be the responsibility of the Developer and Consultant to ensure that the Contractor successfully completes all necessary testing, to the satisfaction of the Town. The Consultant shall provide the Town with a written report acknowledging that all required testing has been successfully completed.

1.16.8 Where the work of the Contractor fails to meet the specifications of the accepted Design, the Developer and Consultant shall be responsible to ensure such work is rectified and retested accordingly.

1.16.9 Following construction completion, plan of record drawings must be prepared and submitted to the Town in accordance with Section 1.21 of these Municipal Engineering Standards prior to a construction completion certificate being issued.

1.17 Materials

1.17.1 Only new materials shall be used in the construction of municipal infrastructure. Contractor to contact the Town forty-eight (48) hours prior to installation to inspect materials.

1.17.2 Any materials which are defective in manufacture or which are damaged prior to installation and acceptance by the Town shall be replaced by the Developer, at the Developer's sole expense.

1.17.3 Where specific materials are outlined in these Municipal Engineering Standards, the Town shall consider applications for substitute products which can be considered comparable in terms of these Municipal Engineering Standards. Written request shall be submitted using the standard revision request form attached in Appendix B 4 and acceptance of such must be obtained from the Town before any substitution can be made.

1.18 Operation and Maintenance Manuals

1.18.1 Four (4) copies and one (1) digital copy of all applicable operation and maintenance manuals shall be provided to the Town prior to application to the Town for a construction completion certificate. The construction completion certificate shall not be issued until such documents are provided to the Town.

1.18.2 Commissioning reports for various infrastructures shall be incorporated into the applicable operation and maintenance manuals.

1.19 Construction Completion Certificate

1.19.1 Prior to applying to the Town for a Construction Completion Certificate (CCC) inspection, the Consultant shall fully inspect the work and ensure that the constructed infrastructure is complete, functional and fully commissioned in accordance with the accepted engineering drawings and these Municipal Engineering Standards.

1.19.2 A CCC Request Form must be provided to the Town, complete with all necessary supporting documentation. A sample of the CCC Request Form is attached in Appendix B. More information regarding the CCC process is provided on the form.

1.19.3 CCC inspections may be requested at any time. At the discretion of the Town of Whitecourt and weather permitting, site amenities can be inspected year round, provided snow cover, temperature, and other considerations do not prevent the ability to perform a thorough inspection. If an inspection occurs after October 15 of any year, additional warranty may be required as described in Appendix B.

1.19.4 Town reserves the right to refuse any CCC application where information is not provided as required or where substantial deficiencies exist.

1.20 Warranty

1.20.1 The warranty period shall start upon the Town's issuance of the Construction Completion Certificate (CCC) and shall not expire until the Town has issued the Final Acceptance Certificate (FAC).

1.20.2 The Developer shall be responsible to correct any defects or deficiencies in design, material, and/or installation that are noted during the warranty period.

1.20.3 A two (2) year warranty period shall apply to all infrastructure except where additional warranty has been agreed to or specified.

1.20.4 Trench Settlement During the Warranty Period

a.) During the Warranty Period, the Developer shall be responsible to replace materials and rectify all failures that occur as a result of settlement of trench backfill or collapse of trench walls.
b.) Trenches in which backfill settles shall be refilled with the specified backfill material. Paved or landscaped surfaces that are adjacent to trenches or on trench backfill, which fail during this period, shall be replaced or repaired in an acceptable manner.
c.) Replacement of materials and rectification of failures that occur as a result of settlement of trench backfill or collapse of trench walls, are entirely the responsibility of the Contractor and such repair work shall be done at the Contractor's expense.
d.) The Developer shall be responsible for extra road maintenance required as a result of trench settlement or disruption of surface drainage during the warranty period.

1.21 Plan of Record Drawings

1.21.1 Plan of record drawings shall include all the information specified in Section 2.0, updated to reflect how the Subdivision was actually constructed. All design information will be struck through and replaced with field verified construction data. This information will be shown in red text.

1.21.2 Prior to issuance of the Construction Completion Certificate (CCC) submit three (3) full size printed sets of the plan of record drawings and digital drawing files to the Town for review. Digital files provided should include both AutoCAD files and PDF files for Town records.

1.21.3 The cover sheet shall include the following information:

a.) Date of construction completion;
b.) Date on which the plan of record information was updated;
c.) Signature and stamp of the professional engineer approving the drawing set;
d.) A table summarizing all underground utilities installed with information regarding pipe material, size, type, class, pressure rating, manufacturer, supplier, and applicable reference standard; and
e.) A table summarizing the following information:
    i. Name of the contractor for wastewater collection system infrastructure construction with construction start and completion dates;
    ii. Name of the contractor for stormwater management system infrastructure construction with construction start and completion dates;
    iii. Name of the contractor for water distribution system infrastructure construction with construction start and completion dates;
    iv. Name of the contractor for road infrastructure construction with construction start and completion dates;
    v. Name of the contractor for sidewalk, curb, and gutter infrastructure construction with construction start and completion dates; and
    vi. Name of the contractor for landscaping infrastructure construction with construction start and completion dates.

1.21.4 Plans shall identify property lots by their legal address and municipal address, as provided by the Town.

1.21.5 Should the Town, upon its review, note any errors, omissions, or discrepancies in the plan of record drawings, the drawings shall be returned to the Consultant with the Town's comments. The Town may also assign drawing numbers and asset numbers that must be reflected on the final plan of record drawing set. The Consultant shall correct the drawings and return to the Town for review. This process shall be repeated until the Town deems the plan of record drawings acceptable.

1.21.6 The FAC will not be issued by the Town until all applicable plan of record drawings have been reviewed and accepted by the Town.

1.22 Final Acceptance Certificate

1.22.1 Prior to applying to the Town for a Final Acceptance Certificate (FAC), the Consultant shall fully inspect the work and ensure that the constructed infrastructure is free of defects or deficiencies in design, material, and/or installation.

1.22.2 Prepare and submit a FAC Request Form, complete with all necessary supporting documentation. A sample of the FAC Request Form is attached in Appendix B. More information regarding the FAC process is provided on the form.

1.22.3 The Town reserves the right to refuse any FAC application where information is not provided as required or where deficiencies exist.

1.23 Infill and Redevelopment Projects

1.23.1 Applications for a development agreement and/or development permits for infill and redevelopment projects must be accompanied by a design report, lot grading plan, and overall utility plan.

a.) Design Report
    i. A copy of the design report must be provided for the Town's review.
    ii. The report should define the methodology utilized by the Designer, demonstrate conformance of the Design with these Standards, and contain all pertinent information regarding the Design.
    iii. The report shall be signed and sealed by a professional engineer, licensed to practice in the Province of Alberta.

iv. The information provided in the report shall follow that prescribed in Section 1.10, as applicable to the nature of the proposed development.

1.23.2 Lot Grading Plan

a.) The lot grading plan shall follow the requirements of Section 2.2.9.

1.23.3 Overall Utility Plan

a.) The overall utility plan shall follow the requirements of Section 2.2.6.
b.) The plan shall include a note stating “No groundwater or stormwater shall be discharged to the wastewater collection system.”

1.23.4 Landscaping Plan

a.) The landscaping plan shall follow the requirements of Section 2.2.12.

1.23.5 Erosion and Sediment Control Plan

a.) Provide and adhere to an Erosion and Sediment Control Plan in accordance with Section 1.10.1.7

1.23.6 Each infill and redevelopment site will be unique in its utility servicing requirements. As such, the Town may request additional details regarding the design in order to ascertain its acceptability.

1.23.7 The development agreement and/or building permit will not be issued until the design report, lot grading plan, overall utility plan and landscaping plan have been submitted, reviewed, and accepted by the Town.

1.23.8 Construction activities shall follow the applicable requirements provided in Section 1.16 and Section 1.17.

1.23.9 Plan of record drawings must be provided to the Town once the project is complete and prior to CCC issuance.

1.24 Abandoning Services, Mains and Other Works

1.24.1 Any mains, services, or other works (such as driveways) that are no longer required must be removed at the developer’s expense.

1.24.2 Where an existing water or sewer service connection must be abandoned, the service connection shall be abandoned at the main, unless otherwise approved by the Town.

1.24.3 Town inspection must occur prior to backfill of materials.

1.25 Tie-Ins to Existing Service Connection Stubs

1.25.1 Prior to connection to an existing service connection stub, the stub shall be exposed and the Town contacted to inspect the stub. A minimum of two (2) business days’ notice must be given to the town to schedule inspections.

1.25.2 In the event that the Town determines the existing stub to be insufficient or unsuitable to accommodate the new connection, the Developer shall replace the stub with a new service from the main to the property line, at the Developer’s sole expense.

2. Drawing Standards

The following standards apply to detailed design drawings submitted to the Town for review and to plan of record drawings for the completed municipal infrastructure.

2.1 General

2.1.1 Detailed design drawings shall provide a complete description of the existing and proposed infrastructure, provide sufficient information to construct the proposed infrastructure, and indicate any provisions for future extension of utilities and systems.

2.1.2 All drawings shall include the following:

a.) A suitable title which identifies the project;
b.) Drawing scale;
c.) North direction indicator;
d.) Date of issue; and
e.) Drawing number (a Town drawing number may be provided by the Town for Plan of Record preparation).

2.1.3 The title block must indicate the following information:

a.) Developer's name;
b.) Consultant's name;
c.) Subdivision name and stage number;
d.) Drawing name;
e.) Drawing number;
f.) Revision number;
g.) Drawing scales (horizontal and vertical) with scale bar;
h.) Table listing the name, signature, and signature date for the designer, drafter, checker, and approver;
i.) Table listing the revision number, date, description, designer, and approver for all drawing revisions;
j.) Table listing the dates for each of the various issues (i.e. preliminary, tender, construction, plan of record) of the drawing with the initials and date of the approver corresponding to each issue;
k.) Professional stamps and permits, as applicable; and
l.) A 10 cm wide by 1.5 cm tall space in the lower right hand corner of the drawing for the Town's drawing number.

2.1.4 Dimensions and measurements shall be in metric units.

2.1.5 All elevations shall be referenced to geodetic datum.

2.1.6 Lettering must clearly legible, 2 mm size or larger.

2.1.7 Drawings shall be standard A-1 size (594 mm by 841 mm).

2.1.8 Where drawing submissions to the Town are required, in addition to the specified number of hardcopies, also provide the Town with one (1) copy of the applicable drawings electronically in AutoCAD and PDF format.

2.2 Required Drawings

The following drawings are required and shall include the information specified:

2.2.1 Cover Sheet

a.) The cover sheet shall identify the subdivision name and stage number and/or development name, Developer's name, Consultant's name, and the Town of Whitecourt.
b.) A key plan of the Town of Whitecourt will be included and will clearly indicate the location of the overall development and identify the location of the subdivision stage.

2.2.2 Legend and Abbreviations Sheet

a.) This drawing shall indicate and define all symbols and abbreviations used in the drawings. Alternatively, the Town may require use of legends on individual drawings, as applicable.

2.2.3 Index Plan

a.) This plan drawing shall delineate the coverage of each plan/profile drawing covering the Subdivision/Development for the drawing set.

2.2.4 Legal Plan

a.) This plan drawing shall illustrate all legal and easement information for the site.
b.) The plan shall indicate the proposed land uses for the site.

2.2.5 Road and Walkway Overall Plan

a.) This plan drawing shall illustrate the location of all road right-of-way, lanes, boulevards, sidewalks, trails, walkways, and emergency access.
b.) Identify light duty and heavy duty pavement including but not limited to asphalt or concrete areas.
c.) Provide cross-sections.
d.) Identification of road right-of-way names or temporary designations.
e.) Alignments of adjacent roads, lanes, boulevards, and walkways including identification by names or designations.
f.) Alignments and locations of existing and proposed surface infrastructure including curb, gutter, sidewalk, sidewalk connectors, paraplegic ramps, and bus stop pads.
g.) Location of any proposed postal boxes. Note that locations shall coordinated with Canada Post and should be provided in locations that are accessible to the general public and do not interfere with the vehicular function of the roadway.
h.) Signage and road marking plan identifying street names, regulatory signs, transit pad location, signs, details, sign placement, and any required temporary or permanent thermoplastic lane markings.
i.) The location of potential future extensions shall be identified.

2.2.6 Overall Utility Plan

a.) This plan shall indicate the alignment, diameter, slope, type, and material of all existing & proposed water, wastewater, and storm mains.
b.) All valves, hydrants, manholes, catch basins, and other appurtenances shall be identified and labeled.
c.) The location of potential future extensions shall be identified.

2.2.7 Stormwater Drainage Basin Overall Plan

a.) This plan shall illustrate the stormwater drainage basin within which the overall development is located.
b.) The limits of the drainage basin shall be clearly delineated.
c.) The location and identification of the Subdivision/development shall be indicated.
d.) The alignment of any existing or proposed trunk sewer mains within the drainage basin shall be shown, along with their respective pipe diameters.
e.) Stormwater catchment areas shall be delineated within the development area.
f.) Existing and proposed stormwater management facilities, ponding areas, and overflow areas within the drainage basin shall be located and identified.
g.) Major drainage routes through the drainage basin, along with any receiving drainage courses, shall be illustrated and identified. The plan shall indicate the anticipated flow depths and velocities resulting from a 1:5-year rainfall event, and identify any ponding areas and overflow areas resulting from a 1:100-year rainfall event.
h.) Where major system flows shall discharge or overflow into any watercourse, ravine, or environmental reserve, the rate and projected frequency of the flows shall be noted on the plan.
i.) Show pre and post development flow calculations with confirmation on all high-density residential and non-residential developments that post development flows are being released to the Town system at pre-development rates.
j.) The plan shall indicate the proposed finished grades of roadways and other surfaces within the Subdivision with arrows indicating direction of overland flow.
k.) The plan shall indicate the intentions for the roof top drainage conveyance and downspout location design, where required.
l.) The plans shall indicate:
    i. Alignment, diameter, grade, pipe material, and direction of flow of all sewer mains; Location of all manholes, catch basins, and other appurtenances;
    ii. Alignment, diameter, and direction of flow of all foundation drain discharge collection sewers with the location of cleanouts;
    iii. Delineation, identification, and area of all local drainage areas contributing drainage to the proposed stormwater management system;
    iv. Location of all stormwater management facilities including all applicable information regarding normal water levels, high water levels, storage volumes, freeboards, pond bottom elevations, side slopes, contributing basin size inlet and
    v. Outlet elevations and locations, overflow elevations and locations;
    vi. Location of potential future extensions;
    vii. Notation indicating the lowest allowable building opening elevation for lots adjacent to stormwater management facilities; and
    viii. Stage-volume and stage-area curves for all stormwater management facilities.
m) Tables shall be provided summarizing design calculations for the stormwater management system and shall list the following information for each sewer main:
    i. Sewer main identification number;
    ii. Upstream and downstream manhole identification numbers;
    iii. Upstream and downstream manhole rim and invert elevations; Incremental drainage area directly served by sewer main (ha);
    iv. Cumulative drainage area served by sewer main (i.e. upstream sewer main drainage area plus incremental drainage area, in ha);
    v. Runoff coefficient, C, for drainage area directly served by sewer main; Incremental drainage area multiplied by the runoff coefficient for drainage area directly served by sewer main;
    vi. Cumulative total of runoff coefficient multiplied by drainage area (i.e. upstream sewer main calculation plus incremental calculation);
    vii. Inlet time (min); Travel time (min);
    viii. Rainfall intensity (mm/hr); Calculated design flow (m^3/s); Pipe size (mm);
    ix. Pipe grade (%); Pipe length (m);
    x. Pipe capacity (m^3/s); and
    xi. Flow velocity (m/s).

Separate tables should be provided to describe interim and ultimate conditions where staging of the development will occur and impose distinct conditions on the proposed stormwater management system.

n) Tables summarizing design calculations for the stormwater management system shall list the following information for each catch basin and lead:
   i. Catch basin identification number; Street name;
   ii. Frame type;
   iii. Depth of flow (mm); Lead diameter (mm); Lead slope (%);
   iv. Design flow rate (m^3/s);
   v. Catch basin capacity (m^3/s); and
   vi. Lead capacity (m^3/s).

2.2.8 Wastewater Drainage Basin Overall Plan

a.) This plan shall illustrate the wastewater drainage basin within which the overall development, defined by the Area Structure Plan, is located.
b.) The limits of the drainage basin shall be clearly delineated.
c.) The location and identification of the Subdivision shall be indicated.
d.) The alignment of any existing or proposed trunk sewer mains within the drainage basin shall be shown, along with their respective pipe diameters.
e.) Wastewater catchment areas shall be delineated within the Subdivision.
f.) Information on underground pipeline systems including the following:
   i. Alignment, diameter, grade, pipe material, and direction of flow of all sewer mains;
   ii. Location of all manholes and other appurtenances;
   iii. Delineation, identification, and area of all local drainage areas contributing drainage to the proposed wastewater collection system; and
   iv. Location of potential future extensions.
g.) Tables summarizing design calculations for the wastewater collection system shall list the following information for each sewer main:
   i. Sewer main identification number;
   ii. Upstream and downstream manhole identification numbers; upstream and downstream manhole rim and invert elevations; incremental number of lots directly served by sewer main;
   iii. Cumulative area and/or number of lots served by sewer main (i.e. upstream area and/or number of lots served plus incremental area and/or number of lots);
   iv. Population density per lot (capita/lot), or Peak Flow Per Ha;
   v. Incremental area and/or population directly served by sewer main;
   vi. Cumulative area and/or population served by sewer main (i.e. upstream area and/or population served plus incremental area and/or population);
   vii. Peaking factor;
   viii. Design flow rate (m^3/s);
   ix. Inflow rate (m^3/s); Infiltration rate (m^3/s); Design flow rate (m^3/s); Pipe size (mm);
   x. Pipe grade (%); Pipe length (m);
   xi. Pipe capacity (m^3/s); and
   xii. Flow velocity (m/s).

Separate tables should be provided to describe interim and ultimate conditions where staging of the development will occur and impose distinct conditions on the proposed wastewater collection system.

2.2.9 Lot Grading Overall Plan

a.) The plan shall include, at a minimum;
   i. The existing surface contours starting at 10 metres outside the development boundary and throughout the site.
   ii. The proposed finished grades.
   iii. The anticipated/proposed building main floor elevation,
   iv. Drainage basin boundaries, storage areas, ponding depths and overflow locations.
   v. The proposed curb line grades.

vi. Any existing floodplain elevations and boundaries, if applicable.

b.) Provide existing spot elevations along development boundaries at property corners, grade breaks, and at 10 m intervals. These boundary elevations are to be maintained as part of the overall grading design plan.

c.) This plan shall indicate the proposed finished surface elevations at lot corners, the proposed direction of flow of surface drainage on each lot.

d.) The location of any benchmarks to be used in the construction of the project shall be identified.

e.) Existing and proposed surface contours shown at 0.5 m intervals.

f.) The geotechnical report should be referenced for builders to consult in the design/construction of building foundations, weeping tiles, and foundation drain discharge systems.

g.) Notes should be included which indicate to builders the requirements with respect to roof leader discharges and foundation drainage, cross-referenced to the applicable detail for stormwater discharge piping.

h.) The plan shall include typical three-dimensional details of the various lot grading types with a depiction of the structure(s), required slopes around the structure(s), and lot grades. Each lot on the plan shall be labeled to identify the applicable detail corresponding to the proposed lot grading type for that lot.

i.) Lots requiring greater than 1.0 m of fill to meet the proposed grades should be clearly indicated on the plan.

j.) Where the use of swales has been accepted by the Town, the plan shall indicate the locations, easement requirements, slopes, cross-sections, and construction details for the swales. Additional spot grades shall be provided at the midpoint of the swale and at the property line.

k.) The plan must clearly convey any potential problems or restrictions with respect to building design and lot grading. Building foundation elevation restrictions for lots adjacent to a stormwater management facility is one example of this.

l.) Any easements or restrictive covenants related to the stormwater management system must be shown and identified on the plan.

m.) Where more than one sheet is required for the lot grading plan, each sheet shall include the typical details and notes which apply.

n.) For rear lot and concrete swales, the channel capacity analysis is required to verify the conveyance of a 1:100-year storm event from the contributing area.

2.2.10 Water Distribution System

a.) With respect to the water distribution system, this plan shall include the following:

i. Alignment, diameter, and material of all water mains;

ii. Location of all valves, hydrants, and other appurtenances;

iii. Calculation of pressures and flows including peak, average, and fire demand for the water distribution system.

iv. Location of potential future extensions; and

v. Identification of all bacteria sampling locations.

2.2.11 Shallow Utilities

a.) This plan shall indicate the alignments for power, gas, and telecommunication lines.

b.) The location of any surface features related to these utilities (i.e. light standards, transformers, boxes, etc.) must be clearly identified.

c.) The location of any surface features which may conflict with the arrangement of these utilities (i.e. driveways, hydrants, curb valves, manholes, catch basins, street furniture, etc.) must be illustrated.

d.) Applicable utility company approvals and associated easements/right of way locations, must be shown on the plan or otherwise accompany the drawing submission.

e.) There are two typical shallow utility alignments that the Town will accept:

i. Power and telecommunication cables are installed in a joint trench within the road right of way and gas is installed in a single trench 3 within a 3.0m utility easement. Refer to Appendix A: Standard Engineering Drawings; or

ii. Gas, power, and telecommunication cables are installed in a joint trench within a 3.5m utility easement, with gas installed 2.7m into private property and power/telecommunications installed 1.0m-2.0m into private property. See Appendix G: 4 Party Franchise Utility Location Details.

2.2.12 Landscaping Plans

a.) Landscaping plans shall include the following:
   i. Land use parcel designation
   ii. Locations of driveways; Location of street furniture; Location of underground structures;
   iii. Location of curbs and boulevards; Location of public sidewalks; Location of private approaches; Location of parking areas;
   iv. Location of proposed retaining walls; Proposed location of boulevard trees;
   v. Planting schedules, including botanical and common name of all proposed plant material, total quantity of each plant on public and private property, height and/or spread of each shrub or perennial at the time of installation, minimum caliper size of each tree at the time of installation.
   vi. Notes regarding root ball type and size, tree branching heights for boulevard trees, special conditions, or unique installation criteria;
   vii. Identification of existing vegetation, trees and/or other natural features to remain in place and or relocated;
   viii. Outline of planting beds and tree wells, including the type and depth of mulch; Location of anticipated irrigation systems;
   ix. Details of hard and soft landscape installations;
   x. Identification of areas to be sodded and seeded, with the applicable seed mix specified;
   xi. Proposed mowed and non-mowed areas.
   xii. Location of proposed site amenities and fencing, with construction details and elevations;
   xiii. Location of trails with details, signage, and proposed drainage;
   xiv. Total measurements (in m^2) of shrub beds, flower beds, islands, buffers, PULs, MRs, ERs, SWMFs, and parks;
   xv. Total measurements (in m^2) of proposed seeded and sodded areas, and existing vegetation;
   xvi. Provide a breakdown of private and public landscaping;
   xvii. Any proposed entrance sign or feature detail; and
   xviii. Any other details that may relate to the final landscape design.

b.) The plan shall identify the following areas:
   i. Preservation Areas (ER)
   Preservation areas are portions of parks, which are to remain in the natural condition.
   ii. Naturalization Zones
   Naturalization zones are portions of parks, which are proposed for reclamation to as natural a state as possible. They include manicured areas and/or disturbed or partially disturbed natural areas.
   iii. Manicured Zones
   Manicured areas are portions of parks that have defined ‘special use areas’. They imply some development as identified in the minimum standards and maintenance that is relatively intense compared to preservation and naturalization areas. Manicured areas include areas where larger numbers of park users are anticipated; i.e. sports fields, playgrounds, community uses.
   iv. Existing Environmentally Sensitive Areas, Historical Areas, Wetlands, Vacant Farmsteads, existing water bodies and wildlife corridor.

c.) This plan shall indicate the location of all street furniture including, but not necessarily limited to, signage (including identification of type), hydrants, bollards, light standards, power transformers, driveway approaches, telephone boxes, cable boxes, mail boxes, bus shelters, benches, garbage cans, manhole covers, valve covers, playgrounds, trails, trees, retaining walls, and fencing.

d.) The plan shall include fencing details including elevation view.

e.) The plan should also illustrate sight triangles for all intersections.

f.) This plan shall be in accordance with the setbacks specified in these Municipal Engineering Standards and the Town’s Land Use Bylaw

g.) The landscaping plan shall be prepared, signed, and sealed by a landscape architect licensed to practice in the Province of Alberta by the Alberta Association of Landscape Architects.

2.2.13 Plan and Profile Drawings

Plan and profile drawings shall meet the following requirements:

a.) General
   i. Plan and profile drawings shall be drawn to a scale of 1:500 horizontal and 1:50 vertical;
   ii. There must be a clear delineation between proposed and existing features; and
   iii. The drawings must show the location and identification of existing and proposed survey markers in the area.

b.) Road Right-of-Way Information
   i. The following information must be included on the plan portion of the drawing: Legal subdivision information including block and lot numbering;
   ii. Alignment of proposed road right-of-way or easement including name or temporary designation;
   iii. Alignments of adjacent roads, walks, lanes, interim connections, utility rights-of- way, easements, and reserves including identification by name or ownership;
   iv. Existing and proposed surface infrastructure including curb, gutter, sidewalk, sidewalk connectors, trails, paraplegic ramps, bus stop pads, boulevard area, etc.;
   v. dimension of right of way width measured relative to adjacent property lines;
   vi. dimensioned measurements of curb, gutter, sidewalk, and boulevard locations;
   vii. horizontal curve data for the centreline of each roadway including chainages of the beginning-of-curve (BC), end-of-curve (EC), delta angle, radius, chord length, and arc length. The radius of curb returns must be indicated.
   viii. Elevations, along the curb and gutter, of all changes in vertical alignment; and elevations of the BC and EC for all curb returns including the grades and chainage around the curve.

   The following information must be included on the profile portion of the drawing: Existing ground profile along the centreline of the proposed roadway or utility;
   ix. Proposed gutter line profile with grade expressed in percentage, accurate to two
   x. decimal places;
   xi. Vertical curve data including chainages and elevations for beginning-of-vertical- curve (BVC), end-of-vertical-curve (EVC), point-of-vertical-intersection (PVI), external value (e), length of curve, elevation and chainage of the low point of sag curves and high point of crest curves, and rate of gradient change (k value); and
   xii. Gutter line grade at all intersecting proposed and existing roads.

c.) Water Distribution System Information

The following information must be included on the plan portion of the drawing:
   i. Horizontal alignment of proposed water mains with dimensioned measurements locating each from adjacent property lines;
   ii. Diameter of water mains;
   iii. Location of all related appurtenances including hydrants, tees, bends, crosses, valves (use different symbols for gate valves and butterfly valves), blow offs, and plugs;
   iv. Location of all service connections and curb cock valves, with dimensioned measurements locating each individual service lateral from the property lot corner along with the service pipe invert elevation at the property line.

The following information must be included on the profile portion of the drawing:
   v. Vertical alignment of proposed water mains within the profile alignment;
   vi. Elevation, diameter, and utility type of existing and proposed utilities which cross or intersect the profile including dimensions between utility crossings;
   vii. Invert-of-pipe elevation at all tees, bends, crosses, plugs, and grade changes; Pipe diameter, pipe type, pipe class, and bedding class and station chainages;
   viii. Description of tie-in points of the proposed system to the existing system; and
   ix. Identification of areas requiring special construction methods such as trenchless installation methods, shored construction, insulation, casings, limited working space areas, etc.

d.) Wastewater Collection System and Stormwater Management System Information
The following information must be included on the plan portion of the drawing:

i. Horizontal alignment of proposed sewer mains and foundation drain discharge collection sewers, with dimensioned measurements locating each from adjacent property lines;
ii. Diameter and direction of flow of sewer mains and foundation drain discharge collection sewers;
iii. Location of all related appurtenances including manholes, catch basins (including frame and cover type, elevation at gutter), plugs, cleanouts, inlet structures, and outlet
iv. structures;
v. Sequential identification numbering of all mains, manholes, and catch basins. The Town shall provide revised identification numbers for updating plan of record drawings;
vi. Horizontal alignment, diameter, grade (in percentage, accurate to two decimal places), pipe type, pipe class, and length of all catch basin leads. Much of this information may be listed in table-format;
vii. Radii of curved sewers; and
viii. Location of all service connections with dimensioned measurements locating each individual service lateral from the property lot corner along with the service pipe invert elevation at the property line.

The following information must be included on the profile portion of the drawing:

i. Vertical alignment of proposed sewer mains and foundation drain discharge
ii. collection sewers within the profile alignment;
iii. Elevation, diameter, and utility type of existing and proposed utilities which cross or intersect the profile;
iv. Diameter, grade (in percentage, accurate to two decimal places), pipe type, pipe class, bedding class, and length of sewer mains between each manhole;
v. Invert elevation of all pipes at each manhole; Rim elevation at each manhole;
vi. Calculated design flow rate, design flow velocity, and total flow capacity for each section of sewer main.
vii. Description of tie-in points of the proposed system to the existing system;
viii. Identification of areas requiring special construction methods such as trenchless installation methods, shored construction, casings, or limited working space areas;
ix. Chainage of BC and EC, radii, and curve length for curved sewers;
x. Identification of any unique manhole features including drop structures and safety platforms;
xi. Locations of riser connections to the sewer mains.

2.2.14 Detail Drawings

a.) Standard details and typical cross-sections must be included in the engineering drawings for each project.
b.) Standard details and typical cross-section shall be in accordance with the Engineering Standard Drawings, attached in Appendix A of these Municipal Engineering Standards or otherwise approved by the Town of Whitecourt
c.) Details and cross-sections shall be drawn to a scale that clearly portrays the required information with clarity and legibility.
d.) Deviation from design standards may require additional detailed drawings.

2.2.15 Intersection Grading Plan

a.) The plan shall include, at a minimum:
i) The curb return grades for all newly constructer curb returns.
ii) Elevations of catch basin rims.
iii) Intersection slopes to clearly indicate road transitions (i.e. crown/crossfall)

3. Roadways

PART I – DESIGN

3.1 General

3.1.1 Roadway design shall conform to the requirements of the Geometric Design Guide for Canadian Roads, Transportation Association of Canada (TAC) and Alberta Geomatic Design Guidelines, latest edition. Other references for roadway design include TAC's Metric Curve Tables and Design Vehicle Dimensions for Use in Geometric Design, latest editions.

3.1.2 Design of traffic calming measures for roadways shall be in accordance with TAC's Canadian Guide to Neighbourhood Traffic Calming, latest edition. Traffic calming measures include vertical changes in the road (speed humps, speed bumps, speed tables, raised intersections), lateral changes in the road (chicanes, offset intersections, lateral shifts), constrictions (narrowing's, pinch points, islands, parking), entrance features (gates, signs, surface treatments), and other measures intended alter driver behaviour, improve conditions for non-motorized road users, and improve the quality of life for residents on traffic calmed streets.

3.2 Definitions

3.2.1 Asphalt Concrete Base (ACB): Base course for arterials, industrial, commercial roadways, collectors and locals.

3.2.2 Asphalt Concrete Overlay (ACO): Surface paving for arterials, industrial and commercial roadways, collectors, and locals.

3.3 Road Classification

3.3.1 Classification and designation shall be in accordance with Alberta Geomatic Design Guidelines.

3.3.2 Roadways and walkways shall be classified during the subdivision/development planning stage.

3.3.3 Traffic calming measures may be required on all collector roadways.

3.3.4 The following table lists the required road cross-section and maximum operating speed for each road classification:

Road Classification	Roadway Lip-to- Lip Width (m)	Minimum* Right-of-Way Width (m)	Maximum Operating Speed (km/h)
Lane:			
Residential	6.0	10.0	
Commercial/Industrial	7.4	10.0	
Local Street:			
Residential	11.0	20.0	50
Commercial/Industrial	11.0	24.0	50
Collector Roads:			
Residential	13.0	20.0	50
Commercial/Industrial	13.0	30.0	50
Arterial Roads:			
Arterial - All	*15.0*	*30.0*	*60*

**The Town may require wider right of ways to accommodate all municipal infrastructure proposed in the development area.*

3.3.5 Roadways shall be classified as follows:

Classification	No. of Housing Units	Estimated Daily Traffic
Local	1 to 100	0 to 1,000
Collector	101 to 300	1,001 to 3,000
Arterial	301 & Up	3,001 & Up

Roadway Geometric Design

3.3.6 Vertical Geometrics

a.) Grade
   i. Maximum grade shall be 6.0%.
   ii. Minimum grade shall be 0.5% along gutters and 1.0% around curb returns and cul-de-sac bulbs.
   iii. For roadways connecting to an intersection, maximum grade shall be 2% over 30-m from the curb return. Minimum gradient or curb radii of 23m or less shall be 0.8%.
   iv. Utility lots shall have a minimum grade of 1% and a maximum grade of 8%.
   v. All roadways shall be crowned or shall have a cross fall for positive drainage. Refer to the applicable Engineering Standard Drawings in Appendix A.

b.) Vertical Alignment
   i. Vertical curves shall meet the following requirements:

	K-Value[1]	
Design Operating Speed km/h	**Crest M-Value**	**Sag M-Value**
50	7	6
60	15	10
70	22	15

1 – K = L/A, where L equals length of vertical curve in metres and A equal's algebraic difference in grade percentage.

   ii. The minimum length of a vertical curve shall be 30 m on local roads, 50 m on collector roads, 60 m on undivided arterial roads, and 70 m on divided arterial roads.
   iii. Vertical curves are not required where the algebraic difference in grade, A, is less than 1.5%.
   iv. For inverted vertical curves, a minimum grade of 0.5% shall be maintained along the gutter line.
   v. The Town may stipulate additional requirements where collector or arterial roads require super elevation.
   vi. Lanes shall have a minimum longitudinal grade of 1%. if gravel surfaced, the land shall be cross sloped from both sides from crown at 3%. If paved that lane shall have a center swale and inverted slopes of 2.5%.

3.3.7 Horizontal Alignment

a.) Roadway alignment shall be centered within the right-of-way.
b.) Right-of-way shall be of adequate width to accommodate the carriageway, ditches, boulevards, underground utilities, street lighting, etc. in a manner acceptable to the Town.
c.) Straight or near-straight residential roadways shall have a maximum unimpeded length of 200 metres, unless traffic calming measures are provided.
d.) Horizontal curves shall meet the following requirements:

Road Classification	Minimum Curve Radius (m)	Maximum Grade (%)	Minimum Tangent Length (m)	Minimum Intersection Spacing (m)
Local Roads:				
Residential	90	6	30	60
Residential Cul-de-Sac	90	6	30	60
Industrial	90	6	30	60
Collector Roads:				
Minor Residential Collector	90	6	60	60
Major Residential Collector	130	6	60	60
Industrial	130	6	60	60
Arterial Roads:				
	225	5	150	180

3.4 Intersections

3.4.1 The minimum angle of intersection of two roadways shall be 75.

3.4.2 Intersection design must incorporate good design practice with respect to sight distances and other safety considerations.

3.4.3 Intersections for local and collector roadways shall be spaced at least 60 m apart, as measured along the road centreline. The Town shall determine the appropriate location of intersections for arterial roadways.

3.4.4 Where the projected traffic volume on arterial or major collector roadways warrants the provision of acceleration/deceleration turning lanes at an intersection, the Developer shall provide for the widening of the arterial road right-of-way, as required.

3.4.5 Intersection corner cut-offs shall be a minimum of 6.0 m. For the intersection of two major collector roadways, the intersection corner cut-offs shall be a minimum of 10 m. For the intersection of a collector roadway with an arterial roadway, the intersection corner cut-offs shall be a minimum of 8 m for the collector roadway and 15 m for the arterial roadway. For the intersection of two arterial roadways, the intersection corner cut-offs shall be a minimum of 15 m.

3.5 Cul-de-Sacs

3.5.1 Typical cul-de-sacs are a maximum of 120 m in length, as measured from the adjoining roadway's nearest curb line to the start of the cul-de-sac's bulb. Cul-de-sacs which exceed 120 m but that are less than 170 m in length require an additional hydrant and looping of the water main to the cul-de-sac. Cul-de-sacs which exceed 170 m in length require a minimum 6.0 m wide public utility lot (PUL) for emergency vehicle access and looping of the water main. Any PUL which is required for emergency vehicle access shall be developed to a standard acceptable to the Town and shall include provisions for limiting public vehicle access. Refer to the Engineering Standard Drawings.

3.5.2 In the case where the cul-de-sac cannot be graded to drain towards the adjoining road, a PUL must be included to provide an outlet for overland flow.

3.5.3 Cul-de-sac bulbs shall have a minimum radius of 14.0 m (16.0 m for commercial/industrial) from the centre to the lip of gutter. Bulb road surfaces may be crowned or crossfall sloped for drainage, at a minimum grade of 1.0% and maximum grade of 3.0% outward from the centre of the bulb.

3.5.4 Islands may be provided in cul-de-sacs. Islands should be designed to allow minimum turning movements of passenger vehicles and have sufficient width to allow for parallel parking. Islands shall be complete with standard curb and gutter, catch basins, and shall also contain a sub-surface drainage system connected to the nearest catch basin and landscaping in accordance with Sections 8 - 14 inclusive and relevant detail drawings.

3.5.5 Temporary gravel turnarounds shall be provided at the end of all subdivisions where future extensions are proposed. The temporary turnaround shall be constructed to the same road base standard as the adjacent permanent road.

3.6 Driveways

3.6.1 Lot layouts shall be such that driveways do not connect directly to any arterial roadways or major collector roadways

a.) Residential - not permitted.

b.) Commercial / Industrial - limited to 50 m to 60 m.

c.) Shared approaches may be required and turning lanes.

3.6.2 A minimum clearance of 3.0 m shall be provided between driveways and adjacent street furniture to either side, except in single detached dwelling sites where a minimum clearance of 1.83 m may be provided. Street furniture placement shall be carefully considered to allow optimum driveway and apron width.

3.6.3 Driveways shall be in accordance with the Engineering Standard Drawings.

3.6.4 Driveways shall not be permitted to connect to an abutting road through a curb return area.. Single family residential driveways shall be a minimum of 12m from the front of curb of the adjacent roadway. All other developments shall not be less than 50m from the front of curb of any arterial or major collector, and shall not be less than 20m from the front of curb of any other public road.

3.7 Pavement Structure

3.7.1 The recommendations of the geotechnical report (from a professional geotechnical firm) shall form the basis of the pavement structure design.

3.7.2 The geotechnical report must include recommendations for pavement structure on insitu conditions and projected traffic volume. The stronger of the 20-year structure recommended in the geotechnical report shall be used.

3.7.3 Pavement shall be designed in such a way that pavement structure recommendations address performance. The design parameters used by the designer such as Equivalent Single Axle Loadings (ESAL's), California Bearing Ratio (CBR), etc. are to be outlined in the design report. The Town reserves the right to require a structural analysis of the pavement, at the Developer's expense, prior to Final Acceptance Certificate.

3.7.4 Pavement structure thicknesses minimums and recommended ESAL's as follows:

Street Classification	Minimum Traffic ESAL's (80kN Axles)	Alternate 1			Alternate 2	
		Asphalt Concrete (mm)	Granular Base (mm)	Granular Sub-Base (mm)	Asphalt Concrete (mm)	Granular Base (mm)
Local Residential	9×10^4	75	150	200	75	300
Local Commercial/ Industrial	8.6×10^5	100	250	300	100	450
Collector Residential	1.35×10^6	100	300	300	100	500
Collector Commercial/ Industrial	2.7×10^6	125	250	350	125	500
Arterial	4×10^6	125	300	350	125	550

3.7.5 When tying new pavement into existing pavement, a minimum 0.75 m wide strip shall be milled out of the existing pavement along the joint of the tie-in to the new pavement, and the joint paved to tie the two pavement surfaces together and prevent separation and differential settling.

3.7.6 Temporary roadways and accesses must be suitably designed for the required service life. The design of such temporary road infrastructure shall be subject to the review and acceptance of the Town.

3.8 Asphalt Surface

3.8.1 Asphalt surface shall not be placed until the base course has been inspected and approved by the consulting engineer. Asphalt materials, mixing, spreading, and rolling shall conform to good practice using ATU's Standards as a guideline.

a.) Manholes, water valve boxes and catch basins are to be raised to finished grade prior to paving operation. The contractor is fully responsible to ensure that all manholes, water valves and catch basins are left in the same condition prior to the work in the contract.
b.) No paving is to be done when the atmospheric temperature is lower than 2 degrees Celsius or if the surface is frozen unless directed by the Town engineer.

3.8.2 The asphalt hot mix concrete pavement shall meet the following test requirements based on the 75 Blow Marshall Method for heavy traffic areas and 50 Blow Marshall method for light/medium traffic areas.

3.8.3 All asphalt concrete thickness to be compacted to 98% density and densities are subject to normal reduction clauses for deficient areas.

3.8.4 Asphalt concrete thickness – for areas deficient in thickness, monies shall be accrued to the Town as follows:

- Areas deficient in thickness by more than 15 mm will not be accepted.
- For areas deficient in thickness by more than 5% of the total design thickness and less than 15mm, the Town shall receive an amount calculated by the following formula:

$$\text{Amount to town} = \left[1 - \frac{(\text{actual thickness})^2}{(\text{specified thickness})^2} \right] \text{ X Current ACP Price}$$

The current ACP Price shall be determined based on recent similar work performed in the Town.

3.8.5 Asphalt Density

3.8.5.1 All asphaltic concrete to be compacted to 98% of density obtained with field Marshall specimens prepared from the samples of mixture being used.

3.8.5.2 For area deficient in density, monies will be accrued to the Town as follows:

Asphalt Concrete Pavement Deficient for Density					
A		B		C	
Specific Density = 97%		Specific Density = 96%		Specific Density = 95%	
Field Density	**Payment Reduction Factor (%)**	**Field Density**	**Payment Reduction Factor (%)**	**Field Density**	**Payment Reduction Factor (%)**
97.0 to 96.6	0	96.0 to 95.6	0	95.0 to 94.6	0
96.5 to 96.1	3%	95.5 to 95.1	3%	94.5 to 94.1	4%
96.0 to 95.6	7%	95.0 to 94.6	9%	94.9 to 93.6	12%
95.5 to 95.1	14%	94.5 to 94.1	18%	≤ 93.5	Remove and Replace
95.0 to 94.6	24%	≤ 94.5	Remove and Replace		
≤ 94.5	Remove and Replace				

3.9 Noise Attenuation

3.9.1 A Noise Impact Assessment, signed and sealed by a professional engineer, may be required in cases where a major arterial roadway and/or railway runs through or adjacent to a proposed residential development. The assessment must list the current noise levels, estimate future noise levels, and identify noise attenuation measures in accordance with the Town's Noise Bylaw.

3.10 Transit Stops

3.10.1 The Town's Infrastructure Department will aid with locating transit stops for the Development during the Area Structure Plan process.

3.10.2 The Town may require transit shelters be installed at specific transit stops. In such situations, the Town will provide the Developer/Consultant with the necessary specifications and design details.

3.11 Roadway Signage

3.11.1 The Developer shall be responsible to organize, order, install, and maintain (up until FAC) all signs necessary to provide safe vehicle/pedestrian navigation through the Subdivision including, but not necessarily limited to, regulatory signage, street name signage, transit signage, construction warning signage, and construction development signage, whether temporarily and permanently installed.

3.11.2 Roadway signage layout and design shall conform to TAC's Manual of Uniform Traffic Control Devices for Canada, latest edition.

3.11.3 Refer to Appendix "I" for further requirements for signage.

3.11.4 Barrier post requirements are provided in the Engineering Standard Drawings.

3.12 Roadway Lighting

3.12.1 All residential areas, institutional areas, and commercial areas require street lighting. The street lighting requirements for industrial areas will be evaluated on a case by case basis.

3.12.2 Roadway lighting shall be designed in accordance with the following, as approved by Fortis Alberta:

a.) Lighting for local roadways shall conform to Roadway Lighting, Illuminating Engineering Society of North America, RP-8-00. LED lighting shall be utilized;
b.) Lighting for collector and arterial roadways shall conform to Guide for the Design of Roadway Lighting, Transportation Association of Canada, latest edition.

3.12.3 Street lights shall be placed at location not interfering with proposed driveways and shall be located in line with the extension of common property lines between two lots.

3.12.4 Lighting at intersections shall conform to the design criteria for the higher classified road.

3.12.5 All street light and power cables to be installed underground in locations approved by the Town.

3.13 Pavement Markings

3.13.1 Introduction

a.) The principles and standards governing pavement marking application are set out in the Canadian Manual of Uniform Traffic Control Devices and as approved by the Town. The guidelines in this document incorporate specific Town of Whitecourt standards to meet local needs and conditions.
b.) Four categories of pavement marking are discussed:
   i. Longitudinal
   ii. Transverse
   iii. Symbols and Letters
   iv. Parking
c.) Additional types and styles of line marking have been proven through best practices in the industry, however at the time of revision of this document, the Town utilizes the types of markings included in these standards on a consistent basis. Additional markings may be performed and added to the guidelines in later revisions.
d.) It is important to note that these standards may be altered for unusual traffic conditions. However, such special situations should be considered exceptions to the rule. Engineering judgment and practical experience are necessary supplements to the use of these standards.
e.) Users of the following standards are assumed to have a basic understanding of traffic engineering terms and be able to recognize the related traffic movements. These standards should be used as a first reference. Where no specific guidelines are provided, the Canadian Manual of Uniform Traffic Control Devices standards are to be used.
f.) Thermoplastic inlaid pavement markings shall be installed for all arterial collector and high density applications.
g.) Thermoplastic inlaid pavement markings shall be installed in all other circumstances with the exception of residential subdivision lane delineators starting at 40m from any intersection traveling into the subdivision.

3.13.2 Longitudinal Markings

a.) Longitudinal markings are lines along the length of the roadway indicating to the driver proper position on the roadway (delineated travel lanes) and may indicate proper direction of travel (yellow centre line to the left).
b.) Directional Dividing Lines
   i. Directional Dividing Lines are used to designate the separation between the portions of the pavement of a two-way road which are available for travel in opposing directions.
   ii. The Directional Dividing Line shall be a solid 10 cm in width and yellow in color.
   iii. Directional Dividing Lines shall be applied:

- For the entire length of roadway for an Arterial road, where no concrete divider is present.
- A minimum of 30 m back along a Collector roadway, where it meets an Arterial Roadway.
- On Collector roads where geometric conditions and/ or specific transit requirements warrant increased guidance to the motorist including, but not limited to, locations with existing:
  - Pavement width transitions
  - Horizontal or vertical curves where sight line distances are of a concern
  - At locations where a penalty box or extended stop bar is distant from an existing concrete divider. The directional dividing line will extend from the concrete divider to the front stop bar.
- A minimum of 30 m in advance of any Railway Crossing.

iv. On most roadways, the directional dividing line will coincide with the geometric centre of the pavement surface. In some cases, however, the directional dividing line may be located in an off-centre position to make more efficient use of the roadway space. Typical examples of this exception include:
- Pavement width transitions.
- Added turning lanes at intersections.
- An uneven number of lanes in each travel direction.
- Zones with parking on one side of the roadway.

c.) Lane Lines

i. Lane lines delineate the edge of travel lanes where there are 2 or more travel lanes on the same side of the Directional Dividing Line (same direction of flow). They are utilized to direct traffic into designated travel lanes as required.

ii. Lane lines shall be used where more than one travel lane in the same direction is present and shall be placed:
- Throughout the entire length of pavement on all arterial and major divided collector roads, where parking is not permitted.
- On collector roads at approaches to signalized intersections where the pavement surface width allows for more than one travel lane and/ or directional guidance is required for traffic movement.
- Lane Lines should extend back from a stop line for a minimum of 30 m. Minimum Lane Width = 3.5 m measured from lip of gutter.
- Maximum Lane Width = 4.2 m measured from lip of gutter.

iii. Lane Lines shall be:
- Used to designate lane movements in the same direction of flow of traffic that carry on continually straight down the roadway.
- 10 cm in width.
- White color.
- 3.0m long segments with 6.0 m long gaps between the lane lines where lane changes are allowed.
- Solid throughout, where lane changes are not allowed (example: Free Flow Lanes) Minimum distance of these solid sections shall be 60 m.
- Terminated at the stop bar, or 4.65 m back from the perpendicular lip of gutter at an intersection.
- Start from the back side of a crosswalk at an intersection or 3.65 m back from the perpendicular lip of gutter at an intersection.
- When approaching an intersection, the last 3.0 m lane line shall be placed coming off of the stop bar and the next 2 to 3 lanes lines fitted as best possible to maintain the 3:6 line marking to gap ratio.

d.) Continuity Lines

i. Continuity lines indicate the continuation of the through-travel lane from dedicated turning lanes and from merging/diverging lanes:

ii. Continuity Lines shall be:
- 20 cm in width
- White in color.
- Used at all acceleration and deceleration lanes
- Used to separate auxiliary turn lanes from through lanes at intersections
- 3.0 m long segments with 3.0 m long gaps between the lane lines where lane changes are allowed.
- Solid throughout, where lane changes are not allowed (example: Penalty Box).

iii. Continuity lines are not required for right turn cut off lanes, where no auxiliary turning lane exists.

iv. For turning lanes or merging lanes that are created through pavement width transitions (the lanes are created through widening of the road), the 20 cm Continuity Line will run parallel with the 10 cm Lane Lines and shall start where the concrete lip of gutter falls away, keeping the minimum width of the straight thru lane.

v. For turning lanes that are created from a previous straight through lane (where 10 cm Lane Lines must turn into 20 cm Continuity Lines) the 20 cm Lane Lines shall start a minimum of 12 seconds of travel time prior to the gore line of the turning movement (or from the stop bar if there is no island at the intersection).
   - On a 60 km/hr roadway this distance = 192 m or approximately 32, 20 cm Lane Lines.
   - On a 50 km/hr roadway this distance = 168m or approximately 28, 20 cm Lane Lines.

   The Town may impose an increase or decease in turning lane distances were warranted.

vi. When approaching an intersection, the last 3.0 m lane line shall be placed coming off of the stop bar and the next 2 to 3 lane lines fitted as best possible to maintain the 3:3 line marking to gap ratio.

e.) Pavement Edge Lines (Shoulder Lines)

i. Edge Lines or Shoulder Lines are used to indicate the limits of the travel lane, such as to separate the travel lane from a paved shoulder.

ii. Edge Lines shall be:
   - Continuous 10 cm solid White line when placed to the right of the travel lane, when not used at a merging or diverging zone.
   - Continuous 20 cm solid White line when placed to the right of the travel lane when used for merging or diverging zones.
   - Continuous 10 cm solid Yellow line when placed to the left of the travel lane.

iii. Typical use of Edge Line markings includes:
   - Where paved shoulders are present in merge and diverge zones
   - At pavement width transitions
   - At V-gutters
   - Where obstructions on the shoulder may be considered to constitute a hazard to the motorist in that lane.

f.) Guide Lines

i. Guide Lines provide travel path guidance to drivers as they proceed through an intersection or merge into proper travel lanes.

ii. Guide Lines shall be 10 cm in width, 0.5 m in length with 0.5 m gaps, and:
   - White; when on the driver's right-hand side, or
   - Yellow when on the inside lanes' driver's left-hand side (i.e. centreline of roadway to centreline of roadway).

iii. Guide Lines shall be used at the following locations:
   - Where a multi-lane turn is present.
   - Where the uphill/downhill roadway grade requires Guide Lines for improved safety of traffic flow.
   - Where the roadway grade changes inside the intersection.
   - At intersections where approaches are not at 90° to each other and driver error may occur. Site specific.

3.13.3 Transverse Markings

a.) Transverse line markings are aligned crossing the roadway to indicate zones of pedestrian crossings or stop locations for vehicles.

b.) Crosswalk Lines

i. Pedestrian Crosswalk Lines indicate a specific zone of pedestrian travel, and are used where there is a conflict between vehicular movement and pedestrian movement. In the Town of Whitecourt, any intersection is a pedestrian crossing, unless otherwise signed as such through traffic control devices.

ii. The Town follows the guidelines expressed in the Transportation Association of Canada; Pedestrian Crossing Control Manual, for the placement of all pedestrian crosswalks.

iii. Standard Pedestrian Crossings utilize two parallel lines running across the roadway to signify the safe crossing area for the pedestrian. Standard Pedestrian Crossings shall:
   - Consist of 2 parallel lines running across the complete width of the roadway.

- Shall be White in color.
- Shall consist of 2, 10 cm wide lines.
- Shall be 3.0 m apart from centerline to centerline. The width may be increased based on location and pedestrian demand, as recommended by the engineer or as requested through the Town.
- The inside crosswalk line (nearest to the centre of the intersection) must be a minimum of 0.65 m back from the extended line of the perpendicular roadway curb face.

Locations where Standard Pedestrian Crossings shall be used are:

- At fully signalized intersections, including right turn cut offs.
- At pedestrian activated signal crossings
- At pedestrian activated warning flashers
- At 4-way stop controlled intersections with sidewalks
- At Collector / Arterial intersections where pedestrian and vehicle conflict is high.
- Intersection locations where a warrant study has been performed and a pedestrian crossing is warranted.

iv. Zebra Bar Pedestrian Crossings

A Zebra Bar Pedestrian Crossing utilize multiple “bars” that flow parallel with the direction of traffic flow, but are placed crossing the width of the roadway to signify the safe crossing area for the pedestrian at locations where a motorist may not normally expect a pedestrian.

Zebra Bar Pedestrian Crossings shall be placed at:

- Mid-block crossings
- Right turn lanes at intersections where islands exist;
- Locations where motorists would not normally expect pedestrian crosswalks;
- Where engineering analysis reveals that the standard pedestrian crosswalk is inadequate.

Zebra Bar Pedestrian Crossings shall be:

- Placed with each bar running parallel with the roadway (parallel to the travel direction)
- 60 cm in width
- 4.0 m in length on roads with a speed limit of 60km/hr or less
- 5.0m in length on roads with a speed limit greater than 60km/hr
- White in color
- Placed in an effort to minimize vehicle tire exposure to the material.

Zebra Bar Pedestrian Crossings are not placed at signalized crossing locations, fully signalized intersections, pedestrian activated traffic signals or pedestrian activated flashing amber crossings.

c.) Stop Bar Lines

i. Stop Lines are used to indicate the point at where a vehicle must stop in compliance with a traffic signal, stop sign or other specific requirement to stop.

ii. Standard Stop Lines

Standard Stop Lines are used at all locations other than Railway Crossing locations, where a Stop Line is deemed necessary.

Standard Stop Lines shall be used:

- At all signalized and multi-way stop controlled intersections.
- At intersections of Arterial / Collector Roadways

Standard Stop Lines shall be:

- 30 cm in width
- White in color
- Applied to the complete distance (width of road) for all travel paths entering into the intersection.
- Installed a minimum of 1.0 m back from the nearest point (if the crosswalk runs at an angle) of the closest crosswalk line.
- Applied perpendicular to the travel lanes of the roadway
- If no crosswalk exists, the stop line shall be placed a minimum of 4.65 m back from the extended line of the perpendicular roadway curb face, unless otherwise specified by the Town.

- The Stop Line on the same side of the intersection where the actual pedestrian crossing markings are located at all Pedestrian Activated Signal Crossings shall be placed 16.0 m back from the pedestrian push button pole.

iii. Railway Crossing Stop Lines

Stop Lines used at all Railway Crossings

Railway Stop Lines shall be:

- Solid 30 cm wide lines, 30 cm spacing between them
- White in color
- Placed a minimum of 5.0 m back from the nearest point of the railway tracks to the nearest stop line.
- Placed perpendicular to the flow of traffic and roadway for the complete lane width of all lanes approaching the railway crossing.

d.) Gore Areas

i. Gore area markings are used to define the beginning and the end of merging and diverging area zones and the approaches to structures in the roadway.

ii. Gore area markings shall:

- Be solid 10 cm wide Yellow Centre Line where traffic passes the gore area in opposing directions.
- Extend from a point 10 m past the point of the physical barrier to a point where the lane widths in opposing travel directions are a constant width.
- Be solid 10 cm wide White lines where traffic passes by the gore area in the same direction on roadways with a speed limit of 70 km/h or less.
- Be unmarked inside the gore area lines unless safety concerns warrant interior markings.
- Extend from the point of the physical obstruction to a point where the lane width of the ramp and through lane reach 5.5 m and 3.7 m (or designed lane width), respectively, when in the same direction of flow.

iii. For left turn slab-on islands, the pavement markings shall be:

- 10 cm in width
- White in color

e.) Diagonal Lines

i. Diagonal markings indicate roadway areas that are not to be used as part of the travel lane, or stopping area.

ii. Chevron Lines

The interior of Gore Areas may be marked with diagonal lines to guide traffic away from the object.

Where traffic is required to pass to the right of the area, the lines must be Yellow.

Where traffic is required to pass to the left of the area, the lines must be White.

Chevron Lines shall:

- Placed at an angle of 2:1 in the direction of travel (2 units along the direction of travel to 1 unit per perpendicular to the direction of travel).
- 45 cm wide, unless otherwise specified by the Town (where it they be requested to be 60 cm wide).
- Have a minimum of 2.0 m distance between Chevron bars.

iii. Stop Box Lines

Stop boxes may be applied on approaches to signalized intersections where the potential for vehicle movement conflicts exist.

The lines used to mark the stop box shall be:

- 10 cm in width (the inside diagonal lines).
- White in color (the inside diagonal lines).
- Laterally defined by the curb and the roadway centerline. Alternatively, in instances of only a single lane Stop Box, defined by the Continuity Lines (which shall run as a solid 20 cm line from the Stop Line to the back line of the cross walk) and the centerline.
- Longitudinally defined by the near side of the crosswalk and the stop line.
- 2 intersecting diagonal lines inside the stop box, centered.

- A minimum length of 6.0 m. This is the distance from back line of the crosswalk to the Stop Box Stop Line.
- Some multi-lane roads may require staggered Stop Boxes or a Stop Box for the inside lane only, rather than one single Stop Box across all lanes. Traffic movement conditions at the intersection should be considered in determining the appropriate stop box arrangement.

3.13.4 Symbols and Letters

a) The goal of the use of symbols is to obtain uniformity and to prevent confusion by utilizing symbols that have restrictive messages that are clearly evident to the driver.

b) Arrows

i. Arrows are used to indicate necessary vehicle movement that is permitted in a travel lane. Use and placement of the arrows are dependent upon lane design and roadway speed. They shall be used in conjunction with other traffic control devices such as lane designation signs mounted overhead or to the side of the road.

ii. The Town does not use the standard MUTCD Pavement Arrows. The Town's standard style of arrows is as shown in Appendix A Engineering Standard Drawings.

iii. Through (Straight) Only Arrows are not common, and are only used where movements in specific lanes are not well indicated.

iv. Left or Right Turn Arrows
Turn arrows indicate a mandatory turn is necessary and the lane it is located in will end. Turn arrows shall be used:
- At intersections where a lane that was a through-only lane before the intersection is required to make a forced left or right turn.
- At "unprotected" left turn lanes; i.e. where no curb is present between the left-turn lane and the traffic travelling in the opposing direction.

v. Through-Left or Through-Right (Double) Arrows
- Double Arrows indicate optional movements of continuing straight thru or making a turn at the intersection.
- Double Arrows shall only be used when necessary in the lane parallel with a forced left / right turn lane.
- The tail of the parallel arrows (the turning movement and the double arrow) shall be aligned in the lane ways.

c) Railway Crossing "X"

i. The Railway Crossing "X" is used to provide warning of an upcoming railway crossing.

ii. The Railway Crossing symbol shall be:
- White in Color
- Have 30 cm line width
- 6.0 m in length
- 2.5 m in symbol width (from outside edge to outside edge at the top and bottom of the "X")
- Located 10 m past the Railway Crossing Warning Sign (closer to the RR tracks).

3.13.5 Parking Line Markings

a) Parking Lines may be used to delineate parking stalls.

b) Standard Parking Lines (including Angle Parking) shall be:
i. White in colour
ii. 10 cm wide, solid line
iii. Minimum 6 m in length
iv. Minimum 3 m in stall width
v. Placed to leave a minimum drive aisle of 7.0 m in width

c) A Parallel Parking Stall must be marked as a minimum of 3 m wide and 7.0 m in length.

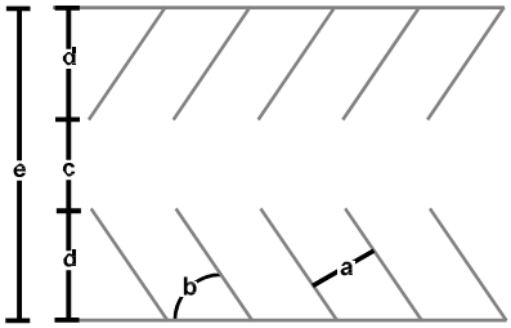
d) Disabled Parking Stalls shall be:
i. White in colour
ii. 10 cm wide, solid line
iii. Minimum 7.0 m in length
iv. Minimum 3.7 m in stall width

v. Clearly marked with the standard Disabled Parking Symbol
vi. Clearly marked with Traffic Control Devices showing the specific parking location or zone for the disabled.

e) Parking Lot lines can be white or yellow in colour.

f) Parking lot line layout to be according to the following minimum parking dimensions:

Stall Width (a)	Parking Angle (b)	Aisle Width (c)		Stall Depth Perpendicular to Aisle (d)	Parking Unit Depth (e)	
		One-Way	Two-Way		One-Way	Two-Way
7.0m	0°	3.4m	7.0m	3.0m	9.4m	13.0m
3.0m	30°	3.1m	7.0m	5.4m	13.9m	17.8m
3.0m	45°	3.6m	7.0m	6.1m	15.8m	19.2m
3.0m	60°	6.0m	7.0m	6.4m	18.8m	19.8m
3.0m	90°	7.0m	7.0m	6.0m	19.0m	19.0m



PART II – MATERIALS

3.14 Sub-grade Materials

3.14.1 Sub-grade materials shall be free of deleterious material.

3.15 Granular Base Course

3.15.1 Granular materials for base courses shall conform to the following gradation (CAN/CGSB-8.2- M):

Sieve Size	Percent Passing
20.0 mm	100
12.5 mm	60 – 92
5.0 mm	37 – 62
2.0 mm	26 – 44
400 µm	12 – 27
160 µm	7 – 18
80 µm	2 – 10

3.15.2 Granular materials for base courses shall comply with the following:

Aggregate Property	Tolerance
Coarse aggregate (> 5,000 µm) with ≥ 2 fractured faces (by mass) Plasticity	60% minimum
index (< 400 µm)	6 maximum
Liquid Limit	25 maximum
Lightweight pieces (by mass)	2% maximum

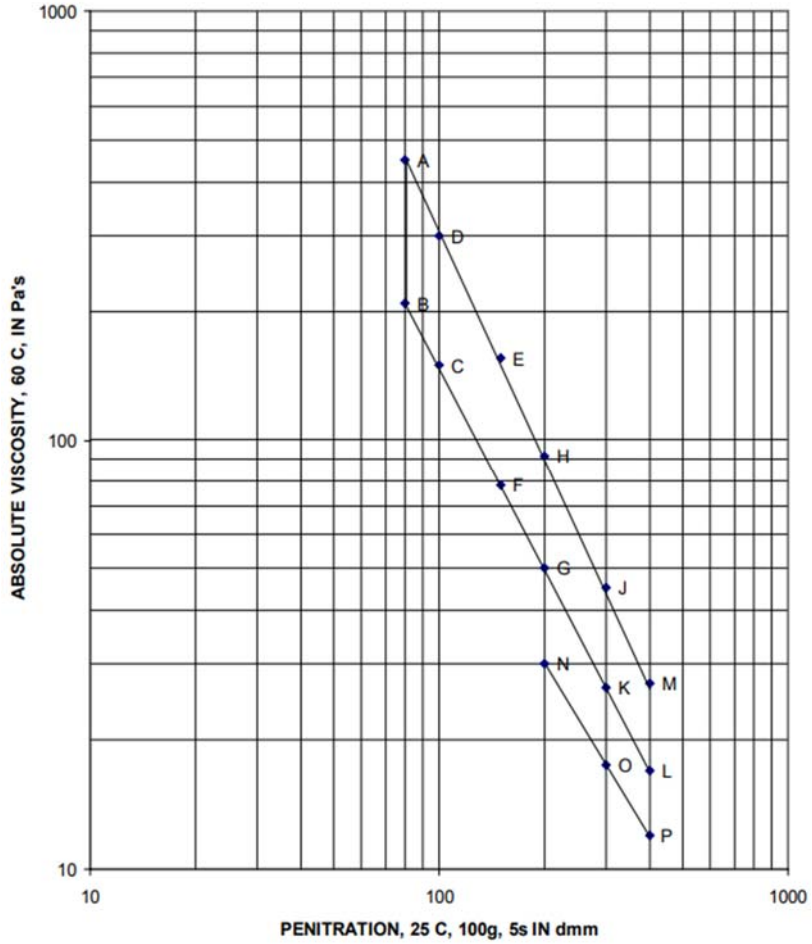
3.15.3 Crushed aggregate shall consist of sound, hard, and durable particles of sand, gravel, and rock. Crushed aggregate shall be free of flaky particles, soft shale, coal, ironstone, clay lumps, organic material, and other deleterious material.

3.16 Asphalt Cement

3.16.1 The asphaltic binder shall be prepared by the refining of petroleum, uniform in character, shall not foam when heated to 175 ºC, and shall meet the following requirements:

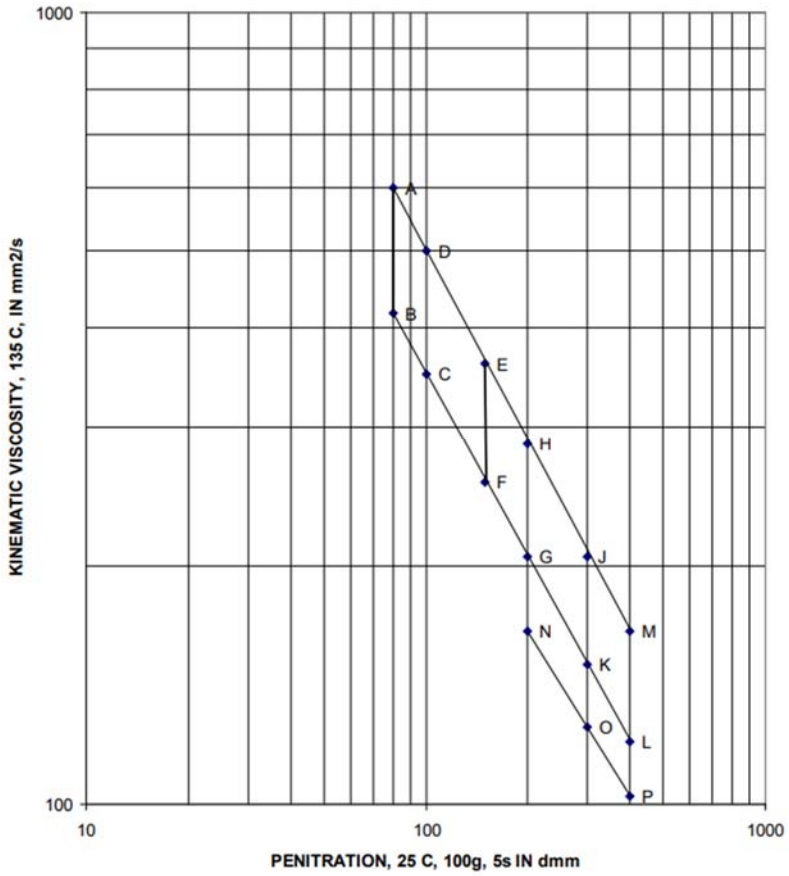
a) Absolute viscosity, to ASTM-D2171, and penetration, to ASTM-D5, must fall within the area plotted on the following log-log scale chart:

Asphalt Cement Absolute Viscosity



b) Kinematic viscosity, to ASTM-D2170, and penetration, to ASTM-D5, must fall within the area plotted on the following log-log scale chart:

Asphalt Cement Kinematic Viscosity



c) Flash point, by Cleveland Open Cup Method, to ASTM-D-92, minimum 205 ºC.

d) Solubility in Trichloroethylene, to ASTM-D2042, minimum 99.5%.

e) Absolute viscosity tests, to ASTM-D2171, on residue from Thin Film Oven Test, to ASTM-D1754, shall yield a maximum ratio of absolute viscosity of residue to the absolute viscosity of the asphaltic binder of 4.0.

f) Ductility at 25 ºC, to ASTM-D113, maximum 100 cm.

g) The temperature at delivery to the site shall be between 135 and 175 ºC.

3.17 Aggregate

3.17.1 Aggregate for ACO shall comply with the following gradation:

Sieve Size	Percent Passing
12.5 mm	100
10.0 mm	85 - 92
5.0 mm	65 - 78
800 µm	27 - 45
63 µm	4 - 10

3.17.2 Aggregate for ACB shall comply with the following gradation:

Sieve Size	Percent Passing
25.0 mm	100
12.5 mm	75 - 90
10.0 mm	65 - 85
5.0 mm	40 - 65
800 µm	20 - 36
63 µm	2 - 10

3.17.3 Coarse aggregate is the total aggregate retained on a 5 mm sieve. Fine aggregate is the total aggregate which passes through a 5 mm sieve.

3.17.4 Aggregate shall comply with the following:

Aggregate Property	Type	
	ACB	**ACO**
Coarse aggregate (> 5,000 µm) with ≥ 2 fractured faces (by mass)	70% minimum	75% minimum
Plasticity index < 400 µm (by mass)	0%	0%
L.A. abrasion wear (by mass)	32% maximum	32% maximum
Soundness loss (by mass)	16% maximum	16% maximum
Lightweight pieces (by mass)	2% maximum	2% maximum

3.17.5 Aggregate shall be sound, hard, and durable, free of elongated particles, soft shale, clay lumps, organic material, and other deleterious material.

3.17.6 Fine aggregate shall contain 75-85% (by mass) of manufactured or crushed fines. Pit run material shall be pre-screened to remove natural sand and then crushed to produce manufactured fines.

3.17.7 Where authorized by the Town, mineral filler may be added as necessary to meet the specified gradation. Mineral filler may consist of Portland Cement, fly ash, ground limestone, or such other commercially ground stone dust, as accepted by the Town. Mineral filler shall have a plasticity index of zero and shall conform to the following gradation:

Sieve Size	Percent Passing
400 µm	100
160 µm	90 minimum
80 µm	70 minimum
45 µm	62 minimum

3.18 Asphalt Concrete Mix Design

3.18.1 The mix design shall be carried out by a qualified laboratory following the Marshall Method of Mix Design, and conforming to the following criteria:

Mix Type	ACB	ACO
Maximum size of aggregate	25 mm	12.5 mm
Number of blows	75	75
Minimum stability	6.7 kN	6.7 kN
Flow value	1.5 – 3.0 mm	1.5 – 3.0 mm
Air voids (% of total mix)	4.0% ± 0.4%	4.0% ± 0.4%
Voids filled	67 – 78%	68 – 80%
Minimum crushed face count	70%	75%
Minimum film thickness	6.0 µm	7.0 µm

3.18.2 Tolerances

a) Aggregate Gradation:

Sieve Size	Percent Passing by Mass	
	Individual Sample	Average of Last 10 Samples
5.00 mm	± 5.0	± 3.0
1.25 mm	± 4.0	± 2.5
630 µm	± 3.0	± 2.0
315 µm	± 3.0	± 2.0
160 µm	± 2.0	± 1.5
80 µm	± 1.5	± 1.0

b) Asphalt Content:
   i) ± 0.3% from the mix design.
c) Mixing Temperature:
d) ± 9 ºC from the mix design.

3.19 Prime Coats and Tack Coats

3.19.1 Prime coat shall be type MC-30 (medium curing) asphalt conforming to the following:

Asphalt Grade Requirements	ASTM Test	MC-30		RC-30		RC-70	
		Min	Max	Min	Max	Min	Max
Flash point, open tag, °C	D1310	38	--	--	--	--	--
Kinematic viscosity at 60°C, mm²/s	D2170	30	60	30	60	70	140
Distillation test: % by volume of total distillate to 360°C							
190°C	D402	--	--	15	--	10	--
225°C		--	25	55	--	50	--
260°C		40	70	75	--	70	--
315°C		75	93	90	--	85	--
Residue from distillation to 360°C Volume % by difference		50	--	50	--	55	--
Test on residue from distillation:							
Penetration at 25 °C, 100 g, 5 s, dmm	D5	120	250	80	120	80	120
Ductility at 25°C, cm	D113	100	--	100	--	100	--
Solubility in trichloroethylene, % by mass	D2042	99.5	--	99.5	--	99.5	--
Water, % by mass or volume	D95	--	0.2	--	0.2	--	0.2
Delivery temperature, °C	--	35	55	35	55	55	75

or grade SS-I-1 anionic emulsified asphalt, conforming to

Asphalt Grade Requirements	ASTM Test	SS-1	
		Minimum	Maximum
Absolute viscosity at 25°C, PA•s	D244	20	60
Residue by distillation, % by mass	D244	55	--
Settlement in 5 days, % difference by mass	D244	--	5
Storage stability test, 24 hr, % by mass	D244	--	1
Retained on No. 1000 sieve, % by mass	D244	--	-.10
Cement mixing test, % by mass	D244	--	2.0
Tests on residue from distillation:			
Penetration at 25°C, 100 g, 5 s, dmm	D5	100	200
Ductility at 25°C and 5 cm/min, cm	D113	60	--
Solubility in carbon tetrachlorine, % by mass	D2042	97.5	--
Delivery temperature, °C		40	70

3.19.2 Asphalt coats shall be uniform in character and shall have a refined petroleum base.

3.19.3 The asphalt coat shall not foam when heated to the application temperature range.

3.19.4 All tests on coats shall be completed within 15 days of the date of delivery. The settlement test may be waived where the coat is applied within 5 days of delivery. The 24-hour storage test may be used in lieu of the 5-day settlement test. In the case of a dispute with respect to the results of these two tests, the 5-day settlement test shall govern.

3.19.5 Dilute SS-1 emulsified asphalt with an equal amount of water for a 50% concentration.

3.19.6 Application rates shall be as follows:

Asphalt Type or Grade	Application Rate
SS-1	0.5 ± 0.2 L/m^2
MC-30	1.5 ± 0.5 L/m^2
RC-30/70	0.3 ± 0.1 L/m^2

3.20 Paving Equipment

3.20.1 Asphalt Plant

a) The asphalt mixing plant shall conform to ASTM-D995 and shall be capable of consistently producing a homogeneous mixture in which all aggregate particles are uniformly and thoroughly coated with asphalt.

3.20.2 Tack or Prime Coat Distributor

a) Distributor shall be self-powered, equipped with a tachometer, pressure gauge, thermometer, adjustable-length spray bar, positive displacement asphalt pump with separate power supply, heating coils, and a burner for even heating of asphalt.
b) The distributor shall be capable of maintaining a constant speed and distributing a uniform application of liquid asphalt over an area 4 m wide at the specified application rate.
c) The distributor shall also be equipped with a hand spray wand connected to a pressure distributor and capable of providing uniform application of liquid asphalt manually.

3.20.3 Paver

a) Paver shall be self-propelled with automatic screed controls to maintain grade from a reference stringline and to control crossfall, smoothness, and joint matching.
b) The paver shall also be equipped with a vibratory screed with extensions and augers capable of uniformly spreading the mixture to specified widths and depths without segregation or tearing.

3.20.4 Rollers

a) Rollers shall be self-propelled and reversible with static, steel-tired or pneumatic-tired rollers, or vibratory rollers. Pneumatic-tired rollers shall be equipped with wind skirts.
b) The rollers shall be equipped with wetting and scraping devices to prevent adhesion. Petroleum derivatives are not permitted for cleaning.
c) Rollers shall be capable of attaining the specified density and smoothness, and shall be able to obtain such within the available compaction time and compatible with the rate of hot-mix asphalt concrete placement.

3.21 Roadway Signage

3.21.1 Signage materials shall conform to TAC's Manual of Uniform Traffic Control Devices for Canada.

3.21.2 All roadway signage shall consist of diamond-grade reflective material for the lettering and background, except for black-coloured portions.

3.21.3 Street name signage shall be as per Town of Whitecourt "Guidelines of Extruded Corner Street Signs", refer to Appendix I

3.21.4 For cul-de-sacs with the same name as the adjoining roadway, include address numbering (100 mm high) on the street signage for the cul-de-sac at the adjoining intersection.

3.22 Pavement Marking

3.22.1 Equipment

a) Where the work is to be carried out on the Town's walking pathway system, equipment must be of an appropriate size to protect the pathway structure, surrounding surfaces, and adjacent appurtenances. Only equipment mounted on a half-ton truck-type chassis, or smaller unit, will be permitted. The equipment must be self-propelled and be equipped to apply the marking material according to the manufacturer's recommendations.
b) Where the work is to be carried out on the Town's road network, equipment proposed by the Contractor for use in carrying out the Work shall be subject to the review and acceptance of the Town.

3.22.2 Marking Materials

a) Marking materials shall be suitable for asphalt concrete surfaces and shall be available in both white and yellow colours. The material, while on the roadway surface and at any natural ambient temperature shall exist as a solid line with cold ductility that permits normal movement with the road surface without chipping or spalling. Propagation of a pavement crack through the lane marking material shall be excluded from this requirement.
b) Paint
   i. White Paint – CGSB 1-GP-12.1C, White 513-301.
   ii. Yellow Paint – Federal Standard 595, color 33538; or CGSB color 505-308.
   iii. Reflectance: White – Min. 80%; Yellow – Min. 50% (ASTM- E1347).
c) Cold and Hot Plastic Markings
   i. Colour:
      Yellow: Conforming to CGSB Colour #505-308 or U.S. Federal Standard 595a Colour chip 33538.
      White: Brilliant white or match U.S. Federal Standard 595a Colour 17886.
   ii. Water Absorption: Max. 0.5% (ASTM-D570).
   iii. Impact Resistance: Min. 1.13 J at 25°C (ASTM-D256).
   iv. Abrasion Resistance: Max. weight loss of 0.60 g (ASTM-D4060).

v. Chemical Resistance: No deterioration when in direct contact with asphalt cement in asphaltic materials or with sodium chloride or calcium chloride or other de-icing materials, and shall be resistant to the effect of ultraviolet light.
vi. Reflectance: White – Min. 70%; Yellow – Min. 45% (ASTM- E1347).
vii. Retroreflectivity: The initial reflectance for the in-place marking, measured 7 to 10 days after application, shall have the minimum reflectance values as follows:

Dry/Night: White – 200 mcd/lux/m^2, Yellow – 175 mcd/lux/m^2

viii. Retained Retroreflectivity: The reflectance for longitudinal lines, for at least 36 months after placement, shall have the minimum reflectance values as follows:

Dry/Night: White – 75 mcd/lux/m^2, Yellow – 60 mcd/lux/m^2

ix. Skid Resistance: Minimum vehicle skid resistance of the in place markings shall not be less than 45 based on Portable Skid Resistance Tester, Road Research Laboratory Road Note Number 27, British Standards Institution.
x. Curing Time: 10 to 35 min (controllable by installer).
xi. Cold Plastic Markings

Two component (cold-extruded and cold-curing) markings shall have a minimum specific gravity of 1.9 at 25°C (ASTM-D792).
The material shall be suitable for application on concrete and on new and old asphalt. Bond strength shall be sufficient for the material to remain in place for a minimum of 2 years when surface applied, and 3 years when "scratched" inlaid.
System 400 or accepted alternate.

xii. Hot Thermoplastic Markings:

Hot-extruded markings shall have a minimum specific gravity of 2.0 at 25°C (ASTM-D792).
Glass sphere content: Min. 20%; Max. 30%, by mass of thermoplastic material.
The material shall be suitable for application on new asphalt and old asphalt.
Bond strength shall be sufficient for the material to remain in place for a minimum of 2 years when surface applied, and 5 years when inlaid.
System 300 or accepted alternate.

d) MMA Spray Material
i. MMA Spray Material shall be manufactured for application by spraying onto pavement in liquid form with glass spheres dropped onto the material immediately after application, and shall have a minimum specific gravity of 1.6 at 25°C (ASTM-D792).
ii. Water Absorption: Max. 0.5% (ASTM-D570).
iii. Abrasion Resistance: Max. weight loss of 0.45 g (ASTM-D4060).
iv. Chemical Resistance: The compound shall not deteriorate by contact with sodium chloride, calcium chloride, or other chemicals used against formation of ice on roadways or streets, or because of oil content of pavement materials or from oil dropping from traffic. It shall be resistant to the effect of ultraviolet light.
v. Reflectance: White – Min. 75%; Yellow – Min. 50% (ASTM- E1347).
vi. Retroreflectivity: The initial reflectance for the in-place marking, measured 7 to 10 days after application, shall have the minimum reflectance values as follows:

Dry/Night: White – 200 mcd/lux/m^2, Yellow – 175 mcd/lux/m^2

vii. Skid Resistance: Minimum vehicle skid resistance of the in place markings shall not be less than 45 based on Portable Skid Resistance Tester, Road Research Laboratory Road Note Number 27, British Standards Institution.
viii. Curing Time: 5 to 20 min (controllable by installer).
ix. Dura-Spray 600 or accepted alternate.

e) Fill Material
i. To be used for any removal and fill applications, or repair of line markings.
ii. LRS 424 or accepted alternate.

f) Glass Beads
i. Glass beads shall be a minimum 80% true spherical shape, clear of cloudiness, dark inclusions, trapped air, or other defects.
ii. Index of Refraction: Minimum of 1.5 in accordance with CGSB 1-GP-71.

xiii. Gradation (ASTM-D1214):

Sieve Size	Percent Passing
850 µm	90 – 100
300 µm	15 – 50
180 µm	0 – 10

PART III – CONSTRUCTION

3.23 General

3.23.1 The following sections represent the minimum requirements for some typical, key construction procedures for roadway construction. These minimum requirements must be met or exceeded by the detailed construction specifications and drawings developed by the Consultant.

3.23.2 Construction activities must adhere to the provisions of the Erosion and Sediment Control Plan prepared for the Development in accordance with Section 1.10.1.7

3.24 Quality Assurance

3.24.1 The Consultant must maintain detailed records of all inspections and testing as evidence of compliance of the work with these Standards. These records shall be provided to the Town.

3.24.2 The Town may at any time require the Contractor to provide evidence of certification by the testing agency the materials and performance of the work meet these Standards.

3.24.3 The Consultant shall provide a written endorsement of the Contractor's compliance with these Standards with the application for the Construction Completion Certificate.

3.25 Quality Control Testing

3.25.1 The Developer shall retain the services of independent testing laboratories or agencies to conduct all quality control testing. The proposed testing laboratory or agency shall be subject to the acceptance of the Town.

3.25.2 Minimum quality control test frequencies, specified as follows, are the minimum number required. The Developer shall ensure that as many tests as necessary are performed to ensure that the work conforms to the requirements of these Standards, regardless of the minimum number specified.

3.25.3 Moisture Density Curves (ASTM-D698):

a.) One for each type of material from each source to be compacted to a specified density. The maximum density shall be the dry unit mass of a soil sample at optimum moisture content as determined in accordance with ASTM-D698 Method A.

3.25.4 Sieve Analyses (ASTM-C136):

a.) Aggregate – one for each 1,000 tonnes of aggregate.

3.25.5 Field Densities (ASTM-D2169 or ASTM-D2922):

a.) Fill – one for each 2,000 m2 of compacted lift.
b.) Sub-grade – one for each 1,000 m2 of compacted lift.
c.) Base Course – one for each 500 m2 of compacted lift.
d.) Shallow utility trench backfill - one for every 50 m of trench for each 150 mm compacted lift.
e.) Deep utility main trench backfill – one for every 50m of trench for each 150m of compacted lift.
f.) Deep utility servicing trench back fill – 1 every second lift per service if service is less than 20m (additional density tests may be required for services greater than 20m).

3.25.6 Hot-Mix Asphalt Concrete Testing:

a.) A minimum of two (2) tests per production day, each with a minimum of three (3) Marshall specimens taken per test, and including the following minimum requirements for testing of each mix type:
- Asphalt content Air Voids Stability
- Flow
- Film thickness
- Moisture content in concrete
- Gradation in concrete
- Plant discharge temperature
- Asphalt storage temperature
- Asphalt application temperature

b.) Abrasion test, soundness test, sieve analysis, and crushed face count for each aggregate source.

c.) Plant inspections, materials sampling, and testing as follows:
- Weekly asphalt plant inspections during production will be conducted to verify plant calibrations, operation, production settings, temperatures, and handling procedures. Samples of materials and mixtures will be taken and tested.
- Samples of asphalt cement will be taken weekly for each source and tested for penetration and kinematic viscosity.
- A minimum of one (1) compacted Marshall specimen shall be tested for density for each 1,000 tonnes of hot-mix asphalt concrete, or for each production day, whichever
- is less.
- A minimum of one (1) sieve analysis, to ASTM-C136, and crushed face count for every 1,000 tonnes of aggregate used in asphalt concrete production.
- The testing agency shall test a trial batch of the job-mix formula to verify the mix design.

3.25.7 Asphalt Pavement

a.) Density
- i. A minimum of one compacted Marshall specimen shall be tested for density for each 1,000 tonnes of hot-mix asphalt concrete, or for each production day, whichever is less.
- ii. Cores will be drilled from a compacted mat placed from the same load of hot-mix asphalt concrete from which the specimen was taken, and tested for density.
- iii. Pavement compaction will be accepted or rejected based on the ratio, in percent, of the core density to the density of the compacted Marshall specimen.
- iv. If the initial core density is below that specified, that initial core density will be discarded and three new cores will be taken within 10 m of the original core location, all within 2.5 m of each other. The average density of the three cores will represent the mat density in that area.

b.) Thickness
- i. A minimum of one core shall be tested for thickness for each 1,000 m2 of asphalt pavement, for each stage of paving. Staged paving being the process whereby a lift or lifts, forming part of the total pavement structure, are deferred to a future date.
- ii. A thickness deficiency at the completion of the first stage of paving may be accepted by the Town provided the deficiency is less than 12 mm and the deficient thickness can be included in the subsequent stage of paving.
- iii. If the initial core thickness remains deficient at the completion of the final lift of paving, that initial core thickness will be discarded and three new cores will be taken within 10 m of the original core location, all within 2.5 m of each other. The average thickness of the three cores will represent the mat thickness in that area.

3.25.8 Tolerances

a.) Smoothness, Grade, and Texture
   i. The maximum variation under a 3 m straightedge shall be as follows:
   ii. Longitudinal variation (parallel to direction of travel) ± 3 mm; and
   iii. Transverse variation (transverse to direction of travel) ± 6 mm.
   iv. The finished grade elevation shall be within 6 mm of the design grade elevation.
   v. The finished surface shall have a tightly knit texture, free of visible signs of deficiency, including:
      - Segregation;
      - Areas exhibiting excess or insufficient asphalt;
      - Improper matching of joints; and
      - Roller marks, cracking, or tearing.
   vi. If any smoothness or grade tolerance is exceeded, or if the surface texture requirements are not met, grind down and resurface defective areas to the satisfaction of the Town.

b.) Mat Thickness
   i. In accordance with Section 3.25.7 of these Standards, where the average core thickness deficiency exceeds 6.0 mm from that specified in Section 3.25.7, the Town may elect to reject the work. In special cases, the Town may elect to accept the work with special provisions of compensation and/or warranty, or accept the work as provided.
   ii. Where the mat thickness exceeds that specified, the mat may be accepted, with no special provisions, provided that all other requirements are met.
   iii. Where the average core thickness deficiency is greater than 13.0 mm, grind down and resurface defective areas to the satisfaction of the Town.

c.) Density
   i. In accordance with Section 3.25.7 of these Standards, where the average core density for a given pavement area is below that specified in Section 3.40.4g, the Town may elect to reject the work represented by that pavement area. In special cases, the Town may elect to accept the work with special provisions of compensation and/or warranty, or accept the work as provided.
   ii. Where the mat density exceeds that specified, the mat may be accepted, with no special provisions, provided that all other requirements are met.
   iii. Where the mat density is less than 94.0%, grind down and resurface defective areas to the satisfaction of the Town.

3.26 Site Preparation

3.26.1 Maintain slopes and adequate drainage and erosion/sediment protection control during grading.

3.26.2 Do not allow mixing of different fill materials.

3.26.3 Locate, mark, and protect all utilities and appurtenances (i.e. manholes, catch basins, valves, and hydrants).

3.26.4 Do not stockpile materials on municipal reserve (MR) or environmental reserve (ER) zoned land unless written authorization of such has been provided by the Town.

3.26.5 Additional safety measures such as fencing may be required as deemed necessary (i.e. adjacent to existing residential areas).

3.26.6 Clearing, grubbing, and topsoil stripping along streets and lanes shall include at least the full width of the right-of-way

3.27 Clearing

3.27.1 Clearing shall only be permitted during periods which do not disturb nesting birds and other wildlife. Perform and document nesting check.

3.27.2 Cut, dig, remove, and dispose of all timber, brush, windfall, stumps, and rubbish offsite except such trees and shrubs that are designated for preservation.

3.27.3 Preserve any designated trees and shrubs from scarring, barking, or other injury during construction operations. Conduct root pruning as necessary as prescribed by a Certified Arborist.

3.27.4 Leave ground surface in a condition suitable for stripping of topsoil.

3.28 Grubbing

3.28.1 Excavate, remove and dispose of all roots, stumps, submerged logs, corduroy and similar objectionable matter to a depth as determined by the geotechnical report.

3.28.2 Fill holes and level areas disturbed by grubbing. Leave ground surface in a condition suitable for stripping of topsoil.

3.29 Topsoil Stripping and Stockpiling

3.29.1 Strip all areas to be excavated for structures, pipes, or roadways to the limits shown on the construction drawings.

3.29.2 Strip the full depth of topsoil or organic material.

3.29.3 Frozen topsoil may be stripped by ripping provided a minimum of 2 passes are made, the first of which shall not exceed 50% of the topsoil depth.

3.29.4 Stockpile and windrow topsoil temporarily and dispose of stripped material that is unsuitable for replacement. Stockpile in a manner that will not endanger persons, the work, or adjacent property.

3.29.5 Do not stockpile material on municipal reserve (MR) or environmental reserve (ER) zoned land unless written authorization has been issued by the Town.

3.29.6 Ensure stockpiles of topsoil, common excavation, and borrow materials are sufficiently separated. Maintain a minimum of 1.0 m separation between topsoil and common excavation material when stockpiling.

3.29.7 Provide erosion and sediment control measures around stockpiles as required.

3.29.8 If the topsoil and subsoil are mixed and the topsoil is adversely affected, engage a soils specialist to determine the necessary remedial work and complete the required remedial work.

3.29.9 Protect completed portions of the work from damage. Repair damaged areas as required.

3.29.10 The Town reserves the right to impose a time limit on the duration which a stockpile may be left in place. Upon expiry of the time limit, the stockpile must be removed and the underlying surface reinstated to the satisfaction of the Town. Where not stated, a stockpile may remain for no longer than 1 year.

3.30 Pavement and Concrete Removal

3.30.1 Breaking and Excavation

a.) Saw cutting: As indicated by the Town, or where indicated in the drawings, or special provisions, saw cut the limits of removal on existing pavement and concrete to a depth necessary to produce a straight clean vertical edge through the full depth of the existing pavement or concrete structure.
b.) The Town will require re-sawing of edges if not maintained straight, clean and vertical until new pavement or concrete is placed against it.
Excavate and remove materials.

3.31 Fillcrete

3.31.1 Mix Design

a.) Supply fillcrete in accordance with the following table.

Compressive Strength at 28 days (MDA)	SlVMD (MM)	Entrained Air (% by volume)	Maximum Aggregate Size (MM)	Minimum Cement (Kg/m^3)
Minimum – 0.15 **Maximum – 0.40**	100 +/- 25	6.0 – 8.0	5	30

3.31.2 Placing

a.) Fillcrete shall be cast on the compacted backfill from one meter below subgrade to base asphalt. Fillcrete shall be rodded or vibrated to eliminate voids, rough areas, and to ensure contact with the sides of the trench.

3.31.3 Protection of Finished Work

a.) Protect fillcrete from freezing and adverse weather conditions for a minimum period of 24 hours after placement.
b.) Fillcrete that is exposed to significant infiltration of water within 24 hours of placement must be removed and replaced.
c.) Minimum of 150 mm cold mix base must be placed on the fillcrete surface before allowing any traffic over fillcrete. Allow 24 hours after fillcrete placement before placing cold mix.

3.31.4 Control Density Fill

a.) Fillcrete that conforms to CSA requirements for trench backfill consists of fine aggregate, sand, cementacious content and resistant to settlement after hydration.

3.31.5 Trench Restoration

a.) Utility shall be bedded and protected prior to placing fillcrete. It shall be struck off levelled corresponding to a minimum of 100 mm below pavement surface, or the bottom of existing asphalt whichever is greater.

3.32 Utility Cut Restoration

No utility cuts shall be undertaken without written approval from the Town of Whitecourt.

3.32.1 Definition

Utility Cut: Utility work undertaken by the Town of Whitecourt, other Government Agencies, Private Companies or Individual Contractors involving trenching, cutting across, or in any way causing damages to existing roadway infrastructure on right of ways, which include road, alley, curb, gutter, walk and crossings.

3.32.2 Road and Alley Removal

a.) Remove the full pavement structure disturbed by utility cut at a minimum width of 300 mm. Remove all cracked and disturbed pavement leaving a clean and straight edge to abut against before paving.
b.) Full depth saw cutting of pavement structure including asphalt concrete and soil cement layers.
c.) Re-saw prior to pavement placement if adjacent pavement is cracked or disturbed, or if a clean vertical edge is not maintained.

3.32.3 Concrete Curb, Curb and Gutter, Walk, Crossings

a.) Remove concrete work disturbed by utility cut or undermined by the failure of the site of utility cut trench.
b.) Before removal, saw cut the concrete through its full depth leaving a straight face.
c.) Concrete may be broken at crack control joints without saw cut, provided a straight vertical face is maintained free of loose material.

3.32.4 Curb and Gutter

a.) Remove any length less than 1.5 m to the next crack-control joint.
b.) Remove a minimum of 600 mm on both sides of a catch basin, when relocating or installing.

3.32.5 Walkways

a.) Remove walk in full panels to the nearest crack joint-control or surface joint, traverse of longitudinal.

3.32.6 Monolithic Walk

a.) Walks greater than 3 meter in width, remove the width including curb and gutter.
b.) Walks less than 3 meter in width, curb and gutter may remain if in good condition.

3.32.7 Crossings

a.) On monolithic or curb line, and if crossing has control joints, remove to the nearest joint. Remove remaining crossing if cracked or less than 1.5 meters. If crossing has no control joints remove at utility cut width.
b.) On boulevard walk or crossing pad, remove a minimum section of 1.5 m by 1.5 m. Remove remaining crossing width if less than 1.5. There should be only one or two panels in the crossing when replacement is completed.

3.32.8 Para ramps to be removed in their entirety.

3.33 Excavation

3.33.1 Excavate the area to the required cross-section and to the required sub-grade elevation.

3.33.2 Where excavation exposes unsuitable materials below the sub-grade, excavate such materials using transition slopes no steeper than 10% along the alignment profile. Make the bottom of the cut level, with no loose material.

3.33.3 Where over-excavation occurs, reinstate grades by backfilling, compacting, and re-grading as required.

3.33.4 Excavate rock and haul to disposal areas.

3.33.5 Excavate unsuitable material and haul to disposal areas.

3.33.6 Location plans and remediation procedures for borrow pits must be in place and proper permitting received by the Town prior to borrow activities being undertaken. Borrow pits must be identified on plan of record drawings.

3.34 Fill and Grade

3.34.1 Place and spread fill material in successive horizontal lifts.

3.34.2 Compact each lift to a minimum 98% Standard Proctor Density, unless otherwise specified or directed by the Town.

3.34.3 Each lift shall not exceed 150 mm in compacted thickness.

3.34.4 Trim side slopes from top down, and finish true to the required alignment, grade, and shape.

3.34.5 Grades shall be within 30 mm of design grades.

3.34.6 Trim high areas, scarify low areas, compact, and re-grade as required to achieve specified grades and compaction.

3.34.7 Ensure cross falls and ditch bottoms are graded to promote positive drainage flow.

3.35 Shallow-Buried Utility Trenches

3.35.1 Shallow-buried utility trenches below roadways must be adequately backfilled and compacted to a minimum 98% Standard Proctor Density (SPD).

3.35.2 The Developer shall coordinate the location of all shallow-buried utility crossings with the respective utility companies. Such utilities that cross beneath roadways must be contained within conduit with their locations marked on the surface at each side of the roadway crossing.

3.36 Sub-grade Preparation

3.36.1 Scarify and loosen sub-grade to a depth of 150 mm, or as otherwise specified or directed by the Town.

3.36.2 Work the sub-grade until the soil is pulverized into pieces no larger than 25 mm across, exclusive of stones.

3.36.3 Scarify, shape, and compact the sub-grade as follows:

a.) Compact the sub-grade to a minimum of 100% of the maximum density for each 150 mm lift of sub-grade under road, curb, gutter, curb ramps, lane crossings, and access crossings.
b.) Compact the sub-grade to a minimum of 98% of the maximum density for each 150 mm lift of sub-grade under walks.

3.36.4 Additional sub-grade treatments (i.e. cement stabilization, granular sub-base, fabrics, geotextiles, etc.) may be required if recommended by the geotechnical report.

3.36.5 Leave the surface of the compacted sub-grade slightly higher than the required elevation; then trim to the required elevation.

3.36.6 Total compacted thickness, shall be in accordance with the construction drawings, no less than 150mm.

3.36.7 Leave the finished surface even and free of depressions, humps, loose debris, and foreign material.

3.36.8 Finished sub-grade surface shall be within 6 mm above the specified elevation or within 25 mm below the specified elevation. Trim any high spots and refinish to meet tolerance. Add acceptable material to low spots, scarify, and blend to the full sub-grade depth, re-compact to the required density, and refinish.

3.36.9 Proof roll the finished sub-grade to confirm adequate bearing capacity of the sub-grade soils. Unstable areas shall be marked out with paint and corrected prior to paving.

3.37 Base Course

3.37.1 The Consultant shall inspect sub-grade prior to placement of the base course.

3.37.2 Place granular material and spread uniformly in lifts not exceeding 150 mm in thickness when compacted.

3.37.3 Scarify, shape, and compact the base course as follows:

a.) Compact the base course to a minimum of 100% of the standard proctor density for each 150 mm lift of base course under road, curb, gutter, curb ramps, lane crossings, and access crossings.
b.) Compact the base course to a minimum of 98% of the standard proctor density for each 150 mm lift of base course under walks.

3.37.4 Leave the surface of the compacted base slightly higher than the required elevation; then trim to the required elevation.

3.37.5 Total compacted thickness shall be in accordance with the construction drawings.

3.37.6 Leave the finished surface even and free of depressions, humps, loose debris, and foreign material.

3.37.7 Finished granular base surface shall have maximum 15 mm variation under a 3 m straightedge, and shall be within 6 mm above the specified elevation or within 15 mm below the specified elevation. Trim any high spots and refinish to meet tolerance. Add acceptable material to low spots, scarify, blend to the full sub-grade depth, respread, re-compact to the required density, and refinish.

3.37.8 If segregation occurs, blade the lift and mix thoroughly before spreading and shaping to grade.

3.38 Protection of Prepared Base

3.38.1 Do not permit traffic over prepared surfaces.

3.38.2 If the site floods, immediately drain the surface by natural flow or by pumping to catch basins, manholes, or ditches, as directed or authorized by the Town.

3.38.3 Repair any damaged areas to the satisfaction of the Town.

3.39 Asphalt Concrete Production

3.39.1 Asphalt concrete production and handling shall be in accordance with the Asphalt Plant Manual, Asphalt Institute Manual Series No. 3 (MS-3).

3.39.2 The production rate shall be compatible with the rate of placement and compaction.

3.40 Paving

3.40.1 General

a.) Refer to the Asphalt Paving Manual, Asphalt Institute Manual Series No. 8 (MS-8), latest edition, for guidance with respect to good paving practice insofar as is consistent with the requirements of this section.

3.40.2 Preparation

a.) Clean the surface to be paved.
b.) Remove and dispose of all debris and accumulations of deleterious material.
c.) Where necessary, raise valve boxes, manhole covers, catch basin grates, and other existing appurtenances to the finished grade of the pavement.

3.40.3 Prime and Tack Coats

a.) Protect property and appurtenances adjacent to areas intended to be prime coated or tack coated. Remove any spattering stains or overspray caused during prime coating or tack coating to the satisfaction of the Town.
b.) Do not apply liquid asphalt when the prevalent weather is foggy, rainy, windy, or when the air temperature is 4ºC or less, unless authorized by the Town.
c.) For prime coats:
    i. Do not allow traffic on prime coat within 6 hours of application or until the prime coat has cured.
d.) For tack coats:
    i. The prepared pavement surface shall be dry and free of dust and other material that may prevent satisfactory bonding of the tack coat.
    ii. Apply tack coat within 24 hours of paving.
    iii. Use traffic barriers to prevent tracking of uncured tack coat. Do not open the surface to traffic until the tack coat is properly cured.
e.) Spray prime coat or tack coat in a uniform coat over the full area to be paved. For tack coats, spray the sides of gutters, catch basins, manholes, and other appurtenances.
f.) Avoid spraying to an extent that ponding occurs.
g.) Hand spray areas that may have been missed or which are inaccessible by the mechanical distributor.
h.) Let the prime coat or tack coat completely cure before proceeding with paving.

3.40.4 Asphalt Paving

a.) No paving activities can commence until the Consultant has inspected the prime coat or tack coat.
b.) Do not pave when rain or snow is imminent, or when the surface is wet, icy, snow- covered or frozen within 150 mm of the surface, unless authorized by the Town.
c.) Do not pave when the air temperature is 4ºC or less, or during excessive wind conditions, unless authorized by the Town.
d.) Transport of Asphalt Concrete
    i. Transport the asphalt concrete in trucks with protective covers secured over the box to prevent funneling air movement under the cover during transport.
    ii. Prior to loading asphalt concrete, thoroughly clean the box of any accumulation of asphaltic material or other deleterious material. Lubricate the inside box surfaces with a light coating of soap or other detergent solution. Petroleum derivatives are not permitted.
    iii. Maintain transport vehicles clean of mud and other matter that may contaminate the paving area.
    iv. Discharge asphalt concrete into the paver hopper without spilling and without the truck box bearing against the hopper.

e.) Mechanical Spreading
   i. Spread the hot-mix asphalt concrete with the paver moving at a uniform speed compatible with the rate of compaction rolling.
   ii. The spreading temperature shall be between 125 and 150 ºC, as measured in the mat immediately behind the paver.
   iii. Spread the asphalt concrete in one or more lifts, to a depth sufficient to obtain the following mat thickness:

Mix Type	Minimum (mm)	Maximum (mm)
ACO	40	75
ACB	75	125

   iv. If segregation of the mixture occurs, immediately suspend spreading activities until the cause of segregation is determined and rectified.
   v. Prior to roller compaction, remove fat spots, sandy accumulations, high spots, low spots, and any other irregularities, and repair with hot-mix asphalt concrete. Scratch the surface with rake tines to ensure adequate bonding of the added mix. Do not broadcast loose material that has been raked off onto the mat.

f.) Hand Spreading
   i. Hand spread asphalt concrete in areas which are not accessible by the paver.
   ii. Do not broadcast loose material.
   iii. Hand place carefully to avoid segregation of the mixture. Use lutes and rakes to thoroughly loosen and uniformly distribute the asphalt concrete.
   iv. Remove lumps that do not readily break down.
   v. Heat hand tools to keep them free from adhesive buildup of asphalt.
   vi. Before rolling, check the surface with a template or straightedge. Remove fat spots, sandy accumulations, high spots, low spots, and any other irregularities, and repair with hot-mix asphalt concrete.

g.) Compaction
   i. Following spreading of hot-mix asphalt concrete, compact the mat with rollers. Final asphalt lift to be compacted using pneumatic rollers.
   ii. Each mat of asphalt concrete shall be compacted to a minimum of 98% Marshall density for all new pavement construction, unless otherwise authorized or directed by the Town.
   iii. Develop and follow the most suitable pattern of rolling for the area to provide uniform compaction across the mat, including joints and edges.
   iv. Compact asphalt concrete until the specified density is obtained.
   v. Perform finish rolling to eliminate equipment marks and to provide a smooth, uniform, and tightly knit finished surface texture.
   vi. Final rolling must be complete before the mat temperature drops to 80 ºC.
   vii. For areas inaccessible by rollers, use an acceptable vibratory plate compactor or hand tamper to compact the asphalt concrete. A small amount of water may be sprayed on the asphalt surface to aid in compaction using a vibratory plate compactor or hand tamper.

3.41 Joints

3.41.1 Transverse Joints

a.) Plan the length of spreading to provide for a minimum 1 m offset of transverse joints in successive lifts and adjacent mats.
b.) Transverse joints shall be straight, have a vertical face painted with tack coat before placement of the adjacent mat, be thoroughly compacted, and shall meet surface tolerances.

3.41.2 Longitudinal Joints

a.) Plan mats so that the surface longitudinal joint will be offset by a maximum of 150 mm from the centre of an indicated marking line between traffic lanes. The joint may be located in the centre of a traffic lane only where authorized by the Town.
b.) Plan the width of spreading to provide for a minimum offset of 150 mm, in a dovetail pattern, of longitudinal joints is successive lifts.
c.) Create longitudinal joints while the edge temperature of the first of two adjacent mats is above 80 ºC.
d.) Allow a 25 to 50 mm overlap between mats.
e.) Upon placing two adjacent mats, roll a 150 mm wide strip along the adjoining edge. Roll the edge immediately to ensure bonding while the joint temperature is above 80 ºC.
f.) For surface lifts in arterial, industrial/commercial, and collector roadways where the adjacent mat cannot be placed before the joint temperature drops below 80 ºC, carefully roll off the edge of a mat. Trim off the rolled asphalt to a width of 150 mm to provide a clean vertical face to the full depth of the mat. Paint the exposed face with tack coat immediately prior to placing the adjacent mat.
g.) Longitudinal joints shall be thoroughly compacted and meet surface tolerances.

3.42 Roadway Signage

3.42.1 Roadway signage shall be completed as soon as possible following completion of roadway and curb/gutter paving.

3.42.2 Roadway signage shall be inspected during the Town's Construction Completion Certificate inspection and Final Acceptance Certificate inspection. The Developer is responsible for correcting any noted deficiencies before the Town will issue the applicable certificate.

3.42.3 During the Warranty Period, the Developer shall be responsible for all sign maintenance.

3.43 Pavement Marking

3.43.1 General

a.) The Contractor shall assume all costs resulting from the use of patented materials, equipment, devices, or processes used on or incorporated in the Work, agrees to indemnify and save harmless the purchaser and his duly authorized representatives from all suits at law, or action of every nature for or on account of the use of any patented materials, equipment, devices or processes.
b.) All conflicting markings shall be removed (surface only or removed and filled) prior to the roadway opening with new marking placement.
c.) Do not apply markings until pre-marking has been approved by Town.
d.) Prior to commencing any work on a roadway, the contractor shall obtain all required Temporary Traffic Control Permits from the Town.
e.) Contractor shall install temporary pavement markings prior to roadway opening with paint in accordance with Section 3.13 and 3.22. Prior to FAC of the road, the contractor shall install permanent thermoplastic pavement markings in accordance with Section 3.13 and 3.22.

3.43.2 Pre-Marking

a.) Pre-marking must be done on a clean, dry pavement surface with pre-marking paint.
b.) Pre-marking shall be within 100mm accuracy of plan dimensions and indicate straight lines and smooth curves

3.43.3 Traffic Control and Work Area

a.) The Contractor shall, at all times, provide warning and passage for all users of the pathway within the area of the Work. The Work shall be carried out as quickly as possible to prevent excessive delay and inconvenience.

b.) Vehicle movement shall not be permitted over applied markings until they have adequately hardened or dried.

3.43.4 Workmanship

a.) Install painted pavement markings on a clean, dry pavement surface.
b.) Remove, or remove and fill, any and all conflicting road markings.
c.) Spraying will not be permitted during high wind conditions, or other adverse weather conditions.
d.) Faulty markings must be removed and replaced within 5 working days.
e.) The Contractor shall minimize overspray as much as possible.
f.) Contractor shall remove any spillage or overspray.

3.43.5 Thickness Tolerances

a.) Cold Plastic Markings:
   i. Surface Applied: 3 mm thick.
   ii. "Scratch" / Inlaid Applied = 2 mm grind / 3 mm above surface.
   iii. Where deficiencies occur in the work, involving average thicknesses greater than 3.0 mm or less than 1.8 mm, the Inspector may order removal and replacement or application of additional material.
   iv. If surface dishing deeper than 0.5 mm occurs, the Inspector may order removal and replacement of material. Variations in asphalt surface profile may be taken into consideration.

b.) Thermoplastic Markings:

   i. Surface Applied: 3 mm thick.
      - Where deficiencies occur in the work, involving average thicknesses greater than 3.0 mm or less than 1.8 mm, the Town may order removal and replacement or application of additional material.
      - If surface dishing deeper than 0.5 mm occurs, the Town may order removal and replacement of material. Variations in asphalt surface profile may be taken into consideration.
   ii. Inlaid Applied:
      - Longitudinal Markings: 5 mm Grind (below asphalt) / 2 mm above asphalt.
      - Transverse Markings: 10 mm Grind (below asphalt) / 2 mm above asphalt.
      - Where grind depth is less than 70 % specified, the Town may order removal, re-grinding of asphalt and re-fill material.
      - If surface dishing is greater than 0.5 mm, the Town may order the removal and replacement of material or additional material. Variations in asphalt surface may be taken into consideration.

3.44 Rejected Work

3.44.1 Completely remove and replace rejected work to the limits specified by the Town.

4. Curbs, Gutters, and Sidewalks

PART I – DESIGN

4.1 General

4.1.1 Unless otherwise approved, all curb, gutter and sidewalk shall be as outlines in these standards.

4.2 Sidewalks and Walkways

4.2.1 Sidewalks and walkways through residential areas, commercial areas, and parks shall form an integrated pedestrian circulation system through the Development.

4.2.2 For all roadways, unless otherwise authorized or directed by the Town, sidewalks will be located in accordance with the Engineering Standard Drawings.

4.2.3 Sidewalks shall be provided on both sides of the roadway, except for industrial roadways. Consult the Town for the site-specific sidewalk requirements in industrial and commercial zones.

4.2.4 For cul-de-sacs, sidewalks are required along the entire perimeter unless otherwise approved by the Town.

4.2.5 The Design must consider pedestrian access and allow for walkways through cul-de-sacs and other locations, as appropriate.

4.2.6 Sidewalks and walkways shall be a minimum 1.5 m wide with a maximum grade of 6% longitudinally, 2% in the crossfall direction, and in accordance with the Engineering Standard Drawings.

4.2.7 Walkways for parks, hereafter referred to as trails, shall be constructed of asphalt concrete in accordance with the Engineering Standard Drawings. Asphalt concrete shall meet the applicable sections of Section 3.0.

4.2.8 The horizontal alignment of sidewalks along roads shall be parallel to the centreline of the right- of-way wherever possible.

4.2.9 Sidewalk and walkway grading shall be done in accordance with the lot grading plan and shall be done in such a way as to avoid conflicts with the drainage pattern within the right-of-way. Walkway landings shall be provided as required in steeper slope areas.

4.2.10 Changes in grade shall be gradual.

4.2.11 No sidewalk or walkway shall be used as a drainage swale.

4.2.12 Paraplegic ramps shall be provided at all intersections with walkway access in accordance with the Engineering Standard Drawings.

4.2.13 Pedestrian protection (i.e. trees, shrubs, bollards, etc.) may be required at the intersection of primary walkways/trails and roadways, as directed by the Town.

4.2.14 The Town may require that benches, waste receptacles, and other street furniture be strategically placed along certain sidewalks or walkways. Refer to the Town's landscape standards for further details regarding street furniture.

4.3 Curb and Gutter

4.3.1 For all roadways, concrete curb and gutter shall be provided in accordance with the Engineering Standard Drawings.

4.3.2 All curb and gutter driveway crossings shall be reinforced with a minimum of two 10m rebar (or equivalent steel reinforcement).

4.3.3 Vertical face curb and gutter shall be provided along all roadways fronting parks and public utility lots (except for emergency accesses) unless other means of protecting vehicular access into these lands is provided. Curb access for Town maintenance equipment must be provided, complete with knockdown bollards.

4.3.4 Where a transition section is required between differing types or sizes of curbs and gutters, the engineering drawings must include a detail showing how the transition is to be constructed.

4.3.5 Curb Returns

a.) For local and collector roadway intersection curb returns, the minimum curb radius shall be based upon the vertical turning movement for the anticipated traffic, vehicle capacity, Town analysis, and speed reduction. Typically, this will require a minimum radius 10 m for local roadway intersections where the road will not be a bus or truck route, and 15 m for all other collector and arterial roadway intersections.
b.) Curb returns on local residential roadways shall have a minimum radius of 10 m. The curb shall transition into a vertical face cross-section 1.0 m prior to the start of the curb return and a reverse transition 1.0 m after the end of the curb return at the intersecting roadway. This requirement may be slightly modified by the Town to accommodate catch basins which must located within the curb return.
c.) Curb returns on local industrial roadways, collector roadways, and arterial roadways shall be constructed with a minimum radius of 15.0 m to accommodate truck turning movements.

4.3.6 All new sidewalks that are to be built abutting existing curb must be pinned. Town must be contacted to inspect project a minimum of 24 hours prior to pouring of concrete.

PART II – MATERIALS

4.4 Portland Cement Concrete

4.4.1 Portland Cement

a.) Portland cement shall conform to type 50 sulphate resistant.

4.4.2 Aggregate

a.) Aggregate shall conform to CAN/CSA-A23.1 Clause 5.
b.) Coarse aggregate is the total aggregate retained on a 5 mm sieve. Fine aggregate is the total aggregate passing through a 5 mm sieve and retained on a 2.5 mm sieve.
c.) Ironstone content in coarse aggregate shall not exceed 1.0% by mass of the total coarse aggregate sample.
d.) Ironstone content in fine aggregate shall not exceed 1.5% by mass of the total, dry, unwashed fine aggregate sample.
e.) Where ironstone content testing results are greater than the maximum specified ironstone content, the concrete represented by the failed test shall be removed and replaced by the Contractor, at the Contractor's sole expense.

4.4.3 Water

a.) Water shall be clear, free from deleterious material that may inhibit proper mixing and curing of concrete, and in accordance with CAN/CSA-A23.1 Clause 4.

4.4.4 Air-Entraining Admixtures

a.) Air-entraining admixtures shall conform to ASTM-C260.

4.4.5 Chemical Admixtures

a.) Chemical admixtures, including water-reducing agents, retarders, and accelerators, shall conform to ASTM-C494.
b.) The use of chemical admixtures shall only be permitted upon written authorization of the Town.

4.4.6 Fly Ash

a.) Fly ash shall conform to CAN/CSA-A3000, A23.5, pozzolan Type F or Type Cl.
b.) Up to 10% of the specified minimum cement content may be replaced with fly ash for concrete production between May 16 and September 30.

4.4.7 Curing Compound

a.) Curing compound shall conform to ASTM-C309, Type 2, Class B, white pigment, resin- based, liquid membrane-forming compound.

4.4.8 Joint Filler and Sealant

a.) Preformed joint filler shall conform to ASTM-D1751.
b.) Joint sealant shall conform to ASTM-D1190, hot-poured elastic type.

4.4.9 Mix Design

a.) The mix design shall conform to the following:

i. Slump: 60 ± 20 mm;
ii. Entrained air limits: greater than 5.5% by volume;
iii. Maximum aggregate size: 20 mm;
iv. Maximum water to cementing materials ratio: 0.45 by mass;
v. Minimum cement content:
vi. 335 kg/m^3 between April 15 and May 15 or between October 1 and October 15; or
vii. 302 kg/m^3 between May 16 and September 30.
viii. Maximum fly ash content:
ix. None between April 15 and May 15 or between October 1 and October 15; or 33 kg/m^3 between May 16 and September 30.
x. Minimum 28-day compressive strength:
xi. 30 MPa for air content 5.5 to 5.9%;
xii. [42 – (2 x air content %)] MPa for air content 6.0 to 8.0%; or
xiii. 26 MPa for air content greater than 8.0%.

b.) If concrete is to be placed by pumping, the specified slump and air content shall be met at the point of pump discharge.
c.) Concrete shall not be placed between October 16 and April 1 unless written authorization has been issued by the Town. All concrete authorized to be placed during this period shall attain a minimum compressive strength of 27.0 MPa at 7 days, and shall be provided with cold-weather protection, in accordance with CAN/CSA-A23.1 Clause 23.2.3.4, sufficient to maintain concrete surface temperatures 10 ºC or greater for 7 consecutive days following placement. Submit a detailed work plan for all such authorized cold-weather concrete work to the Town for review and acceptance at least 5 days in advance of such scheduled concrete work at the site.

d.) For slip formed concrete, limit slump as follows:
   i. For curbs and gutters: 20 ± 10 mm; and
   ii. For walks: 30 ± 10 mm.

4.5 Concrete Formwork

4.5.1 Formwork Materials

a.) Formwork materials shall be in accordance with CAN/CSA-S269.3; plain, reusable, pre- coated plywood sheets or formed steel panels.
b.) The use of forms that are dented, rough, out of shape, or otherwise unsuitable shall not be permitted.
c.) The use of earth forms is prohibited, except where specifically authorized by the Town.

4.5.2 False work Materials

a.) False work materials shall be in accordance with CAN/CSA-S269.1.

4.5.3 Form Ties

a.) Form ties shall be removable or snap-off metal ties, fixed or adjustable length, and free of devices which may leave holes larger than 25 mm diameter in the concrete surface.

4.5.4 Form Release Agents

a.) Form release agents shall be chemically active agents containing compounds that react with free lime in concrete resulting in water insoluble soaps.

4.5.5 Void Forms

a.) Void forms, where required, shall be inert closed cell expanded polystyrene.
b.) “Frost Cushion” by Beaver Plastics, or accepted alternate.

4.5.6 Form Stripping Agent

a.) The form stripping agent shall be colourless mineral oil, free of kerosene, with viscosity between 15 and 24 mm^2/s at 40 ºC, flashpoint minimum 150 ºC, open cup method.

4.5.7 Slipform Equipment

a.) Slipform equipment shall be of a design suitable to the Work, suitable for use with vibratory equipment, and capable of uniformly extruding, spreading, shaping, and consolidating freshly poured concrete into a dense, homogeneous formation.
b.) The equipment should produce a concrete surface requiring minimal hand finishing.
c.) The equipment shall be self-propelled and capable of automatically controlling alignment and grade.

4.5.8 Reinforcement

Reinforcing for concrete structures, where required, shall conform to the following:

4.5.9 Reinforcing Steel

a.) Reinforcing steel shall be grade 400, billet steel, deformed bars in accordance with CAN/CSA-G30.18, unless otherwise specified or directed by the Town.
b.) Weldable, low alloy steel deformed bars, where specified, shall duly conform to CAN/CSA-G30.18.

4.5.10 Tie Bars

a.) Tie bars shall be grade 300, billet steel, uncoated, deformed bars in accordance with CAN/CSA-G30.18, unless otherwise specified or directed by the Town.
b.) Epoxy-coated tie bars, where specified, shall conform to ASTM-D3963.

4.5.11 Steel Dowels

a.) Steel dowels shall be clean, straight, free of flattened or burred ends, uncoated and in accordance with CAN/CSA-G30.18.
b.) Epoxy-coated tie bars, where specified, shall conform to ASTM-D3963.

4.5.12 Cold-Drawn Steel Wire

a.) Cold-drawn steel wire shall be uncoated and in accordance with CAN/CSA-G30.3M.
b.) Epoxy-coated cold-drawn steel wire, where specified, shall conform to ASTM-D3963.

4.5.13 Welded Steel Wire Fabric

a.) Welded steel wire fabric shall be uncoated and in accordance with CAN/CSA-G30.5M.
b.) Epoxy-coated welded steel wire fabric, where specified, shall conform to ASTM-D3963.

4.5.14 Tie Wire

a.) Tie wire shall be cold-drawn, annealed steel in accordance with CAN/CSA-G30.3.

4.5.15 Epoxy Coatings

a.) Epoxy coatings shall be in accordance with ASTM-D3963.

4.5.16 Galvanizing

a.) Galvanizing shall be in accordance with CAN/CSA-G164.

4.5.17 Plain Round Bars

a.) Plain round bars shall be in accordance with CAN/CSA-G40.21.

4.5.18 Chairs, Bolsters, Bar Supports, and Spacers

a.) Chairs, bolsters, bar supports, and spacers shall be suitable for strength and support of reinforcing and live loads during construction.

PART III – CONSTRUCTION

4.6 General

4.6.1 The following sections represent the minimum requirements for some typical, key construction procedures for sidewalk, curb, and gutter construction. These minimum requirements must be met or exceeded by the detailed construction specifications and drawings developed by the Consultant.

4.6.2 Construction activities must adhere to the provisions of the Erosion and Sediment Control Plan prepared for the Development in accordance with Section 1.10.1.7

4.7 Quality Assurance

4.7.1 The Consultant must maintain detailed records of all inspections and testing as evidence of compliance of the work with these Standards. These records shall be provided to the Town upon request.

4.7.2 The Town may at any time require the Contractor to provide evidence of certification by the testing agency to ensure the materials and performance of the work meet these Standards.

4.7.3 The Consultant shall provide a written endorsement of the Contractor's compliance with these Standards with the application for the Construction Completion Certificate.

4.8 Quality Control Testing

4.8.1 The Developer shall retain the services of independent testing laboratories or agencies to conduct all quality control testing. The proposed testing laboratory or agency shall be subject to the acceptance of the Town.

4.8.2 Minimum quality control test frequencies, specified as follows, are the minimum number required. The Developer shall ensure that as many tests as necessary are performed to ensure that the work conforms to the requirements of these Standards, regardless of the minimum number specified.

a.) Moisture Density Curves (ASTM-D698):
   i. One for each type of material from each source to be compacted to a specified density. The maximum density shall be the dry unit mass of a soil sample at optimum moisture content as determined in accordance with ASTM-D698 Method A.

b.) Sieve Analyses (ASTM-C136):
   i. Aggregate – one for each 1,000 tonnes of aggregate.

c.) Field Densities (ASTM-D2169 or ASTM-D2922):
   i. Fill – one for each 2,000 m^2 of compacted lift.
   ii. Sub-grade – one for each 1,000 m^2 of compacted lift.

d.) Portland Cement Concrete Testing:
   i. Abrasion test, soundness test, sieve analysis, and crushed face count for each aggregate source.
   ii. Plant inspections, materials sampling, and testing as follows:
      - Weekly concrete plant inspections during production will be conducted to verify plant calibrations, operation, production settings, and handling procedures. Samples of materials and mixtures will be taken and tested.
      - Slump testing, to CAN/CSA-A23.2-1C and CAN/CSA-A23.2-5C, to be taken between the 10% and 90% points of discharge of a concrete load, and conducted with every strength test, or as directed by the Town.
      - Air content testing, to CAN/CSA-A23.2-1C and CAN/CSA-A23.2-4C or CAN/CSA-A23.2-6C, to be taken between the 10% and 90% points of discharge of a concrete load, and conducted with every strength test, or as directed by the Town.
      - Air void examination, to ASTM-C457, modified point count traverse method at 100-times magnification, to be performed on one 100 mm diameter core, drilled from hardened concrete, for every 1,000 m of concrete curb, gutter, or sidewalk poured, or other frequency as directed by the Town. The top of the core shall be ground down to 2 mm ± 0.5 mm below and parallel to the finished concrete surface to produce a surface suitable for microscopic examination.
      - Ironstone content testing shall be conducted with every strength test, or as directed by the Town.
      - Strength testing, to CAN/CSA-A23.1-9C and CAN/CSA-A23.2-2C, to be taken at a minimum frequency of one test for each 60 m3 of concrete, or fraction thereof, in any one day, or as directed by the Town.
      - Cores, as necessary, to verify the finished concrete thickness.
      - A minimum of one (1) sieve analysis, to ASTM-C136, and crushed face count for every 1,000 tonnes of aggregate used in concrete production.
      - Conduct a complete petrographic analysis of the fine and coarse aggregate for the proposed mix design and provide results of abrasion loss, $MgSO_4$ soundness loss, cement-aggregate reactivity, and ironstone content testing.
   iii. All testing shall be performed by a technician certified by CSA or ACI.

4.9 Site Preparation

4.9.1 Prepare the site in accordance with Section 3.26 of these Standards.

4.10 Clearing

4.10.1 Conduct clearing in accordance with Section 3.27 of these Standards.

4.11 Grubbing

4.11.1 Complete grubbing in accordance with Section 3.28 of these Standards.

4.12 Topsoil Stripping and Stockpiling

4.12.1 Strip and stockpile topsoil in accordance with Section 3.29 of these Standards.

4.13 Excavation

4.13.1 Complete any necessary excavation in accordance with Section 3.33 of these Standards.

4.14 Fill and Grade

4.14.1 Fill and grade the area in accordance with Section 3.34 of these Standards.

4.15 Shallow-Buried Utility Trenches

4.15.1 Backfill and compact shallow-buried utility trenches in accordance with Section 3.35 of these Standards.

4.16 Sub-grade Preparation

4.16.1 Complete sub-grade preparation in accordance with Section 3.36 of these Standards.

4.17 Base Course

4.17.1 Construct any required base course in accordance with Section 3.37.

4.18 Protection of Prepared Base

4.18.1 Protect prepared surfaces in accordance with Section 3.38.

4.19 Formwork

4.19.1 Fabrication and Erection

a.) Verify lines, levels, centres, and dimensions against the construction drawings prior to proceeding with fabrication and erection of formwork and false work.
b.) Fabricate and erect false work in accordance with CAN/CSA-S269.1.
c.) Fabricate and erect formwork in accordance with CAN/CSA-S269.3 in such a manner to produce finished concrete conforming to the shapes, dimensions, locations, levels, and tolerances specified herein and required by CAN/CSA-A23.1.
d.) Align form joints and make watertight. Lay out forms in such a manner to minimize the number of form joints.
e.) Do not place shores or mud sills on frozen ground. Provide suitable drainage through the site to prevent washout of soil supporting mud sills and shores.
f.) Use 25 mm chamfer strips on exterior corners and 25 mm fillets on interior corners of concrete members, unless otherwise specified or directed by the Town.
g.) Form chases, slots, openings, drips, recesses, and expansion and control joints where required.
h.) Build in anchors, sleeves, and other inserts as required. Ensure that anchors and inserts are installed such that they will be flush with the finished concrete surface.

4.19.2 Slipforming

a.) Set and maintain a grade line by establishing a taut string or wire line, set against the survey control datum.
b.) Provide stable support for the traveling slipform machine.
c.) Protect adjacent work and property from damage. Repair any damage caused during the performance of the Work to the satisfaction of the Town, at the sole cost of the contractor.
d.) Coordinate concrete delivery and placement to maintain uniform advancement of the slipforming operation without interruption. If progress is interrupted at any time, immediately suspend vibrating and tamping.
e.) Maintain adequate slump to prevent slipformed concrete from sagging.
f.) Slipformed surfaces shall be smooth, dense, and free of pockets and honeycombing.
g.) Correct minor irregularities in the slipformed finish using hand finishing methods.

4.19.3 Form Removal

a.) Strip forms within 48 hours of concrete placement to facilitate finishing operations.
b.) Re-shoring to remove forms shall be done in accordance with CAN/CSA-S269.1.

4.19.4 Hand-Forming

a.) Hand-form and place concrete at corners, curb crossings, and catch basins concurrent with slipforming operations. Where such concurrent work is impractical, complete hand- form areas within 7 days of slipforming adjacent work.

4.20 Reinforcing

4.20.1 Fabrication, Shipping, and Handling

a.) Fabricate reinforcing steel in accordance with CAN/CSA-A23.1 and ACI-315 – Details and Detailing of Concrete Reinforcement.
b.) Protect epoxy- and paint-coated portions of bars with adequate covering during shipping and handling.

4.20.2 Field Bending and Welding

a.) Field bending and welding shall only be permitted where specifically authorized by the Town.
b.) Weld reinforcement in accordance with CAN/CSA-W186.
c.) Field bending shall be performed without the use of heat, by applying slow and steady pressure.
d.) Remove and replace any bars that develop cracks or splits.

4.20.3 Placing Reinforcement

a.) Place reinforcement in accordance with applicable shop drawings and CAN/CSA-A23.1.
b.) Place sufficient chairs, tie wires, and supports to adequately maintain the position of the reinforcement during placement of the concrete, in accordance with the tolerances provided by the referenced CAN/CSA guidelines.
c.) Use plain round bars as slip dowels in concrete where required. Apply asphalt paint to the end of the dowel intended to move with the hardened concrete. When the paint is dry, apply a coat of mineral lubricating grease.
d.) The Consultant shall inspect reinforcement placement before concrete placement is permitted.
e.) Ensure sufficient cover is achieved over reinforcement when placing concrete.
f.) Reinforcing steel, anchor bolts, or other inserts shall not be inserted during concrete placement.

4.20.4 Field Touch-Up

a.) Touch-up all damaged and cut ends of epoxy-coated, painted, or galvanized reinforcing with compatible finish to provide a continuous finish.

4.21 Pouring

4.21.1 Concrete Delivery

a.) Concrete delivery shall be in accordance with CAN/CSA-A23.1 Clause 18.4.
b.) Rotating drum trucks, capable of adequately agitating and mixing the concrete during transport, shall be used for concrete delivery.
c.) Rotate the drum at mixing speed for at least 3 minutes immediately before discharge.
d.) Re-tempering
   i. Re-temper the concrete mixture with water at the site when slump at the point of initial discharge is less than that specified, and only upon authorization of the Consultant.
   ii. Re-temper the concrete mixture with air-entraining admixtures at the site when entrained air in the concrete at the point of initial discharge is less than that specified, and only upon authorization of the Consultant. Only Town-accepted air- entraining admixtures shall be used. A qualified technician shall coordinate the re-tempering process at the site. Only one opportunity shall be granted to re-temper any one load to meet the required air content. If re-tempering fails to meet the specifications, the load shall be rejected. A load of concrete that has been rejected following a failed attempt at re-tempering with air-entraining admixtures shall not be re-tempered at the concrete plant and subsequently returned to the site for use in the Work.
   iii. If the need for re-tempering with water or air-entraining admixtures becomes consistent, the Consultant or Town may refuse to accept concrete loads that have been re-tempered, and may require the Contractor to revise the mix design accordingly before concrete production can continue.
e.) On-site mix adjustments with cementitious materials, sand aggregate, or any chemical admixtures, other than air-entraining admixtures and superplasticizers, is strictly prohibited, unless authorized by the Town in writing.
f.) The use of air de-entraining admixtures, or any other chemical admixtures, including water-reducing agents, retarders, and accelerators, is strictly prohibited, unless authorized by the Town in writing.
g.) Where the ambient temperature is greater than 23 ºC, the maximum concrete mix temperature shall not exceed 30 ºC at the time of placement. If the concrete mix temperature exceeds 30 ºC at the time of placement, all such concrete represented by that load shall be rejected.
h.) Where the ambient temperature is less than 5 ºC, the concrete mix temperature shall be between 15 ºC and 30 ºC at the time of placement. If the concrete mix temperature is outside of these specified limits at the time of placement, all such concrete represented by that load shall be rejected.
i.) Completely discharge the concrete load within 90 minutes of initial mixing of water, cement, and aggregate at the plant. The discharge time may be extended to up to 120 minutes with the use of hydration control admixtures, where accepted by the Town. The supplier must submit sufficient evidence that the plastic concrete properties (slump, air content, and temperature) can be maintained through the extended discharge time period. Such evidence must be submitted for Town review and acceptance at least ten (10) days in advance of scheduled concrete work at the site.
j.) Provide the Consultant with a delivery ticket for each concrete load, clearly indicating the following information:
   - Concrete supplier Concrete plant location Ticket number
   - Truck number
   - Mechanical date and time stamp of initial plant mixing
   - Mix design identification
   - Cement type
   - Aggregate size
   - Type and amount of admixtures
   - Volume of water added
   - Volume of concrete
   - Site arrival time
   - Start and end of discharge times
   - Any other information that may reasonably be requested by the Town

4.21.2 Concrete Placement

a.) Place concrete in accordance with CAN/CSA-A23.1.
b.) Thoroughly clean all reinforcement and formwork before placing concrete.
c.) Moisten the sub-grade or sub-base surface, reinforcement, and formwork with water prior to placing concrete to minimize absorption of water from the concrete following placement.
d.) Do not place concrete during a rain event, when a rain event is imminent, nor when the weather is unsuitable for concrete placement.
e.) Pour concrete continuously and rapidly between predetermined construction joints.
f.) Use pencil vibrators for curb and gutter, and vibrating screeds for walks.
g.) Continuously place concrete for the duration of the scheduled pour. Arrange concrete delivery such that the discharge interval between loads is less than 30 minutes. Install a construction joint where the discharge interval exceeds 30 minutes.
h.) Curbline walks, curb ramps, and curb crossings shall be poured monolithically. The use of dowels and joint sealant at the back of the curb is strictly prohibited.
i.) Curb and gutter shall be constructed in accordance with the Engineering Standard Drawings.
j.) Sidewalk shall be constructed in accordance with the Engineering Standard Drawings.
k.) Sidewalk rehabilitation shall be constructed in accordance with the Engineering Standard Drawings.

4.22 Finishing

4.22.1 Finishing

a.) Perform initial and final concrete surface finishing in accordance with CAN/CSA-A23.1.
b.) The finished concrete surface shall be glare-free and slip resistant.
c.) The use of water to facilitate finishing operations is strictly prohibited. To aid in concrete finishing, the surface may be fogged with an evaporation reducer acceptable to the Town.
d.) Protect the work area from rain to avoid excessive moisture on the unfinished surface.
e.) Finishing shall be performed by, or under the direction of, qualified concrete finishers.

4.22.2 Tool all edges to a width of 50 mm and round all edges to a 6 mm radius, unless otherwise specified or directed by the Town.

4.22.3 Apply a brush final finish longitudinally along curb and gutter. Apply a brush final finish transversely along walks. Broom finish as follows:

a.) Use a brush with nylon bristles that can form surface grooves no deeper than 3 mm.
b.) Remove excess water from the brush bristles prior to brushing.
c.) Brush in a uniform pattern over the entire surface in the specified direction.

4.22.4 For sidewalks, stamp the Contractor's name and year of construction in the plastic concrete at the limits of construction for each stage of the Development. Sidewalks must be also imprinted with "CC" and "CO" stamps, indicating the location of the curb valve for the water service and the location of any sewer clean outs for each lot. In the case where there is no walkway in front of a lot, the stamps shall be placed on the top of the curb.

4.23 Crack-Control Joints

4.23.1 Crack-control joints are intended to control the location of shrinkage cracks in hardening concrete. Construct joints in accordance with the following:

a.) Formed Joints
  i. Form the groove by inserting a metal or fibre strip, or polyethylene film into the plastic concrete.
  ii. Finish the edges to a 6 mm radius.
  iii. Remove the insert immediately following the initial set of the concrete.
  iv. Seal the joint with Sika 2C or approved equivalent product to be preapproved by the Town.

b.) Tooled Joints
   i. Form the groove by hand using a jointing tool with a thin metal blade to impress a plane of weakness into the plastic concrete.
   ii. Finish the edges to a 6 mm radius.
   iii. Seal the joint with Sika 2C or approved equivalent product to be preapproved by the Town.

4.23.2 Joints shall be 3 to 5 mm wide at the following depths:

a.) Minimum 50 mm deep to a maximum of 25% of the gutter depth for curb and gutter; and
b.) Minimum 25 mm deep to a maximum of 25% of the walk thickness for walks.

4.23.3 Joint spacing shall be a maximum of 3 m.

4.23.4 Surface Dummy Joints

a.) 5 mm wide by 10 mm deep and centered between contraction joints across walks.
b.) For monolithic construction, place surface joints across the walk portion and contraction joints on the curb and gutter, both joints being on the same side.
c.) Place a longitudinal joint on walks continuing through crossings where required.

4.24 Isolation Joints

4.24.1 Isolation joints are required next to immovable structures, where indicated on the construction drawings, and where directed by the Consultant or the Town.

4.24.2 Construct the joint by sawing or forming to create a clean break through full cross-section of the concrete member.

4.24.3 Make the joint wide enough to allow a snug fit for the pre-formed joint filler.

4.24.4 Alternatively, place pre-formed joint filler against the structure and pour the concrete against the filler.

4.25 Construction Joints

4.25.1 Construction joints are required between concrete pours or for joining new concrete to existing concrete, and at the beginning and end of driveway sections.

4.25.2 Review and confirm the location of all construction joints prior to commencing construction.

4.25.3 Construct the joint with a keyway, dowels, or tie bars as required.

4.25.4 Vertically trim existing concrete by saw cutting at least 50 mm deep and breaking.

4.25.5 Transverse Construction Joints

a.) Use 10M deformed tie bars at 300 mm spacing, extending minimum 300 mm into both sides of the joint.
b.) At the end of a joint pour, vary joint spacing as follows:
   i. Where a joint pour ends within 300 mm of a required joint location, equally space the last two joints; and
   ii. Where a joint pour ends within 800 mm of a required joint location, equally space the last three joints.

4.25.6 Longitudinal Construction Joints

a.) Use 10M deformed tie bars at 1,000 mm spacing, extending minimum 300 mm into both sides of the joint.

4.25.7 Leave the joint in place until the concrete has set, then carefully remove the joint form to avoid damaging the fresh concrete.

4.25.8 Finish the edges to a 6 mm radius.

4.25.9 Roughen all formed construction joints to expose the aggregate of the hardened concrete. The Contractor may elect to apply a suitable retardant to the forms of the construction joint, and remove retarded surface mortar using low-pressure water jets or stiff brushes.

4.26 Sidewalk Joints Abutting an Existing Curb

4.26.1 Form a 10 mm wide by 30 mm deep slot between the back of the curb and the walk.

4.26.2 Fill the slot with Sika 2C or approved equivalent product to be preapproved by the Town.

4.27 Protection

4.27.1 Protect freshly placed concrete from freezing, premature drying, adverse weather conditions, tampering, and physical disturbance in accordance with CAN/CSA-A23.1 Clause 21.

4.27.2 Concrete shall be protected from freezing for a minimum of 4 days following placement, or for the time necessary to achieve 75% of the specified 28-day compressive strength, whichever is greater.

4.28 Curing

4.28.1 Membrane Curing

a.) Membrane curing is required when the maximum daily air temperature is not expected to exceed 5 ºC for 72 hours following concrete placement.
b.) Cure exposed concrete surfaces using an acceptable curing compound applied with a pressurized spray nozzle.
c.) Apply a continuous and uniform coating of the compound over the surface. Follow compound manufacturer's instructions for the optimal application dose rate.

4.28.2 Moist Curing

a.) Moist curing shall only be used where directed by the Town.
b.) After the concrete has set, maintain a moist condition on the concrete surface by using wet burlap or polyethylene film over the surface for a minimum of 7 days.

4.29 Backfilling

4.29.1 Use only suitable excavated or borrow material for fill.

4.29.2 Backfill behind curb with suitable clay within 7 days of concrete placement. Backfill a minimum 300 mm width behind the curb in two 150 mm lifts. Compact each lift with mechanical tampers to a minimum 95% Standard Proctor Density. Backfill to the top of curb elevation, unless walk construction immediately follows.

4.29.3 Backfill along the edge of the walk immediately following removal of formwork. Provide sufficient depth for topsoil placement as specified or directed by the Town. Compact backfill a minimum of 300 mm out from the walk edge with mechanical tampers, to a minimum 98% Standard Proctor Density.

4.30 Tolerances

4.30.1 Concrete

a.) Surface Temperature
   i. Where the concrete surface temperature is found to be less than 0 ºC within 96 hours following placement, the Town may elect to reject the work. In special cases, the Town may elect to accept the work with special provisions of compensation and/or warranty, or accept the work as provided. The application of such shall apply to the area or extents represented by, or measured by, field testing.
   ii. Where the surface temperature is found to be less than 0 ºC within 48 hours following placement, remove and replace defective areas to the satisfaction of the Town.

b.) Slump
   i. Where the measured slump from any load is determined to be deficient from that specified, a second test shall be performed on another portion of the same load. If the second test fails, the load will be rejected and the Contractor shall remove any portion of that load that may already have been poured.

c.) Air Content
   i. For concrete where the air content is found to be less than specified, the Town may authorize re-tempering of the concrete as defined in Section 4.21.1 d.).
   ii. For air content less than 4.0, no re-tempering shall be permitted and the load will be rejected. The Contractor shall remove any portion of that load that may already have been poured.

d.) Strength
   i. Where the concrete strength is found to be less than the minimum specified requirement, the Town may elect to reject the work. In special cases, the Town may elect to accept the work with special provisions of compensation and/or warranty, or accept the work as provided. The application of such shall apply to the area or extents represented by, or measured by, field testing.
   ii. Where the concrete strength is found to be less than 85% of the minimum specified requirement, remove and replace defective areas to the satisfaction of the Town.
   iii. The Developer may, at its sole expense, elect to provide evidence of strength by coring and testing to CAN/CSA-23.2-14C, by a qualified independent testing agency, within 7 days of a failed 28-day cylinder test or within 3 days of a failed 7-day cylinder test. Three cores shall be drilled from the concrete area represented by the failed test at locations reviewed and accepted by the Town. The average strength of the three cores will be used in the subsequent application of Section 4.30.1d.).

4.30.2 Walk Surface, Gutter Surface, and Curb Top

a.) Maximum 5 mm variation under a 3 m straightedge.
b.) Where the specified tolerance is exceeded, correct such work to the satisfaction of the Town.

4.30.3 Gutter Lip and Walk Grade

a.) Maximum 5 mm variation from the designated elevation at any station as established from the corresponding survey stake.
b.) Where the specified tolerance is exceeded, correct such work to the satisfaction of the Town.

4.30.4 Gutter Lip Alignment

a.) Maximum 10 mm variation over any 30 m section.
b.) Where the specified tolerance is exceeded, correct such work to the satisfaction of the Town.

4.30.5 Concrete Thickness

a.) Where the concrete thickness is found to be less than the minimum specified requirement, the Town may elect to reject the work. In special cases, the Town may elect to accept the work with special provisions of compensation and/or warranty, or accept the work as provided. The application of such shall apply to the area or extents represented by the core sample(s).

b.) Where the thickness deficiency is found to be more than 15 mm of the minimum specified requirement, remove and replace defective areas to the satisfaction of the Town.

4.31 Rejected Work

4.31.1 Completely remove and replace rejected work to the limits of the nearest crack control or construction joints.

4.31.2 All rejected products and work shall be adequately removed from the site and corrected to the satisfaction of the Town.

5. Water Distribution System

PART I – DESIGN

5.1 General

The water distribution system shall be designed with sufficient capacity to convey peak flows. The Design must include hydraulic network analyses for the Development, updated for each subdivision stage. The Town may provide the necessary boundary conditions for the hydraulic analyses. The following *minimum* criteria shall apply to the Design, as applicable to the Development:

5.1.1 Average and Peak Demands:

a.) Design Population: Equal to the ultimate estimated population for the design area
b.) Population Density for Residential Areas: 40 persons/ha
c.) 25,000 L/ha/day for Commercial/Industrial/Institutional
d.) Average Day Demand: Design Population x 350 L/capita/day
e.) Maximum Day Demand: Average Day Demand x 2.0
f.) Peak Hour Demand: Average Day Demand x 4.0
g.) Where the Development may have commercial or industrial users with appreciable water demands, such shall be duly considered in the hydraulic analyses.

5.1.2 Fire Demand:

a.) Fire demand conditions shall be analyzed based on the criteria provided in *Water Supply for Public Fire Protection, A Guide to Recommended Practice*, Fire Underwriters Survey, latest edition.
b.) For commercial, industrial, institutional, and multi-family residential lots with internal fire suppression systems, the Design must include hydraulic analyses to determine the required system configuration and sizes to provide direct flow to the fire suppression systems in combination with hydrant flows.
c.) The Designer is responsible for satisfying themselves as to the available fire flow to, or near, the site prior to completing the Design. It shall be the Designer's responsibility to complete a hydrant flow test on a nearby hydrant to determine available fire flow. Hydrant flow tests must be coordinated through the Town's Utilities department. A copy of the hydrant flow test results must be provided to the Town.
d.) The Designer must ensure that the Town's requirements are met with respect to onsite hydrant requirements based on the type of the proposed development and the layout of the site. The Town will provide input in this regard during its review of the Design.

5.2 Water Mains

5.2.1 Pipe Diameter:

a.) Minimum 200 mm for residential developments
b.) Minimum 300 mm for commercial/industrial developments
c.) Minimum 250 mm for multi-family residential development

5.2.2 Flow Velocity:

a.) Maximum 3.0 m/s

5.2.3 Hazen-Williams Roughness Coefficient, C (based on the use of PVC pipe):

a.) 100 for pipes ≤ 200 mm diameter
b.) 120 for pipes > 200 mm diameter

5.2.4 Normal Operating Pressure:

a.) 350 kPa to 700 kPa

5.2.5 Peak Hour Demand Operating Pressure:

a.) Minimum 280 kPa at ground level at any point in the system (by hydraulic analysis)

5.2.6 Maximum Day Demand Plus Fire Flow Operating Pressure:

a.) Minimum 150 kPa at ground level at any point in the system (by hydraulic analysis)

5.2.7 Pipe Design

a.) Strength design shall be integral to the pipe selection process considering design and purpose.

5.2.8 Horizontal Alignment

a.) Water mains shall be located within the road right-of-way within the pavement surface, in accordance with the Engineering Standard Drawings.
b.) The Consultant shall design typical cross-sections depicting the locations of the various necessary infrastructure to suit the particular development. Such cross-sections shall be subject to the review and acceptance of the Town.
c.) Water mains must be located at least 3.0 m horizontally from any sewer main, 2.0 m horizontally from any gas line, and 2.0 m horizontally from any catch basin or manhole, as measured between the nearest walls of the two mains.
d.) In accordance with Section 3.5.1, cul-de-sacs which exceed 120 m but that are less than 170 m in length require an additional hydrant and looping of the water main to the cul-de- sac through a Public Utility Lot (PUL). Cul-de-sacs which exceed 170 m in length require a minimum 6.0 m wide PUL for emergency vehicle access and looping of the water main.
e.) A 1.0 m easement is required on the lots to either side of a PUL. PUL widths shall be a minimum of 6.0 m for a single utility and 9.0 m for two utilities. A 12.0 m PUL is required where water, sanitary and storm is installed.
f.) Curved water mains shall run parallel to the centreline of the road, without exceeding the maximum deflection per pipe specifications.
g.) Water mains through new subdivisions must be looped. The Town may temporarily waive this requirement for a staged subdivision, up to 50 lots in size, where the Developer can demonstrate that the required fire flows can be provided through a single water feed to the stage. Looping must be provided within 1 year of temporarily servicing the subdivision.
h.) The maximum length of a dead-end line is 120 m. A fire hydrant shall be provided at the end of the dead-end, and each dead-end line must be equipped with an isolation valve. Where the hydrant is located in line with the main it shall be removed and relocated upon future stages of development.

5.2.9 Vertical Alignment

a.) Water mains shall be installed to provide a minimum depth of cover of 3.0 m, as measured from the top of the pipe to the final finished grade at the surface.
b.) Mains shall be installed to provide adequate water service connection depth at the property line (minimum 3.0 m).
c.) At crossings of water mains with sewer mains, the following requirements shall apply:
    i. Typically, water mains shall cross overtop of sewer mains with sufficient vertical separation to allow for proper bedding and support of both mains.
    ii. Where it is necessary for a water main to cross under a sewer main, the water main shall be protected by providing the following:
        - A minimum vertical separation of 0.5 m, as measured between the nearest pipe walls of the two mains;
        - The sewer main shall be structurally supported to prevent joint deflection and settling; and
        - A full length of pipe shall be used for the water main at the crossing location. The pipe section shall be centered beneath the sewer main so that the nearest joints in the water main are equidistant from the crossing location.

d.) Where a water main elevation profile has a crest with a change in elevation of greater than two pipe diameters, as measured from the obvert of the pipe at the lowest (sag) point to the invert of the pipe at the highest (crest) point, an air-release device, such as a blow- off or hydrant, may be required near the crest point to remove trapped air from the main.

5.3 Hydrants

5.3.1 Hydrants shall be located within the road right-of-way in accordance with the Engineering Standard Drawings.

5.3.2 Hydrants shall be set plumb with the pumper nozzle at right angles to the road centerline. Refer to the Engineering Standard Drawings Appendix A for a typical hydrant detail.

5.3.3 The centre of the hydrant barrel shall be 1.0 m from the property line (within the ROW). Hydrants shall not be perched above sewer mains.

5.3.4 The maximum distance between hydrants shall not exceed 150 m in single-family residential areas and 90 m in commercial, industrial, institutional, and multi-family residential areas.

5.3.5 Wherever possible, hydrants shall be located at the projection of property lines to avoid potential conflict with driveways. At intersections, hydrants shall be located adjacent to corner cut-offs. Where hydrant placement must be immediately adjacent to a potential driveway location, the Town may direct that bollards be installed to protect the hydrant.

5.3.6 For cul-de-sacs, a hydrant must be installed at or near the entrance intersection. Cul-de-sacs exceeding 120 m in length require a hydrant and looping of the water main in accordance with Sections 3.5.1 and 5.2.8.

5.3.7 Hydrants shall be located a minimum of 5 m away from any manhole.

5.3.8 Hydrants shall be located such that the distance from any building to a hydrant shall not exceed 75 m of unobstructed distance. For commercial, industrial, institutional, or multi-family residential buildings with standpipes, there must be a hydrant located within 45 m of the standpipe with unobstructed vehicle access provided between the hydrant and the fire department connection to the building.

5.3.9 If deemed necessary, the Town may require additional hydrants be installed at high-value or high- risk properties.

5.3.10 All hydrants shall be off-line type. Hydrant leads shall include a valve, located 1.0 m from the mainline tee. Each hydrant valve shall be located far enough off the hydrant to avoid conflict with the hydrant when operating the valve. Wherever possible, the main water valve shall be spaced 1.0 m from the hydrant valve (see Engineering Standard Drawings).

5.3.11 Where a subdivision development is adjacent to a forest or undeveloped green space, the fire hydrant is to be installed on the nearest street and near a pathway access where possible.

5.4 Water Main Valves

5.4.1 Wherever possible, water main valves shall be located 1.0 m from the hydrant valve, where this is not possible/ practical, main valves shall be located at the projection of property lines to avoid potential conflict with driveways. At intersections, valves shall be located at the beginning of curb returns.

5.4.2 Valves shall be located such that, in the event of a shutdown, no more than 1 hydrant will be out of service, no more than 3 valves shall be required to achieve the shutdown, and no more than 20 single-family residential units will be affected by the shutdown.

5.4.3 Valves shall be the same size as the water main to which they connect.

5.4.4 Provide a valve near tie-in locations for proposed future extensions of the water main complete with 6.0 m long pipe extension and 1.0 m section with test point.

5.4.5 When a branch connection off of an existing water main is required, the Design must provide for hot-tapping into existing water mains. Wet-tapping shall be accomplished through use of a tapping valve and sleeve while maintaining uninterrupted service through the existing water main.

5.5 Pressure Relief Valves

5.5.1 Pressure relief valves may be required to achieve a required pressure zone(s) through the subdivision.

5.5.2 Pressure relief valve design shall be based on the hydraulic network analysis for the subdivision and consultation with the Town.

5.6 Water Service Connections

5.6.1 Each residential lot shall have its own water service connection designed in accordance with the following sections and the Engineering Standard Drawings.

5.6.2 Service connections for commercial, and institutional lots, and apartment developments shall be sized according to the anticipated user requirements (minimum size 25 mm).

5.6.3 Residential service connection pipe diameter shall be a minimum of 20 mm unless the length of the service exceeds 20 m, as measured from the main to the property line, in which case the minimum diameter shall be 25 mm.

5.6.4 The Designer shall verify the minimum pipe diameter requirements for lots with extraordinarily long service connections and/or multi-floor buildings where available pressure may pose a problem for the building's plumbing fixtures.

5.6.5 Wherever possible, service pipes shall be aligned at right angles to the main. If installation is not at right angles to the main all connections, bends, tees, curb cocks, elevations, and locations shall be identified on the plan of record drawings.

5.6.6 Water service connections shall have a minimum depth of cover of 3.0 m as measured from the top of the pipe to the final finished grade.

5.6.7 Service connections shall be located such that they do not conflict with potential driveway locations, where possible.

5.6.8 Water service connections shall include a main stop at the connection to the water main and a curb stop located at the property line, in accordance with the Engineering Standard Drawings. Curb valves shall be located off of paved surfaces.

5.6.9 Water service connection shall be installed on the upstream side of the sewer service relative to the direction of flow of the sewer main.

5.6.10 Where the water service is 50 mm or smaller in size, the water and wastewater services may be located in a common trench. Where services are located in a common trench, provide minimum 300 mm horizontal and vertical separation between water and sewer services.

5.6.11 Where the water service is larger than 50 mm diameter, water service pipes shall be located in a separate trench, at least 3 m from any sewer services and 2.0 m from any other buried utility lines.

5.6.12 Service connections shall be extended beyond the gas line into the lot to terminate a minimum of 4.0 m from the property line or 1.0 m past the utility easement.

5.6.13 For service connections 100 mm in diameter and larger that connect to an existing water main, the Design must provide for hot-tapping into existing water mains. Hot-tapping shall be accomplished through use of a tapping valve and sleeve while maintaining uninterrupted service through the existing water main. An additional valve shall be installed at the property line. Remove valve casing from hot tap once pressure testing completed.

PART II – MATERIALS

5.7 Water Mains

Water mains shall be polyvinyl chloride (PVC) pipe, or accepted alternate. PVC fittings shall be used for water mains. Where PVC fittings cannot be obtained, cast iron fittings may be permitted. Any proposed alternative pipe must be approved by the Town and conform to all applicable American Water Works Association (AWWA), American Standards for Testing and Materials (ASTM), Canadian Standards Association (CAN/CSA), and National Sanitation Foundation (NSF) standards.

5.7.1 Pipe

a.) PVC pipe shall meet CAN/CSA-137.3.
b.) Pipe from 100 mm to 300 mm in diameter shall conform to AWWA-C900 with a minimum pressure class of 1,034 kPa (DR18).
c.) Pipe from 350 mm to 900 mm in diameter shall conform to AWWA-C905 with a minimum pressure class of 690 kPa (DR25).
d.) Strength design, considering trench and road loading, shall be integral to pipe design process.
e.) PVC pipe shall have a joint with an integrally thickened bell end and flexible elastomeric gasket. Joints shall conform to ASTM-D3139 with gaskets conforming to ASTM-F477.
f.) Joint lubricants shall be in accordance with NSF Standards 14 and 61, and shall be compatible with gasket materials.
g.) Pipe shall be installed within two years from the production data indicated on the certification.

5.7.2 Fittings

a.) Polyvinyl Chloride (PVC)
  i. PVC injection-molded fittings shall conform to AWWA-C900, C905, and C907, as applicable, and shall be certified to CAN/CSA-B137.3.
  ii. Fitting diameter, class, and pressure rating shall match the water main.
  iii. Use push-on type ends complete with one gasket for each bell.
  iv. Gaskets shall conform to ASTM-F477.
  v. Include mechanical joints as required in addition to necessary thrust blocking in accordance with Section 5.7.3.
b.) Cast Iron
  i. Cast iron, rubber gasket type conforming to AWWA-C110, minimum 1,720 kPa working pressure.
  ii. Use push-on type ends complete with one gasket for each bell, conforming to AWWA-C111.
  iii. Fitting exterior must be factory coated with an asphaltic or epoxy coating conforming to AWWA-C213.
  iv. Include mechanical joints as required in addition to necessary thrust blocking, in accordance with Section 5.7.3.

5.7.3 Mechanical Joint Restraints

a.) Joint restraints shall conform to AWWA-C111 and ASTM-F1674.
b.) All nuts and bolts shall be Type 304 stainless steel.
c.) Diameter and pressure rating to match the pipe and fitting to which the restraint is being applied. The pressure rating of the restraint shall include a minimum safety factor of 2.0.
d.) Gland shall be constructed of high strength ductile iron conforming to ASTM-A536.

5.8 Hydrants

5.8.1 Hydrants shall conform to AWWA-C502.

5.8.2 All external nuts and bolts, including the ground flange, shall be Type 304 stainless steel.

5.8.3 Each hydrant shall have one 146 mm diameter Storz pumper connection and two 63.5 mm diameter hose connections to conform to Alberta Mutual Aid Thread standard. Connections must be a minimum of 415 mm above the ground flange. Hose connections must be at 90-degrees to each side of the pumper connection. 100 mm diameter Storz fitting shall be provided on the pumper connection.

5.8.4 The barrel of the hydrant shall be a minimum of 150 mm inside diameter. Two-piece barrels shall be used with a 300 mm on top of the barrel (not the bottom). Barrels shall be of sufficient length to provide a minimum of 3.0 m of cover over the water main.

5.8.5 A gravel drainage pit, covered with polyethylene, shall be provided at the bottom of the hydrant as shown on the standard detail in Appendix "A".

5.8.6 A gate valve, in accordance with Sections 5.4 and 5.9, shall be provided with each hydrant lead.

5.8.7 Hydrant exterior below grade must be factory coated with an asphaltic or epoxy coating.

5.8.8 All hydrants shall be painted Tremclad Yellow (No. 270-97X). Storz port caps shall be painted BL-6-OSHA Safety Blue.

5.8.9 McAvity, Mueller/Canada Valve.

5.9 Water Main Valves

5.9.1 Gate Valves

a.) Gate valves shall be used for water mains 300 mm in diameter or smaller. Butterfly valves shall be used for pipes larger than 300 mm in diameter.
b.) Gate valves shall be resilient-seated type conforming to AWWA-C509.
c.) Epoxy-coated cast iron body and disc.
d.) All external nuts and bolts shall be Type 304 stainless steel.
e.) Non-rising stem.
f.) Bell ends, single-ring gasket, and push-on joints suitable for connecting to PVC pipe.
g.) Valve size shall be equivalent to the pipe size.
h.) Operating pressure shall be minimum 1,200 kPa, cold water service.
i.) Provide a 50 mm square operating nut that turns counter-clockwise to open.
j.) Valve stem to be Type 304 stainless steel.
k.) Provide "O"-ring valve stem seals.
l.) Valve Box and Extension
    i. Valve boxes shall be two-section, cast iron, adjustable, sliding-type (Type A) complete with cast iron lid. Refer to the detail in Appendix "A".
    ii. The internal spindle shall extend to within 150 mm of the finished surface and shall include a top operating nut and rock disc. Internal spindle and rock disc shall be greased prior to installation to allow for future removal.
    iii. Valve boxes shall be of sufficient lengths to provide for adjustments of 300 mm in the up or down direction.
    iv. Valve box extensions shall be cast iron, Type A, suitable for use with the valve boxes installed.
    v. Extension stem shall be 25 mm square, mild steel, with 50 mm square operating nut and flange.
m.) Mueller, Norwood, or accepted alternate.

5.9.2 Butterfly Valves

a.) Butterfly valves shall be used for pipes larger than 300 mm in diameter. A vault chamber shall be required at the direction of the Town.
b.) Butterfly valves shall be rubber-seated type conforming to AWWA-C504, Class 150 B.
c.) Wafer, short body flanged, or fully lugged in accordance with AWWA-C504.
d.) Epoxy-coated cast iron body and disc.
e.) All external nuts and bolts shall be Type 304 stainless steel.
f.) Use a valve size equivalent to the pipe size.
g.) Provide "O"-ring shaft seals in a removable, corrosion-resistant recess to allow seals to be replaced without removing the valve shaft.
h.) All butterfly valves shall have a flange adapter on one side for the purpose of valve removal. Flange adapter to be equipped with internal pipe stops.
i.) Actuator
    i. Provide a manual gear actuator conforming to AWWA-C504.
    ii. Counter clockwise to open.
    iii. 50 mm square operating nut.
    iv. Type 304 stainless steel actuator input shaft.
    v. Actuator to transmit required valve opening and closing torque at an input torque of 135.6 Joules (100 ft-lb).
    vi. Actuator to be third party certified to AWWA-C504.
j.) Mueller, or accepted alternate.

5.10 Pressure Relief Valves

5.10.1 The Designer shall provide detailed technical specifications for any pressure relief valves proposed in the Design to the Town for review and acceptance.

5.10.2 Pressure relief valves shall conform to all other applicable standards and guidelines.

5.10.3 Pressure relief valves shall be clay valve or accepted alternate.

5.11 Water Service Connections

5.11.1 Standard Water Service Pipe

a.) For pipe diameters from 19 mm to 25 mm nominal diameter, water service pipe shall be copper.
b.) For pipe diameters greater than 25 mm, and up to 50 mm diameter, water service pipe shall be copper, or accepted alternate.
c.) Copper water service pipe shall be Type K copper pipe conforming to ASTM-B88, and complying with AWWA-C800.
d.) For water services larger than 50 mm nominal diameter, use pipe, fittings, and valves that are of the same pressure rating and material as the water main, in accordance with the applicable requirements of Section 5.7 and Section 5.9.

5.11.2 Service Saddles

a.) Service saddles shall be bronze or Type 304 stainless steel, tapered inlet thread, conforming to AWWA-C800. Straps to be type 304 stainless steel.
b.) Fasteners to be lubricated at the time of installation to prevent binding.
c.) "O"-ring gaskets to be constructed of synthetic rubber suitable for potable water use, and shall provide pressure-tight seal on the water main.
d.) Mueller, Cambridge Brass, Smith-Blair, or accepted alternate.

5.11.3 Couplings

a.) Couplings to be compression type, conforming to AWWA-C800. Mueller, Cambridge Brass, or accepted alternate.

5.11.4 Corporation Main Stops

a.) For copper pipe, corporation main stops shall be brass compression type, conforming to AWWA-C800. Mueller, or accepted alternate.

5.11.5 Curb Valves

a.) For copper pipe, curb valves shall be brass type with stop and drain, conforming to AWWA-C800. Mueller, or accepted alternate.
b.) Service Box
   i. Service boxes shall be two-section, epoxy-coated, galvanized iron, adjustable type.
   ii. The top section of the service box shall be 33 mm outside diameter, 600 mm in length, threaded at the top, and shall provide a sliding fit outside of the bottom section for adjustments of 300 mm in the up or down direction.
   iii. The bottom section shall rest on a minimum 50 mm thick by 200 mm wide by 300 mm long concrete block, pressure treated wood, or accepted equivalent.
   iv. The service box cap shall be cast iron, 90 mm in diameter, threaded to allow connection to the cast iron top section of the box, and shall include a brass plug. The brass plug, shall be threaded to match the cap.
   v. The operating rod shall be Type 304 stainless steel, 2,150 mm in length.
   vi. The bottom 25 mm of the rod cold-forged square shall be connected with a stainless steel or brass cotter pin.
   vii. Mueller, Norwood, or accepted alternate.

5.12 Cathodic Protection

5.12.1 All cast iron fittings, hydrants, valves, curb valves, and service boxes shall be cathodically protected with a 5.5 kg zinc anode.

5.12.2 Zinc anodes shall conform to ASTM B418, Type 2.

5.12.3 Lead wires shall be 2 m long, No. 10A WG/7.

5.12.4 Lead wires shall be connected with suitable clamps or welds in accordance with the manufacturer's recommendations.

5.13 Bedding and Backfill

5.13.1 Class A Bedding

Concrete, complying with the following:
a.) Concrete shall be made with Type HS sulphate resistant Portland cement to CAN/CSA- A3000.
b.) Maximum slump 75 mm, compressive strength of 25 MPa at 28 days.
c.) In freezing weather, provide concrete with a temperature of not less than 10°C, and maintain this temperature for 72 hours.

5.13.2 Class B Bedding

a.) Sand, complying with the following gradation shown in the following table.

Sieve Size	Percent Passing
9.5 mm	100
4.75 mm	90 - 100
150 µm	20 max.

5.13.3 Gravel

a.) Pit-run gravel shall be maximum size 75 mm complying with the following gradation:

Sieve Size	Percent Passing
75 mm	100
4.75 mm	80 maximum
0.5 mm	60 maximum
75 micro-m	10 maximum

b.) Gravel for stabilization of trench bottoms

i. Well graded sandy gravel - 75 mm maximum size complying with the following gradation:

Sieve Size	Percent Passing
75 mm	90 - 100
4.75 mm	20 - 50
0.5 mm	5 - 25
75 micro-m	0 - 5

ii. Washed rock - 75 mm maximum size with maximum 5% passing the 4.75 mm sieve.

5.13.4 Native Fill

a.) Native fill is material excavated from trench excavation and approved by the Consultant for use as fill. Native fill material shall be free of stones larger than 200 mm, organic material, and other deleterious material.

5.13.5 Fillcrete

a.) Unshrinkable fill (fillcrete) materials shall conform to the following:

i. Portland Cement to CAN/CSA-A3000 – Type GU, Type HE, or Type HS.
ii. Fine aggregate to CAN/CSA-A23.1, Clause 5.3.2, Table 1.
iii. Water to CAN/CSA-A23.1, Clause 4, clear and free from detrimental amounts of oil, acid, alkali, organic material, sediment, or other substances which inhibit effective mixing and curing of concrete.
iv. Air-entraining admixtures to ASTM-C260.
v. Chemical admixtures to ASTM-C494, including water-reducing agents, retarders, and accelerators. Chemical admixtures are not permitted unless accepted in writing by the Town.
vi. Fly ash to CAN/CSA -A23.5, pozzolan Type C.
vii. Fillcrete mix design shall conform to the following table:

Compressive Strength at 28 Days (MPa)	Slump (mm)	Entrained Air (% by volume)	Maximum Aggregate Size (mm)	Maximum Fly Ash Content (%)	Minimum Cement (kg/m^3)
Minimum 0.15	100 ±25	Minimum 6.0	5	2	30
Maximum 0.40		Maximum 8.0			

viii. Fillcrete shall be produced in accordance with CAN/CSA -A23.1-C18, and shall conform to the accepted mix design.

PART III – CONSTRUCTION

5.14 General

5.14.1 The following sections represent the minimum requirements for some typical, key construction procedures for water distribution system construction. These minimum requirements must be met or exceeded by the detailed construction specifications and drawings developed by the Consultant.

5.14.2 Construction activities must adhere to the provisions of the Erosion and Sediment Control Plan prepared for the Development in accordance with Section 1.10.1.7.

5.15 Quality Assurance

5.15.1 The Consultant must be on site and qualified and must maintain detailed records of all inspections and testing as evidence of compliance of the work with these Standards. These records shall be provided to the Town upon request.

5.15.2 The Town may at any time require the Contractor to provide evidence of certification by the testing agency that the materials and performance of the work meet these Standards.

5.15.3 The Consultant shall provide a written endorsement of the Contractor's compliance with these Standards with the application for the Construction Completion Certificate.

5.16 Quality Control Testing

5.16.1 The Developer shall retain the services of independent testing laboratories or agencies to conduct all quality control testing. The proposed testing laboratory or agency shall be subject to the acceptance of the Town.

5.16.2 Minimum quality control test frequencies, specified as follows, are the minimum number required. The Developer shall ensure that as many tests as necessary are performed to ensure that the work conforms to the requirements of these Standards, regardless of the minimum number specified.

a.) Field densities (ASTM-D2167 or ASTM-D2922):
- i. Pipe Bedding - one for each 25 m of pipe installed.
- ii. Pipe Zone Backfill - one for each 25 m of pipe installed.
- iii. Trench Backfill - one for every 100 m of trench of 1.0 m fill depth.
- iv. If any density test results in less than the required compaction, two more tests shall be taken for the depth and length of backfill or bedding represented by the failed test. If the average of the three tests results in a density less than required, the depth and length of backfill or bedding represented by the failed tests shall be reworked, the soil moisture modified as necessary, re-compacted, and re-tested until the required compaction is met.

b.) Moisture density curves (ASTM-D698):
- i. Pipe Bedding - one for each 25 m of pipe installed.
- ii. Pipe Zone Backfill - one for each 25 m of pipe installed.
- iii. Trench Backfill - one for every 100 m of trench of 1.0 m fill depth.

c.) Sieve analyses (ASTM-C136):
- i. Pipe Bedding - one for each 25 m of pipe installed.
- ii. Pipe Zone Backfill - one for each 25 m of pipe installed.
- iii. Trench Backfill - one for every 100 m of trench of 1.0 m fill depth.

5.17 Site Preparation

5.17.1 Prepare the site in accordance with Section 3.26 of these Standards.

5.18 Clearing

5.18.1 Conduct clearing in accordance with Section 3.27 of these Standards.

5.19 Grubbing

5.19.1 Complete grubbing in accordance with Section 3.28 of these Standards.

5.20 Topsoil Stripping and Stockpiling

5.20.1 Strip and stockpile topsoil in accordance with Section 3.29 of these Standards.

5.21 Operating Existing Valves and Hydrants

5.21.1 Town of Whitecourt Infrastructure staff are the only personnel that are authorized to operate existing valves and hydrants.

5.21.2 Apply to the Infrastructure Department and to request any valve or hydrant operations at least 48 hours in advance. Following approval, infrastructure personnel shall be dispatched to open or close existing valves or hydrants.

5.22 Trench Excavation

5.22.1 Refer to the Engineering Standard Drawings.

5.22.2 Where applicable, any recommendations of the geotechnical report regarding trenching methods shall be duly incorporated into the construction specifications and drawings, and observed by the Contractor.

5.22.3 Where required, temporary protective structures, bracing, shoring, and sheeting are the responsibility of the Contractor and shall be designed by a Professional Engineer registered in Alberta.

5.22.4 Observe safety regulations of the Occupational Health and Safety Act with regard to protection of the work, property, and structures adjacent to the Work and maintenance of the trench widths.

5.22.5 Existing pipelines shall be exposed by hand digging or hydro-vacuuming. No mechanical excavation shall be undertaken within 1.0 m of the anticipated location of an existing pipeline. Hydro-vacuuming is the preferred method of confirming the location of existing utilities near the surface.

5.23 Alignment and Grade

5.23.1 Lay pipe to the required alignment and grade, with fittings, valves, hydrants, and all other appurtenances at the locations identified on the construction drawings or otherwise directed by the Town.

5.23.2 Provide minimum 3.0 m depth of cover on water mains, unless otherwise authorized by the Town in writing. Where depth of cover is proposed to be less than 3.0m, insulation may be approved by the Town.

5.23.3 Acceptable tolerances are as follows:

a.) Alignment - the centreline of the pipe shall not be more than 100 mm off the given alignment.
b.) Elevation - the pipe invert shall not be more than 50 mm off the elevation indicated on the approved construction drawings.

5.23.4 Maintain, and provide to the Town upon request, grade sheets for the installation of the pipe.

5.23.5 No deviation shall be made from the required alignment or grade without the written consent of the Town.

5.24 Pipe Bedding and Pipe Zone Backfill

5.24.1 Pipe Bedding and Backfill shall be as recommended by the geotechnical report. Class B bedding shall be used for all areas with suitable soil conditions. Where unstable soil conditions exist, Class A bedding or better shall be used, at the discretion of the Town.

5.24.2 Refer to the Engineering Standard Drawings for pipe bedding details.

5.24.3 For Class “A” Bedding:

a.) Place a cradle of concrete bedding under the pipe and the full width of the trench to the depth shown on the Engineering Standard Drawings.
b.) Place sand above the concrete and compact to 98% of Standard Proctor Density to 300 mm above the top of the pipe.

5.24.4 For Class B Bedding:

a.) Place sand bedding under the pipe and the full width of the trench to the depth shown on the Engineering Standard Drawings and compact to 98% of Standard Proctor Density.
b.) Place selected native soil or sand above the bedding and compact to 98% of Standard Proctor Density to 300 mm above the top of the pipe.
c.) For installation in high water table areas washed rock wrapped in geotextile may be required. Refer to Appendix A Engineering Standard Drawings for detail.

5.24.5 Provide bell or coupling holes as required and support the pipe uniformly and continuously throughout its length.

5.24.6 Backfill in the pipe zone shall be sand complying with the gradation specified in Section 5.13.

5.24.7 Granular bedding and pipe zone backfill shall be placed and compacted in uniform lifts not exceeding 150 mm in depth.

5.25 Pipe Installation

5.25.1 General

a.) Follow manufacturer’s instructions for pipe installation. Where manufacturer’s instructions and these specifications are in conflict, notify the Town who will provide judgment on which method will govern the Work.
b.) Lay and join PVC pipe in accordance with AWWA-M23.
c.) Install calcium hypochlorite tablets in pipes, in accordance with Section 5.32.4.

5.25.2 Laying Pipe

a.) Lay pipes on prepared bedding with excavated joint holes that allow the joint ends to be kept clean of soil and bedding material, to facilitate completing the joint and to avoid load concentration on the bells or couplings.
b.) Lay pipes with the bell ends facing in the direction of the laying operations.
c.) Cut pipes where necessary to install fittings and valves. Make cuts in accordance with the manufacturer's recommendations using recommended cutting tools. Cut pipes squarely and accurately.
d.) Test bolting of all mechanical couplings and restraints on completion using a torque wrench. Torque shall conform to the pipe or fitting manufacturer’s recommendations.
e.) Pipe deflections at joint shall not exceed those specified by the pipe manufacturer.
f.) Do not lay pipe in water or when, in the opinion of the Town, trench conditions are unsuitable.
g.) Cover open ends of installed pipe, when pipe laying is not in progress, to keep out trench water.

5.25.3 Joining Pipe

a.) Join pipe in accordance with the manufacturer's recommendations.
b.) Clean and check the sealing surfaces to ensure that they are smooth, concentric, and free from imperfections that might affect the sealing performance of the gasket.

5.25.4 Connecting to Existing Mains

a.) Notify the Town in writing at least five (5) days prior to connecting to an existing water main.
b.) Provide the Town with a work plan and contingency plan detailing the procedures to be observed in the event of problems during the connection process or other emergency.
c.) Written authorization must be received from the Town at least 24 hours before connecting to existing mains.

5.25.5 Plugging of Dead Ends

a.) Insert standard plugs into the bell ends of fittings or pipe bells at dead ends.

5.26 Setting Hydrants

5.26.1 Install hydrants at the required locations and at the required directions.

5.26.2 Set hydrants plumb with hose nozzles parallel or at right angles to the street centreline.

5.26.3 Set hydrants with ground flanges above final curb and sidewalk grades.

5.26.4 Provide a coarse gravel drainage pit, complete with filter cloth, where hydrant barrels can be drained to the surrounding soil.

5.26.5 Hydrant ports shall be left open except where the hydrant is located in areas of high water tables and/or where the possibility of contamination exists, as indicated by the geotechnical report. At these locations, the port shall be closed and the hydrant shall be labeled "No Drain".

5.26.6 Construct hydrant thrust blocks so that drains are not plugged.

5.26.7 Support hydrants with suitable concrete blocking. Thrust blocks shall be in accordance with Standard Engineering Drawings.

5.26.8 Provide Class I or Class II compacted backfill, in accordance with Section 5.31.7, for a minimum 1.5 m radius around all hydrants.

5.27 Setting Fittings and Valves

5.27.1 Install fittings and valves at the required locations.

5.27.2 Support all fittings and valves with blocking as shown on the Engineering Standard Drawings.

5.27.3 Install valve boxes plumb and support valve boxes to prevent the transmission of strain or shock to the valve.

5.27.4 Set the top of valve boxes flush with finished grades in unpaved areas and 5 to 15 mm below grade on paved areas.

5.27.5 Provide Class I or Class II compacted backfill, in accordance with Section 5.31.7, for a minimum 1.5 m radius around all valves.

5.28 Thrust Blocks and Mechanical Joint Restraints

5.28.1 Install thrust blocks at all dead ends and at all fittings, valves, and hydrants, in accordance with the Engineering Standard Drawings, or where otherwise directed by the Town.

5.28.2 Place concrete thrust blocks against solid ground with a minimum bearing area as shown on the Engineering Standard Drawings, or as directed by the Town.

5.28.3 Pour the concrete in a manner that will leave pipes, fittings, valves, and hydrants accessible for repair.

5.28.4 Valves and fittings shall be mechanically restrained as follows:

Working Pressure	Diameters Requiring Restraint
Up to 700 kPa	300 mm and up
700 to 1,000 kPa	200 mm and up
1,000 to 1,380 kPa	All sizes

5.28.5 Install mechanical restraints in accordance with manufacturer's instructions.

5.28.6 See Appendix A Standard Engineering Drawings.

5.29 Water Service Connections

5.29.1 Services crossing under roads shall be augered as shown on the Engineering Standard Drawings. At the end of cul-de-sacs and for lots located adjacent to the mains, open trenching installation of the services may be permitted with the written authorization of the Town.

5.29.2 Services installed by open trench or through auger pits shall be bedded in accordance with Section 5.25.

5.29.3 Pipe zone backfill shall be placed to 300 mm above the crown of the highest service in the trench or auger pit.

5.29.4 Service connections shall be extended beyond the gas line into the lot to terminate a minimum of 0.15 m from the back of the easement line, and cap the open end of the pipe.

5.29.5 Install red-painted stakes, 50 mm by 100 mm in size, extending from the termination point of the service point to a minimum of 0.5 m above the finished surface elevation.

5.29.6 Backfill trenches and auger pits in accordance with Section 5.31.

5.29.7 Augering and Boring:

a.) Auger or bore services under existing roads, sidewalks, curbs, and gutters.
b.) Auger holes and bore holes shall be large enough to pass service pipes through without disturbing joints.
c.) Fill the auger or bore hole around the pipe with a dry or slurry mixture of sand and cement.

5.29.8 Tapping Water Mains

a.) Tapping of PVC water mains shall be in accordance with AWWA-C605 and AWWA- M23 and in accordance with the specific pipe manufacturing guidelines.
b.) Drill and tap water mains that are under pressure using a tapping machine.
c.) Dry-tapping may be used for service connections to new water mains with written approval from the Town Engineer. Wet-tapping may be used to tie-in a new service to an existing water main; all coupons must be recovered from the main and accounted for.
d.) Direct taps to water mains may be used where the tap diameter is 25 mm diameter or smaller and the water main is 300 mm diameter or smaller. Service saddle taps must be used where the tap diameter is greater than 25 mm diameter or where the water main is larger than 300 mm diameter.
e.) Do not tap a curved pipe where the bend radius is less than 300 times the pipe outside diameter.
f.) Tap into the upper half of water main and incline upward 0° to 30° from the crown of the main. Stagger multiple taps at least 600 mm apart; with adjacent taps offset 30° with respect to each other. Taps shall be greater than 300 mm from any coupling or saddle.
g.) Insert the main stop in accordance with the manufacturer's instructions.

5.29.9 Pipe Installation

a.) Provide 300 mm diameter "goose-necks" in the water service at the corporation main stop and as required to maintain a minimum 300 mm clearance over wastewater and stormwater service pipes. Refer to the Engineering Standard Drawings.
b.) Lay pipe slack in the trench.
c.) Copper services should be one continuous section of pipe. In the event that the service pipe length exceeds the length of a standard roll of copper pipe, use only double union couplings to connect two sections of copper pipe. Wherever possible, locate double unions outside of paved areas and near curb valves. Plan of record drawings must identify the services which contain unions.

5.29.10 Curb Valves and Services Boxes

a.) Support curb valves on a minimum 50 mm thick by 200 mm wide by 300 mm long concrete block.
b.) Set the services box plumb and adjusted to grade.
c.) Brace service boxes sufficiently during backfilling operations.
d.) Mark the curb stop location with a 50 mm x 100 mm x 1,500 mm, fluorescent red painted marker, set 1 m into the finished ground surface.

5.29.11 Testing

a.) The water service pipe, from the main to the curb stop, will be included in the hydrostatic pressure test, as specified in Section 5.32.

5.29.12 Record of Services

a.) Maintain red-line markups as the as-constructed location and elevation of all service connections for preparation of plan of record drawings. Plan of record drawings must indicate the locations and elevations of water mains, corporation main stops, curb valves, and pipes in relation to property lines.

5.30 Cathodic Protection

5.30.1 Install cathodic protection on all cast iron fittings, valves, and hydrants in accordance with the Engineering Standard Drawings, and the manufacturer's instructions.

5.30.2 Embed zinc anodes into the trench wall to provide a minimum 50 mm native material compacted around the anode.

5.30.3 A minimum of 3L of water shall be poured on each anode to initiate operation of the anode prior to backfilling.

5.31 Trench Backfill

5.31.1 Trench backfill is defined as backfill above the pipe zone.

5.31.2 Place backfill in a dry trench.

5.31.3 Place backfill by rolling down a slope in the trench or lower by machine. Prevent backfill from dropping vertically.

5.31.4 Backfill as close as possible to pipe laying operations so that trenches are left open no longer than absolutely necessary.

5.31.5 Protect all open excavations when construction is not ongoing with fencing, barricades, flashing lights, etc., and provide watchmen for site security and public safety if required by the Town.

5.31.6 Plan the backfilling operation so that exposure of the backfill material to frost is kept to a minimum. Use no large frozen chunks of soil as backfill.

5.31.7 Classes of Trench Backfill

a.) Class I (Roads and Lanes)
   i. Place pit-run gravel or sand in uniform 150 mm lifts over the whole width of the trench, each lift compacted to 98% of the maximum density as determined by the Standard Proctor Compaction Test.
   ii. Bring the compacted granular material up to the original grade and restore the surface to original or better condition.
   iii. Remove excess granular material to allow surface restoration.

b.) Class II (Non-Paved Areas)
   i. Place native backfill material in uniform lifts not exceeding 150 mm over the width of the trench, each lift compacted using mechanical compaction equipment. Compact to 95% of the maximum density as determined by the Standard Proctor Compaction Test.
   ii. Backfill material shall be free of wood, brush, or other perishable, objectionable material. No rocks larger than 200 mm shall be present in the backfill material.
   iii. The moisture content of the backfill material shall be controlled as necessary to achieve the necessary compaction. Supply and add water if it is necessary to increase moisture content. Spread and dry backfill material if moisture content is above optimum.
   iv. Supply and place imported material if moisture content cannot be adjusted.
   v. Where the excavated material is unsuitable for backfilling purposes, use imported material.
   vi. Where the excavation is carried out on a gravel road, bring the compacted excavated material up to the base of the surface gravel and place surfacing gravel to match the existing surface.

c.) Fillcrete
   i. Backfill the trench with fillcrete where backfilling with Class I or Class II backfill is not feasible.
   ii. Uniformly place fillcrete from the top of bedding to the designated or pre- existing sub-grade elevation.
   iii. Protect fillcrete from freezing or other adverse weather conditions for a minimum of 24 hours following placement.
   iv. Fillcrete that is exposed to significant infiltration of water within 24 hours of placement must be removed and replaced.
   v. A minimum of 150 mm of granular base course must be placed on the fillcrete surface before allowing any vehicular traffic over the fillcrete. Granular base course may be placed 24 hours following the placement of the fillcrete.

5.32 Hydrostatic Pressure Testing and Cleaning

All new water mains must pass a hydrostatic pressure test and be thoroughly cleaned before they shall be accepted by the Town and placed into service.

5.32.1 Pre-Testing: Contractor to pretest all newly installed water mains including all hydrants, services and private service leads that extend 4m into properties. Contractor to pretest all lines prior to requesting the Town presence to witness final test. Developers engineer must be on site to witness the final pressure test. During the test, Town staff will verify that all valves within the test section are open prior to starting the final pressure test and witnessing. If connecting into an existing water main or service and required to test against an existing valve(s), it is the Contractor's responsibility to verify that there are no leaks on the existing section prior to construction of any new section. If the existing line fails a pressure test, the Town will decide the course of action to be taken.

5.32.2 Test Preparation

a.) The Developer shall supply all testing equipment and personnel to perform hydrostatic pressure testing.
b.) Notify the Town at least 24 hours in advance of filling the line for testing. Failure to notify the Town may result in the tests being deemed unacceptable.
c.) Testing shall not be done under winter conditions unless the line can be safely drained or immediately placed into operation.
d.) Concrete thrust blocks must be cured prior to commencing testing activities.
e.) Ensure all corporation main stops are open and all curb valves are closed.
f.) Ensure the test section is isolated and open all main valves within the test section.
g.) Maximum length of water main test sections shall be 450 m, unless otherwise authorized or directed by the Town.

5.32.3 Pressure Testing

As per EPCOR specifications in Appendix F

a.) At the point of the test, apply hydrostatic pressure of 1.5 times the operating pressure or 690 kPa, whichever is the greater, and at no point in the test section shall the hydrostatic pressure be less than 1.25 times the operating pressure.
b.) When the test pressure is achieved, the test will begin.
c.) Mark the gauge and level of water in the storage barrel at the beginning of the test. These will be used to calculate leakage at the end of the test.
d.) Maintain the test pressure, within ± 20 kPa, for two hours.
e.) During the test, inspect all exposed pipe, fittings, and appurtenance locations for signs of leakage or distress.
f.) At the end of the test, pump the test section back to the test pressure.
g.) The leakage allowance for PVC pipe will be determined by the Consultant using the following formula:

$$L = \frac{ND\sqrt{P}}{128{,}300}$$

Where: N = number of joints in the test section;
D = nominal pipe diameter in mm; and
P = average test pressure in kPa.

h.) The number of joints is estimated from the total length of pipe installed plus 1 joint allowance for each water service connection.
i.) An additional allowance is made when testing against closed metal-seated valves. This allowance is 0.0012 L per hour per mm of nominal valve size.
j.) If the total volume of makeup water used to pump the test section back up to the test pressure exceeds the allowable leakage, inspect the test section for and repair leaks or defective pipes, or remove trapped air and repeat the test.
k.) Repair and re-test until leakage is within the specified limits.
l.) Upon successful completion of testing procedures, complete any remaining backfilling and surface restoration.

5.32.4 Disinfection

As per EPCOR specifications in Appendix F

a.) Submit a detailed work plan for disinfection procedures to the Town for review at least two (2) weeks prior to conducting such activities. The work plan must provide sufficient detail regarding water supply source, disinfection procedures, flushing procedures, discharge location, discharge de-chlorination procedures, and testing locations for chlorine residual and bacteriological testing.
b.) Only the Town may operate existing utility systems. There are no exceptions.
c.) Disinfect the water main in accordance with AWWA-C651. The preferred method of disinfection is with calcium hypochlorite tablets, further described in the following.
   i. Calcium hypochlorite tablets shall be placed in the water main during construction.
   ii. Use 5-gram tablets and place one at each end of the water main, at 150 m intervals, at each hydrant lead, in each hydrant, and at other appurtenances to provide an average dose of 25 mg/L in the water main.
   iii. Attach the tablets to the top inside of each piece of pipe during construction using Le Page's white, waterproof glue, or approved equivalent.
   iv. The number of tablets required can be calculated from:

$$N = 6.28\,x10^{6}(D^{2})(L)$$

Where: N = number of tablets required;
D = nominal pipe diameter in mm; and
L = length of pipe being disinfected in m

   v. Slowly fill the water main, maintaining flow velocity below 0.3 m/s, to prevent premature dislodging of the tablets.
   vi. Upon complete filling of the water main, allow minimum 12 hours of contact time at water temperatures greater than 5°C.
   vii. After 12 hours, test the chlorine residual and take bacteriological test samples. The free chlorine residual must be greater than 20 mg/L and the samples must successfully pass bacteriological testing prior to the water main being placed into normal operation. Should the test sample fail either of these testing procedures, the water main will be flushed and disinfected. This process shall be repeated until water samples pass these tests.
d.) Disinfection may be carried out simultaneously with pressure and leakage testing, provided the provisions of AWWA-C651 are followed.
e.) If repairs are made on any section of pipe, disinfection shall be repeated.

5.32.5 Flushing

a.) Flush water mains clean of all dirt, debris, and other deleterious material prior to placing the water mains into normal operation.
b.) The flushing flow rate shall be sufficient to achieve a minimum flow velocity of 0.8 m/s through the pipe.
c.) Flush water mains and safely discharge the water so that no downstream damage occurs.
d.) Discharge flushing water in a manner and to locations acceptable the Town. Sufficiently de-chlorinate flushing water in accordance with Section 5.32.6 prior to discharge.
e.) Where flushing is insufficient to clear material buildup in the water main, the Contractor shall undertake foam swabbing of the water main.

5.32.6 De-Chlorination

a.) Flushing water must be sufficiently de-chlorinated prior to release. The maximum allowable free chlorine residuals that must be achieved prior to release are as follows:
   i. 5.0 mg/L to sanitary sewers;
   ii. 0.20 mg/L to storm sewers; or
   iii. 0.20 mg/L to watercourses.
b.) No disposal of flushing water shall be permitted until the proposed de-chlorination procedures have been reviewed and accepted by the Town.

c.) The preferred de-chlorination method includes utilizing a continuously fed neutralizing chemical introduced to the chlorinated water as it is flushed from the water main and before the water enters the receiving environment. Alternatively, a de-chlorination tank system may be used.
d.) Acceptable de-chlorination chemicals include sodium thiosulphate, sodium sulphite, and sodium bisulphate.
e.) Follow the instructions of the de-chlorination chemical supplier for mix ratios required for chlorine neutralization, application methods, and safety procedures.

5.33 Inspection of Valves and Hydrants

5.33.1 Upon completion of backfilling and surface restoration, check the operation of all valves and hydrants.

5.34 Placing Water Mains into Service

5.34.1 Testing and cleaning, in accordance with Section 5.32, must be completed prior to placing a new water main into service.

5.34.2 Chlorine residual and turbidity values must meet the requirements provided by the Guidelines for Canadian Drinking Water Quality and Alberta Environment before placing the main into service.

5.34.3 Notify the Town in writing at least five (5) days prior to placing a new water main into service. Include a work plan identifying valve operation sequencing, water quality monitoring to ensure water quality in the existing system is not adversely affected, emergency procedures, and any other activities necessary to the successful commissioning of the water main. Written authorization must be received from the Town at least 24 hours before commissioning the water main.

5.34.4 Notify and arrange for a representative of the Town's Infrastructure Department to conduct all necessary valve operations. Only the Town may operate boundary valves; there are no exceptions. One boundary valve shall be opened slowly, releasing air from the new main through hydrants or air release valves until the pressure is equalized and stable, then other boundary valves will be slowly opened.

5.34.5 Maintain a watch for a break in the new water main. In such an event, isolate the water main so that service interruptions will be minimal.

5.34.6 The Town will turn on service connections.

5.34.7 Assist the Town in obtaining water samples for bacteriological testing. Standby and be prepared to perform any necessary sampling in the event that water quality concerns arise.

5.34.8 In cooperation with the Town, maintain a watch for leaks on the water main within 3 days of commissioning. Promptly repair any leaks which are detected.

5.34.9 If any water sample fails bacteriological testing, the Town will issue directions for remedial action.

5.35 Hydrant Flow Testing

5.35.1 The Developer shall be responsible for providing all labour and materials to complete selective hydrant flow testing of new water mains to verify available flows and pressures within the new water distribution network in comparison with the design calculations and hydraulic analyses.

5.35.2 The Consultant must be present for all testing and shall be responsible for preparing and endorsing the test results.

5.35.3 The Town must be notified at least one (1) week in advance of hydrant flow testing. The Infrastructure Department to be contacted to operate the hydrant(s).

5.35.4 The results of the hydrant flow testing shall be summarized in a written report in a format acceptable to the Town by the Developers engineer, and submitted to the Town with the Developer's application for the Construction Completion Certificate.

5.35.5 Where the actual flows do not meet minimum fire and service requirements, all hydrants installed under the Design must be flow tested and the Developer shall be responsible for completing all necessary corrective measures to meet the required service level.

6. Wastewater Collection System

PART I – DESIGN

6.1 General

The wastewater collection system shall be designed with sufficient capacity to convey peak flows, including an allowance for inflow and infiltration (I/I). The following *minimum* criteria shall apply to the Design, as applicable to the proposed development:

6.1.1 Average and Peak Flows in Residential Areas:

a.) Population Density: minimum 40 persons/ha
b.) Average Sewage Generation Rate: 320 L/capita/day
c.) Peaking Factor shall be the larger of 2.5 or

$$= 1 + \frac{14}{4\sqrt{P}}$$ where P= contribution population in 1,000s

6.1.2 Average and Peak Flows in Commercial, Industrial, and Institutional Areas:

a.) The lower limit for average Sewage Generation Rate shall be 20m^3/day/Ha
b.) Peaking factor will vary with the nature of the development. The Consultant shall conduct an analysis of the proposed commercial, industrial, and institutional developments to estimate the peaking factor. Regardless of the results of the analysis, a minimum peaking factor of 3.0 shall apply.

6.1.3 Inflow/Infiltration (I/I) Allowance:

a.) Inflow: 0.4 L/s for every manhole located within a sag area on a roadway with some form of water inflow control in place
b.) Infiltration: 0.28 L/s/ha

6.2 Gravity Sewer Mains

6.2.1 Pipe Diameter:

a.) Minimum 200 mm

6.2.2 Flow Velocity:

a.) Minimum 0.6 m/s
b.) Maximum 3.0 m/s

6.2.3 Manning's "n":

a.) n = 0.013

6.2.4 Required Sewer Capacity:

a.) Estimated Design Flow / 0.86

6.2.5 Pipe Slope

a.) Minimum slope shall conform to the following table:

Pipe Diameter (mm)	Minimum Slope (%)
200	0.40
250	0.30
300	0.22
375	0.15
450	0.12
≥ 525	0.10

b.) The first 100 m section of sewer main shall have a minimum slope of 1.0%.
c.) Minimum slopes shall be increased by 50% for curved sewers.

6.2.6 Pipe Design

a.) Strength design shall be integral to the pipe selection process.

6.2.7 Horizontal Alignment

a.) Sewer mains shall be located within the road right-of-way, in accordance with the Engineering Standard Drawings.
b.) For commercial, industrial, institutional, and multi-family residential developments, the Consultant shall design typical cross-sections depicting the locations of the various necessary infrastructure to suit the particular development. Such cross-sections shall be subject to the review and acceptance of the Town.
c.) Sanitary sewer mains must be located at least 3.0 m horizontally from any water main and 1.8 m horizontally from any storm sewer main or gas line, as measured between the nearest pipe walls of the two mains.
d.) Public Utility Lot (PUL) widths shall be a minimum of 6.0 m for a single utility and 9.0 m for two utilities. A 1.0 m easement is required on the lots to either side of a PUL.
e.) Curved sewers shall run parallel to the centreline of the road. Long radius-type bends or a combination of 22½º bends and straight pipe shall be used to achieve the curve.

6.2.8 Vertical Alignment

a.) Mains shall be installed to provide a minimum depth of cover of 3.0 m, as measured from the top of the pipe to the final finished grade at the surface.
b.) Mains shall be installed to provide adequate sewer service connection depth at the property line.
c.) At crossings with water mains, refer to Section 5.2.9 c.
d.) At crossings with storm water mains, the following requirements shall apply:
   i. Typically, storm water mains shall cross above sanitary sewer mains with sufficient vertical separation to allow for proper bedding and support of both mains.
   ii. Where it is necessary for a storm water main to cross under a sanitary sewer main, the storm water main shall be protected by providing the following:
      - A minimum vertical separation of 0.5 m, as measured between the nearest pipe walls of the two sewer mains;
      - The sanitary sewer main shall be structurally supported to prevent joint deflection and settling; and
      - A full length of pipe shall be used for the sanitary sewer main at the crossing location. The pipe section shall be centered above the storm sewer main so that the nearest joints in the storm sewer main are equidistant from the crossing location.

6.3 Manholes

6.3.1 The maximum distance between manholes shall not exceed 120 m.

6.3.2 Manholes are required at all changes in pipe diameter, grade, and direction, at junctions, at the ends of mains, and at either end of a curved sewer.

6.3.3 Manholes must be located to accommodate access by maintenance equipment and vehicles.

6.3.4 Wherever possible, manholes shall be located on the projection of property lines to avoid conflict with driveways.

6.3.5 At manholes where changes in pipe diameter occur, the crowns, or obverts, of the mains shall be placed at the same elevation. Regardless of the design flow and pipe slope, pipe diameter shall not be permitted to be decreased through the downstream direction.

6.3.6 For straight-run manholes, a minimum drop of 12 mm shall be provided between the manhole inlet and outlet. For corner-run manholes, a minimum drop of 50 mm shall be provided between the manhole inlet and outlet.

6.3.7 For corner-run manholes, designed to achieve a necessary change in direction of the sewer main, the angle of direction change shall not exceed ±90º. This may be further restricted in cases where the estimated sewer flows through the main are not high enough to achieve sufficient cleansing velocity. For sewer mains greater than 600 mm in diameter, changes in flow direction at manholes should not exceed 45°, unless a suitable transition manhole is provided.

6.3.8 Drop structures are required at manholes with a vertical separation of 300 mm or greater between the inlet and outlet mains. Internal drop structures may be used for sewer mains of 250 mm diameter or less. External drop structures must be provided for sewer mains greater than 250 mm diameter. Refer to the Engineering Standard Drawings for further information on drop structures.

6.3.9 Do not locate manholes within sag areas or depressions where surface ponding might occur. Where such is unavoidable, provision must be made to suitably seal the manhole from surface runoff inflow.

6.4 Wastewater Gravity Service Connections

6.4.1 Each lot and multi-family unit shall have its own wastewater service connection designed in accordance with the following sections and the Engineering Standard Drawings.

6.4.2 Service connections for commercial, industrial, and institutional lots, and apartment developments, shall be sized according to the anticipated user requirements.

6.4.3 Service connection pipe diameter shall be a minimum of 100 mm.

6.4.4 The minimum slope of service connections shall be 2.0%.

6.4.5 Sewer service connections shall have a minimum depth of cover of 2.60 m and a maximum depth of cover of 3.0 m, as measured from the top of the pipe to the final finished grade.

6.4.6 Where a sewer service must connect to a sewer main exceeding 4.5 m in depth below the finished surface, a riser shall be installed to 2.9 m depth at the property line in accordance with the Engineering Standard Drawings.

6.4.7 Where bends are required, long radius-type bends shall be used. Alternatively, a combination of 22.5º bends and straight lengths of pipe may be used.

6.4.8 The sewer service shall be installed on the downstream side of the water service pipe relative to the direction of flow of the sewer main.

6.4.9 Where the water service is 50 mm or smaller in size, the water and wastewater services shall be located in a common trench. Where services are located in a common trench, provide minimum 300 mm horizontal and vertical separation between water and sewer services.

6.4.10 Where the water service is larger than 50 mm diameter, water service pipes shall be located in a separate trench, at least 3 m from any sewer services and 1.8 m from any other buried utility lines.

6.4.11 Service connections shall be extended beyond the gas line into the lot to terminate a minimum of 1.0 m from the back of the easement line, or 4.0 m past the property line.

6.4.12 At the end of cul-de-sacs, the three lots nearest to the manhole may have their sewer services connected to the manhole just above the benching. Sufficient spacing between the connections shall be provided to maintain the structural integrity of the manhole. Benching of this manhole must be epoxy coated or resin lined to provide smooth surface.

6.4.13 Where the service length, measured from the main to the building, will exceed 30 m, provide a cleanout manhole at the property line. Cleanout manholes shall be in accordance with the Engineering Standard Drawings.

6.4.14 Service connections for commercial, industrial, institutional, and multi-family residential lots, shall be designed with consideration of the depth requirements for servicing of these lots and the potential impact on the depth requirement for the downstream sewer main.

6.4.15 For industrial, commercial, institutional, and multi-family residential lots, a sampling manhole shall be provided on the wastewater service connection, just inside of the road right-of-way. The manhole shall be installed at the time that the lot is developed and the service is installed.

6.5 Unapproved Connections

6.5.1 Weeping tiles, roof leaders, and other stormwater or groundwater handling appurtenances shall not be permitted to tie-in to the wastewater collection system. Refer to Section 7.0 for the requirements pertaining to these systems.

6.6 Lift Stations and Sewage Force Mains

6.6.1 Wherever possible, every reasonable effort should be made in the design to provide a drainage system for the Development that relies solely on gravity for conveyance in order to minimize the overall operation and maintenance requirements and life cycle costs of the system.

6.6.2 Where absolutely necessary, the Town may accept design proposals which include lift stations and force mains to convey wastewater out of the Development. Economic analysis, long term costs, maintenance provisions, orderly development and temporary servicing schemes will all be deciding factors.

6.6.3 The Consultant shall consult with the Town while conducting the Design to obtain the Town's preliminary comments and input regarding any proposed lift station and force main. The Town may have additional requirements of the Design in this respect.

6.6.4 General Lift Station Requirements

a.) Pumps should be non-clog type, capable of passing a 75 mm solid, easily removed from servicing, equipped with pressure gauges/tapes, stand by pump, backup power connection & proper discharge and suction velocities.
b.) Pumping capacity shall be designed for peak flows with 100% redundancy.

c.) Backup power generation capability is required at all new lift stations.
d.) The backup generator and station controls shall be located in a suitable building located adjacent to the lift station.
e.) Shall be “SCADA” ready and designed to accommodate emergency pumping.
f.) The lift station shall be situated in a such a manner as to minimize the impact to adjacent development in terms of visibility, odour, and noise.
g.) All structures shall be architecturally compatible with the Development and located such that it is readily accessible by Town staff. Adequate heating, ventilation, lighting, access and safety provisions must be provided. Grounds surrounding the lift station shall be aesthetically pleasing and compatible with surrounding development.
h.) Lift station grounds shall be fenced, gated, and landscaped to the approval of the Town.
i.) Lift stations shall not be located in areas subject to flooding during a major rainfall event.
j.) Lift stations shall be properly commissioned with test results and calibration of all major equipment; a checklist and verification of operability of valves, gates, air releases, lifting equipment, ventilation, lighting, heating, plumbing, electrical, and other systems as required.
k.) Three hardcopies and one digital copy of all maintenance and service manuals shall be provided to the Town prior to the issuance of a Construction Completion Certificate.

6.6.5 Force mains shall be designed and constructed in accordance with the same requirements for water mains, as specified in the applicable sections of Section 5.0.

6.6.6 The Design shall be in accordance with Alberta Environment Standards and Guidelines and shall fully describe the details regarding any proposed lift station and force main system. The Town may request additional details regarding the design in order to ascertain its acceptability.

6.6.7 The force main and lift station shall be properly designed to service the ultimate capacity of the contributing development area.

PART II – MATERIALS

6.7 Gravity Sewer Mains

Gravity sewer mains shall be polyvinyl chloride (PVC) or concrete pipe.

6.7.1 PVC Pipe and Fittings

a.) PVC pipe shall be acceptable for up to 900 mm diameter sewer mains.
b.) PVC pipe and fittings shall meet CAN/CSA-B182.2 with locked-in elastomeric ring gasket and integral bell system joint type.
c.) Minimum pipe dimension ratio shall be DR35. Required pipe dimension ratio may be increased depending on strength design, considering trench depth and road loading, and soil types.
d.) Pipe shall be installed within two years from the production date indicated on the certification.
e.) Joint lubricants shall be compatible with gasket material.

6.7.2 Concrete Pipe and Fittings

a.) Non-Reinforced Circular Concrete Pipe and Fittings
  i. Non-reinforced concrete pipe shall be acceptable for less than 350 mm diameter sewer mains where strength design, considering trench and road loading, for the pipe is suitable.
  ii. Pipe and fittings shall meet CAN/CSA-A257.1, Class 3, and designed for flexible rubber gasket joints to CAN/CSA-257.3, and constructed with Type HS sulphate resistant Portland cement to CAN/CSA-A3000.
b.) Reinforced Circular Concrete Pipe and Fittings
  i. Reinforced concrete pipe shall be acceptable for sewer mains with a diameter of 300 mm and up.
  ii. Pipe and fittings shall meet CAN/CSA-257.2, concentric reinforcing, designed for flexible rubber gasket joints to CAN/CSA-257.3, and constructed with Type HS sulphate resistant Portland cement to CAN/CSA-A3000.
  iii. Strength design, considering trench and road loading, shall be integral to pipe design process. D-load shall be as determined by load analysis.

c.) Lined Pipe and Fittings

i. Reinforced concrete gravity sewer mains greater than 750 mm in diameter must be lined with a suitable liner, non-susceptible to surface damage from H2S induced corrosion.
ii. Liner shall be PVC or HDPE and shall be cast into the interior pipe wall.
iii. Liner shall be free of cracks, cleavages, or other defects adversely affecting the protective characteristics of the material.
iv. The lining shall be repairable at any time during the life of the pipe or the structure.
v. In accordance with ASTM-D412, the minimum tensile strength across welded joints shall be 14 MPa.
vi. Liner shall be T-Lock, as manufactured by Ameron Protective Lining Products, or accepted alternate.
vii. Alternate pipe materials, non-susceptible to surface damage from H_2S, may be proposed and will be reviewed by the Town.

6.8 Manholes

6.8.1 Manholes shall be minimum 1,200 mm in diameter and in accordance with the Engineering Standard Drawings.

6.8.2 Manhole materials shall be reinforced concrete, constructed of Type HS sulphate resistant cement.

6.8.3 Precast manhole sections, adjusting neck rings, and manhole steps shall conform to CAN/CSA- A257.4 and ASTM-C478.

6.8.4 Wherever possible, pre-benched standard manhole bases shall be used and shall include pre-cored connections with watertight joints. Duraseal, or accepted alternate.

6.8.5 Manhole joints shall meet the requirements of CAN/CSA-257.3 and ASTM-C443. Furthermore, all joints shall be sealed with a non-shrink grout both inside and outside for the full circumference of the manhole. Where manholes are located in areas with high water table and/ or high susceptibility to infiltration, must be wrapped and sealed to the satisfaction of the Town.

6.8.6 Manhole steps shall be standard safety type, constructed of hot-dipped iron in accordance with ASTM-A615 and ASTM-A123 or aluminum, forged of 6061-76 aluminum alloy, with a minimum tensile strength of 200 MPa.

6.8.7 Frames and Covers

a.) Manhole frames and covers shall be made of iron and shall conform to ASTM-A48 and in accordance with the Engineering Standard Drawings.
b.) Frames for manholes on paved surfaces shall be Norwood NF-90 floating type (in sag locations) with rubber gasket seal and solid cover, as manufactured by Norwood Foundry Ltd., or accepted alternate. Norwood NF-80 floating type to be installed at all other paved locations.
c.) Frames for manholes not on paved surfaces shall be Norwood NF-39 with solid cover, as manufactured by Norwood Foundry Ltd., or accepted alternate.
d.) Covers shall be imprinted with “Sanitary Sewer”.

6.8.8 Perched manholes, or accepted alternate, are required for sewer mains from 600 mm to 1,050 mm in diameter unless soil conditions do not allow or directed by the Town otherwise, and shall be in accordance with the Engineering Standard Drawings.

6.8.9 Tee-riser manholes, or accepted alternate, are shall be used for sewer mains greater than 1,050 mm in diameter and shall be in accordance with the Engineering Standard Drawings.

6.8.10 For manholes exceeding 7 m in depth, the Town may stipulate additional requirements for manholes.

6.8.11 The Town may require lockable covers be provided where safety or security risks may be a concern.

6.9 Wastewater Gravity Service Connections

6.9.1 Single-family residential sewer services shall be PVC pipe conforming to Section 6.7.1.

6.9.2 Sewer services for all other developments, in accordance with Section 6.4, shall comply with Section 6.7.

6.9.3 Wye-type, or Tee-type fittings shall be used to connect service connections to sewer mains for all new construction. Tee-type fittings must be positioned such that the service connection discharges into the upper half of the sewer main. Strap-on type service saddles shall only be permitted for service connections to existing mains.

6.10 Force Mains

Force mains shall be PVC or high density polyethylene (HDPE) pipe.

6.10.1 PVC Pipe and Fittings

a.) PVC pipe and fittings shall conform to Section 5.7 of these Standards.

6.10.2 HDPE Pipe and Fittings

a.) HDPE pipe shall be classified as PE3408, conforming to CSA B137.1 for 150 mm diameter and smaller, and CGSB-41-GP-25M for 200 mm diameter and larger.
b.) Minimum acceptable pipe diameter for shall be 100 mm.
c.) Pipe material shall conform to ASTM-D1248 Type III, Class C, Category 5.
d.) Pipe Design:
   i. The pipe shall be designed in accordance with ASTM-F714.
   ii. Minimum acceptable pipe class shall be DR-26.
   iii. Strength design, considering trench and road loading, shall be integral to pipe design process.
e.) All fittings to be fusable and designed to operate at not less than the design working pressure of the pipe system for which it is to be installed.

6.10.3 Valves

a.) Valves for force mains shall be gate valves conforming to Section 5.9 of these Standards, or plug valves (Milliken, Val-Matic or approved alternate) and must be suitable for wastewater applications.

6.11 Bedding and Backfill

6.11.1 Refer to Section 5.13 of these Standards.

PART III – CONSTRUCTION

6.12 General

6.12.1 The following section represent the minimum requirements for some typical, key construction procedures for wastewater collection system construction. These minimum requirements must be met or exceeded by the detailed construction specifications and drawings developed by the Consultant.

6.12.2 Construction activities must adhere to the provisions of the Erosion and Sediment Control Plan prepared for the Development in accordance with Section 1.10.1.7.

6.13 Quality Assurance

6.13.1 Refer to Section 5.15 of these Standards.

6.13.2 All PVC pipe shall be tested by the manufacturer and marked in accordance with CAN/CSA- B182.2.

6.14 Quality Control Testing

6.14.1 Refer to Section 5.16 of these Standards.

6.15 Site Preparation

6.15.1 Prepare the site in accordance with Section 3.26 of these Standards.

6.16 Clearing

6.16.1 Conduct clearing in accordance with Section 3.27 of these Standards.

6.17 Grubbing

6.17.1 Complete grubbing in accordance with Section 3.28 of these Standards.

6.18 Topsoil Stripping and Stockpiling

6.18.1 Strip and stockpile topsoil in accordance with Section 3.29 of these Standards.

6.19 Trench Excavation

6.19.1 Refer to Section 5.22 of these Standards.

6.20 Alignment and Grade

6.20.1 Lay pipe to the required alignment and grade, with manholes and all other appurtenances at the locations identified on the construction drawings or otherwise directed by the Town.

6.20.2 Provide minimum 3.0 m depth of cover on sewer mains, unless otherwise authorized by the Town in writing. Where depth of cover is less than 3.0 m, provide insulation, to the approval of the Town.

6.20.3 Acceptable tolerances are as follows:

a.) Alignment – the centreline of the pipe shall not be more than 100 mm off the specified alignment.
b.) Elevation – the pipe invert shall not be more than 6 mm plus 0.01 mm per mm diameter of the pipe off the specified elevation.
c.) Joints – for concrete pipe, deflections at joints shall not exceed that specified by CAN/CSA-A257. For PVC pipe, deflections at joints shall not exceed those recommended by the manufacturer.

6.20.4 All pipe shall be laid sloping in the desired direction with no reversed grades on any pipe lengths.

6.20.5 Maintain, and provide to the Town upon request, grade sheets for the installation of the pipe.

6.20.6 No deviation shall be made from the required alignment or grade without the written consent of the Town.

6.21 Pipe Bedding and Pipe Zone Backfill

6.21.1 Refer to Section 5.24 of these Standards.

6.22 Pipe Installation

6.22.1 General

a.) Provide 48-hour notice to the Town's Infrastructure for inspection of materials. All materials must be inspected and approved by the Town prior to install.
b.) Follow manufacturer's instructions for pipe installation. Installation of PVC pipe and fittings shall be in accordance with CAN/CSA-182.11.
c.) Do not allow contents of existing sewers or sewer connections to flow into the trench.

d.) Do not use heavy vibratory equipment for compaction of backfill until at least 1 m of backfill has been placed over the pipe.
e.) When pipe laying is complete, the sewer must be thoroughly cleaned of all dirt, stones, rubbish, and debris. Deleterious material shall be prevented from entering the installed lines and traveling into the existing system.
f.) Do not install PVC pipe and fittings in areas that are, or may be, contaminated with organic solvents, petroleum products, or other materials which may negatively effect the structural integrity of the PVC product.

6.22.2 Laying Pipe

a.) Lay pipe with the bells upgrade, and proceed upgrade.
b.) Any bowed pipe shall be laid on its side such that the bow is horizontal.
c.) Produce a smooth, uniform invert.
d.) Plug lifting holes with non-shrink grout.
e.) For connections to existing sewer pipes, submit a field-jointing plan to the Town for review and acceptance prior to commencing the field joint.

6.22.3 Joining Pipe

a.) Join pipe in accordance with the manufacturer's recommendations.
b.) Clean and check the sealing surfaces to ensure that they are smooth, concentric, and free from imperfections that might affect the sealing performance of the gasket.
c.) Lubricate sliding surfaces and couple the pipes immediately.

6.22.4 Connecting to Existing Mains

a.) Notify the Town in writing at least one (1) week prior to connecting to an existing sewer main. Apply in writing to the Town's Infrastructure Department including a work plan identifying necessary flow control and a contingency plan detailing the procedures to be observed in the event of problems during the connection process or other emergency. Written acceptance must be received from the Town at least 24 hours before connecting to existing mains.

6.22.5 Connecting to Existing Manhole

a.) Manhole connection shall not exceed a reasonable size to permit the smooth movement of the new pipe into the manhole.
b.) All due care shall be taken to avoid damage to surrounding areas of the manhole. Any areas of the manhole that have been damaged during the manhole connection shall be repaired by the Contractor to the satisfaction of the Town.
c.) Following installation of the new pipe, the manhole connection area shall be suitably repaired, link sealed and grouted, providing a watertight seal around the pipe.
d.) The flow channel in the manhole shall be modified to provide a smooth continuation of flow from the manhole connection pipe through the manhole.

6.22.6 Plugging of Dead Ends

a.) Insert standard plugs into the bell ends of fittings or pipe bells at dead ends.

6.23 Setting Manholes

6.23.1 General

a.) Bases shall be placed on solid, unfrozen ground.
b.) Construct manhole unit plumb and true to alignment and grade.
c.) Cover all interior and exterior joints with suitable non-shrink grout. Wrap and seal manhole, if required.
d.) External drop structure assemblies shall be encased in concrete.
e.) Plug all lifting holes with non-shrink grout.

6.23.2 Manhole Benching

a.) Build pipes and stubs into manholes and form smooth flow channels, or use pre-benched manhole base sections.
b.) Benching shall provide smooth inverts on regular curves through the manhole.

6.23.3 Manhole Completion

a.) Backfill around the manhole with sand, as specified in Section 5.13.2, or fillcrete. Sand, or approved alternative backfill shall be placed and compacted to minimum 98% Standard Proctor Density in uniform lifts not exceeding 150 mm in depth.
b.) Wherever possible, set the conical tops such that the vertical side is on the right hand side of the manhole, when looking upstream.
c.) Ensure manhole rungs are aligned.
d.) In grassed areas, provide 300 mm depth clay cap around the manhole.
e.) Place frame and cover on top section to elevation indicated, and adjust tops flush finished grades. If adjustment is required, use concrete grade rings (maximum 200 mm), placed with non-shrink cement mortar. Parge, make smooth and watertight, inside and out.
f.) Manholes in high water table to be wrapped and sealed.

6.24 Wastewater Gravity Service Connections

Gravity wastewater services, in accordance with Section 6.4, shall conform to the following:

6.24.1 New services on existing development crossing under roads shall be augered as shown on the Engineering Standard Drawings, as applicable. At the end of cul-de-sacs and for lots located adjacent to the mains, open trenching installation of the services may be permitted with the written authorization of the Town.

6.24.2 Services installed by open trench or through auger pits shall be bedded in accordance with Section 5.24.

6.24.3 Pipe zone backfill shall be placed to 300 mm above the crown of the highest service in the trench or auger pit.

6.24.4 Service connections shall be extended beyond the gas line into the lot to terminate a minimum of 1.0 m from the back of the easement line, or 4.0 m past the property line.

6.24.5 Plug the service connection following installation, as per manufacturers specifications.

6.24.6 Install red-painted stakes, 38 mm by 89 mm in size, extending from the termination point of the service point to a minimum of 1.0 m above the finished surface elevation.

6.24.7 Backfill trenches and auger pits in accordance with Section 5.31.

6.24.8 Augering and Boring

a.) Refer to Section 5.29.7.

6.24.9 Connection to the Sewer Main

a.) Install in-line tee-type fittings in accordance with the manufacturer's recommendations on new subdivisions.
b.) Where the use of strap-on type service saddles has been authorized by the Town, install in accordance with the manufacturer's recommendations for existing developments.
c.) Apply construction adhesive or similar non-destructive sealant, to ensure a watertight seal.

6.24.10 Pipe Installation

a.) Refer to Section 6.22.

6.24.11 Record of Services

a.) Refer to Section 5.29.12.

6.25 Trench Backfill

6.25.1 Refer to Section 5.29.12 of these Standards.

6.26 Low Pressure Sewage Systems

6.26.1 System Design Overview

a) The sanitary sewer system shall be of sufficient capacity to service the ultimate population projection of the development area. The flows and factors outlined in the following sections shall be used in the design of low pressure sanitary sewer systems.

The Developer and the Developer's Consultant are responsible to ensure that the infrastructure is designed and constructed to achieve manufacturers' design life expectations consistent with good design and construction practice. System proposals must identify disposal means in accordance with Alberta Environment regulations and guidelines. Plan-profile drawings, specifications and a letter report shall be prepared by a qualified Professional Engineer and be submitted to the Town and Alberta Environmental Protection for review and approval prior to construction.

6.26.2 Estimating Average Sewage Flows

a.) Refer to Section 6.1 of these Standards for average sewage flow calculation parameters.
b.) Recommended pump rate and head will need to be provided. This information shall be included in any design submissions and the developer shall ensure that all future purchasers are aware of this requirement.

6.26.3 Pipe Sizing

a) A report from the Developer's Consultant must be prepared to ensure that pipe sizing is calculated in consideration with the topography of the serviced lands and the population projections. Minimum pipe size 75mm.

6.26.4 System Materials

a) The Developer shall supply and install only new materials.
b) All such materials which are defective in manufacture, damaged in transit, or have been damaged after delivery shall be replaced by the Developer at their expense.
c) All Standards referred to mean the latest editions of that Standard.
d) Where products are specified, it is intended that approved equals are also accepted, to the approval of the Town.

6.26.5 High Density Polyethylene (HDPE) Pipe

a.) High Density Polyethylene (HDPE) pipe shall be DR11 or DR13.5, PE 3408 Iron pipe sized (IPS) and shall conform to CSA B137.1, ASTM F714 and ASTM D3350 Standards. Pipe sized from 13mm through 76mm shall conform to ANSI/AWWA C901-02 Standard. Pipe sized from 100 mm through 1575 mm shall conform to ANSI/AWWA C906-00 Standard.
b.) Approved manufactured pipe fittings shall be used. If unavailable other alternative must meet Town of Whitecourt approval first.
c.) All joints are to be thermal heat fused. Mechanical service connections are not approved.
d.) All components shall be made of corrosion resistant material.

e.) Pipe age not to exceed two years at time of installation.

6.26.6 Low Pressure Sewer Mains

a.) Sewer main alignments shall be as depicted on the Standard Engineering Drawings.
b.) Mains shall be at a depth adequate to provide a minimum of 3 m depth of cover from finished grade to top of pipe.
c.) Auguring or directional drilling is required under all existing roads, unless otherwise approved.
d.) Compaction of any trenches and auger pts and repair of any settlements that occur within warranty period is required.
e.) A separate service line with a curb stop, marked “SEWER” at the property line is required for each lot.
f.) Flushing access manholes are required at that start of each collection main to facilitate removal of main line blockages.
g.) Manual air/vacuum relief valves are required at all high points for removal of hydrogen sulphide gases from anaerobic decomposition of organics.
h.) A minimum distance of 3 m horizontal separation must be maintained between a sewer main and any water main.
i.) A minimum distance of 1.8 m horizontal separation must be maintained between a sewer main and any gas line as measured between the nearest pipe walls of the two mains.
j.) Marker posts shall be installed perpendicular to all valves, air release and flushing standpipe locations, adjacent to the property line.
k.) Any downstream receiving manhole shall be lined with epoxy coating or other approved material to prevent corrosion.

6.26.7 Fittings

a.) High Density Polyethylene (HDPE), DR 11 conforming to ASTM F714 and CAN B137.1, shop molded fittings shall be used.
b.) All HDPE molded fittings shall meet the requirements of ASTM D2683 for socket-type fittings, ASTM D3261 for butt-type fittings, or ASTM F1055 electrofusion-type fittings.

6.26.8 Valves

a.) Gate valves for 75 mm and larger shall be iron body, bronze mounted gate valves with a non-rising spindle, which open by turning in a counter clockwise direction. All valves shall conform with AWWA C500 for bronze mounted solid wedge gate valves or AWWA C509 for resilient seated gate valves. Interior to be factory coated with epoxy coating conforming to AWWA C50. Exterior to be factory epoxy coated. Corrosion reduction to be provided by installation of a zinc sacrificial anode. Valves to be flanged for polyethylene pipe.
b.) Brass ball valve curb stops shall be used for valves 50 mm and smaller conforming with ASTM B62 compression type. Curb service boxes to be epoxy coated with stainless steal stem to suit 3.0 m depth of bury. Curb box cap to be marked “SEWER”. All curb stops shall incorporate stainless steel sleeves for connections to polyethylene pipe.
c.) Cast iron main valve boxes conforming to ASTM A48, Class 25 type A of the sliding type shall be required on all main valves. Coating inside and outside shall be an asphaltic coating. Set screws to be galvanized. Top cap of box to be marked “SEWER”.
d.) Extension stem to be 25 mm square mild steel with 50 mm operating nut and flange suitable for 3.0 m bury. A rock disk nut is required on all valves.
e.) Schedule 40 PVC valve boxes for the bottom boot of Norwood Foundry Type A Sliding type valve boxes or approved equal are permitted in areas not exposed to vehicle load.

6.26.9 Service Connections

6.26.9.1 General

a.) Each lot must have a separate service.
b.) Proper sewer service curb stops or valves are required for each service connection on a low pressure sewage force main. These shall be installed to the centerline of all lots at 0.3m off property line, in accordance with the engineering standard drawings and shall have the word “sewer” stamped on the cap or lid to differentiate them from water curb stops.
c.) Service connections shall be extended beyond the gas line into the lot to terminate a minimum of 4.0 m from the property line or 1.0 m past the utility easement.

6.26.9.2 Details

a.) Sanitary sewer service pipe shall be 40 mm, DR 11 high density polyethylene pipe.
b.) Main connections shall be made by means of fused in-line tees or saddles. All fittings and joints must be assembled by electro fusion or butt fusion for HDPE piping. Services to be in one piece, no mechanical connections are permitted between main connection and curb stop.
c.) Curb stop shall be non-draining type.
d.) Minimum depth of cover shall be 3 m from finished grade over top of pipe.

6.26.10 Septic Tank/Pump

a.) Use two-compartment tank or a single-compartment tank with a pump vault, sized and constructed in accordance with Alberta Plumbing Codes.
b.) Any non-residential building with a sump may be required to have a sediment tank for sump drainage located prior to their pump out.
c.) Extend tank access risers at least 150 mm above finished ground surface, provide watertight manhole covers and divert surface runoff away from the manhole cover.
d.) Tank must be large enough to provide the following:
    i) 450 mm for pump submergence, minimum.
    ii) Full day of emergency storage capacity above the high water alarm level, utilizing the septic tank freeboard capacity below ground and/or below building drain outlet invert.
    iii) Minimum 12-hour retention time below high water alarm level for proper treatment of the sewage flow.
    iv) Storage of sludge and scum accumulation.
    v) Typically, 3800 L (100 gal) minimum total tank storage for an average three-bedroom dwelling.
    vi) Reference “Alberta Private Sewage System Standard Practice” current version), for Septic Tanks, Sewage Holding Tanks and Sewage Effluent Tanks.
e.) Tank must be sealed watertight tank (fibreglass, or one-piece precast pump tank or special provisions for assuring watertight tank.)
f.) Tanks shall be vented such that the airspace above the wastewater level is always at atmospheric pressure.
g.) Anti-buoyancy provisions must be adequate. Where high ground water exists, tank assemblies shall be securely anchored to avoid floating.
h.) All pipe and wire conduits into tank must be through hubs or fittings made during the construction of the tank and installed in a watertight and gastight fashion.
i.) No drainage or any water other than sanitary waste water shall be allowed to enter the tank.
j.) The effluent shall enter the pump compartment or pump vault from the clear zone of the tank between the scum and sludge layers.

6.26.11 Pump Requirements

a.) Pump operating parameters shall be based on the present and future system requirements as determined by the Engineer.

b.) Pump units shall be submersible types, either semi-positive displacement or centrifugal, with integrally built grinder assembly and isolation valves. Pump units shall pump directly into low-pressure mains. Pumping equipment shall meet all applicable safety, fire and health requirements for the intended application and location.
c.) The unit shall operate at 120 or 240 volts' single phase, and be able to provide the required flows at the design total dynamic head. All complete grinder pump installation manuals including but not limited to electrical wiring, piping installations and detailed installations, shall be provided to the installer and Town personal prior to construction.
d.) Property owners are responsible for all cleaning, maintenance and replacement of low pressure pump units within their private property. All operation and pump maintenance manuals must be provided to the property owner and to any future purchasers.
e.) The pump unit shall be constructed such that open shafts are not exposed inside the raw sewage passageways where they can become clogged.
f.) Grinder pump rated maximum pumping pressures shall not exceed 85% of low pressure collection pump systems, designed maximum working pressure.
g.) Pump discharge pipe must be of DR 11 HDPE or stronger and include check valve, disconnect union and gate valve within the pump tank.
h.) Pump assembly shall include all level controls to turn unit on/off at set levels. In addition, high level pump operation alarms shall be provided.
i.) When any pump is located at a high elevation than the elevation of the terminal end then a siphon-break valve must be provided for that pump.

6.26.12 System installation

The system shall be installed as per the manufacturer's specifications and the detailed construction specifications prepared by the Developer's Engineer.

6.26.13 Trenching, Bedding and Backfilling

See Section 5.22

6.26.14 Inspection and Testing

a.) The low-pressure collection system shall be pressure tested prior to commissioning, after backfilling operations are complete and at least 36 hours after the casting of concrete thrust blocks.
b.) Zero infiltration/exfiltration is permitted.
c.) Components to be tested shall included the entire collection system including any service pumps. Test duration shall be a minimum of two hours, or if the pipe network is buried eight hours.
d.) Before acceptance of the work, the entire system shall be subject to a hydrostatic pressure test in the presence of the developer's consultant and the Town of Whitecourt representative. The Developer shall provide all necessary labour, materials and equipment for the test including a suitable pump, measuring tank, pressure hoses, connections, plugs, caps, gauges, and all other apparatus necessary for filling the main, pumping to the require test pressure and recording the pressure and expansion-leakage losses. The Developer shall provide evidence that the gauges used are accurate.
e.) Expel air from collection system, by slowly filling main with water. High points must have automatic air/vacuum relief valves to vent air when filling and be closed when pressure is applied.
f.) A hydrostatic test pressure of 1.5 times the maximum operating pressure of the pipe at the lowest point in the system main shall be applied (but not less that 350kpa (50psi).
g.) Pressurized pipe to require test pressure over a two-hour period and hold required test pressure for an additional hour to allow for pipe expansion and stretching prior to the leakage test if the pipe is exposed. If the pipe network is buried, test duration shall be a minimum of eight hours prior to leakage test.
h.) Test period shall be for two hour durations. Amount of make-up water (leakage) required to return the pipe to required test pressure shall not exceed the allowance given in the following table.

Field Testing of Low Pressure Sewer Systems

Nominal Pipe Size (mm)	Allowance for Expansion (leakage) (litres/100m of pipe) 2 Hour Test
50	1.6
75	1.9
100	3.1
150	7.5
200	12.5

Total time under test pressure must not exceed eight hours. If tests are not accepted due to leakage or equipment failure, test section must be permitted to "relax" for eight hours' period prior to the next testing sequence.

6.27 Gravity Sewer Main Inspection and Testing

6.27.1 Any sewer mains that fail to pass inspection and testing, or having obstructions, breaks, or any other defects, shall be repaired, re-inspected, and re-tested to the satisfaction of the Town, at the Developer's sole expense.

6.27.2 Prior to applying to the Town for a Construction Completion Certificate and placing sewer mains into operation, the sewer mains shall be thoroughly cleaned of all debris and inspected by CCTV.

6.27.3 Closed-Circuit Television (CCTV) Inspection

a.) CCTV inspection of all installed sewer mains must be completed.
b.) One copy of the written CCTV inspection report, including still photographs (showing typical pipe details, joints, and service connections, and any defects) and video footage of inspection must be provided to the Town with the application for the Construction Completion Certificate and Final Acceptance Certificate.
c.) Video footage must be in full colour video format, unless otherwise accepted by the Town.
d.) Where the CCTV inspection shows infiltration present within any un-commissioned sewer main, the Town may require an infiltration or exfiltration test be completed.

6.27.4 Testing

a.) Where testing is required, the Town will determine if the test shall be an infiltration or exfiltration test.
b.) The Town will direct which sections of the main shall be tested.
c.) The Developer shall provide all water, materials, equipment, and labour required for the testing. Equipment shall include plugs, meters, and other measuring equipment that is acceptable to the Town, to measure exfiltration or infiltration.
d.) Infiltration testing shall be performed by plugging the upstream end of the test section and measuring flow at the downstream end.
e.) Exfiltration testing shall be performed by plugging both ends of the test section and filling the test section to provide a hydrostatic head of 600 mm above the top of the highest point in the test section.
f.) The test duration shall be 4 hours.
g.) The allowable leakage shall be as follows:

Type of Pipe	Allowable Leakage
Concrete Pipe	60 L/mm dia./km/day
PVC Pipe	5 L/mm dia./km/day

h.) No additional leakage allowance will be made for manholes.

6.28 Sewer Service Inspection and Testing

6.28.1 All sewer services shall be visually inspected using a lamp test and/or ball tested at the time of installation to ensure consistent alignment and grade. The Consultant must witness all such tests.

6.28.2 For service connections longer than 30 m, three (3) months prior to the expiry of the Warranty Period, the Developer shall be responsible for conducting CCTV inspection of the service connections, in accordance with the applicable requirements of Section 6.27.3

6.28.3 Any sewer services that fail to pass inspection and testing, or having obstructions, breaks, or any other defects, shall be repaired, re-inspected, and re-tested to the satisfaction of the Town, at the Developer's sole expense.

6.28.4 The Consultant must provide a written report confirming satisfactory inspection and testing of each sewer service. The report shall be provided with the application for the Construction Completion Certificate.

6.29 Final Inspection

6.29.1 Three (3) months prior to the expiry of the Warranty Period, the Developer shall be responsible for arranging for an additional CCTV inspection of the installed sewer mains, in accordance with the applicable requirements of Section 6.27.3.

6.29.2 Any sewer mains having obstructions, breaks, sags, or any other defects, shall be repaired, re- inspected, and re-tested to the satisfaction of the Town, at the Developer's sole expense, prior to application for the Final Acceptance Certificate.

6.29.3 One copy of the written CCTV inspection report, including still photographs and video footage of inspection must be provided to the Town with the application for the Final Acceptance Certificate.

6.29.4 The Final Acceptance Certificate shall not be issued by the Town until the CCTV reports and footage has been reviewed and accepted by the Town.

7. Stormwater Management System

PART I – DESIGN

7.1 General

7.1.1 The Town's stormwater management objectives are as follows:

a.) Prevent all property damage and flooding, and minimize disruption to public activity due to runoff from a 1:5 year return frequency, or more frequent, rainfall event;
b.) Prevent significant damage, physical injury, and loss of life due to runoff from a 1:100 year return frequency, or more frequent, rainfall event; and
c.) Improve stormwater quality, through filtering of contaminants, prior to discharge to receiving watercourses and prevent erosion of the receiving watercourse.

7.1.2 Refer to Section 7.12 for details regarding Stormwater Management System Design for infill or redevelopment projects.

7.1.3 The Town's stormwater management system consists of two distinct conveyance systems: a minor system and a major system (i.e. the dual drainage concept). Under this concept, the minor system is designed for drainage and the major system is designed for flood control. The minor system consists of buried storm sewers and the major system generally consists of roadways and open channels.

7.1.4 In addition to the minimum requirements set forth by these Standards, the requirements of the *Stormwater Management Guidelines for the Province of Alberta*, Alberta Environment, latest edition, must be duly addressed by the Design. Wherever feasible and applicable, Alberta Environment's stormwater quality best management practices (BMPs) shall be applied within the Design. In accordance with Alberta Environment's *Municipal Policies and Procedures Manual* (latest edition), stormwater management techniques to improve water quality shall be included to effect a minimum of 85% removal of sediments of particle size 75 µm or greater. These include grassed swales and runways to trap silt, and ponds designed with detention times to promote settling.

7.1.5 Effluent from sanitary sewers or any other potentially contaminated drainage from industrial or commercial sites shall not be discharged into storm sewers.

7.1.6 The Design shall provide for the interception, conveyance, and storage of all overland drainage which enters the Development from surrounding, undeveloped areas for the indefinite future or interim period until development of such areas occurs. Furthermore, the stormwater management system shall be designed to ensure the Development does not adversely affect the existing drainage pattern of surrounding areas, whether during or following construction.

7.1.7 Where a capacity deficiency is determined within stormwater management infrastructure located downstream of the Development, the Developer may be required to upgrade the existing infrastructure.

7.2 Minor System General Design Criteria

The following *minimum* criteria shall apply to the Design for the minor system, as applicable to the proposed development:

7.2.1 General

a.) The minor system shall be designed to accommodate runoff such that a 1:5 year rainfall event must stay within piped system, and a 1:20 year rain fall event must stay within road carriageway or drainage ditch.
b.) The minor system shall accommodate design flows such that:
   i. An equivalent width of one traffic lane remains free from inundation at design flows on local and collector roadways;

ii. An equivalent width of one traffic lane in each direction remains free from inundation at design flows on arterial roadways; and

iii. No surcharging of sewer pipes occurs.

c.) Computer simulation modeling shall be required for the design of minor drainage systems. Computer simulation modeling shall be completed using a computer program acceptable to the Town and in accordance with acceptable standard design practices. Modeling results shall be fully detailed in the Design Report to be submitted with the application for the Development Agreement.

7.2.2 Design Flows

a.) The Rational Method shall be employed to estimate design flows for areas smaller than 65 ha, as follows:

$$Q = \frac{CiA}{360}$$

Where: Q = runoff rate (m³/s)
C = runoff coefficient
i = rainfall intensity (mm/hr)
A = contributing area (ha)

b.) Runoff Coefficient

i. Where the site-specific conditions of ultimate site development are unknown, runoff coefficients may be selected from the following table on the basis of the zoning or proposed land uses for the Development.

Land Use	Runoff Coefficient, C	Imperviousness Range (%)
Parks, Reserves, Grassed Areas	0.20	10 – 50
Single Family Residential	0.40	40 – 60
Multi-Family Residential	0.70	50 – 100
Downtown Commercial	0.85	50 – 100
Neighbourhood Commercial	0.70	50 - 100
Industrial	0.70	50 - 100
Paved Areas and Roofs	0.95	90 – 100
Gravel Areas	0.3	10 - 50

ii. Where the site-specific conditions of ultimate site development are known, runoff coefficients shall be consistent with the imperviousness (imp) for each respective land use and shall be calculated using the following formula for design rainfall events with a return period of 10 years or less.

$$C = (0.95\ imp)\ \ 0.1(1.0\ imp)$$

iii. To apply the preceding formula to determine the runoff coefficient for a design rainfall event with a return period greater than 10 years, modify the calculated runoff coefficient in accordance with the following table.

Return Period (t_R)	Runoff Coefficient Multiplier
10 year < t_R ≤ 25 year	1.1
25 year < t_R ≤ 50 year	1.2
t_R > 50 year	1.25

c.) Rainfall intensity

i. Rainfall intensity (i) is determined from the appropriate Intensity-Duration- Frequency (IDF) curve based on the time of concentration (t_c), as calculated by the following formula:

$$t_c = t_i + t_t$$

Where: t_c = time of concentration (min)
t_i = inlet time (min)
t_t = travel time (min)

ii. Inlet time, t_i, is the time for drainage to travel from the extreme limits of the catchment to the first point of inflow into the storm sewer being designed. Inlet time is dependent on the imperviousness, ground slope, and size of the catchment. A maximum inlet time of 15 minutes shall apply to single-family residential areas. Inlet time must be less than 15 minutes for commercial, industrial, institutional, and medium/high density residential areas due to a larger percentage of the area being impervious. For conceptual or preliminary designs, inlet time can be estimated from the catchment area and imperviousness using the following table:

	Design Inlet Time (t_i)	Imperviousness		
		30%	50%	> 70%
Area	$t_i \leq 8.0$ ha	8.0 min	8.0 min	5.0 min
	$8.0 < t_i < 40$ ha	9.2 min	9.2 min	6.0 min
	$t_i \geq 40$ ha	10.4 min	10.4 min	7.3 min

iii. Travel time, t_t, is the time for drainage to travel through the conveyance system from the point of inflow to the design location. Travel time is dependent on the pipe material, pipe slope, and the design flow rate.

iv. The value of the design rainfall intensity (i) for the rational formula is to be selected from the appropriate intensity duration frequency (IDF) curve, with a duration chosen to coincide with the time of concentration, t_c. The Environment Canada IDF curve for Whitecourt can be found in Appendix H.

d.) Catchment Area

i. Catchment area is the area, in ha, of the catchment contributing inflow into the storm sewer being designed.

e.) Foundation Drain Discharge Flows

i. The geotechnical report must include estimates for weeping tile flows and define any special design and construction considerations for foundations or other infrastructure within the Development that might be impacted by weeping tile flows causing settlement or other deleterious effects.

ii. Where the estimated foundation drain flows are significant during spring and summer months, they must be added to the design flows used to size infrastructure for the minor system.

iii. To be connected to foundation drain discharge collection sewers (i.e. 3rd. pipe system).

7.3 Gravity Sewer Mains

7.3.1 Pipe Diameter:

a.) Minimum 300 mm

7.3.2 Flow Velocity:

a.) Design mean flow velocity 0.9 to 1.0 m/s
b.) Minimum 0.6 m/s
c.) Maximum 3.0 m/s

7.3.3 Manning's "n": n = 0.013

7.3.4 Pipe Slope:

a.) Minimum slope shall conform to the following table:

Pipe Diameter (mm)	Minimum Slope (%)
300	0.22
375	0.15
450	0.12
≥ 525	0.10

b.) The first upstream section of sewer main shall have a minimum slope of 0.4%.

c.) Minimum slopes shall be increased by 50% for curved sewers.

7.3.5 Storm Trunk Sewer Mains

a.) Storm trunk sewers are defined as storm sewer mains which serve drainage areas greater than 30 ha.

b.) Storm trunk sewers shall be designed to accommodate, without surcharge, the anticipated design flow multiplied by a safety factor of 1.25 in order to account for potential future changes in land use and ensure trunk sewers do not surcharge before upstream lateral storm sewers.

c.) In cases where a storm trunk sewer will receive both uncontrolled flow from a drainage area greater than 30 ha *and* controlled discharge from stormwater management facilities, the storm trunk sewer shall be designed to accommodate the anticipated uncontrolled design flow multiplied by a safety factor of 1.25 plus the design maximum outflow rates from the stormwater management facilities.

7.3.6 Horizontal Alignment

a.) Storm sewer mains shall be located within the road right-of-way, in accordance with the Engineering Standard Drawings.

b.) For commercial, industrial, institutional, and multi-family residential developments, the Consultant shall design typical cross-sections depicting the locations of the various necessary infrastructure to suit the particular development. Such cross-sections shall be subject to the review and acceptance of the Town.

c.) Storm sewer mains must be located at least 3.0 m horizontally from any water or sanitary sewer main and 1.8 m horizontally from any storm sewer main or gas line, as measured between the nearest pipe walls of the two mains.

d.) Town owned and operated storm sewer mains that must cross through, or be located within, private property or any other property controlled by other authorities, shall be protected by easements, secured by the Developer, in the name of the Town as the grantee. Easements shall be of sufficient width to provide a working clearance to the satisfaction of the Town from the edge of the easement to the nearest side of the sewer main. Manholes, catch basins, and other point infrastructure should not be located within easements unless specifically authorized by the Town.

e.) Without limiting the requirements of Section 3.6.1 of these Standards, Public Utility Lot (PUL) widths shall be a minimum of 6.0 m for a single utility and 9.0 m for two utilities. A 1.0 m easement may also be required on the lots to either side of a PUL.

f.) Curved sewers shall run parallel to the centreline of the road. Long radius-type bends or a combination of 22½º bends and straight pipe shall be used to achieve the curve.

7.3.7 Vertical Alignment

a.) Sewer mains shall be installed to provide a minimum depth of cover of 1.5 m, as measured from the top of the pipe to the final finished grade at the surface unless otherwise approved. Depth shall be adequate to provide the minimum depth of cover over sump pump discharge collection sewers and catch basin leads.

b.) At crossings with water mains, refer to Section 5.2.9c).

c.) At crossings with sanitary sewer mains, refer to Section 6.2.8d).

7.4 Manholes

7.4.1 The maximum distance between manholes shall not exceed 120 m.

7.4.2 Manholes are required at all changes in pipe diameter, grade, and direction, at junctions, at the ends of mains, and at either end of a curved sewer.

7.4.3 At manholes where changes in pipe diameter occur, the crowns, or obverts, of the mains shall be placed at the same elevation. Regardless of the design flow and pipe slope, pipe diameter shall not be permitted to decrease through the downstream direction.

7.4.4 For straight-run manholes, a minimum drop of 12 mm shall be provided between the manhole inlet and outlet. For corner-run manholes, a minimum drop of 50 mm shall be provided between the manhole inlet and outlet.

7.4.5 For corner-run manholes, designed to achieve a necessary change in direction of the sewer main, the angle of direction change shall not exceed ±90º. This may be further restricted in cases where the estimated sewer flows through the main are not high enough to achieve sufficient cleansing velocity. For sewer mains greater than 600 mm in diameter, changes in flow direction at manholes should not exceed 45°, unless a suitable transition manhole is provided.

7.4.6 Drop structures are required at manholes with a vertical separation of 300 mm or greater between the inlet and outlet mains. Internal drop structures may be used for sewer mains of 250 mm diameter or less. External drop structures must be provided for sewer mains greater than 250 mm diameter. Refer to the Engineering Standard Drawings for further information on drop structures.

7.5 Catch Basins

7.5.1 The maximum distance between catch basins along roadways shall not exceed 120 m.

7.5.2 Catch basins shall be located such that no ponding shall occur during the 1:5 year, or more frequent, rainfall event.

7.5.3 Provide sufficient catch basins such that the flow depth in gutters does not exceed the top of curb during the 1:20 year rainfall event.

7.5.4 At intersections, locate catch basins with sufficient inlet capacity on the upstream side in order to prevent drainage from passing through the intersection.

7.5.5 At curb returns, locate catch basins on the upstream side of crosswalks.

7.5.6 At sag locations and depressions, locate catch basins with sufficient inlet capacity such that ponding does not exceed 150 mm.

7.5.7 Wherever possible, catch basins shall be located on the projection of property lines to avoid conflict with driveways.

7.5.8 Catch basins shall have a minimum barrel diameter of 900 mm and minimum sump depth of 600 mm.

7.5.9 Catch basins and leads shall not be located beyond the limits of the public rights-of-way. Where the lots are authorized to grade to the back, in accordance with Section 7.11.3, a catch basin must be provided where the drainage easement ties-in to the nearest public right-of-way.

7.5.10 Catch basins shall not be placed within the walking surface of pararamps or sidewalks.

7.6 Catch Basin Leads

7.6.1 Catch basin leads shall be designed to accommodate, without surcharge, the anticipated design flow.

7.6.2 Pipe Diameter:
a.) Minimum 250 mm

7.6.3 Flow Velocity:
a.) Minimum 0.6 m/s
b.) Maximum 3.0 m/s

7.6.4 Manning's "n":
a.) n = 0.013

7.6.5 Slope:
a.) Minimum 1.0%

7.6.6 Catch basin leads shall be a maximum of 30 m in length unless a catch basin manhole is provided at the upstream end of the catch basin lead.

7.6.7 Catch basin leads shall be installed to provide a minimum depth of cover of 1.50 m, as measured from the top of the pipe to the final finished grade at the surface.

7.6.8 Catch basin leads must be connected to a catch basin manhole or to a manhole on the storm sewer main. No direct connections to storm sewer mains shall be permitted.

7.7 Stormwater Service Connections

Each lot shall have its own stormwater service connection (if shown on the approved construction drawings) designed in accordance with the following:

7.7.1 Commercial, Industrial, Institutional, and Multi-Family Developments

a.) Service connections for commercial, industrial, institutional, and multi-family developments shall be a minimum diameter of 250 mm and sized according to the anticipated site requirements and shall include sewer mains, catch basins, catch basin leads, catch basin manholes, and manholes as required to manage onsite drainage in accordance with the other sections of this section. The service connections shall be designed with consideration of the depth requirements for servicing of these lots and the potential impact on the depth requirement for the downstream sewer main. The storm management plan shall include an inlet controlled device.
b.) For car wash facilities, wastewater from the facility must drain to the wastewater collection system and shall not be permitted to be connected to the stormwater management system.

7.7.2 Detached Residential Developments

a.) Stormwater service connections for detached residential (single family) developments shall be adequate to convey foundation drain discharge flows into the foundation drain discharge collection system.
b.) Service connection pipe diameter shall be a minimum of 100 mm.
c.) The minimum slope of service connections shall be 2.0%.
d.) Service connections shall have a minimum depth of cover of 1.5 m throughout the length of the service, as measured from the top of the pipe to the final finished grade. Service connections shall be supported throughout their entire length.
e.) Service connections shall be located such that they do not conflict with driveway locations.
f.) Service connections shall be extended beyond the gas line into the lot to terminate a minimum of 1.0 m from the back of the easement line.
g.) Lot services shall be located as shown on the Engineering Standard Drawings, with the water service located nearest the driveway, followed by the wastewater service, and then the stormwater service located furthest from the driveway on the lot. Sewer services shall be installed on the downstream side of the water service relative to the direction of flow of the sewer main.
h.) Sump pump discharge connections at the building shall be in accordance with the Engineering Standard Drawings.
i.) Where the water service is 50 mm or smaller in size, the water and wastewater services shall be located in a common trench if they are not installed by auger or boring methods.

7.8 Foundation Drain Discharge Collection Sewers

7.8.1 Foundation drain discharge collection sewers shall be designed to convey, without surcharge, the anticipated design flow from detached residential stormwater service connections into the Town's storm sewer system.

7.8.2 Pipe Diameter:
a.) Minimum 150 mm

7.8.3 Flow Velocity:
a.) Minimum 0.6 m/s
b.) Maximum 3.0 m/s

7.8.4 Manning's "n":
a.) n = 0.013

7.8.5 Slope:
a.) Minimum slope shall be in accordance with the table provided in Section 7.3.4a).

7.8.6 Foundation drain discharge collection sewers are dedicated strictly to the collection of discharge from sump pumps which must be installed in all buildings with basements and weeping tiles. No other type of connection shall be permitted to these sewers. Roof leaders on buildings must drain to the surface, unless otherwise authorized by the Town.

7.8.7 The sewers shall be provided inside of the private side of the property line along all single- family residential lots and multi-family residential (non-apartment) units.

7.8.8 These sewers shall have a minimum depth of cover of 1.5 m and a maximum depth of cover of 2.90 m, as measured from the top of the pipe to the final finished grade.

7.8.9 Foundation drain discharge collection sewers must be connected to a catch basin manhole or to a manhole on the storm sewer main. No direct connections to storm sewer mains or catch basin leads shall be permitted.

7.8.10 The sewers must be located at least 3.0 m horizontally from any water or sanitary main and 1.8 m horizontally from any storm sewer main or gas line, as measured between the nearest pipe walls of the two mains.

7.8.11 Curved sewers shall run parallel to the adjacent property line. Long radius-type bends or a combination of 22½º bends and straight pipe shall be used to achieve the curve.

7.8.12 Cleanouts
a.) Cleanouts must be provided on sump pump discharge collection sewers for maintenance.
b.) Cleanouts shall be in accordance with the Engineering Standard Drawings.
c.) The maximum distance between cleanouts shall not exceed 100 m.
d.) Cleanouts are required at all changes in pipe diameter, grade, and direction, at junctions, at the ends of sewers, and at either end of a curved sewer.
e.) Wherever possible, cleanouts shall be located on the projection of property lines to avoid conflict with driveways.
f.) Cleanouts shall consist of a bi-directional tee design.

7.9 Oil and Grit Interceptors

7.9.1 The Town may require oil and grit interceptors (OGIs) be installed on new or redeveloped commercial or industrial sites. This requirement will depend on a number of factors including, but not necessarily limited to, business type, hours of operation, parking area, location, use of hazardous materials onsite, and downstream infrastructure.

7.9.2 Developments with large parking areas or risk of petroleum product spill will be required to install an oil and grit separator. All gas/service stations must have a stormceptor or other oil and grit separator as approved by the Town.

7.9.3 The Town may require OGIs to be installed in a new residential subdivision where the Development is immediately upstream of a stormwater management facility or discharges to a natural drainage course.

7.9.4 OGIs shall use the hydraulic energy of the conveyed stormwater to separate, trap, and store stormwater pollutants.

7.9.5 OGIs must be capable of trapping fine sand, silt, clay and organic particles in addition to larger sand and gravel particles, and small floatables.

7.9.6 OGIs shall be capable of removing 85% of the average annual total suspended solids (TSS) load and 95% of the floatable free oil without scouring previously captured pollutants.

7.9.7 The Design shall provide calculations substantiating removal efficiencies and shall include correlation to field monitoring results for the proposed OGI system.

7.10 Lift Stations and Stormwater Force Mains

7.10.1 Refer to Section 6.6 of these Standards.

7.11 Major System General Design Criteria

The following *minimum* criteria shall apply to the Design for the major system, as applicable to the proposed development:

7.11.1 General

a.) The major system shall be designed to accommodate runoff generated by a 1:100 year rainfall event.
b.) The maximum depth of peak flows and ponding shall not exceed 150 mm on arterial roadways.
c.) Apply computer simulation modeling in accordance with Section 7.2.1c.
d.) The Design must include an analysis of the capacity and characteristics of the downstream receiving drainage course and identification of any measures to be completed to prevent downstream flooding and/or for erosion and sediment control.
e.) Major system design shall ensure that all structures are protected from a 1:100 year event.

7.11.2 Conveyance Components

a.) Major system conveyance components must provide continuous overland flow routes to a designated receiving watercourse.
b.) Overland flow routes shall accommodate design flows plus anticipated overflows from stormwater management facilities.
c.) The depth of peak flows and ponding for major system conveyance components (i.e. roadways, channels, etc.) shall be limited to prevent significant hazard to the public, property damage, and erosion.
d.) The maximum depth of peak flows and ponding along major system conveyance components shall be a minimum of 350 mm below the lowest anticipated landscape grade or opening along adjacent lots and buildings.
e.) Manning's n:
    i. = 0.013 for roadways
    ii. n = 0.050 for grassed boulevards
f.) Arterial roadways shall not form a part of the major system conveyance system. Where the nature of the terrain imposes unreasonable difficulty in achieving this objective, the Town may authorize the use of an arterial roadway as part of the major system conveyance system provided the all other applicable conditions are met. Such situations shall be reviewed by the Town on a case-by-case basis.
g.) Concrete Swales
    i. Within public right-of-ways and easements, swales may be employed for the collection and conveyance of runoff to appropriate points of interception or release. Minimum width of such right-of-ways or easements to be 4.0 m for concrete swales and 6.0 m for multi-use easement.

ii. Swales shall be in accordance with the Engineering Standard Drawings.

h.) Culverts

i. Culverts may be provided to connect swales and drainage channels across roadways and other surface improvements.

ii. Culverts shall be a minimum 400 mm diameter.

iii. Refer to the Engineering Standard Drawings.

iv. Energy dissipation and sediment and erosion control must be considered in culvert design.

v. Minimum cover above pipe to be 600 mm or as otherwise approved.

7.11.3 Lot and Landscape Grading

a.) Lot grading plan will be submitted to the Town for approval.

b.) Lots shall be designed to drain from back to front. Where the nature of the terrain imposes unreasonable difficulty in achieving this objective, the Town may authorize an alternate approach, provided all other applicable conditions are met. Such situations shall be reviewed by the Town on a case-by-case basis. The Town may require the installation of suitable flow velocity and erosion controls, and the establishment of a suitable easement along the back of the lots.

c.) A minimum grade of 10% shall be provided out to a minimum of 2.0 m around all buildings.

d.) A minimum grade of 2% and maximum grade of 10% shall be provided on all landscaped areas.

e.) A minimum grade of 2% and maximum grade of 8% shall be provided on all driveways.

f.) Lot and landscape grading shall be designed such that the maximum depth of peak flows and ponding shall be a minimum of 150 mm below the lowest anticipated finished ground elevation at buildings. A suitable overflow route or sufficient ponding volume must be provided from or at all ponding areas to achieve this minimum freeboard and limit ponding to a maximum depth of 350 mm.

g.) Reverse slope driveways or other lot improvements that may capture runoff and fail to drain during major rainfall events shall be avoided.

7.11.4 Storage Components

a.) Major system storage components, also referred to as stormwater management facilities, which are to be owned and operated by the Town, shall be designed based on the critical volume determined for each stormwater management facility from the 1:100 year rainfall event, and as prescribed by applicable Alberta Environment and Parks standards and guidelines. The design of these facilities must incorporate calculations for a range of rainfall durations to assess which will result in the critical volume for the catchment area.

b.) Commercial, industrial, institutional, and high-density residential developments (including apartment and high-density multi-family sites) require onsite stormwater management facilities. These stormwater management facilities shall be designed based on the critical volume determined from the 1:25 year rainfall event. Suitable overland flow routes shall be provided from the facility to accommodate overflows for more significant rainfall events. The Design must limit post-development peak runoff flows from the Development to predevelopment rates.

c.) Where one or more stormwater management facilities are proposed in an Area Structure Plan, the Developer shall consult with the Town regarding site-specific requirements for each facility. Such may include special landscaping, fencing, lighting, recreational, and operation and maintenance requirements. The Town may also have specific requirements for stormwater quantity or quality control, which must be adequately addressed by the Design.

d.) The geotechnical report shall be integral to the design of stormwater management facilities.

e.) Warning signage shall be provided around all stormwater management facilities for public safety, to the satisfaction of the Town.

f.) Where stormwater management facilities will be constructed in phases, the Design shall fully detail how such phasing shall be achieved and how the interim system shall operate.

g.) Landscaping in and around stormwater management facilities shall incorporate bark chips or other floatable decorative landscaping materials only above the 1:100 year flood line and have a maximum of 75 mm of wood chip mulch. Biodegradable erosion blankets shall be used below the 1:100 year flood line.

h.) Detailed operation and maintenance manuals shall be provided for all stormwater management facilities in accordance with Section 1.18.

i.) Wet Ponds

i. Wet ponds temporarily store stormwater runoff to restrict post-development peak discharge rates and promote settling of solid particles. Where storage is required for residential subdivisions, wet ponds or constructed wetlands are recommended and should be incorporated into the Schools, Parks, and Open Spaces plan of the Area Structure Plan.
ii. Wet ponds, which are to be owned and operated by the Town, shall be located within a designated PUL. Lands subject to inundation under the design rainfall event shall be included within the PUL.
iii. Minimum depth of the pond at normal water level shall be 2.5 m.
iv. Minimum width of the water surface at the normal water level shall be 25.0 m.
v. Inlets and Outlets:
- Inlets and outlets must be located as far from each other as possible in order to avoid hydraulic short-circuiting and maximize detention time and circulation through the facility.
- Inlets and outlets shall be fully submerged with pipe obverts a minimum of 1.0 m below the normal water level and inverts a minimum of 150 mm above the lake bottom.
- The facility's normal operating level shall be at or below the pipe invert at the nearest manhole on the inlet storm sewer main.
- The facility's anticipated high water level during a 1:5-year rainfall event shall be at or below the pipe obvert at the nearest manhole on the inlet storm sewer main. This will typically require the installation of a drop structure on the inlet storm sewer main.
- Sediment basins shall be provided at inlets for control of heavy solids.
- An emergency overflow must be provided to redirect flows in excess of the design peak flow for the facility. The overflow shall tie-in to a suitable overland flow route.

vi. Pond design shall provide for semi-annual turnover under average annual precipitation conditions.
vii. The facility's normal water level shall be a minimum of 300 mm below the lowest basement weeping tile of the buildings located adjacent to the facility.
viii. Side slopes must meet recommendations of the geotechnical report and shall be a maximum of 5:1 to the normal water line (NWL), 3:1 below the NWL for a distance of 2.0 m, and 5:1 for the remainder of the pond slope to the pond bottom.
ix. The pond bottom and side slopes shall be constructed of materials as recommended by the geotechnical report.
x. A manhole shall be provided adjacent to the pond that is hydraulically connected to the wet pond to allow direct measurement of the water level of the pond.
xi. Alberta Environment stormwater quality best management practices must be addressed by the design for the facility.
xii. Erosion control must be provided around the perimeter of wet ponds. Such shall be compatible with adjacent land use and provide for low maintenance and public safety.
xiii. All-weather vehicle access must be provided to all inlet, outlet, and control structures, and other works in or around the facility which may require maintenance, with suitable provision for launching boats into the pond.

j.) Dry Ponds
i. Dry ponds temporarily store stormwater runoff to restrict post-development peak discharge rates and only contain standing water during design rainfall events. The Town prefers avoiding the use of dry ponds for new developments. Where storage is required for commercial, industrial, or high-density residential developments, the Town may accept dry ponds if the use of wet ponds or constructed wetlands are impractical.
ii. Dry ponds, which are to be owned and operated by the Town, shall be located within a designated PUL. Lands subject to inundation under the design rainfall event shall be included within the PUL.
iii. Maximum active storage depth of the pond shall be 1.5 m.
iv. Inlets and Outlets:
- Inlets and outlets must be located as far from each other as possible in order to avoid hydraulic short-circuiting and maximize detention time and circulation through the facility.
- Inlets and outlets to dry ponds must include gratings over openings for public safety. Gratings shall have a maximum clear bar spacing of 150 mm and shall be suitably anchored to the inlet/outlet. Grated outlet structures must be designed with twice the required hydraulic capacity in order to prevent plugging, and designed for a maximum flow velocity of 1.0 m/s through the grating. Gratings must be designed to allow maintenance access.

- Inlet and outlets structures must be protected with suitable fencing and guardrails.

v. The facility's anticipated high water level during a 1:5 year rainfall event shall be at or below the pipe obvert at the nearest manhole on the inlet storm sewer main. This will typically require the installation of a drop structure on the inlet storm sewer main.
vi. Sediment basins shall be provided at inlets for control of heavy solids. Outlets shall include a slide gate or other suitable feature to control outflow from the facility.
vii. Outlet capacity shall be sufficient to ensure post-event drawdown allows storage capacity to be available for the 1:5 year rainfall event with 24 hours and for the 1:25 year event within 48 hours, and that 90% of the facility's full storage capacity is available within 96 hours.
viii. An emergency overflow must be provided to redirect flows in excess of the design peak flow for the facility. The overflow shall tie-in to a suitable overland flow route.
ix. Pond design shall include provisions for maintenance of the dry pond between rainfall events.
x. The pond shall be graded to promote proper drainage of the facility between rainfall events. Minimum slope of the pond bottom shall be 2%.
xi. Side slopes must meet recommendations of the geotechnical report and shall be in accordance with the Engineering Standard Drawing.
xii. The pond bottom and side slopes shall be constructed of materials as recommended by the geotechnical report.
xiii. Landscaping in and around stormwater management facilities shall be as per the approved landscaping plan submitted.
xiv. Stormwater quality best management practices must be addressed by the design for the facility.
xv. All-weather vehicle access must be provided to all inlet, outlet, and control structures, and other works in or around the facility which may require maintenance.

k.) Constructed Wetlands
i. Constructed wetlands store stormwater runoff for extended periods of time to restrict post-development peak discharge rates and improve stormwater quality. Constructed wetlands are specifically recommended for any storage facilities that are located immediately upstream of a receiving watercourse, at the end of a storm sewer main.
ii. Requirements for the design of constructed wetlands for stormwater management shall be reviewed on a case-by-case basis in order to address site- specific stormwater quantity and quality requirements within existing environmental factors.
iii. Minimum requirements of current Alberta Environment and Parks standards and guidelines pertaining to the design of constructed wetlands shall expressly apply.

l.) Underground Storage Facilities
i. Underground storage facilities include various proprietary systems for storing surface runoff in buried storage vaults. Such facilities are not preferred and shall only be allowed upon the discretion and written acceptance of the Town.

7.12 Stormwater Management System Design for Infill and Redevelopment Projects

7.12.1 Refer to Section 1.23 for submission requirements.

7.12.2 The Design shall provide for the interception, conveyance, and storage of all overland drainage which enters the Development from surrounding areas for the indefinite future or interim period until infill or redevelopment of such areas occurs. Furthermore, the stormwater management system shall be designed to ensure the Development does not adversely affect the existing drainage pattern of surrounding areas, whether during or following construction.

7.12.3 Peak allowable outflow rate from the onsite collection system to the receiving storm sewer system shall be equal to pre-development flows or equal to the available conveyance capacity of the receiving sewer during a 1:5 year rainfall event, whichever is less.

7.12.4 Sewers
a.) Pipe Diameter:
i. Minimum 250 mm

b.) Flow Velocity:
    i. Minimum 0.6 m/s
    ii. Maximum 3.0 m/s
c.) Manning's "n":
    i. n = 0.013
d.) Slope:
    i. Minimum slope shall be in accordance with the table provided in Section 7.3.4a).
e.) Pipe Design
    i. Strength design shall be integral to the pipe selection process.
f.) Depth of Cover
    i. Sewer mains shall be installed to provide a minimum depth of cover of 1.50 m, as measured from the top of the pipe to the final finished grade at the surface.

7.12.5 Where conditions are favourable, sump pump discharge should be connected to the stormwater collection system in accordance with Section 7.8.

7.12.6 Lot and landscape grading shall be designed such that the maximum depth of peak flows and ponding shall be a minimum of 300 mm below the lowest anticipated opening elevation at buildings. A suitable overflow route or sufficient ponding volume must be provided from or at all ponding areas to achieve this minimum freeboard and limit ponding to a maximum depth of 350 mm.

7.13 Storm Outfalls

7.13.1 Outfall pipe obvert shall be above the high water level of the receiving channel under the 1:5 year rainfall event. Outfall pipe invert shall be above the normal ice level of the receiving channel under average annual precipitation conditions. Where these requirements cannot be reasonably achieved, the outfall pipe obvert shall be 1.0 m below the normal water level of the receiving channel under average annual precipitation conditions.

7.13.2 Drop structures and energy dissipation works shall be included where necessary to prevent erosion. Further erosion protection works including, but not necessarily limited to, rip rap and filter fabric treatment, shall be required at the end of storm outfalls into the downstream channel.

7.13.3 For concrete sewer pipe, pipe joints shall be grouted inside and out, or otherwise sealed with a suitable product or method to improve joint integrity, for at least 10 pipe lengths upstream from the outfall.

7.13.4 Storm outfalls must include gratings over outlets for public safety. Gratings shall have a maximum clear bar spacing of 150 mm and shall be suitably anchored to the outfall structure. Grated outlet structures must be designed with twice the required hydraulic capacity in order to prevent plugging, and designed for a maximum flow velocity of 1.0 m/s through the grating. Gratings must be designed to allow maintenance access.

7.13.5 Storm outfall structures must be protected with suitable fencing and guardrails.

7.13.6 Storm outfalls shall be located such that there is minimal impact to adjacent property. Landscaping around outfalls shall be compatible with adjacent land use and provide for low maintenance, using native plant material and a grass seed mix.

7.13.7 All-weather vehicle access must be provided to all storm outfalls for maintenance purposes.

PART II – MATERIALS

7.14 Storm Sewer Mains, Catch Basin Leads, and Foundation Drain Discharge Collection Sewers

Storm sewer mains, catch basin leads, and foundation drain discharge collection sewers shall be polyvinyl chloride (PVC) or concrete pipe conforming to the following:

7.14.1 PVC Pipe and Fittings

a) PVC pipe shall be acceptable for sewer mains up to 900 mm diameter.

b) PVC pipe and fittings shall meet CAN/CSA-B182.2 with locked-in elastomeric ring gasket and integral bell system joint type.

c) Minimum pipe dimension ratio shall be DR35. Strength design, considering trench and road loading, shall be integral to pipe design process.

d) Pipe shall be installed within two years from the production date indicated on the certification.

e) Joint lubricants shall be compatible with gasket material.

7.14.2 Concrete Pipe and Fittings

a.) Non-Reinforced Circular Concrete Pipe and Fittings

i) Non-reinforced concrete pipe shall be acceptable for 200 mm to 250 mm diameter sewer mains where strength design, considering trench and road loading, for the pipe is suitable.

ii) Pipe and fittings shall meet CAN/CSA-A257.1, Class 3, and designed for flexible rubber gasket joints to CAN/CSA-275.3, and constructed with Type HS sulphate resistant Portland cement to CAN/CSA-A3000.

b) Reinforced Circular Concreate Pipe and Fittings

i) Reinforced concrete pipe shall be acceptable for sewer mains with a diameter of 250 mm and up.

ii) Pipe and fittings shall meet CAN/CSA-257.2, concentric reinforcing, designed for flexible rubber gasket joints to CAN/CSA-275.3, and constructed with Type HS sulphate resistant Portland cement to CAN/CSA-A3000.

iii) Strength design, considering trench and road loading, shall be integral to pipe design process. D-load shall be as determined by load analysis.

7.15 Culverts

7.15.1 Corrugated metal pipe (CMP) shall be acceptable for culverts and temporary inlets and outlets for stormwater management facilities.

7.15.2 CMP shall conform to CAN/CSA-G401 with welded or coupled joints.

7.16 Manholes

7.16.1 Manholes shall be minimum 1,200 mm in diameter and in accordance with the Engineering Standard Drawings.

7.16.2 Catch basin manholes shall be minimum 1,200 mm in diameter.

7.16.3 Manhole materials shall be reinforced concrete, constructed of Type HS sulphate resistant cement.

7.16.4 Precast manhole sections, adjusting neck rings, and manhole steps shall conform to CAN/CSA- A257.4 and ASTM-C478.

7.16.5 Pre-benched standard manhole bases shall be used and shall include pre-cored connections with watertight joints, Duraseal or accepted alternate.

7.16.6 Manhole joints shall meet the requirements of CAN/CSA-257.3 and ASTM-C443. Furthermore, all joints shall be sealed with a suitable non-shrink grout on the inside and outside for the circumference of the manhole.

7.16.7 Manhole steps shall be standard safety type, constructed of hot-dipped iron in accordance with ASTM-A615 and ASTM-A123 or aluminum, forged of 6061-76 aluminum alloy, with a minimum tensile strength of 200 MPa.

7.16.8 Frames and Covers

a) Frames and covers shall be made of iron conforming to ASTM-A48 and in accordance with the Engineering Standard Drawings.
b) Frames for manholes on paved surfaces shall be Norwood NF-80 floating type with rubber gasket seal and solid cover, as manufactured by Norwood Foundry Ltd., or accepted alternate.
c) Frames for manholes not on paved surfaces shall be Norwood NF-39 with solid cover, as manufactured by Norwood Foundry Ltd., or accepted alternate.
d) Cover shall be imprinted with the word “Storm”.

7.16.9 Perched manholes, or accepted alternate, are required for sewer mains from 600 mm to 1,050 mm in diameter and in accordance with the Engineering Standard Drawings.

7.16.10 Tee-riser manholes, or accepted alternate, are required for sewer mains greater than 1,050 mm in diameter and in accordance with the Engineering Standard Drawings.

7.16.11 For manholes exceeding 7 m in depth, the Town may stipulate additional requirements for manholes.

7.16.12 The Town may require lockable covers be provided where safety or security risks may be a concern. Where required, such shall be subject to the review and acceptance of the Town.

7.17 Catch Basins

7.17.1 Catch basins shall be minimum 900 mm in diameter with a minimum sump depth of 600 mm in accordance with the Engineering Standard Drawings.

7.17.2 Catch basin materials shall be reinforced concrete, constructed of Type HS sulphate resistant cement.

7.17.3 Catch basin steps shall be standard safety type, constructed of hot-dipped iron in accordance with ASTM-A615 and ASTM-A123 or aluminum, forged of 6061-76 aluminum alloy, with a minimum tensile strength of 200 MPa.

7.17.4 Frames and Covers

a) Frames and covers shall be made of iron conforming to ASTM-A48 and in accordance with the Engineering Standard Drawings.
b) Top inlet, round top frames and covers shall be Norwood NF-38 or NF-39 open grate type, as manufactured by Norwood Foundry Ltd.
c) Side inlet frames and covers for straight-faced curb shall be Norwood NF-51 two piece or NF-36A, as manufactured by Norwood Foundry Ltd.
d) Side inlet frames and covers for rolled-faced curb shall be Norwood NF-33, K-2, or DK-7, as manufactured by Norwood Foundry Ltd.,

7.18 Stormwater Service Connections

7.18.1 Single-family residential sewer services shall be PVC pipe conforming to Section 7.14.1.

7.18.2 Tee-type fittings shall be used to connect service connections to sewer mains for all new construction. For existing concrete main service connection inserted tee-type fittings shall be used whenever possible. The tee-type fittings will be positioned such that the service connection discharges into the upper half of the sewer main. Stainless steel strap-on type service saddles shall only be permitted for service connections to existing mains, or where otherwise this may be the only option (i.e. connections to large diameter sewer mains).

7.18.3 Sewer services for all other developments, in accordance with Section 7.7, shall comply with Section 7.14.

7.19 Oil and Grit Interceptors

7.19.1 Oil and grit interceptors shall be as manufactured by Stormceptor, CDS Technologies, or accepted alternate.

7.20 Stormwater Force Mains

7.20.1 Refer to Section 6.10 of these Standards.

7.21 Bedding and Backfill

7.21.1 Refer to Section 5.13 of these Standards.

PART III – CONSTRUCTION

7.22 General

7.22.1 The following sections represent the minimum requirements for some typical, key construction procedures for stormwater management system construction. These minimum requirements must be met or exceeded by the detailed construction specifications and drawings developed by the Consultant.

7.22.2 Construction activities must adhere to the provisions of the Erosion and Sediment Control Plan prepared for the Development in accordance with Section 1.10.1.7.

7.23 Quality Assurance

7.23.1 Refer to Section 6.13 of these Standards.

7.24 Quality Control Testing

7.24.1 Refer to Section 5.16 of these Standards.

7.25 Site Preparation

7.25.1 Prepare the site in accordance with Section 3.26 of these Standards.

7.26 Clearing

7.26.1 Conduct clearing in accordance with Section 3.27 of these Standards.

7.27 Grubbing

7.27.1 Complete grubbing in accordance with Section 3.28 of these Standards.

7.28 Topsoil Stripping and Stockpiling

7.28.1 Strip and stockpile topsoil in accordance with Section 3.29 of these Standards.

7.29 Trench Excavation

7.29.1 Refer to Section 5.22 of these Standards.

7.30 Alignment and Grade

7.30.1 Lay pipe to the required alignment and grade, with manholes and all other appurtenances at the locations identified on the construction drawings.

7.30.2 Provide minimum 1.50 m depth of cover on sewer mains, unless otherwise authorized by the Town in writing. Where depth of cover is less than 1.50 m provide insulation.

7.30.3 Acceptable tolerances are as follows:

a) Alignment – the centreline of the pipe shall not be more than 100 mm off the specified alignment.
b) Elevation – the pipe invert shall not be more than 6 mm plus 0.01 mm per mm diameter of the pipe off the specified elevation.

c) Joints – for concrete pipe, deflections at joints shall not exceed that specified by CAN/CSA-A257. For PVC pipe, deflections at joints shall not exceed those recommended by the manufacturer.

7.30.4 All pipe shall be laid sloping in the desired direction with no reversed grades on any pipe lengths.

7.30.5 Maintain, and provide to the Town upon request, grade sheets for the installation of the pipe.

7.30.6 No deviation shall be made from the required alignment or grade without the written consent of the Town.

7.31 Pipe Bedding and Pipe Zone Backfill

7.31.1 Refer to Section 5.24 of these Standards.

7.32 Pipe Installation

7.32.1 Refer to Section 6.22 of these Standards.

7.33 Setting Manholes

7.33.1 Refer to Section 6.23 of these Standards.

7.34 Setting Catch Basins

7.34.1 General

a.) Bases shall be placed on solid, unfrozen ground.
b.) Construct catch basin unit plumb and true to alignment and grade.

7.34.2 Catch Basin Completion

a) Backfill around the catch basin with sand, as specified in Section 5.13.2, or fillcrete. Course sand backfill (1 3/8 screenings or acceptable approved alternate), shall be placed and compacted to minimum 98% Standard Proctor Density in uniform lifts not exceeding 150 mm in depth.
b) Place frame and cover to the elevation indicated, and adjust tops flush finished grades.
c) Where grade rings are not available in the height required for proper spacing any other materials used to correct heights must be approved by the Town of Whitecourt and cannot be deleterious materials (i.e. Styrofoam, wood, brick, etc.).

7.35 Stormwater Service Connections

7.35.1 Refer to Section 6.24 of these Standards.

7.36 Trench Backfill

7.36.1 Refer to Section 5.31 of these Standards.

7.37 Stormwater Main Inspection and Testing

7.37.1 CCTV inspection to be completed for all stormwater mains, catch basin leads, and foundation drain discharge collection sewers.

7.37.2 Refer to Section 6.26 of these Standards.

7.38 Stormwater Service Inspection and Testing

7.38.1 Refer to Section 6.27 of these Standards.

7.39 Final Inspection of Stormwater Mains

7.39.1 Refer to Section 6.28 of these Standards.

8. Landscaping Standards – General

8.1 Landscaping Standards

8.1.1 General

Sections 9 through 14 present the minimum acceptable requirements for the design and construction of some typical, key landscaping system components. These minimum requirements must be met or exceeded by the detailed construction specifications and drawings developed by the Consultant.

8.1.2 Qualifications for Landscape Contractors

a) Landscape contractors shall be reputable, experienced and have current membership in the Landscape Alberta Nursery Trades Association. Contractor must be willing to provide proof of their experience.
b) Certified Landscape Trade Journeymen and ISA-certified Arborists are required where applicable.
c) All work shall be done under the direction and supervision of a foreman with at least 5 years' experience.
d) All work shall conform to best management practices (BMP) and the Canadian Standards for Nursery Stock (Latest edition).

8.2 Park Development Guidelines

8.2.1 Parks, open spaces, and reserve requirements are determined at the area structure plan/subdivision stage in alignment with the Town of Whitecourt Municipal Development Plan, Land Use Bylaw and Council approved policies. All parks, open spaces, and reserves are required to be graded, top-soiled, and sodded/seeded. The Town may require the Developer to install low maintenance trees and shrubs, benches, waste receptacles, picnic tables, pathways, lighting, and services to any of these areas.

8.3 Boulevard Development Guidelines

8.3.1 Boulevard areas are to be graded, top-soiled, and sodded.

8.3.2 Coordinate boulevard landscaping with the location of street furniture to avoid conflicts.

8.4 Development Guidelines for Arterial Roads, Major Collector Roads and Subdivision Entrance Features.

8.4.1 Arterial, major collector roads, and subdivision entrances shall have enhanced landscaping to the satisfaction of the Town. Subdivision entrances off of arterial and major collector roadways that serve in excess of 75 residential lots shall have a unique entrance feature or sign with landscaping to include low maintenance trees and shrubs to the satisfaction of the Town. All planting shall be deer resistant, and conform to fire smart best practices. Signage, retaining walls, and other structural features to the approval of the Town of Whitecourt.

8.4.2 Shrubs will be massed within planting beds and planted appropriate to species. Shrubs shall meet the following:

a) Deciduous: minimum 450 mm height
b) Coniferous: minimum 300 mm spread, subject to availability

8.4.3 Trees shall meet the requirements specified in Section 11.0.

8.4.4 Trees shall be positioned within planting beds or tree wells.

8.4.5 Manicured planting beds shall incorporate a minimum 150mm high "Black Diamond" or equivalent edger subject to Town approval.

8.4.6 All manicured planting beds shall incorporate a minimum of 100 mm organic mulch (i.e. wood chip mulch) or 75 mm depth inorganic mulch (i.e. decorative crushed granular, crushed shale, or washed rock) to the satisfaction of the Town. Mulch shall be pulled away from the bases of tree trunks and shrub stems as per landscape engineering standard drawing.

8.4.7 Islands shall not be grassed unless specifically directed or authorized by the Town.

8.4.8 Free-standing architectural features (i.e. signs, sculptures, entry gates, etc.) shall not be located within grassed areas.

8.4.9 All paving stones, paving stone headers, concrete, or other special hard surfaced verge or walk shall be subject to the review and acceptance of the Town.

8.4.10 Typical cross-section details for island and median planting plans shall show all underground infrastructures.

8.4.11 Retaining walls shall be engineered.

8.5 Walkway Design Guidelines

8.5.1 Areas adjacent to walkways and trails must be graded, top-soiled, and sodded

8.5.2 All pathways and trails are to be illuminated in accordance with the current edition of the Transportation Association of Canada (TAC) guidelines.

8.5.3 Trees shall be required adjacent to all walkways along arterial and collector roadways, as well as subdivision entrances, unless otherwise approved by the Town.

8.5.4 Provide a minimum of five trees for every 35 m of walkway where trees are required. Shrubs may be substituted at the rate of seven shrubs for every one tree.

8.5.5 Trees and shrubs shall meet the requirements specified in Section 11.0.

8.6 Major Utility Right-of-Way Design Guidelines

8.6.1 Major utility right-of-ways shall include landscape improvements. Where the utility authority does not approve of landscaping within their right-of-ways, the requirement for all or a portion of the landscaping may be waived, subject to the authorization of the Town.

8.6.2 Right-of-way landscape improvements may range from low maintenance naturalization to more formal landscape designs, depending on the existing landscape character established within the right-of-way.

8.6.3 Healthy, vigorous trees within or abutting the right-of-way shall be preserved. Any trees that are requested to be removed are subject to Town of Whitecourt approval.

8.6.4 Landscape improvements for major utility right-of-ways shall be in accordance with the applicable sections of these Design Standards and subject to the review and acceptance of the Town and the applicable utility authorities.

8.7 Public Utility Lot Design Guidelines

8.7.1 PULs shall be graded, top-soiled, and seeded or sodded, to the approval of the Town of Whitecourt.

8.7.2 Provide a minimum of 80 trees per hectare within the PUL. Shrubs may be substituted at the rate of seven shrubs for every one tree.

8.7.3 Trees and shrubs shall meet the requirements specified in Section 11.0.

8.7.4 Healthy, vigorous trees within or abutting the PUL shall be preserved. Any trees that are requested to be removed are subject to Town of Whitecourt approval.

8.7.5 Pedestrian access may be required to be provided within a PUL to ensure connectivity for trail users.

8.8 Stormwater Management Facilities in Parks Design Guidelines

8.8.1 Dry ponds and areas surrounding new stormwater management facilities must be graded, topsoiled, and seeded or sodded.

8.8.2 Plant materials will be selected with consideration to hydrological characteristics, soil characteristics, facility side slopes, and intended park use.

8.8.3 Provide a minimum of 80 trees per hectare within the public lands around the facility, above normal water level. Shrubs may be substituted for trees at a rate of seven shrubs for one tree.

8.8.4 Trees shall meet the requirements specified in Section 11.0.

8.8.5 Shrubs must meet the requirements of Section 8.5.2.

8.8.6 Inlets and outlets shall be landscaped with mass planting and large rocks, or acceptable alternative concrete revetment, to provide visual screening and security buffering for the public.

8.8.7 Where possible, relatively flat open areas should be designed to encourage active recreational uses.

8.8.8 Special or unique park features (i.e.: artificially pumped dry streams, special play courts, bridges, and other architectural or structural features) must be designed by suitable, accredited professionals, as applicable. All such features which are to be located below the 1:5-year flood line shall be designed to withstand this event to the satisfaction of the Town. Such features may be subject to a maintenance reserve, to be established by the Developer.

8.9 Naturalization Design Guidelines

8.9.1 Existing natural and naturalized areas affected by Subdivision development, which cannot be protected during construction, shall be restored with native plant materials consistent with the surrounding environment, new drainage patterns, soil conditions, and ecological rehabilitation. In such cases, the Town shall be consulted during the design to assist in planning, the selection of appropriate replacement plant materials, and the retaining of wildlife corridors.

8.9.2 The Developer's landscape architect shall design an appropriate mix of native trees, shrubs, ground covers, and native seed mixes, consistent with these Design Standards, to rehabilitate affected naturalized and natural areas.

8.9.3 The landscape architect shall, when required, coordinate this restoration with other consultants to implement geotechnical, structural, and bioengineering principles and recommendations.

8.9.4 Landscape drawings shall identify all existing plant communities to be established and all other information necessary to implement the proposed landscape improvements.

8.9.5 The landscape architect shall specify all tree, shrub, and ground cover sizes. A tree mix of 60% coniferous and 40% deciduous is recommended.

8.9.6 To establish healthy growing environments, 10% of all plant materials shall be of larger sizes.

8.9.7 Forestry stock, seedlings, deciduous tree whips, propagated cuttings, and rooted cuttings may be acceptable for use, subject to Town inspection and acceptance prior to installation.

8.9.8 Appropriate plant installation specifications and details shall be included on landscape drawings.

8.9.9 Herbicides may be used to eradicate vegetation on natural slopes prior to planting of trees and shrubs, subject to the review and acceptance of the Town. No chemical treatment shall be permitted within 30 m of any body of water.

8.10 Environmental Reserve Design Guidelines

8.10.1 At no time shall encroachment into any natural area or designated buffer area occur without express written consent from the Town of Whitecourt. Environmental reserves shall be temporarily fenced and otherwise protected from adjacent construction.

8.10.2 Any environmental reserve areas damaged during construction must be rehabilitated to the satisfaction of the Town of Whitecourt.

8.11 Multiple Family, Institutional, Commercial, or Industrial, Site Design Guidelines

8.11.1 The front properties of a development shall be used for ornamental plantings only. Property owners are required to landscape the boulevard and the property from the back of the sidewalk up to their property line that is adjacent to the public roadway. Deciduous trees must be planted at regular intervals, and coniferous trees must be planted in clusters of 3, 5, or 7 etc. Trees must be located a minimum of 2 m from property line, and must avoid any conflict with Utility lines. Sightlines must be considered for the building and any site signage appurtenances. Maintenance shall be the responsibility of the Developer/Owner, and not the Town.

8.11.2 In order to reduce incompatible characteristics of abutting properties with different land use districts, minimum landscaping standards shall be applied to planting buffers on the interior property lines of the most intense land use.

8.11.3 Refer to Appendix E for Landscaping Templates for Buffers and Perimeter Planting on Interior Lots.

8.12 Fencing Design Guidelines

8.12.1 All fencing shall be subject to Town of Whitecourt approval.

8.12.2 Uniform fencing shall be provided and installed by the developer adjacent to and at the following locations and shall not hinder sight lines:

- Arterial roadways
- Parks and playfields (trees/shrubs and other landscaping methods are preferred over fencing to buffer parks and playfields adjacent to a roadway, however, park structure and amenities must be adequately setback from the roadway to provide a safe distance from any vehicular traffic)
- Public walkways and public utility lots
- School sites
- Town owned lands (i.e. fire hall sites, etc.)
- Multiple family sites
- Neighbourhood commercial sites
- Institutional sites
- Other areas as required by the Town.

8.13 Site Amenity Design Guidelines

8.13.1 Furniture shall be provided by the Developer and placed at strategic locations through the Subdivision. Refer to Section 14.0. The Town shall maintain the right to stipulate specific requirements for furniture.

8.14 Trail Design Guidelines

a.) Trails shall be 2.5m wide paved. See Engineering Standard Drawings

b.) Trail heads shall have gates and lighting installed at all entrances.

8.15 General Guidelines – Construction Inspection Process

8.15.1 The Developer's Landscape Architect shall ensure that the contractor(s) adhere to the following procedures through the construction process:

a) Ensure that utility locates are performed prior to any construction, including Alberta First Call and other appropriate authorities.
b) Review and approve all below grade utilities flagged before construction commences.
c) Ensure that Erosion control measure and safety measure i.e. signage, barricades, etc. are arranged prior to any construction.
d) Protect existing landscaped areas including natural areas, sod, trees and shrubs.
e) Arrange for a project initiation meeting on site with Town Representative to ensure there is a clear understanding of the Town's requirements during construction, establish a construction start date, and agree upon the progress schedule and subsequent inspection stages.
f) Approve rough grading, topsoil spreading, new seeding and sodding, new tree locations.
g) Approve plant materials prior to installation.
h) Coordinate review of topsoil and recommend amendments as required. Contact Town to review topsoil.
i) Direct the review and inspection of all construction and installation while in progress.

8.15.2 The Town will inspect plant materials prior to installation for vigor and form requirements and the existence of disease or pests if requested.

8.15.3 The Developer's Landscape Architect shall notify the Town's representative 2 business days in advance at each stage of construction when the work is ready for inspection.

8.15.4 Contractor(s) shall provide details of the source location in writing if requested by the Town.

8.15.5 The failure of construction to comply with approved plans and specifications will be considered sufficient cause to stop work or invoke the security clauses of the Development Agreement. Construction deficiencies shall be rectified to meet the appropriate plans and specifications, at the Developer's expense.

8.15.6 The Developer's Landscape Architect shall submit a request to the Town in writing for plant material substitutions. If approved, the Developer's Landscape Architect shall identify the approved changes on the red line or plan of record drawing, as appropriate.

8.15.7 Every precaution shall be taken not to damage, injure or mark existing structures or landscaping on town owned property. Should the developer, its consultants, contractors, employees, or equipment incur any damage, it shall be restored at the developer's expense to the satisfaction of the Town. If remediation work is not done by the developer, the work will be complete by the appropriate Town department or delegate at the developer's expense.

8.15.8 The Developer shall ensure that adjacent property is protected from dust, sand, and wet soil during construction. It is the Developer's responsibility to ensure all debris is removed from adjacent lands, and construction damage is repaired to its original condition.

8.16 Additional Guidelines – Construction Completion Certificate

In addition to the guidelines provided in Section 1.19, the following guidelines apply to the Construction Completion Certificates (CCCs) for landscaping activities.

8.16.1 When landscape construction work is satisfactorily complete, the Developer's Landscape Architect shall submit a written request for a CCC inspection of the works using the form provided in Appendix B-2. The request shall include a maintenance schedule, three (3) copies of the approved or redline drawings at an 11x17 size, and PDF submitted electronically or on a USB.

8.16.2 Landscape CCC includes the following:

a.) Turf and Plantings for Boulevards, including planting islands and entrance features.
b.) Turf and Planting for MR, ER, PUL, SWMF, Road Boulevards
c.) Parks, Park Amenities and Playground Equipment
d.) Hard Surfaces and Special Pavements
e.) Fencing

8.16.3 In preparation for acceptance of the development by the Town, CCCs shall be issued subject to the following conditions and procedures:

a.) All stages must be 100% complete prior to a CCC inspection for landscaping. Boulevards must be 100% complete prior to a CCC inspection for landscaping.
b.) The Developer's Landscape Architect, contractor(s), and the Town Representatives shall attend the CCC inspections. Attendees shall be requested to sign the CCC form to show agreement with any noted deficiencies.
c.) CCC inspections for all sod/seeded areas will occur once grass is established at minimum to second cutting.
d.) Following the CCC inspection, the Town will forward a copy of the inspection report listing all deficiencies to the Landscape Architect, or delegate, and the contractor.
e.) All deficiencies identified during the CCC inspection shall be repaired or corrected within a maximum of 3 weeks. Upon the correction of all listed deficiencies, the Landscape Architect or Delegate will request a re-inspection. If all deficiencies are corrected, the Town will approve the CCC. If deficiencies are not corrected by the agreed date, the Developer's Landscape Architect must request a new CCC inspection. The maintenance period will commence from the CCC approval date.
f.) The Developer shall maintain all work prior to the CCC and during the maintenance period after the CCC approval dates.

8.16.4 CCC inspections may be requested at any time. At the discretion of the Town of Whitecourt and weather permitting and site amenities can be inspected year round, provided snow cover, temperature, and other considerations do not prevent the ability to perform a thorough inspection. If an inspection occurs after October 15 of any year additional warranty is required as described in Appendix B.

8.17 Maintenance

8.17.1 Upon issuance of the CCC, a two-year maintenance period for all landscaping activities is required.

8.17.2 If a CCC inspection occurs after October 15 of any year additional warranty may be required.

8.17.3 Maintenance shall include but not be limited to pruning, watering, fertilizing, cultivating, mowing, weeding, re-seeding, top dressing, aerating, sweeping, raking, replanting, mulching, tightening and repair of guy wires and stakes, resetting plants to proper grades or upright position, restoration of the planting saucer, application of such sprays, wraps, or other materials as necessary to keep plantings free of insects, rodents, weed, diseases and in vigorous and viable condition.

8.17.4 All grounds must be kept in a clean and tidy condition and the Developer shall be responsible for repairing any damages that occur during the Maintenance Period.

8.17.5 The Developer shall immediately report any damage caused through maintenance to the Town and complete repairs and replacements to the approval of the Town within seven (7) days from date of approval given for repair/replacement.

8.17.6 Weed, pest, insect, and disease control chemicals to be applied only in accordance with current regulations. Developer to provide signage 48 hours prior to spraying and Town to be given 96 hours notice prior to spraying.

8.17.7 Ensure all catch basins, swales, and ditches are clear and draining freely.

8.17.8 Daily maintenance logs shall be kept during the warranty period and may be required to be submitted to the Town of Whitecourt prior to issuance of a Final Acceptance Certificate.

8.18 Additional Guidelines – Final Acceptance Certificate

In addition to the guidelines provided in Section 1.22, the following guidelines apply to the Final Acceptance Certificates (FACs) for landscaping activities.

8.18.1 After the required maintenance period has come to an end, the Developer's Landscape Architect shall submit a written request for an FAC inspection using the form provided in Appendix B-2. If amendments were made to any of the landscaping activities following issuance of CCC, new as-built redline drawings will be required as per section 8.17.1.

8.18.2 FAC inspections may be requested between June 1 and September 30, weather permitting, at the discretion of the Town and provided snow cover, and other considerations do not prevent the ability to perform a thorough inspection.

9. Landscaping Standards – Sub-Grade and Topsoil

PART I – DESIGN

9.1 Design Guidelines

9.1.1 Provide a minimum 2% gradient across all reserve parcels, medians, traffic islands, boulevards, public utility lots/ROW's and stormwater dry ponds.

9.1.2 Excessive fill that compromises the site design will not be acceptable

9.1.3 The Town may require that stripping material or excess fill be shaped within a park/playfield to create a toboggan hill(s). Where toboggan hills are required, the following provisions must be met:

a.) The toe of the slope must be set back a minimum of 18m from any roadways, trees, plants, benches, waste receptacles, fences, power boxes, lights, play equipment or other obstructions to allow for safe use of the hill for sledding.
b.) Maximum height shall be 6m with a minimum width at the top of 4m.
c.) Whenever possible, top soiling and seeding or sodding of hills and berms should be delayed until the spring following construction to allow for settlement of the soil

9.1.4 Geotechnical testing may be required where questionable sub-grades exist.

9.1.5 Joint Use Site Guidelines:

a.) School building envelope to have same grades as sports field envelope (i.e. 2%).
b.) School building envelopes and adjacent road grades must be at the same elevation.
c.) School building envelope is to have topsoil applied to a minimum depth of 250 mm.
d.) For every one metre in elevation in excess of 2% slope, a minimum increase of three metres will be required on site.
e.) If non-engineered fill is to be incorporated in an MSR site, the non-engineered fill drawing, documenting the limit and depth of the fill area and confirming the fill area is outside the building envelope, shall be provided at CCC.

9.2 Drainage Guidelines

9.2.1 Where possible drainage is to be directed to the reserve parcels, PUL/ROWs and stormwater dry ponds in grass swales.

9.2.2 Drainage shall not be directed into existing tree stands.

9.2.3 Grass swales are to drain at a minimum 2% gradient.

9.2.4 Grass swales exceeding sixty metre runs are to have a minimum gradient of 4.0%. If the swale is to drain less than 4.0%, it shall have weeping tile along the entire length of the swale tied into a catch basin or water drainage along a concrete swale of an approved equal

9.2.5 The Town reserves the right to limit the amount of off-site drainage onto a reserve parcel and PUL/ROW when, in their opinion, such drainage will compromise the integrity of the site.

9.2.6 All trapped lows must be approved by the Town prior to construction. Trap lows must not compromise the use of the site and must be integral part of the design.

9.2.7 All drainage swales that empty onto reserve parcels, boulevards, PULs, ROWs, and stormwater dry ponds should have concrete splash pads. Concrete splash pads should be installed at a 10% pitch or erosion fabric will be required at their end.

9.2.8 Residential and commercial lots shall not use MRs to convey drainage.

PART II – GENERAL

9.3 Examination

9.3.1 Report to the Town, in writing, any conditions or defects encountered in the site before or during any construction upon which the work of this section depends and which may adversely affect its performance.

9.3.2 Do not commence work until those conditions or defects have been investigated and corrected.

9.3.3 Commencement of work shall imply acceptance of existing surfaces and conditions and no claims for damages or extras resulting from such conditions or defects will be accepted later, except in cases where such conditions could not have been known prior to commencement of work.

9.3.4 Protect all existing trees and planting areas.

9.4 Samples

9.4.1 Samples of topsoil may be requested for approval by the Town.

a.) Sample and soil analysis report to be provided prior to construction.
b.) Submit required sample of topsoil to the testing laboratory and indicate intended use, type of mulches applied, type of sub-soil and quality of drainage.
c.) Obtain approval of the topsoil in writing from the Town. Topsoil testing shall be done on the source of topsoil. Four samples shall be taken (i.e. one within every 25% vertical increment of the stockpile) at a depth of one foot. The location of the samples within each vertical increment shall be determined by the Town.
d.) Submit for the Town's approval the name of the testing company who will conduct the soil analysis. The proposed testing laboratory is subject to approval by the Town.
e.) Submit two (2) copies of the soil analysis report, including the location of the topsoil stockpile or source and recommendation for correction to the Town. Test the topsoil for NPK, a particle size analysis (soil texture), soluble salt content, organic matter, pH, and micro/macro nutrient status. Recommendations should clearly state the type, quantity and application procedure for amendment.
f.) Should the source of topsoil be exhausted, test topsoil from new source, submit soil analysis report and recommendations for correction and obtain the approval of the Town.

9.4.2 Retain approved samples on site until work has been inspected and approved.

9.4.3 All work shall conform to approved samples.

9.5 Product Delivery, Storage and Handling

9.5.1 Stockpile topsoil in locations designated by the Town.

9.5.2 Stockpiling on future MR lands is not permitted, unless written permission is granted by Town Services.

9.5.3 Do not spread topsoil in a muddy condition.

9.6 Inspections

9.6.1 The Contractor shall have an approved set of drawings and specifications available prior to calling the Town for inspection.

9.6.2 The Town shall approve both rough grade prior to placing of topsoil and finished grade at appropriate times before contractor proceeds with next phase of work. For all joint use sites and community parks, as well as dry ponds containing sports field in MR and MSR sites, the Contractor shall:

a.) At Sub-Grade Inspection:
    i. Supply grade stakes at all corners of sports fields as well as along their centre line.

ii. Supply grade stakes at the toe and heel of all slopes and swales. Spacing of the stakes is to be determined by the Town prior to their installation.
iii. Be available for a joint site inspection with the Town and have on site a survey crew fully equipped to provide any additional elevations as may be requested.

b.) At Finished Grade Inspection:

i. Supply grade stakes at the corners, centre and quarter points of sports filed, break of slopes and along drainage channels.

PART III – PRODUCTS

9.7 Fill

9.7.1 Fill materials shall exclude all matter likely to breakdown and cause subsidence.

9.7.2 Fill materials shall be free of stones, clods, sticks, sod, roots, organic matter, frozen lumps, concrete, any toxic materials (e.g.: salt, oil, etc.), debris and other foreign material.

9.7.3 Fill shall not contain quack grass rhizomes.

9.8 Sand

9.8.1 Sand for horticultural use when tested by laboratory sieves shall be uniformly graded and meet the following grading requirements:

Passing	Cumulative % by Weight
2.5 mm	100
1.25 mm	90-100
0.8 mm	80-90
315 micro-m	30-60
160 micro-m	2-10
63 micro-m	1 maximum

9.8.2 Sand shall be natural and coarse (except for the removal of very fine particles and gravel). Sand shall be free from vegetation, clay balls and other foreign material. Care shall be taken in the selection of material from the pit to produce a uniform product.

9.9 Crushed Gravel

9.9.1 Crushed gravel shall be maximum size 25 mm complying with the following gradation.

Sieve Size	e
25 mm	100
19 mm	95-100
9.50 mm	60-80
4.75 mm	40-60
2.00 mm	25-45
425 micro-m	10-25
75 micro-m	2-10

9.9.2 Volume of rock in topsoil not to exceed 20%.

9.10 Topsoil

9.10.1 The following topsoil requirements are for boulevard and parks projects. For projects with specialized plant communities including, for example, species demanding unusually acid or alkaline soils (calcifuges or calcicoles), an appropriate soil specification shall be submitted to the Town for review and acceptance.

9.10.2 Topsoil shall be loose, loamy, friable soil, free from subsoil, refuse, roots, stones > 25mm, slag, clay, stones, lumps, quack grass and other perennial weeds and roots, rhizomes, noxious odors, chemical contaminants, live plant roots, or other foreign materials.

9.10.3 If the seed bank of an imported topsoil yields quack grass, noxious weeds, or restricted weeds as designated by the Weed Designation Regulation of the Weed Control Act of the Province of Alberta, or sufficient weeds of any type to choke the desired vegetation, up to three repetitions of cultivation, germination and appropriated translocated herbicide application will be required.

9.10.4 Topsoil pH to be between 6.0 and 7.5. Use lime or sulphur, as indicated by analysis of topsoil, to bring pH to the required range.

9.10.5 Stone content shall not exceed 10% by dry weight. The maximum stone size, in any direction, shall not exceed 25 mm.

9.10.6 Topsoil shall be free from weeds and weed seeds, and shall be in a reasonably moist condition.

9.10.7 Topsoil shall be capable of sustaining vigorous plant growth.

9.10.8 Soil mix for tree, shrub, and flower beds shall consist of black topsoil, a fertile friable natural loam containing not less than 4 – 6 % of organic matter for clay loams and not less than 2% for sandy loams.

PART IV - EXECUTION

9.11 Site Preparation

9.11.1 Locate and protect all existing trees and shrubs

a.) All existing trees and shrubs and the areas under their canopies to protect the root zone shall be fenced with timber posts of a height of 1,800 mm above ground level. Rails and either boards or snow fence at the discretion of the Town to protect against any damage, including leakage of toxic fluids or compaction of the soil through pedestrian, or vehicular traffic, or use as a storage or lay-down area.

b.) The Developer and/or Owner of the project will be responsible for any such damage including by third parties if enabled by lack of protection by Contractor.

9.11.2 Complete trench backfilling before beginning grading.

9.11.3 Maintain slopes and adequate drainage during grading.

9.11.4 Do not allow mixing of topsoil and subsoil material.

9.11.5 Locate, mark, and protect all utilities and appurtenances (i.e. manholes, catch basins, valves, and hydrants).

9.12 Clearing

9.12.1 Clearing shall only be permitted during periods which do not disturb nesting birds and other wildlife. Perform and document nesting check.

9.12.2 Cut, dig, remove, and dispose of all timber, brush, windfall, stumps, and rubbish except such trees and shrubs that are designated for preservation. Designated areas to be preserved shall be protected as per the ISA “Tree preservation During Construction” regulations. (www.treesaregood.com)

9.12.3 Preserve such designated trees and shrubs from scarring, barking, or other injury during construction operations. Maintenance charges for scarring, barking, or other injury to trees or shrubs will be assessed in accordance with the ISA “Tree Preservation during Construction” regulations.

9.12.4 Trim branches from timber and salvage usable timber. Salvaged timber shall be coordinated with the Town.

9.12.5 Where grubbing is not to be done, all trees, roots, and existing stumps shall be cut off flush with the original ground surface.

9.12.6 Cut, remove, and dispose of dangerous trees overhanging and off the right-of-way as per Contracted Arborist.

9.12.7 Pull down, remove, and relocate or dispose of any structures, fences, and /or any physical obstructions.

9.12.8 Dispose of branches and debris in accordance with Section 9.13.

9.12.9 Leave ground surface in a condition suitable for stripping of topsoil.

9.13 Disposal

9.13.1 Remove and dispose of surplus materials as directed by the Town.

9.13.2 The Contractor shall dispose of all waste materials at sites located by the Contractor and approved by the Town.

9.13.3 Waste materials at site shall be disposed of offsite at authorized public disposal sites at all times.

9.14 Salvage

9.14.1 Remove merchantable timber as in accordance with Provincial guidelines and regulations.

9.14.2 Merchantable timbers, in general, includes trees with a bottom diameter of 150 mm or greater and a top diameter of 100mm or greater.

9.14.3 All timber of materials salvaged shall be coordinated with the Town.

9.14.4 Trim branches from salvaged timber, cut into 3 m lengths and pile neatly in stockpiles.

9.14.5 Dispose of branches and debris in accordance with Section 9.13.

9.14.6 Salvageable items, as designated by the Town, are to be deposited in the Town's storage yard.

9.15 Grubbing

9.15.1 Excavate, remove and dispose of all roots, stumps, submerged logs, corduroy and similar objectionable matter to a depth as determined by the geotechnical report.

9.15.2 Fill holes and level areas disturbed by grubbing. Leave ground surface in a condition suitable for stripping of topsoil.

9.16 Topsoil Stripping and Stockpiling

9.16.1 Strip the site to the limits shown on the Drawings, or strip those areas specified or ordered in writing.

9.16.2 Strip all areas to be excavated for structures, pipes, or roadways to the limits shown on the Drawings or directed by the Town. Retain all subsoil in areas shown on the Drawings to be dedicated as municipal reserve and other lands to be retained as green space.

9.16.3 Strip the full depth of topsoil or organic material only for structures, pipes, or roadways. Sustain as much native topsoil for intended green infrastructure.

9.16.4 Topsoil shall only be stripped in dry weather and ground conditions to prevent damage to its crumb structure.

9.16.5 Frozen topsoil may be stripped by ripping provided a minimum of 2 passes are made, the first of which shall not exceed 50% of the topsoil depth.

9.16.6 Stockpile and windrow topsoil temporarily and dispose of stripped material that is unsuitable for replacement. Stockpile in a manner that will not endanger persons, existing vegetation, living nature, or adjacent property.

9.16.7 Ensure stockpiles of topsoil, common excavation, and borrow materials are sufficiently separated. Maintain a minimum of 1.0 m separation between topsoil and common excavation material when stockpiling.

9.16.8 If the topsoil and subsoil are mixed and the topsoil is adversely affected, the Contractor shall, at the Contractor's own expense, engage a soils specialist to determine the necessary remedial work, and shall perform the required work.

9.16.9 Disposal of unsuitable material shall be in accordance with Section 9.13.

9.16.10 Developer shall locate and protect all utilities; survey control monuments, plant material root systems that are designated to remain, including natural features, pavement, concrete and structures.

9.16.11 Plant material on Town or private land shall not be removed without the written approval of the Town.

9.16.12 All areas disturbed during the development process must be rehabilitated to its original state or better, as approved by the Town.

9.16.13 Plant material to be preserved on the site shall be of high quality worthy of preservation. All plant material to be approved by the Town representative.

9.16.14 All trees presently growing on the site, which are to remain, shall be protected to avoid any damage to them during construction operations. Refer to Appendix D. Trees approved for removal shall be cut and stumps removed to a minimum depth of 600 mm below proposed finished grades and disposed of offsite.

9.16.15 Burying of such material on the site shall be permitted only if approved by the Town. The Developer shall identify these burial locations on the plan of record.

9.16.16 "Close cut" clearing (hand clearing) shall be utilized adjacent to areas to be preserved to ensure no damage to existing plant material and root systems.

9.16.17 Existing grades around plant material are to be retained. If grades are raised or lowered around preserved plant material, the developer will be responsible for constructing proper soil retention to ensure the health of the plant material.

9.16.18 The Developer will replace all plant material that has died or suffered as a result of construction or grade changes in preserved areas.

9.17 Excavation, Fill and Grade

9.17.1 Excavate to the required sub-grade elevation.

9.17.2 Remove and dispose rocks and any other unsuitable materials.

9.17.3 Grades shall be within 25 mm of design grades.

9.17.4 Place and spread fill material in successive horizontal lifts.

9.17.5 Compact each lift to a minimum 98% Standard Proctor Density, unless otherwise specified or directed by the Town.

9.17.6 Each lift shall not exceed 150 mm in compacted thickness.

9.17.7 Trim side slopes from top down, and finish true to the required alignment, grade, and shape.

9.17.8 Trim high areas, scarify low areas, compact, and re-grade as required to achieve specified grades and compaction.

9.18 Sub-grade Preparation

9.18.1 Work the soil with cultivating and mixing equipment until the soil is pulverized into pieces no larger than 25 mm across, exclusive of stones.

9.18.2 Grade sub-grade to even running contours as shown on the approved drawings and given levels with a tolerance of ± 75 mm, scarify to 300 mm and roll to create a firm smooth surface.

9.18.3 Remove all debris from the Sub-grade and ensure it is not contaminated and free of all deleterious materials.

9.18.4 The final sub-grade surface shall be sloped so that there is no runoff onto adjacent property or ponding.

9.18.5 Fine grade to ensure positive drainage away from buildings and sidewalks.

9.18.6 Compact finished sub-grade and all fill material for areas under turf or planting.

9.18.7 Leave the surface of the compacted sub-grade slightly higher than the required elevation; then trim to the required elevation.

9.18.8 Leave the finished surface even and free of depressions, humps, loose debris, and foreign material.

9.18.9 Do not permit vehicular traffic over the prepared sub-grade.

9.18.10 Sub-grade may be inspected by the Town prior to topsoil placement.

9.19 Topsoil Placement

9.19.1 Do not place topsoil when sub-grade or topsoil is frozen, excessively wet or dry, or in a condition that inhibits proper grading, cultivation, or compaction.

9.19.2 Spread topsoil uniformly over prepared sub-grade to achieve a minimum compacted depth of 200 mm for sodded and seeded areas, unless otherwise specified or directed by the Town.

9.19.3 Cultivate topsoil to a minimum depth of 200 mm, breaking down lumps. Remove stones larger than 25 mm, weeds, roots, and other foreign material from the site.

9.19.4 Manually spread topsoil around trees and plants to prevent damage by grading and leveling equipment.

9.19.5 Float the area until the surface is smooth. Cut smooth and flush all areas adjacent to catch basins.

9.19.6 Fine grade to eliminate rough or low areas and to ensure positive drainage.

9.19.7 Boulevards – The finished topsoil level shall conform to the adjacent curb and sidewalk elevations and must provide for adequate drainage of sidewalk areas after turf establishment.

9.19.8 Buffer Strips – The finished topsoil level shall slope uniformly from the property line towards the back of the sidewalk at not less than 2%.

9.19.9 Utility Lots and Walkways –The grade must be sloped away from the sidewalk at a minimum grade of 2%.

9.19.10 Medians and Islands – The finished topsoil level shall be even from curb to curb with crowning to accommodate drainage.

9.19.11 Compact topsoil with rollers to the satisfaction of the Town.

9.19.12 Final topsoil grades for seeded areas shall be flush to finished grades at surface structures (i.e. manholes, sidewalks, driveways, and curbs).

9.19.13 Apply topsoil to the following minimum depths measured at right angles to the Sub-grade after leveling with a tolerance of 25 mm over a distance of 2.4 m:

a) Min 200 mm for seeded areas.
b) Min 200 mm for sodded areas.
c) Min 650 mm for planting beds.

9.19.14 When abutting an existing turf area, cut the existing turf to form a straight, non-jagged joint with the new seeded or sodded area.

9.19.15 Make good any damage caused by topsoil spreading activities.

9.19.16 Control dust so as to have no impact on surrounding land uses.

9.19.17 Clean all adjacent walks, streets and properties as a result of work done under this section at the end of each working day or as directed.

9.19.18 The Consultant shall inspect the topsoil preparation prior to the Contractor proceeding with seeding or sodding.

9.20 Spreading of Topsoil – Natural Areas, ERs

In addition to the requirements provided in Section 9.19, comply with the following:

9.20.1 In restoration the depth and finish grade of the topsoil should be tied to the depths and finish of the pre-existing native profile. This should be specified in the restoration plan and approved by the Town.

9.20.2 Rough grade topsoil to ensure positive drainage and to emulate the pre-development drainage patterns and rates.

10. Landscaping Standards – Pathways and Trails

PART I – DESIGN

10.1 Objectives

10.1.1 The following guidelines are intended to assist in the development of a high-quality and fully integrated pathway system.

10.1.2 The objective of the planning guidelines is to lay out a pathway network which links together residential area parks, natural areas, riverbanks, and public recreational facilities.

10.2 Pathway Classifications

10.2.1 The Town of Whitecourt pathway and trail systems facilitate non-motorized movements for recreation and transportation purposes.

10.2.2 The park trail system is a multi-use facility and no one user or type of user is to be given preference. The spine of the system parallels the major physical features of the park systems, including waterways, escarpments and ravines. It should be designed as a continuous facility that connects individual communities to:

a) Town wide and Regional Parks and recreation cultural facilities;
b) Natural features, including water courses, escarpments, ravines, river valley parks and associated open space;
c) Local pathway, bikeways and trail systems; and
d) transit routes.

10.2.3 The local pathway system provides secondary routes within the Town, linking residential areas to facilities such as neighborhood parks, schools and other local community designation. Local pathway may also serve as links to the park trail systems.

10.2.4 Town of Whitecourt pathways and trails are classified into four categories as follows:

a) Shared Use Trails – Unpaved: Trails with an unpaved surface, typically hard-packed gravel, shale, dirt, or other natural media. Suitable for biking, walking, running and more, except where otherwise indicated by local signage (i.e. Memorial Point Trail).
b) Shared Use Pathways – Paved: Pathways with a paved asphalt surface suitable for biking, walking, running and more, except where otherwise indicated by local signage (i.e. Riverside Trail).
c) Paved Off-Street Pathways: Pathways with a paved surface, which serve as arterial connectors providing access between roadways, pathways, subdivisions, back alleys, and parks. These pathways are components of the Whitecourt sidewalk network (i.e. Mink Creek Road Trail system).
d) Special Use Trails: Trails that serve a specific function such as the Mountain Bike Trails and the OHV/Snowmobile Trails (i.e. Creekside Trail).

10.3 Planning Guidelines

10.3.1 Alignments

a) Pathways and trails shall be shown schematically in an Area Structure Plan and confirmed in further subdivision and/or development applications.
b) Where desirable pathways and trails should be routed along the edges of environmentally significant areas or into locations with less sensitivity in natural environmental parks in order to minimize the impact on the park or natural area and reduce future damage and desire lines.

10.3.2 Street Crossings

a) Route pathways and trails to street intersections where possible.
b) Mid-block crossings are discouraged. If mid-block crossings are to be provided, appropriate line markings must be provided, and signage is to be installed to Town standards.
c) Avoid necessity for building mid-block pedestrian overpasses on major streets.

d) Adjust subdivision layout to minimize quantity of crossings.
e) Line up pathways and trail entrances to ensure visual continuity.

10.3.3 Play Equipment Sites
a) Pathways and trails should not be within at least 5 m from play area surfaces.
b) Provide a minimum 2.4m wide asphalt link from the play equipment site to adjoining or pathway or trail.

10.3.4 Parking Lots
a) Route pathways and trails to facilitate pedestrian access to buildings on site.
b) Provide asphalt links from parking lots adjacent to pathways and trails.
c) Locate pathway and trail entrance at street.

10.3.5 Natural Areas
a) Align trails around significant areas and sites; never through.
b) Avoid damage to natural features, vegetation and wildlife habitat.
c) Send proposed design plans for all natural areas and Reserve parcels to the Town for approval.

10.4 Design Guidelines

The objective of the design guidelines is to produce a safe and enjoyable pathway and trail system incorporating the needs of multiple users (i.e. walkers, child strollers, runners/joggers, people with disabilities, cyclists, in-line skaters and skateboarders), and therefore, stringent attention must be given to design details. Where location and design considerations prevent transportation and recreation functions from being accommodated together, the recreation function should be given a higher priority.

10.4.1 Safety Clearance and Setback requirements
i. Avoid locating pathways or trails over manholes.
ii. Ensure a 2.5 m minimum clearance from park water services.
iii. Set back pathways and trails a minimum of 1.0 m form face of curb.
iv. Provide minimum 0.5 m clear of all obstacles on both sides (i.e. trees, signs, light poles etc.).
v. Provide minimum 2.1 m clear of all obstacles overhead (i.e. tree branches, bridges, etc.).

10.4.2 Safety Railings
i. Safety railings shall be installed when a pathway or trail is within two metres of the top of a 2:1 slope or steeper, and the slope is greater than or equal to one metre n depth.
ii. Minimum railing height and design to be in accordance with the Town's Engineering Standard Drawings, or equivalent as approved by Town.
iii. Chain link fence is only acceptable when the wire mesh is attached to, but not protruding, above the top rail. Attachment shall be with a knuckle finish.
iv. Wooden fences are not preferred.

10.4.3 Trail & Pathway Entrances/Wheelchair Ramps
a) For pathway or trail entrances and wheelchair ramps, extend pathway or trail to street curb in all cases.
b) Ensure pathways and trails join streets at right angles.
c) Line up entrances for visual continuity where route crosses street.
d) Ensure catch basins or manholes are not located at entrances or wheelchair ramps.

10.4.4 Sight-Lines
a) Where possible, ensure no obstructions to visibility within 5.0 m of junction with other pathways/trails and streets (trees, shrubs, utility boxes, fences etc.).

10.4.5 Maximum Grades
a) Over 8%: re-route, unless otherwise authorized
b) 5% to 8%: not longer than 50 m (keep bicycles and pedestrians separate and avoid curves and constrictions). Where such portion of a pathway or trail network meets a roadway, provide tee bollards at the entrance to prevent bikers from accidentally entering the roadway.
c) 3% to 5%: no longer than 200 m.
d) Under 3%: acceptable (required if wheelchair accessible).

10.4.6 Super-elevation
   a) On curves 2%,
   b) Maximum 5%

10.4.7 Minimum Design Curve Radii
   a) Minimum design curve radii of 7.5m

$$\text{Minimum } r - v^2/[127\ (e+f)]$$

10.4.8 Stairs
   a) Stairs are not acceptable within a pathway or trail network.

10.4.9 Lighting
   a) Provide on all paved off-street pathways as required by the Town.
   b) Provide on other shared use trails as required by the Town. Minimum requirement of 1 streetlight at all trail heads entrances.

10.4.10 Amenities
   a) In general, provide one pathway or trail entrance every 150 m or as needed.
   b) One park bench every 400 m; one trash receptacle every 400 m. Environmentally sensitive areas should be assessed on an individual basis.

PART II – GENERAL

10.5 Examination

10.5.1 Report to the Town, in writing, any conditions or defects encountered in the site before or during any construction upon which the work of this section depends and which may adversely affect its performance.

10.5.2 Do not commence work until those conditions or defects have been investigated and corrected.

10.5.3 Commencement of work shall imply acceptance of existing surfaces and conditions and no claims for damages or extras resulting from such conditions or defects will be accepted later, except in cases where such conditions could not have been known prior to commencement of work.

10.5.4 Protect all existing trees and planting areas. In accordance with Appendix D.

10.6 Samples

10.6.1 Samples of sub-base and asphalt may be requested by the Town. Sieve analysis (ASTM-D698) may be required for sand and crushed gravel. Submit one test result per 1,000 tonnes of material, or one test per minimum 100 m of pathway.

10.6.2 Retain approved samples on site until work has been inspected and approved.

10.6.3 All work shall conform to approved samples.

10.7 Inspection

10.7.1 The contractor shall have an approved set of drawings and specifications available prior to calling the Town for an inspection.

10.7.2 The contractor shall obtain approval for the pathway alignment and sub-base (i.e. compaction and depth of gravel) prior to surfacing with asphalt.

PART III – PRODUCTS

10.8 Sub-Base

10.8.1 25 mm minus crushed gravel, minimum 150 mm depth, 98% standard proctor density.

10.9 Asphalt Concrete

10.9.1 Surface: Type ACO hot mix asphalt concrete, in accordance with the requirements provided in Section 3.0.

10.10 Signage

10.10.1 Coordinate with the Town to ensure appropriate Town branding is included on all signage.

10.10.2 Information Signs

a) Signboard shall be 19 mm Crezon. Signboard back and edges shall be primed with an exterior primer and painted using a white exterior alkyd paint.
b) Face shall be white Scotchcal vinyl film. Lettering, name panel, and signature to be screen printed using compatible ink or superimposed using die cut Scotchcal vinyl film. Alternate vinyl films will be considered provided the product has a written guarantee for a minimum life expectancy of five years.
c) Park name panel to be burgundy, Pantone 209c or 207u, with a black border. Park name lettering to be white Helvetica medium.
d) SC signature to be black, PMT to be supplied as required.
e) Foundation post shall be 200 mm x 200 mm full dimension recycled plastic, 3.66 m long. Set post in 400 mm diameter concrete footing with fillcrete in accordance with Section 5.13.5.
f) Appearance post shall be 200 mm x 200 mm full dimension recycled plastic, 1.9 m long.
g) Fastening hardware to be galvanized steel.
h) Signboard cap to be 19 mm extruded aluminum channel, or approved alternate, and painted white to match the signboard.

10.10.3 Playground Signs

a) Signboard shall be 19 mm Crezon. Signboard back and edges shall be primed with an exterior primer and painted using a white exterior alkyd paint.
b) Sign shall be 300 mm x 350 mm in size.
c) Wording and lettering to be submitted to the Town for review and approval prior to fabrication.
d) Sign designs provided by manufacturers that match and attach to equipment may be considered.

PART IV - EXECUTION

10.11 Asphalt Pathway Paving

10.11.1 Conform to the applicable requirements for asphalt paving testing, and inspections outlined in Sections 3.23 to 3.39.

11. Landscaping Standards – Plant Material

PART I – DESIGN

All landscaping and plant materials to be deer resistant and in accordance with FireSmart best practices.

11.1 Minimum Setback Requirements

11.1.1 Trees shall be spaced from infrastructure in accordance with the minimum setbacks provided in the following table, unless specified otherwise:

Infrastructure Designation	Setback Distance for Trees
Existing Fences	3.5 m
Median and Road Curb Face	2.0 m
Driveways	2.0 m
Fire Hydrants	2.0 m
Street Lights (Arterial Roadways) Street Lights (Collector and	5.0 m
Local Roads)	3.0 m
Buried Utilities (power, cable, telephone, traffic signals) Power	1.0 m
Hardware	3.5 m
Telephone Pedestals	1.5 m
Water Valves	1.8 m
Buried Gas Mains and Services	1.5 m
Street Corners (distance from intersecting curb) Yield and Stop	12.0 m
Signs (Arterial Roadways)	12.0 m
Yield and Stop Signs (Collector and Local Roadways) Bus Stop	7.0 m
Signs and other signs	5.0 m
Sidewalks and Trails	2.0 m
Fence Lines	2.5 m

11.1.2 Trees shall not be planted in any location from which the tip of any branch will grow closer to overhead power lines than 2.4 m laterally or 4.5 m vertically.

11.1.3 Boulevard trees shall be diversified to minimize pests and disease, and shall be planted at equal intervals, which may vary depending on their ultimate size, in accordance with the following:

a) Large and medium size trees: 10 to 13 m spacing.
b) Small size trees: 7 to 10 m spacing.

11.2 Tree Selection

11.2.1 Tree selection shall be consistent with the following requirements:

a) Adequate, year-round sightlines shall be maintained for pedestrian and vehicular safety.
b) Minimum 1.8 m branching height for all trees.
c) The following tree species are acceptable for landscaping within public areas. Proposed alternates shall be subject to the review and acceptance of the Town.
d) Due to climate change and the increasing risks of new pests, the Town recommends planting a variety of species on any residential block (i.e. larger species for larger boulevards, and smaller species for a smaller boulevard, alternating species along a block, patterned plantings etc.).
e) No fruit-bearing species are permitted near sidewalks or trails.

Botanical Name	Common Name	Approx. Height at Planting	Min. Caliper at Planting
Large Trees			
Acer negundo	Manitoba Maple	3.7 - 4.6 m	60 mm
Acer saccharinum	Silver Maple Autumn	3.7 - 4.6 m	60 mm
Acer x freemanii 'Autumn Blaze'	Blaze Maple	3.7 - 4.6 m	60 mm
Betula papyrifera	Paper Birch	3.7 - 4.6 m	60 mm
Fraxinus pennsylvanica 'Bergeson',	Bergeson, Patmore, Prairie	3.7 - 4.6 m	60 mm
'Patmore', 'Prairie Spire', and	Spire, and Summit Green Ash		
'Summit'		3.7 - 4.6 m	60 mm
Fraxinus mandshurica** Fraxinus	Manchurian Ash	3.7 - 4.6 m	60 mm
Americana	White Ash		
Fraxinus 'Northern Gem' and	Northern Gem and Northern	3.7 - 4.6 m	60 mm
'Northern Treasure'	Treasure Hybrid Ash		
Tilia americana	Basswood	3.7 - 4.6 m	60 mm
Ulmus americana Ulmus Americana	American Elm	3.7 - 4.6 m	60 mm
'Brandon' Salix	Brandon Elm	3.7 - 4.6 m	60 mm
pentandra	Laurel-Leaf Willow	3.7 - 4.6 m	60 mm
Salix alba	White Willow	3.7 - 4.6 m	60 mm
Salix alba 'Vitellina'	Golden Willow	3.7 - 4.6 m	60 mm
Medium Trees			
Aesculus sp	Buckeye	3.7 - 4.6 m	60 mm
Aesculus glabra	Ohio Buckeye	3.7 - 4.6 m	60 mm
Aesculus hippocastanum	Horse Chestnut	3.7 - 4.6 m	60 mm
Juglans cinerea	Butternut	3.7 - 4.6 m	60 mm
Populus tremula 'Erecta'	Swedish or Trembling Aspen	3.7 - 4.6 m	60 mm
Populus x canescens 'Tower'*	Tower Poplar	3.7 - 4.6 m	60 mm
Malus 'Spring Snow' or 'Big River'	Spring Snow or Big River	3.7 - 4.6 m	60 mm
Quercus macrocarpa*	Flowering Crab	3.7 - 4.6 m	60 mm
Acer ginnala	Burr Oak	3.7 - 4.6 m	60 mm
Sorbus Americana*	Amur Maple American	3.7 - 4.6 m	60 mm
Sorbus aucuparia*	Mountain Ash European	3.7 - 4.6 m	60 mm
Tillia cordata	Mountain Ash Little	3.7 - 4.6 m	60 mm
Tillia x flavescens	Leaf Linden Dropmore	3.7 - 4.6 m	60 mm
Ulmus davidiana	Linden Discovery Elm	3.7 - 4.6 m	60 mm
		3.7 - 4.6 m	60 mm
		3.7 - 4.6 m	60 mm
		3.7 - 4.6 m	60 mm
Small Trees			
Malus x astringens Cultivars*	Snowbird Hawthorn	3.0 - 3.7 m	60 mm
Maackia amurensis* Sorbus	Rosybloom Crabapple	3.0 - 3.7 m	60 mm
decora*	Amur Maackia	3.0 - 3.7 m	60 mm
Cultivars*	Showy Mountain Ash	3.0 - 3.7 m	60 mm
Syringa retuculata	Chokecherry	3.0 - 3.7 m	60 mm
	Schubert Chokecherry	3.0 - 3.7 m	60 mm
	Japanese Tree Lilac	3.0 - 3.7 m	60 mm
Prunus Cerasifera	Purple Leaf Plum	3.0 - 3.7 m	60 mm

*Fruit or nut bearing trees are not permitted near sidewalks or trails. These trees should be planted in beds to reduce maintenance. Alternate trees in Boulevard)
** Prone to disease (Cotton Psyllid, Bronze Leaf, Black Knot)

11.2.2 Refer to the following chart for recommended coniferous trees:

Botanical Name	Common Name	Min. Height at Planting	Mature height
Abies sp. Picea spp.	Fir	2.4 m	8 – 10 m
Pinus sp. Larix sp.	Engleman, Norway, White, Baby Blue and Colorado	2.4 m	15 m
	Spruce	2.4 m	15 m
	Swiss Stone Scot, White, Lodgpole, Ponderosa Pine	2.4 m	3 – 10 m
	Siberian Larch, Tamarack		

11.2.3 Refer to the following chart for recommended deciduous shrubs:

Botanical Name	Common Name	Min. Height at Planting	Mature ht./spr.
Berberis spp. Caragana spp.	Barberry	400 mm	0.6–6 m/0.6–6 m
Cornus spp.	Caragana	400 mm	0.6–6 m/0.6–9 m
Euonymus spp.	Dogwood	400 mm	0.4–3 m/1.2–3 m
	Winged and Dwarf Narrow-leaved	400 mm	0.6–1.5/0.6–1.5 m
Hippophae spp. Hydreangea	Burningbush		
spp. Loniceria spp.	Sea Buckthorn	400 mm	Up to 4 m
Philadelphus spp.	Hydrangea	400 mm	0.6–2.4 m/0.6–2.4 m
Physocarpus sp. Potentilla	Honeysuckle	400 mm	0.6–3.7 m/1-3 m
sp.	Mock Orange	400 mm	0.6–1.5 m/0.3-1.5 m
Ribes spp.	Ninebark	400 mm	0.4–3 m/0.6-3 m
Rosa spp.	Potentilla	400 mm	0.6–1 m/1 m
Sambucus spp.	Currant	400 mm	1.2–2.1 m/1.2-2.1 m
Spirea spp.	Rose	400 mm	0.6–3 m/0.6-1.8 m
Syringea spp.	Elder	400 mm	0.9–7.6 m/0.9-5.5 m
Corylus cornata	Spirea	400 mm	0.4–1 m/0.6-2.4 m
Viburnum spp.	Lilac	400 mm	0.9–3 m/1.5-5 m
	Beaked Hazelnut	400 mm	0.4-3 m/1.2-3 m
	Cranberry	400 mm	0.6–3 m/1-3 m
Salix Spp.	Blue Fox, Dwarf Arctic Willow	400 mm	0.6 – 1.5 m

11.2.4 Refer to the following chart for recommended coniferous shrubs:

Botanical Name	Common Name	Min. Spread at Planting	Mature size
Juniperus spp. Juniperus	Common, Horizontal, Pfitzer, Bar Harbor, Savin Juniper	300 mm	0.3 – 1 m
scopulorum Picea abies var.	Rocky Mountain Juniper Compact, Gregoryana, Nest Spruce	300 mm	Up to 5 m
Picea pungens var. Pinus	Globe,	300 mm	1.5 m Up
sylvestris var. Pinus mugo	Hoopsii, Koster Spruce Sentinal,	300 mm	to 3 m Up
var.	Green Compact Pine Mugo Pine	300 mm	to 2 m
	var.	300 mm	0.6 – 3 m
Arctostaphylos ura-ursi	Kinnikinnick	300 mm	Up to 3 m

11.3 Planting Season

11.3.1 Planting must be done between May 1 and September 15 and during the normal planting season for the type of plant being planted.

PART II – GENERAL

11.4 Scope

11.4.1 Supplying trees, shrubs, groundcovers and other associated materials; planting, transplanting, plant maintenance and inspection.

11.5 Substitutions

11.5.1 All requests for substitutions of planting materials shall be vetted through the consultant responsible for preparing the contract drawings. Such requests shall be forwarded to the Town for approval prior to installation.

11.6 Product Delivery, Storage, and Handling

11.6.1 Plant material shall be handled with care and skill to prevent injury to trunk, branches and roots.

11.6.2 All branches shall be carefully tied-in in such a way as to prevent damage, breakage or bruising before transporting and the plants protected during shipment by tarpaulin(s) or other suitable covering to prevent excessive transpiration. All points of contact between plant material and conveyance vehicle shall be padded.

11.6.3 When the temperature exceeds 20°C, plants shall not be shipped without authorization from the developer's landscape architect/Town's representative. When temperature exceeds 25 degrees C, planting of plant material is not permitted. If trees are shipped at the above referenced temperature, the Town has the authority to issue a Stop Work Order.

11.6.4 Plants shall be transported at a reasonable speed to prevent transpiration.

11.6.5 Plants with broken or abraded trunks or branches or with broken or cracked root balls, or which are badly desiccated, or bare root plants that have broken dormancy are subject to rejection.

11.6.6 Roots or root balls of all plants shall be adequately protected at all times from the sun and from drying winds and frost.

11.6.7 All balled and burlapped plants which cannot be planted immediately upon delivery shall be set on the ground and shall be well protected with soil, wet moss or other acceptable material not longer than 24hours. Bare root plants that cannot be planted immediately shall be planted or heeled-in in trenches, immediately on delivery. All plants shall be kept moist until planting begins.

11.6.8 Damaged plants supplied by contractors shall be replaced at no cost to the Town.

11.7 Inspections

11.7.1 The Town will inspect the marked tree locations upon 48 hours' notice and notify the developer of any revisions that may be required, or will approve the proposed tree locations as marked.

11.7.2 The Developer shall notify the Town prior to the start of a planting project to facilitate inspections during the process. The Developer shall also notify the Town when the planting project is completed. The Town's representative will conduct an inspection of the planted trees, upon 48 hours' notice, and notify the Developer of any deficiencies that may require correction.

PART III - PRODUCTS

11.8 Plant Materials

11.8.1 Trees, Shrubs, Vines, Groundcovers

a) All plants shall be nursery grown under cultural practices recommended by the Canadian Nursery Trades Association unless specific instructions have been issued by the landscape architect and accepted by the Town, for the collection from native stands, woodlots or other unmaintained areas.
b) All nursery-grown material shall meet the horticultural standards of and comply with all applicable sections of the latest edition of the *Canadian Standards for Nursery Stock*, by the Canadian Nursery Trades Association. All such material shall have been transplanted and/or root pruned regularly to create a fibrous ball but neither transplanted nor root pruned within the nine (9) months prior to delivery.
c) Any trees dug from native stands, wood lots, orchards or neglected nurseries and which have not received proper cultural maintenance as advocated by the Canadian Nursery Trades Association, shall be designated as “collected plants”. The use of “collected plants” will not be permitted.
d) All plants shall be typical of their species or variety and shall have a single central leader and balanced branching habit. They shall be structurally sound, healthy and vigorous, well branched and densely foliated when in leaf. They shall be free from disease and insect pests, eggs or larvae, rodent damage, sunscald, frost cracks and other abrasions or scars to the bark. They shall show vigorous bark on all edges and all parts shall be moist and show live, green cambium tissue when cut.
e) All plant materials shall have been grown in the climate of Canadian Horticultural Zone 2 or 3 for at least two (2) years. Plant material brought in from other provinces and/or states must be accepted by the Town prior to planting.
f) Trees purchased from outside Northern Alberta (i.e. south of Red Deer) must be grown for two years prior to planting.
g) Plant sources and history must be supplied to the Town prior to planting.
h) Trees shall have one sturdy, reasonably straight, and vertical trunk and a well-balanced crown with a fully developed leader, unless that would be uncharacteristic of the species and with the exception of Malus baccata plus associated hybrids and cultivars (flowering crab-apples) single, central leaders. All trees with weak crotches may be rejected.
i) All trees shall be free of disease, insect infestation, rodent damage, sunscald, frost cracks, and other abrasions or scars to bark. All trees must be certified pest and disease free. All parts of the tree shall be moist and show live, green cambium tissue when cut. No more than 1/3 of the total height of the tree shall be clear trunk.
j) Trees with branches which may grow to interfere with vehicular or pedestrian traffic are not acceptable in boulevards where the clear stem shall be not less than 1.8 m.
k) Shrubs shall have a natural form typical of the species with interfering branches removed and shall have the number of canes as specified in the *Canadian Standards for Nursery Stock*, by the Canadian Nursery Trades Association.
l) Vines shall have at least three runners, each of 300 mm minimum length.
m) Ground covers shall have well developed tops of a size proportional to the roots, typical of the species.
n) Plants that have been sheared to produce an untypical shape or shoot density are not acceptable.
o) All plant dimensions shall be measured when the branches are in their normal position. ‘Height’ and ‘spread’ refer to the main body of the plant and not the dimension from base of root ball to branch tip or from branch top to branch tip. The ‘Caliper’ of a tree shall be measured 0.9 m to 1.2 m above the soil collar of the tree as it stood in the nursery and refers to the diameter of the tree at breast height (DBH).
p) All plant material shall conform to the measurements specified in the landscape plan, unless the Town authorizes a substitution. If larger plants are used, the ball of earth shall be increased in proportion to the size of the plant. Refer to Canadian Standards for Nursery Stock (CSLA).

11.8.2 Digging of Plants

a) Dry soil shall be watered two or three days before digging trees or shrubs.
b) All plants shall be dug and delivered to the site as specified on the Plant List.
c) Tree spades used for lifting plants shall have sharp blades.
d) Immediately after digging, the root systems of all plants shall be kept moist to prevent drying out until planted on the site.

e) Deciduous trees and shrubs in full leaf and dug in late spring or early summer shall be hardened off before replanting by placing in a cool, sheltered area as soon after digging as possible, placed close together, tops kept moist by syringing and balls by sprinkling or wetting down with water. Root balls shall be covered with wood chips, damp straw or canvas and held in this position for 24 to 48 hrs before planting.
f) All plants specified as 'Balled and Burlapped' (B/B) shall be dug while dormant and moved with solid balls wrapped in burlap.
g) No plants shall be used when the ball of earth surrounding the roots has been cracked or broken preparatory to or during the process of planting, or when the burlap, staves and ropes, required in connection with their transplanting, have been removed.

11.8.3 Root Ball

a) The size of root ball for trees must be greater than the minimum size below
b) Deciduous trees:

Caliper	Root Ball Diameter
60 mm	800 mm
75 mm	900 mm
100 mm	1,200 mm
125 mm	1,500 mm
150 mm	1,800 mm
200 mm	2,300 mm
250 mm	2,440 mm

For this table, the caliper shall be measured 150 mm above the soil collar of the tree. For deciduous trees of caliper exceeding 250 mm, root ball diameter shall be increased 150 mm for every additional 25 mm of caliper.

c) Coniferous trees:

Height	Root Ball Diameter
2.25-2.50 m	1,200 mm
2.50-2.75 m	1,400 mm

The height shall be measured from the soil collar of the tree. For coniferous trees over 2.75 m in height, root ball diameter shall be increased 150 mm for every 300 mm in height.

11.9 Edger

11.9.1 Manicured planting beds shall incorporate a spade cut edge.

11.9.2 Weed liner will not be permitted.

11.10 Fertilizer

11.10.1 For the first application, soluble fertilizer shall be delivered mixed as specified for tree and shrub growth in the topsoil backfill report from an acceptable soils laboratory.

11.11 Tree Stakes, Ties, and Guys

11.11.1 Tree stakes shall be "T" bars of steel, 40 mm x 40 mm x 5 mm thick and 2.1 m in length. "U"- bar stakes may be used where accepted by the Town.

11.11.2 Stakes shall be primed with one brush coat of zinc-rich paint to CGSB1-GP-1816

11.11.3 Tree ties shall be 10-gauge galvanized wire inserted into a 200 mm length of 10 mm diameter polyethylene tubing to protect the tree at the support point.

11.11.4 Guys shall be double lengths of 9-gauge galvanized wire.

11.12 Water

11.12.1 Water shall be clean and free of any substance that may inhibit vigorous growth of the plants.

PART IV - EXECUTION

11.13 Planting Operations – Trees and Bare Root Plants

11.13.1 Tree pits in boulevards shall be dug in such a way that the minimum separation between the edge of the sidewalk and the edge of the excavation is 225 mm. In narrow boulevards pits may be elliptical rather than circular in plan, and dug two to three times wider than the root ball.

11.13.2 The depth of planting beds and pits shall be adjusted to permit a layer of native soil under balls or roots of all plants to ensure they are firmly bedded. If the sides and bottom of the planting pit are glazed or consist of dry and heavy clay, a hand spade shall be used to scarify the soil to encourage root elongation before planting.

11.13.3 Planting pit surfaces, whether sides or base, which are of dry clay or glazed shall be scarified to facilitate root elongation and moisture movement.

11.13.4 In poorly drained sites, trees and shrubs shall be planted so the top of the root ball is above grade.

11.13.5 All trees shall be planted in the same orientation as they were in the nursery, where possible.

11.13.6 Plants shall be set in the center of pits, plumb, straight, and at such a level that after settlement the crown of the plant will be no lower than the surrounding finished grade.

11.13.7 Topsoil backfill of tree pits shall be carefully tamped around the root ball for the first one third to half of the hole depth to help stabilize the ball. The loose soil shall be worked down into the remainder of the pit with a hand spade while being flooded with water to ensure all air pockets are eliminated and filled with muddy soil.

11.13.8 If the sides of the root ball have become crusted through drying-out or digging under wet conditions, the top half of the affected area shall be slit with a sharp spade or shovel to facilitate root extension from the ball surface into the backfill soil.

11.13.9 After a burlap wrapped root ball is in the planting pit, half backfilled, the wire basket shall be cut back to expose the top third of the root ball, and basket and burlap shall be removed. The remaining burlap shall be slit along the sides with a sharp knife. No burlap shall be allowed to remain visible after planting to wick moisture away from the soil ball into the atmosphere. Heavy or treated burlap or plastic shall be removed before the tree is planted to prevent formation of a moisture barrier around the ball. When burlap wrapped plant material is being planted in clay soils, all the burlap shall be removed. The wire basket may be removed completely contact Town Public Works for details.

11.13.10 After the tree is planted, a circular soil dike, 100 mm in height, shall be constructed just outside the root ball's surface area to prevent run-off during watering.

11.13.11 For all trees with trunks exposed to lawn mowing operations, a 100 mm depth of deciduous wood chip mulch shall be placed around the trunk base and extended a further 300 mm radially from the trunk to avoid mower damage, pest disease, and bark rot from occurring.

11.13.12 Install 100 mm depth of mulch over the top of the root ball and extended a further 300 mm radially from the tree trunk to discourage winter damage of the bark by rodents and to allow air circulation to the root system.

11.14 Planting Operations – Shrubs

11.14.1 Shrubs shall be planted in topsoil beds of minimum 650 mm depth.

11.14.2 Planting topsoil shall be firmly tamped in place around root balls of shrubs and bare root plants while ensuring that the plant remains vertical. Particular care shall be taken to ensure that no air pockets remain under or around the roots. Planting topsoil shall be thoroughly watered immediately after tamping.

11.14.3 No planting, except ground covers, vines, and herbaceous plant material, shall be placed closer than 400 mm at maturity to the edge of shrub beds, hard surfaces, or building foundations.

11.15 Stakes, Ties, and Guys

11.15.1 Trees shall be supported by stakes and ties or by guy wires in accordance with the following schedule:

a) Coniferous Trees

Height	Staking Method
< 1.5 m	2 steel stakes and 2 ties
1.5-3.0 m	2 steel stakes and 2 ties
3.0-3.5 m	3 guy wires and 3 anchors
3.5-4.5 m	4 guy wires and 4 anchors
> 4.5 m	Refer to deciduous trees > 200 mm

b) Deciduous Trees – Bare Root

i) To 75 mm caliper, use 2 steel stakes and 2 ties.

c) Deciduous Trees – Balled and Burlapped or Tree Spade

Caliper	Staking Method
< 75 mm	2 steel stakes and 2 ties
75-200 mm	3 guy wires and 3 anchors
≥ 200 mm	4 guy wires and 4 anchors

11.15.2 Connection of Ties and Guy Wires to Trees:

a) All exposed portions of tree stakes are to be rust free, scaled, primed and painted brown. Tree stakes are to be a minimum of 2.0 linear metres in length, plain T-posts (1.33 lbs/ft) complete with 1 1/2" x 1 3/8" x 84" punched with 7 holes.
b) All ties and guy wires shall be looped in a figure-eight at least 3 times around the tree trunk and attached to stakes or anchors in such a way that they can be kept taut to form an open "Figure-8", branches are protected from undue strain, and the tree's bark is protected from damage.
c) Where the guy wires encircle the trunk or branches they shall be encased in new, 12 mm diameter, two-ply, reinforced, black-rubber hose.
d) Turnbuckles shall be factory galvanized and shall have eyes with a length of 150 mm and threaded openings of 10 mm diameter for tightening.
e) Fluorescent warning flags shall be attached to guy wires.

11.15.3 Bare Root Tree Staking

a) The stakes shall be driven vertically a minimum depth of 600 mm into the undisturbed soil of the base of the tree pit before the plant is placed in position.
b) When two stakes are used they shall be located at northwest and southwest of the tree.

11.15.4 Balled and Burlapped Trees and Tree Spade Plants Staking

a) The stakes shall be driven vertically a minimum depth of 300 mm into the undisturbed soil and shall be located just outside the root ball or tree plug to avoid any root damage.
b) When two stakes are used they shall be located at northeast and southwest of the tree.

11.15.5 Tree stakes and guy wire shall be removed following the maintenance period after combined review by Town and Consultant. They shall be removed by the contractor prior to the FAC inspection.

11.16 Pruning

11.16.1 Immediately following planting, any dead, broken, or interfering branches shall be pruned together with any diseased branches which have not caused the plant's rejection. No plants having disease are to be planted and may be rejected by the Town.

11.16.2 The amount of pruning shall be limited to the minimum necessary and exceed no more than 25% of the living foliage in one season.

11.16.3 One section of any bad fork or weak crotch which has not caused the plant's rejection shall be removed at transplanting time.

11.16.4 The manner of pruning shall preserve the natural character of the plant. This is subject to pruning 25% of crown maximum.

11.16.5 Due to the risk of Dutch Elm Disease, elm trees shall only be pruned between the period of October 1 and March 31, when the Elm Bark Beetle is inactive.

11.16.6 Pruning tools shall be clean and sharp.

11.16.7 All pruning cuts shall be clean and leave no stubs or rough wood and be in accordance to the ANSI Z133.1 Standards. Small cuts shall be close to the branch collar and parallel to the adjoining branch or trunk. On large limbs, flush cuts shall be avoided and cuts made at the collar shall have the lower part slanting slightly away from the trunk to leave a smaller wound.

11.16.8 Tree trunks conduct moisture and nutrients from the roots to the crown of the tree. This function takes place in the outer part of the woody stem called the sapwood. If the sapwood is cut, bruised, or scarred in such a way that it may affect the uptake of moisture and nutrients, the tree shall be replaced. If the affected area is small enough not to limit the uptake of moisture and nutrients, the affected area shall be shaped with a sharp, clean knife so as not to retain water, which may cause decay.

11.16.9 Bark that is cut, bruised, or scarred shall be cut back to living tissue with a clean edge. The affected area shall be shaped with a sharp knife so as not to retain water.

11.16.10 Wound surfaces shall not be treated with wound-dressing products unless otherwise specified or directed by the Town.

11.16.11 As a rule, growth is maximized if pruning is done just before the period of rapid growth in the spring. Prune during proper times in accordance with the following guidelines:

a. Shade Trees – October 15 to April 15
b. Birch and Maple – June 15 to July 15
c. Fruit trees – March 15 to April 15
d. Evergreens – April 15 to May 15
e. Elm Trees – In according to provincial legislation

11.17 Construction Completion Inspection

11.17.1 The CCC shall be issued following a satisfactory inspection by the Town's representative, developer's representative and contractor which all plant material has been supplied and installed in accordance with the approved drawings and any approved substitutions and is alive and healthy. The maintenance period of two (2) years begins to run from the date of the satisfactory inspection. All plant material requiring wood chip mulch shall be installed prior the Construction Completion Certification and topped up prior to the Final Acceptance Certification.

11.18 Warranty

11.18.1 Replace any plants that die or appear to be dying during the Warranty Period. In case of any doubt regarding the condition and satisfactory establishment of a rejected plant, the Developer may elect to maintain such a plant through another complete growing season at the end of which the rejected plant, if found to be dead or in an unhealthy or badly impaired condition, shall be replaced by the Developer. Any replaced plant material shall have a maintenance period of one (1) year, unless otherwise authorized.

11.19 Maintenance

11.19.1 Maintenance shall include all measures and activities necessary to establish and maintain plants in an acceptable, vigorous, and healthy growing condition for the duration of the Warranty Period.

11.19.2 Refer to Section 8.18.

11.20 Final Inspection

11.20.1 At the time of final inspection, all the plants shall be alive, healthy and in good condition, root balls and shrub beds shall be weed-free with the specified depth of mulch throughout.

11.20.2 Tree stakes and guy wires shall be removed immediately prior to final inspection.

12. Landscaping Standards – Mulch

PART I – DESIGN

Not applicable.

PART II - GENERAL

12.1 Examination

12.1.1 Report to the Town, in writing, any conditions or defects encountered on the site before or during any construction upon which the work of this section depends and which may adversely affect its performance.

12.1.2 Do not commence work until those conditions or defects have been investigated and corrected.

12.1.3 Commencement of work shall imply acceptance of existing surfaces and conditions and no claims for damages or extras resulting from such conditions or defects will be accepted later, except in cases where such conditions could not have been known prior to commencing work.

12.2 Samples

12.2.1 Samples of mulch may be requested for approval by the Town.

12.2.2 Retain approved samples on site until work has been inspected and approved.

12.2.3 All work shall conform to approved samples.

12.3 Substitutions

12.3.1 All requests for substitutions of mulch shall be vetted through the consultant responsible for preparing the contract drawings. Such requests shall be forwarded to the Town for approval prior to installation.

12.4 Product Delivery, Storage, and Handling

12.4.1 Supply mulch as specified on approved landscape drawings and specifications.

12.4.2 Protect mulch stockpile on site from contamination of airborne herbicides, pesticides, fertilizers and other hazardous chemicals.

12.4.3 Avoid the placement of mulches in excessively wet conditions or when frozen.

12.4.4 All organic mulches shall be generally free of diseases, moulds, fungi and insect infestations.

12.4.5 All organic mulches shall be free of inorganic materials such as metal, glass, rock and other foreign materials.

12.5 Inspection

12.5.1 Give timely notice (minimum 48 hours), in writing, to the Town when materials are available for inspection.

12.5.2 Remove all rejected materials from site immediately.

PART III – PRODUCTS

12.6 Organic Mulches

12.6.1 Deciduous/coniferous wood chip mulch shall consist of chipped ash, elm, maple, poplar, birch, and other deciduous woods plants or coniferous wood containing bark, wood, and needles.

12.6.2 Mulch may contain bark, wood (and leaves in summer) and/or needles, and may contain seed.

12.6.3 Mulch shall be free of non-organic material, wood preservatives, and diseased wood.

12.6.4 Chip size shall be 50 to 75 mm.

12.6.5 Mulch shall contain no more than 5% by dry weight of soil, sawdust, and peat moss.

12.7 Inorganic Mulches

12.7.1 Clean pea gravel, crushed clay brick, and crushed shale to a minimum sieve size of 25 mm. The Town may determine the maximum sieve size.

12.7.2 Inorganic mulches shall be free of organic material.

12.8 Prohibited Mulches

12.8.1 The following mulches are prohibited: sawdust and shavings, peat moss, manures or raw composts, paper products, plastics, rubbers, aluminum foils, gelatinous sprays, plywood and other lumbers containing chemical adhesives or wood preservatives.

PART IV - EXECUTION

12.9 Installation

12.9.1 Plants must be watered before mulch is installed.

12.9.2 During application all mulches shall be kept at least 250 mm away from tree trunks and bases of shrubs.

12.9.3 Apply mulches in areas as per drawings and spread by hand rake to a settled depth of 100 mm.

12.10 Preparation

12.10.1 Tree wells and planting beds shall be free of weeds prior to mulch installation.

12.11 Clean Up

12.11.1 Immediately after installation, remove all mulches and other debris from the roadways, walkways and surrounding areas, leaving the area neat and tidy. Clean all areas, which are contaminated as a result of landscape construction operations.

12.11.2 Maintain all areas neat and tidy at all times until acceptance.

12.12 Maintenance

12.12.1 During the maintenance and warranty period, the Developer shall maintain the mulch free of weeds, debris, mould, fungi, disease, or insect infestations.

12.12.2 Refer to Section 8.18.

13. Landscaping Standards – Seed and Sod

PART I – DESIGN

Refer to Section 8.0.

PART II – GENERAL

13.1 Examination

13.1.1 Report to the Town, in writing, any conditions or defects encountered on the site before or during any construction upon which the work of this section depends and which may adversely affect its performance.

13.1.2 Do not commence work until those conditions or defects have been investigate and corrected.

13.1.3 Commencement of work shall imply acceptance of existing surfaces and conditions and no claims for damages or extras resulting from such conditions or defects will be accepted later, except in cases where such conditions could not have been known prior to commencing work.

13.2 Samples

13.2.1 Samples of grass seed may be requested for approval by the Town.

13.2.2 Retain approved samples on site until work has been inspected.

13.2.3 All work shall confirm to approved samples.

13.3 Product Delivery, Storage, and Handling

13.3.1 Deliver seed in the original containers, tagged with identification as to the analysis of the seed mixture, percentages of seed, year of production, net weight, and date.

13.3.2 Deliver seed to the site only when ready for seeding.

13.3.3 During transportation, protect sod with tarpaulins to prevent sun scalding and drying out, and to ensure arrival in the site in a healthy condition.

13.3.4 All manufactured items subject to deterioration shall be stored in a weatherproof place on site in such a way that their effectiveness is not impaired.

13.3.5 Sod must be installed on the day of arrival at the site. If delays in installation occur due to weather, protect sod on the site from sun, keep moist, and store in a cool location until installation.

13.3.6 Handle sod carefully to prevent tearing or breaking.

13.3.7 Fertilizer shall be delivered mixed, in standard size unopened containers, showing weight, analysis, and name of manufacturer. These containers shall be stored in a weatherproof place to keep the fertilizer dry.

13.3.8 Follow manufacturer's delivery, storage, and handling instructions.

13.4 Substitution

13.4.1 All requests for substitutions of seed mixes shall be vetted through the Consultant. Such requests shall be forwarded to the Town for review and approval prior to installation.

13.5 Inspection

13.5.1 The Town will inspect all seed and sod installations.

13.5.2 Prior to the commencement of installation, all materials may be inspected and approved whether at the source of local supply or on site at the discretion of the Town. Previous approval will not impair the right of the Town during the course of construction to reject sod which has been damaged or which, in any way, does not conform to the specifications.

13.5.3 Give timely notice, in writing, to the Town when materials are available for inspection.

13.5.4 At the time of inspection, all turf shall be alive and in a healthy, satisfactory growing condition.

13.5.5 Remove all rejected materials from site immediately.

PART III - PRODUCTS

13.6 Grass Seed

13.6.1 All grass seed mixes shall have a minimum purity of 98% and minimum germination of 95%.

13.6.2 All seed must be from a recognized seed firm having membership in the Canadian Seed Trade Association. Seed must meet the requirements for the Seeds Act for Canada No. 1 grade seed and seed shall be certified No. 1 grade. The Town may request germination tests, purity tests, and/or weed seed analyses to confirm conformance.

13.6.3 Seed Mixes:

Percentage content of seed blends is by weight.**Riparian Blend**		
Botanical Name	**Common Name**	**Percent of Mixture**
Elymus trachycaulus spp. Subsecundus	Awned or Bearded Wheatgrass	20%
Elymus lanceolatus	Northern Wheatgrass	20%
Festuca hallii	Plains Rough Fescue	20%
Stipa curtiseta	Western Porcupine	20%
Festuca saximontana	Rocky Mountain Fescue	10%
Koeleria macrantha	Junegrass	10%
Wet Meadow Mix		
Botanical Name	**Common Name**	**Percent of Mixture**
Poa palustris	Fowl Bluegrass	25%
Elymus trachycaulus ssp. Subsecundus	Awned Wheategrass	20%
Deschampia caespitosa	Northern Tuffed Hairgrass	15%
Tisetum spicatum	Spiked Trisetum	15%
Puccincelia distans	Alkali Grass	15%
Beckmania syzigachne	Beckmann's Sloughgrass	10%
Parks and Boulevards Mix		
Botanical Name	**Common Name**	**Percent of Mixture**
Poa pratensis ssp.	Blend of three varieties of certified Kentucky Bluegrass	55%
Festuca rubra sp.	Creeping Red Fescue	35%
Lolium perenne	Perennial Ryegrass	10%
Naturalization and Low Maintenance Mix		
Botanical Name	**Common Name**	**Percent of Mixture**
Festuca ovina	Sheep Fescue	35%
Festuca duriuscula L. var Duriuscula	Hard Fescue	35%
Poa compressa L. var Rubens	Ruben's Canada Bluegrass	30%
Salt Tolerant Mix		
Botanical Name	**Common Name**	**Percent of Mixture**
Puccinellia distans 'Fults'	Fults Distans Alkali Grass	50%
Poa secunda	Sandberg Bluegrass	15%
Lolium perenne L.	Citation III Perennial Rye	15%
Agropyron cristatum L.	AC Parkland Crested Wheatgrass	20%

13.6.4 Acceptable cultivars:

Seed	Acceptable Cultivar
Kentucky Bluegrass	A34, Able 1 Alpine, America, Banff, Baron, Challenger, Cheri, Cynthia, Midnight, Nugget, Ram 1, Touchdown, Washington
Creeping Red Fescue	Jasper, Fortress, Boreal, Shademaster, Flyer
Wheat Grass	AEC Hillcrest Awned, Elbee Northern, Walsh Western Streambank, Sodar Streambank
Perennial Ryegrass	Fiesta II, Palmer, Manhattan

13.7 Sod

13.7.1 Sod shall conform to the specifications of the Canadian Nursery Sod Growers of Landscape Alberta Nursery Trades Association, be vigorous and healthy with a strong fibrous root system, free from disease, insect pests, stones, burns, dry or bare spots, and tears.

a. Sods shall be machine stripped at a uniform thickness of 15 mm (± 5 mm), delivered and installed within a period of 24 hours, unless a suitable preservation method is authorized prior to delivery. Sod shall be thickness determined at the time of stripping and shall exclude top growth and thatch.
b. Sod shall conform to the following mix:

Seed	Percent of Mixture
Kentucky Bluegrass[1]	70-90%
Creeping Red Fescue	10-30%

1 – Must contain a minimum three certified Kentucky Blue grass cultivars.

c. Other grasses and clover shall not be apparent in the sod and there shall be no more than one broadleaf weed or ten other weeds for every 45 m^2.
d. Wooden pegs required to hold sod in place shall have dimensions of approximately 15 mm x 35 mm x 300 mm. Metal pegs will not be accepted.

13.8 Binder

13.8.1 Use Turfmaster Hydro Seal or equivalent, compatible binder additive at the manufacturer's recommended rate, sufficient to mix a consistent slurry.

13.8.2 Binder shall be mixed and supplied by a recognized supplier and shall have tested rates of purity.

13.9 Mulch

13.9.1 Mulch shall be wood cellulose fibre containing no contaminants.

a. Fibre shall be supplied by a recognized supplier and shall a certified weight and composition.
b. Minimum application rate is 16.0 kg of air dry fibre per 100 m^2.
c. Fibre shall be measured as it is fed into the seeder.

13.10 Fertilizer

13.10.1 Use standard commercial fertilizers with guaranteed chemical analyses.

13.10.2 Fertilizers shall be clearly labeled and supplied in unopened, moisture-proof containers.

13.10.3 Fertilizer requirements are as follows:

Type 1 – Rate 3.5 kg/100 m^2	
Total Nitrogen	19%
Available Phosphoric Acid	19%
Potash	19%
Type 2 – Rate 3.5 kg/100 m^2	
Total Nitrogen	10%
Available Phosphoric Acid	30%
Potash	10%
Type 3 – Rate 3.5 kg/100 m^2	
Ammonia	12%
Phosphate	51%
Sulphate	0%

13.10.4 Fertilizers shall be granular, water-soluble type.

13.10.5 The Town may require changes to the fertilizer feed rates if an analysis of the topsoil shows this to be necessary.

13.11 Water

13.11.1 Water shall be clean and free of any substance that may inhibit vigorous growth of the plants.

13.11.2 The Contractor prior to submission of his/her bid or quotation shall investigate the type and distance of water supply available.

13.11.3 A permit shall be required if water is to be obtained from a Town hydrant.

PART IV – EXECUTION

13.12 Preparation

13.12.1 Remove weeds and debris from topsoil.

13.12.2 Verify grades and check that topsoil has been placed as required.

13.12.3 Notify the Town prior to commencing seeding or sodding operations.

13.12.4 Apply fertilizer according to the manufacturer's instructions or as directed by the Town.

13.12.5 Apply fertilizer with a spreader at the designated rate.

13.12.6 Mix fertilizer thoroughly into the upper portion of the topsoil.

13.12.7 Float and level out the finished topsoil surface.

13.13 Seeding

13.13.1 Seeding or sodding must be done between May 1 and September 30, unless otherwise approved by the Town in writing depending on weather conditions.

13.13.2 Do not seed when prepared topsoil is covered with frost, snow, or standing water.

13.13.3 Conduct seeding operations in low wind conditions only. Do not carry out seeding operations when wind velocities pose the risk to cause seed mix to be blown. Suspend and delay seeding operations if the Town determines wind conditions are unsuitable.

13.13.4 Proceed with seeding operations in accordance with sound horticultural practices.

13.13.5 Hand broadcast seeding is unacceptable except for site-specific repair work and pre-authorized work in naturalization areas.

13.13.6 Mechanical Seeding

a. For slopes flatter that 3H:1V, apply Parks and Boulevards Mix, unless otherwise specified, by mechanical dry spread (Brillion or Cyclone type) at a rate of 24 kg/1,000 m^2.
b. Apply in two passes, each pass at a rate of 12 kg/1,000 m^2 and perpendicular to each other.
c. Lightly roll seeded area after seed application is complete.
d. Spread Type 3 fertilizer evenly over the area and at the rate specified.
e. Thoroughly harrow the site after fertilizing.

13.13.7 Hydro Seeding

a. For slopes 3H:1V or steeper, apply Naturalization and Low Maintenance Mix, unless otherwise specified, by hydro seeder.
b. Mix seed with water, mulch, and fertilizer in the following application rates:

Ingredient	Quantity
Grass Seed	2.0 kg/100 m^2
Mulch	16 kg/100 m^2
Water	160 L/100 m^2
Fertilizer	3.5 kg/100 m^2

c. Thoroughly mix seed, water, mulch, fertilizer, and binder (where specified) in a slurry.
d. Uniformly apply the slurry mixture and cover with an acceptable mulch.

13.13.8 Seed Germination, Dry Seed, and Hydro Seed Applications

a. If 95% of seed fails to germinate within two (2) growing months, re-cultivate and re-seed until germination takes place.
b. Approximately six (6) weeks after germination, apply supplementary fertilizer 27-14-0 at a rate determined by topsoil analysis, or such other fertilizer as may be required by the Town.

13.14 Sodding

13.14.1 Firm the sod-bed by rolling before application.

13.14.2 Thoroughly irrigate the soil prior to placing sod. Sod shall not be laid on soil that is dry and powdery.

13.14.3 Cut sod by suitable methods and in accordance with the recommendations of the Landscape Alberta Nursery Trades Association.

13.14.4 Handle sod carefully when loading and installing to prevent tearing or breaking.

13.14.5 Installation

a. Lay sod evenly in staggered rows with edges and ends butted tightly. If sodding is required on any slope 3H:1V or steeper, sod may be pegged with short wooden pegs set flush with the ground, 25 pegs per 10m^2, to prevent sod from slipping.
b. On slopes, lay sod with the longer dimension oriented downhill.
c. Blend edges of sod with existing grass or cultivated areas.
d. Where sod butt joins surface paving or other surface features (i.e. manholes, catch basins, sidewalks, curbs, driveways, roads), position the sod turf crown flush with the finished hard surface.
e. Top dress seams as required with topsoil.

f. Water the sod and upper 200 mm of topsoil with water spray. Do not cause erosion.
g. Let sod and soil dry out sufficiently to prevent damage, and then roll sod with a roller to ensure good bonding between the sod and the topsoil, and to smooth out humps and depressions.
h. Immediately after rolling, saturate sod and upper 200 mm of topsoil with fine spray. To prevent grass and soil from drying out, continue adequate watering for 8 to 10 days after laying, or until roots are well established.
i. Four (4) weeks after laying, and following initial cutting, apply organic supplementary fertilizer 27-14-0 at a rate determined by topsoil analysis, or such other fertilizer as may be required by the Town.

13.15 Clean-up

13.15.1 Immediately after planting, remove all debris and excess material from the site, leaving the area neat and tidy. Clean all areas, which are contaminated as a result of planting operations.

13.15.2 Maintain all areas in a neat and tidy manner at all times until acceptance.

13.16 Construction Completion Inspection

13.16.1 At time of the construction completion inspection, all grassed areas shall have a healthy, full even stand of grass, free of diseases, weeds, thin, burned-out patches or non-flush joints and shall be not more than 65 mm in height.

13.17 Maintenance

13.17.1 During the Warranty Period, areas showing deterioration, bare spots, or thin areas shall be re- seeded or re-sodded. Seed shall be properly germinated and/or sod properly knitted prior to final inspection. Refer to Section 8.18.

13.18 Final Inspection

13.18.1 Final inspection of seeded or sodded areas will be made prior to the end of the Warranty Period.

13.18.2 At the time of inspection, all the areas shall be alive and in a healthy, satisfactory growing condition, and free from weeds. Any deficiency in this respect shall be remedied at the developer's expense.

13.18.3 Seeding/Sod
a. Grass shall be cut to 65 mm at the time of the inspection throughout the area for which the FAC is sought.
b. No bare soil visible when the grass if observed from a standing position, nor burned spots.
c. Grass shall be free of disease and growing vigorously with no footprints, deep ruts, soil lumps or grass clippings visible.
d. No restricted weeds, noxious weeds, or prohibited noxious weeds, as defined by the Weed Control Act of Alberta, shall be present. No more than one broadleaf weed or ten other weeds per 45 m^2.
e. Sod has knitted and no cracks are visible between joints.

Third party damage that occurs within the maintenance period is the responsibility of the Developer.

14. Landscaping Standards – Site Amenities & Fencing

PART I – DESIGN

14.1 General

14.1.1 Refer to Section 8.0 for required locations of site amenities and fencing.

14.1.2 Site amenities, screen, uniform and solid fences are to be designed to complement other proposed architectural and urban amenities, and meet the following objectives:
a. Safety and security;
b. Delineation of private and public lands;
c. Pedestrian barrier; and
d. Visual continuity.

14.1.3 All site amenities, including site furniture, must be reviewed and approved by the Town prior to installation.

14.1.4 All site furnishings should be of a consistent style and type within the community and/or development phase.

14.1.5 Screen, uniform, and solid fences are to be structurally designed to achieve a minimum life expectancy of 20 years.

14.1.6 Gates shall be installed on all residential lots that back onto a public park. Gates shall not be provided on residential lots that back onto MRs or ERs, unless otherwise approved.

14.1.7 Uniform fencing, if provided, shall be subject to the review and acceptance of the Town. Such fencing shall be located inside of the residential lot property line and shall be consistent in appearance throughout the Subdivision.

14.1.8 Solid fences shall have no gaps between boards, or between posts and boards, and shall have a 75 mm gap between the bottom of the fence board and finished grade.

14.1.9 Chain link fence shall be constructed and installed in accordance with the manufacturer's specifications.

14.1.10 Entrances from arterial or major roadways that serve in excess of 75 residential lots shall have a feature or sign, with landscaping, to the approval of the Town. Additional right of way may be required to accommodate these features.

14.1.11 Optional amenities are nonstandard infrastructure development (i.e. ornamental fencing, water features, gazebos, sculptured, entrance features / signs, decorative fixtures etc.) in a public park or road right-of-way. Town branding may be required to be included on the amenity, as per direction from the Town.
a. The intent to construct optional amenities must be identified at the Preliminary design stage via a letter of intent or other mechanism.
b. If a Developer or homeowners'/community association intends to construct an optional amenity they may be required to enter into a Maintenance Agreement with the Town. The Maintenance Agreement must be executed prior to FAC approval.
c. Maintenance manuals shall be submitted to the Town prior to FAC approval for all optional amenities associated with irrigation and/or water systems.
d. Community Entrance Features that contain the name, logo, address of the community, or the Developer's identification cannot be placed on Municipal Reserves. Community Entrance Features with this type of information must be placed on private lands or within wider road right-of-ways upon approval of the Town.

14.2 Minimum Setback Requirements

14.2.1 Site amenities shall be spaced from infrastructure in accordance with the minimum setbacks provided in the following table, unless otherwise specified:

Infrastructure Designation	Setback Distance
Benches	1.0 m from back of walkway
Trash Receptacles	250 mm from back of walkway

PART II – GENERAL

14.3 Examination

14.3.1 Report to the Town, in writing, any conditions or defects encountered on the site before or during any construction upon which the work of this section depends and which may adversely affect its performance.

14.3.2 Do not commence work until those conditions or defects have been investigated and corrected.

14.3.3 Commencement of work shall imply acceptance of existing surfaces and conditions and no claims for damages or extras resulting from such conditions or defects will be accepted later, except in cases where such conditions could not have been known prior to commencing work.

14.4 Product Delivery, Storage, and Handling

14.4.1 During transportation, protect site amenities and fencing materials from damage and weathering.

14.4.2 On delivery, store all materials off the ground and protect from adverse conditions to prevent deterioration, damage or impairment of the structure.

14.4.3 Handle site furnishings carefully to prevent paint damage or breaking.

14.4.4 Follow manufacturer's delivery, storage, and handling instructions.

14.5 Substitution

14.5.1 All requests for substitutions shall be vetted through the Consultant responsible for preparing the contract drawings. Such requests shall be forwarded to the Town for approval prior to installation.

14.6 Inspection

14.6.1 The Town will inspect all site amenity and fence installations.

14.6.2 Prior to the commencement of installation, all materials may be inspected at the discretion of the Town. Previous approval will not impair the right of the Town during the course of construction to reject amenities which have been damaged or which, in any way, does not conform to the specifications.

14.6.3 Give timely notice, in writing, to the Town when materials are available for inspection.

14.6.4 Remove all rejected materials from site immediately.

PART III - PRODUCTS

14.7 General

14.7.1 Site amenities shall conform to Town's standards.

14.8 Benches

14.8.1 All bench styles and material are subject to the approval of the Town prior to installation.

14.8.2 Wabash Valley CN420(D) or CN425(P) diamond pattern, Plastisol coating complete with black powdercoat finish, unless otherwise specified

14.9 Waste Receptacles

14.9.1 All waste receptacle styles and material are subject to the approval of the Town prior to installation.

14.9.2 Wabash Valley LR300P diamond pattern, Plastisol coating complete with black powdercoat finish, unless otherwise specified.

14.10 Picnic Tables

14.10.1 All picnic table styles and material are subject to the approval of the Town prior to installation.

14.10.2 Wabash Valley SG106(P) diamond pattern, Plastisol coating complete with black powdercoat finish, unless otherwise specified.

14.11 Bollards

14.11.1 All bollard styles and material are subject to the approval of the Town prior to installation.

14.11.2 Bollards shall be installed by developer in open spaces such that Public Parks, PUL's, MR's or SWMF's are protected from unauthorized public access by vehicles.

14.12 Amenities

14.12.1 All optional amenities are subject to the approval of the Town prior to installation.

PART IV – EXECUTION

14.13 Site Amenities

14.13.1 1 All site amenities to be installed in accordance with the approved Engineering Drawings and the manufacturers' instruction.

14.14 Fencing

14.14.1 All fencing to be installed in accordance with the approved Engineered Drawings and manufacturer's instructions.

14.14.2 Gates may be required at Pathway and Trail head entrances to the satisfaction of the Town.

14.14.3 Wood Fences

a. Posts will be rejected when structural integrity is compromised, or when the following conditions apply:
    i. Cracks are 50% of the depth of the post in the face it occurs;
    ii. Cracks exceed 25% of the width of the post on the face it occurs, or are wider than 12 mm; or if
    iii. Mechanical damage is evident.

b. Cracks from 6 to 12 mm are to be re-stained with fence stain, ensuring that the stain penetrates the wood.
c. Board spacing shall be tight, ensuring that the spacing between boards does not exceed 12 mm when the boards are dry.
d. Fence boards, including stringers, shall be stained prior to installation.
e. Fence posts shall be stained prior to installation of the stringers and fence boards.
f. Nailer strips shall be fastened to the posts.
g. On double-board fencing, fascia boards shall be fastened to the fence boards.
h. For noise attenuation, on double-board fencing, adjust yard side pressure treated bottom stringer to provide no gap on ground. Bottom of double-board fencing on road side to be 75 mm above ground.
i. Standard wood screen fence to be 75 mm above grade.

14.14.4 Chain Link Fences

a. Maximum spacing of posts shall be 3 m on centre.
b. Install line, corner, and terminal posts plumb, set is concrete footings in accordance with the following table:

Fence Height	Component	Concrete Depth	Hole Dia. at Top
1.2, 1.5, and 1.8 m	Line Posts	760 mm	250 mm
	Gate and Corner Posts	900 mm	300 mm
2.4, 3.0, and 3.6 m	Line Posts	900 mm	250 mm
	Gate and Corner Posts	1060 mm	300 mm

c. Set top of concrete flush with finished grade. Slope and trowel-finish top to ensure water runoff.
d. Position bottom of fabric 25 mm above finished grade with bottom tension wire between posts.
e. Align top of posts to ensure that the top rail varies gradually with changes in ground elevation.
f. Pass top rail through line post tops to form continuous bracing. Install 150 mm long couplings mid-span at pipe ends.
g. For fences 1.8 m and taller, brace each gate and corner post back to adjacent line post with horizontal brace rail. Install brace rail, one bay from corner and gate post.
h. Attach fabric to corner and gate posts with tension bars and clips. Stretch fabric between posts at maximum intervals of 3.0 m.
i. Install straining posts every 90 m.
j. Install gates with fabric to match the fence. Install two hinges per leaf.
k. Install centre rests set in concrete, and cane bolts at centre of double-gate openings.
l. Welded gate frame joints shall be painted with one coat of zinc paint.
m. Cut fabric for crawl holes, selvage knuckle end closed top and bottom. Place two-part frames around opening in fabric and bolt together.

14.15 Construction Completion Inspection

14.15.1 The Construction Completion Certificate for site amenities and fencing shall be issued following a satisfactory inspection by the Town. The maintenance and warranty period commences from the date of the issuance of the CCC.

14.16 Maintenance

14.16.1 During the maintenance and warranty period, the developer shall maintain the fencing and site amenities and repair all damage immediately upon notice. Refer to Section 8.18.

14.17 Final Acceptance Inspection

14.17.1 Final inspection of site amenities and fencing will be made prior to the end of the maintenance period. All fencing and site amenities shall conform to the construction documents and be free of deficiencies.

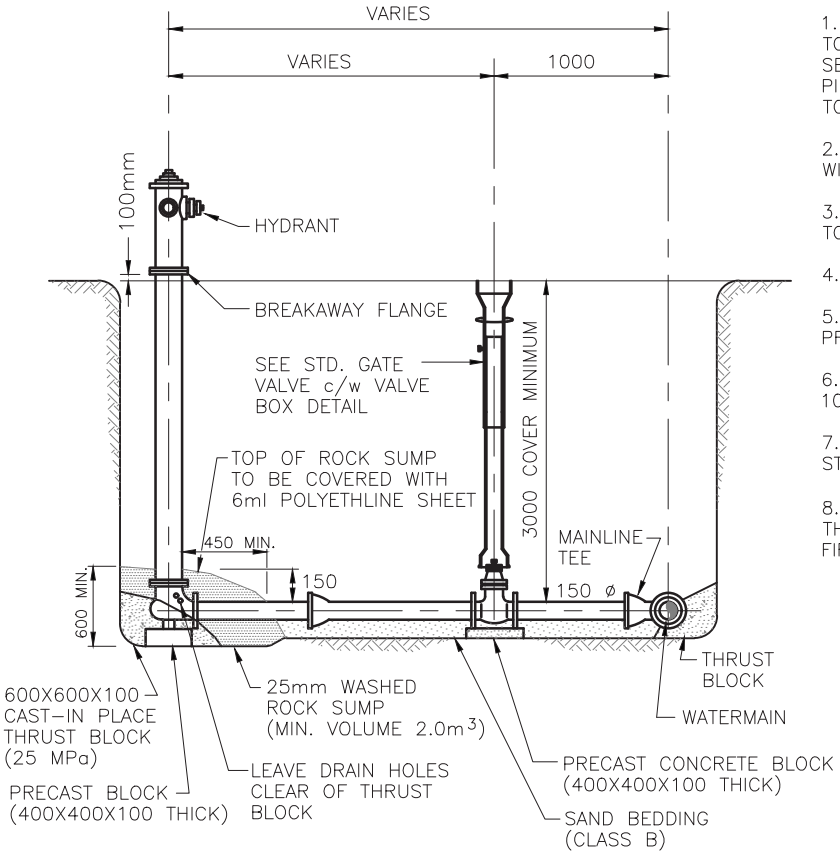
14.17.2 Wood fences shall be repainted and/or re-stained prior to FAC inspection.

APPENDIX A

ENGINEERING STANDARD DRAWINGS

TOWN OF WHITECOURT

A-01



NOTES:

1. HYDRANT TO BE SET PLUMB WITH BARREL EXTENSIONS TO SUIT DEPTH OF HYDRANT LEAD. HYDRANT LEAD TO BE SET LEVEL WITH A MIN. OF 3.0m OF COVER ABOVE TOP OF PIPE. EXTENSION TO BE INSTALLED BETWEEN HYDRANT AND TOP OF BARREL.

2. ALL THRUST BLOCKING TO BE AGAINST UNDISTURBED SOIL WITH DRAIN HOLES CLEAR OF CONCRETE.

3. VALVE BOX TO BE INSTALLED IN VERTICAL POSITION WITH TOP FLUSH WITH FINISHED GRADE.

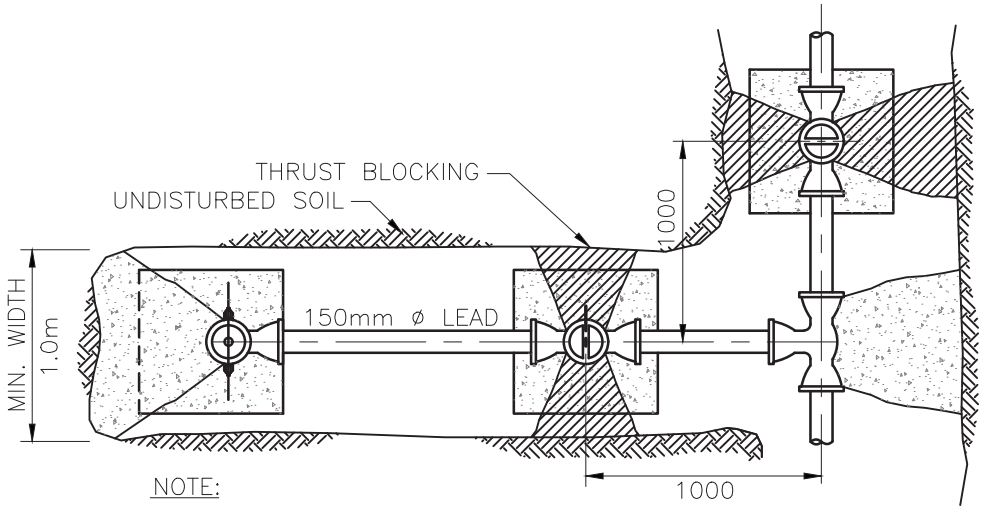
4. HYDRANTS SHALL BE COMPRESSION TYPE AS SPECIFIED.

5. ALL CAST IRON VALVES AND FITTINGS SHALL BE CATHODIC PROTECTED BY SACRIFICIAL ANODES.

6. HYDRANT TO BE INSTALLED WITH BREAKAWAY FLANGE 100mm ABOVE FINISHED GRADE.

7. CONCRETE TO BE TYPE 50 WITH 30MPA COMPRESSIVE STRENGTH.

8. PUMPER PORT (100mm STORZ) TO BE POSITIONED SO THAT IT FACES THE ROAD OR MOST ACCESSIBLE SPOT FOR FIRE TRUCK.



NOTE:

SUMP TO CONTAIN 0.5 Cu. METRES OF CLEAN COARSE GRAVEL. (WASHED ROCK).

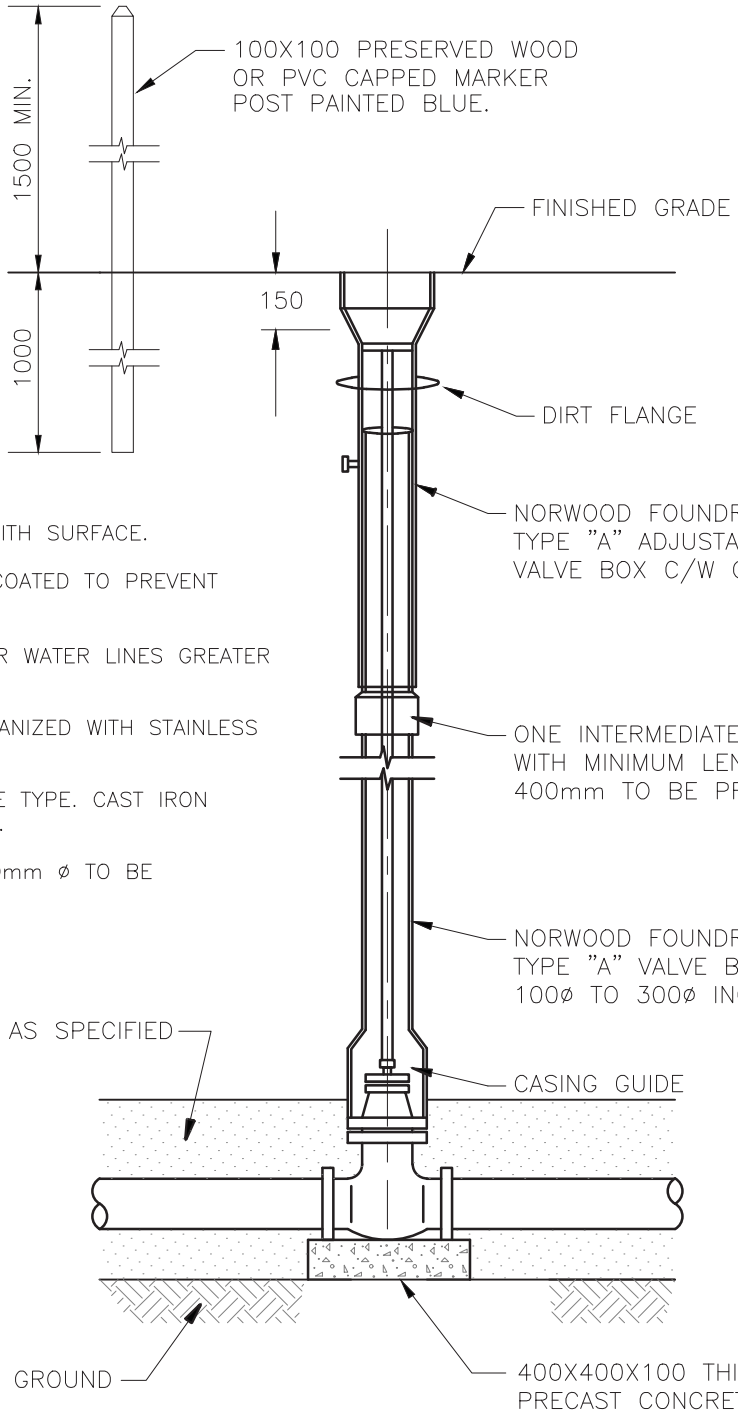
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

TYPICAL FIRE HYDRANT

Whitecourt

TOWN OF WHITECOURT

A-02



NOTES:

1. VALVE BOX TOPS TO BE SET FLUSH WITH SURFACE.

2. VALVE BOXES SHALL BE BITUMINOUS COATED TO PREVENT CORROSION.

3. TYPE "B" VALVE BOX TO BE USED FOR WATER LINES GREATER THAN 300mm ø

4. VALVE TO BE EPOXY COATED OR GALVANIZED WITH STAINLESS STEEL NUTS AND BOLTS.

5. VALVE TO BE RESILIENT SEATED WEDGE TYPE. CAST IRON CLASS 150 FOR 300mm ø AND SMALLER.

6. VALVES FOR LINES GREATER THAN 300mm ø TO BE BUTTERFLY VALVES.

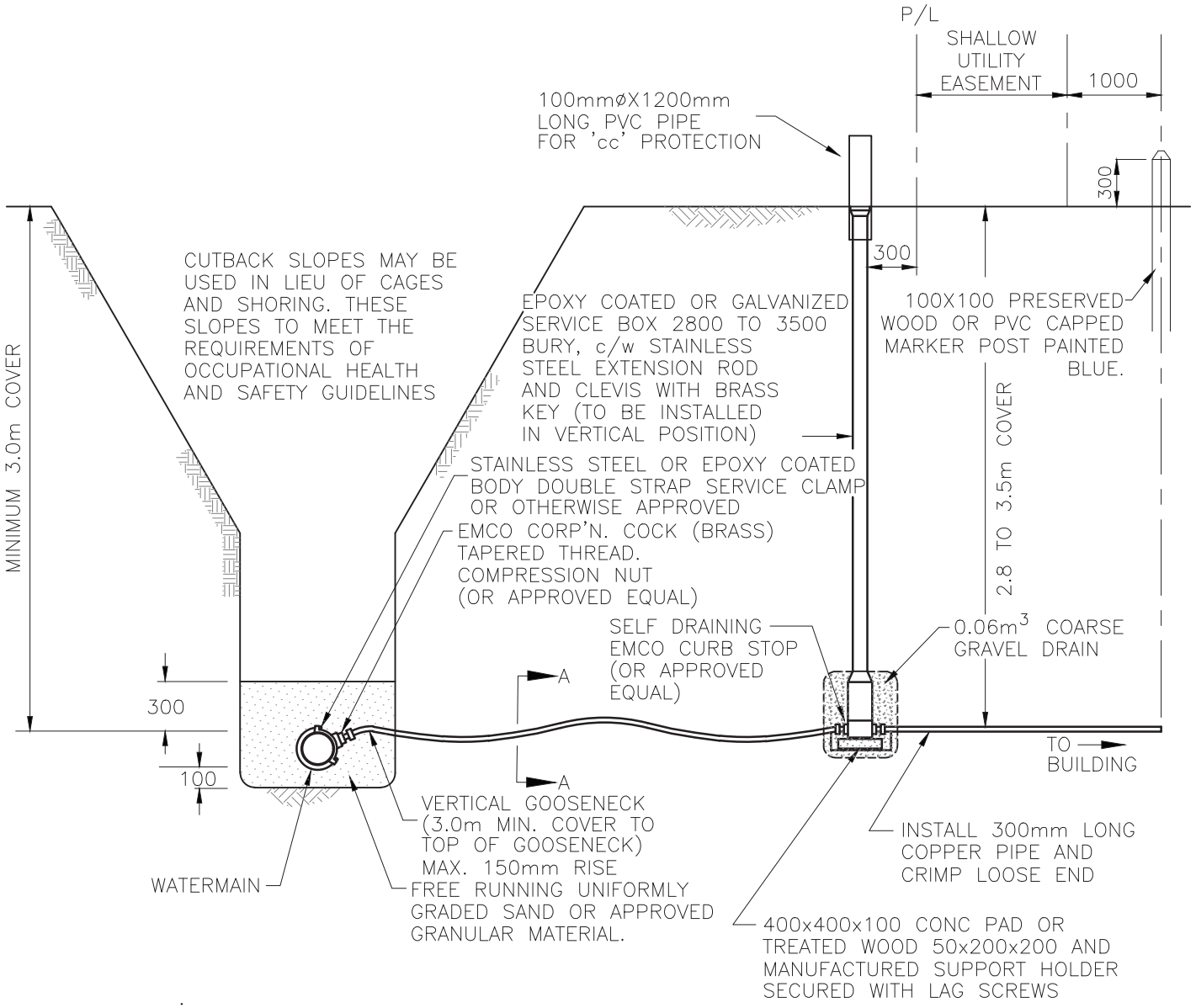
7. MINIMUM COVER 3.0 METRES.

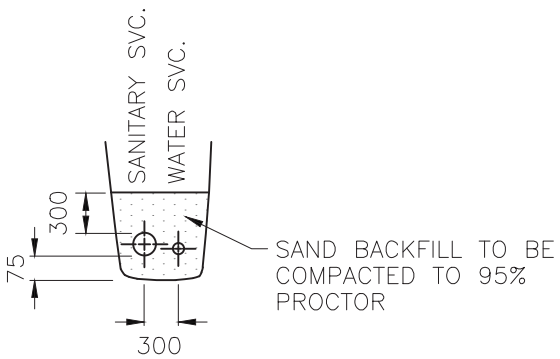
FOR CAST-IN-PLACE CONCRETE BASE
INCREASE THICKNESS TO 150mm AND ADD
TWO 10M BARS AT 300mm O/C EACH WAY.

SCALE: N.T.S.	BURIED VALVE	Whitecourt
DATE: DECEMBER 2019		
APPD:		

TOWN OF WHITECOURT

A-03





NOTES:

1. WATER SERVICE TO BE TAPPED AT THE 2 TO 3 O'CLOCK POSITION.

2. WATER SERVICE TO BE TYPE K COPPER.

3. WATER SERVICE TO BE STRAIGHT IN THE TRENCH.

4. WATER SERVICE IS TO BE GOOSENECKED IN THE VERTICAL PLANE AT THE CORPORATION STOP.

5. COMPRESSION FITTINGS MUST BE USED FOR WATER SERVICE CONNECTIONS.

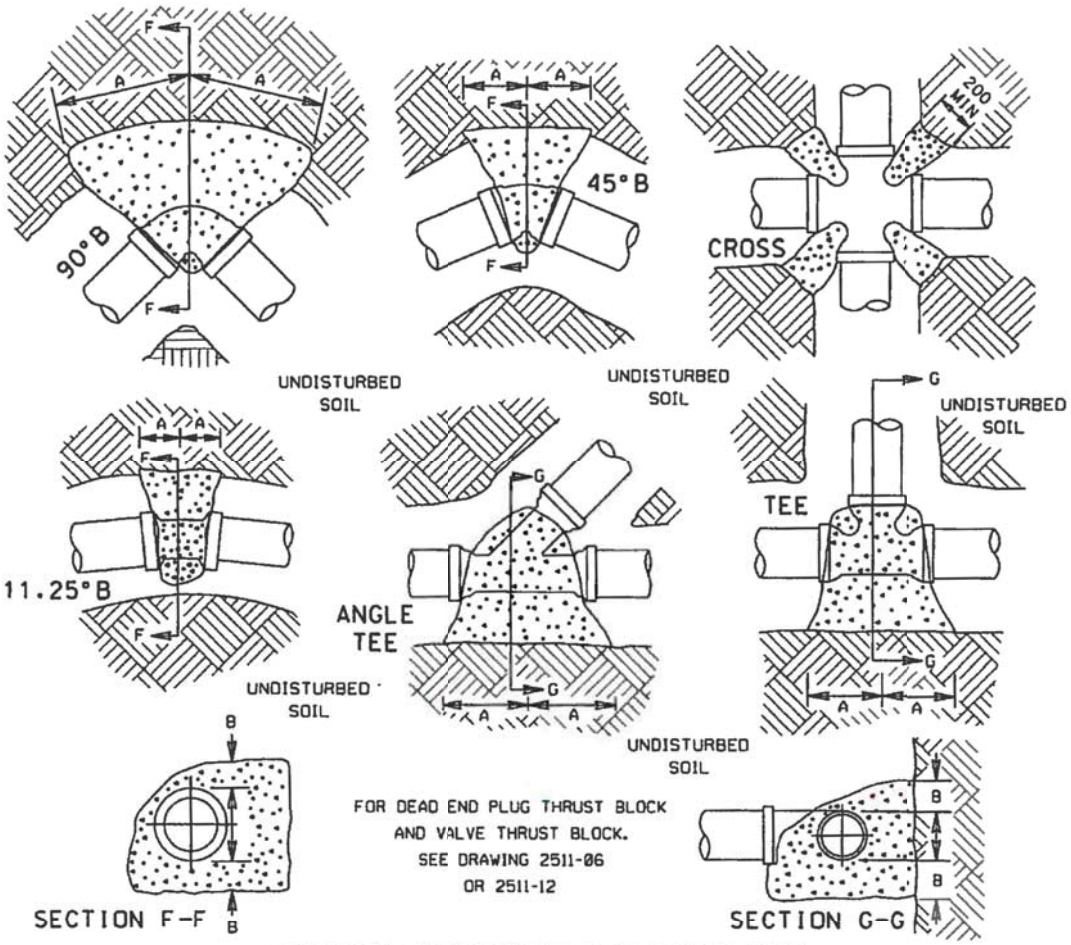
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

WATER SERVICE CONNECTION

Whitecourt

TOWN OF WHITECOURT

A-04



REQUIRED DIMENSIONS & BEARING AREA

	TEE & DEAD END & VALVE									
DIA (mm)	100	150	200	250	300	350	400	450	500	600
A (mm)	250	370	550	740	930	920	1000	1000	1000	1000
B (mm)	75	100	100	100	100	200	250	350	450	700
AREA (m^2)	0.14	0.28	0.47	0.71	1.00	1.44	1.87	2.35	2.88	4.11
	90° BEND									
DIA (mm)	100	150	200	250	300	350	400	450	500	600
A (mm)	350	520	770	860	960	940	1000	1000	1000	1020
B (mm)	75	100	100	150	200	350	450	600	750	1100
AREA (m^2)	0.19	0.39	0.67	1.00	1.41	2.04	2.65	3.32	4.08	5.81
	45° BEND									
DIA (mm)	100	150	200	250	300	350	400	450	500	600
A (mm)	190	280	420	470	600	700	850	820	960	950
B (mm)	75	100	100	150	150	200	200	300	300	500
AREA (m^2)	0.12	0.21	0.36	0.54	0.77	1.11	1.44	1.80	2.21	3.15

	22.5° BEND									
DIA (mm)	100	150	200	250	300	350	400	450	500	600
A (mm)	100	170	220	290	310	410	440	510	540	640
B (mm)	75	75	100	100	150	150	200	200	250	300
AREA (m^2)	0.06	0.11	0.19	0.28	0.39	0.57	0.73	0.92	1.13	1.61
	11.25° BEND									
DIA (mm)	100	150	200	250	300	350	400	450	500	600
A (mm)	100	100	120	160	200	260	310	330	380	470
B (mm)	75	75	75	75	75	75	75	100	100	100
AREA (m^2)	0.03	0.06	0.10	0.14	0.20	0.29	0.37	0.46	0.57	0.81

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. DESIGN BASIS:
   a. HYDRAULIC PRESSURE 1035kPa (150 psi)
   b. SOIL BEARING CAPACITY 72kPa (1500 lb/sq.ft.) (MEDIUM SOFT CLAY)
3. TEMPORARY BLOCKING MUST BE APPROVED BY THE ENGINEER.
4. CONCRETE STRENGTH SHALL BE 25MPa AT 28 DAYS.
5. CONCRETE TO BE TYPE SULPHATE RESISTANT ACCORDING TO CSA-A3000-13
6. CONCRETE TO BE CLEAR OF BELLS.
7. CONCRETE TO BE PLACED UNDER ALL FITTINGS.
8. CONCRETE THRUST BLOCK REQUIRED FOR ALL FITTINGS.
9. BEARING SURFACE MUST BE ON UNDISTURBED SOIL.

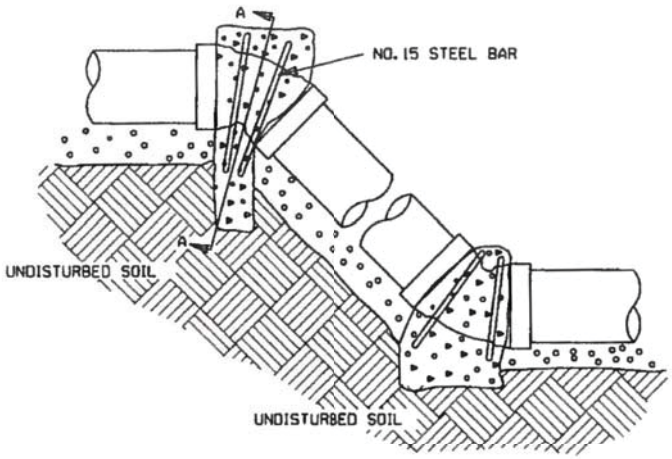
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

HORIZONTAL CONCRETE THRUST BLOCK DETAIL

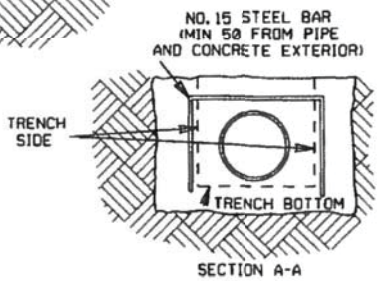
Whitecourt

TOWN OF WHITECOURT

A-05



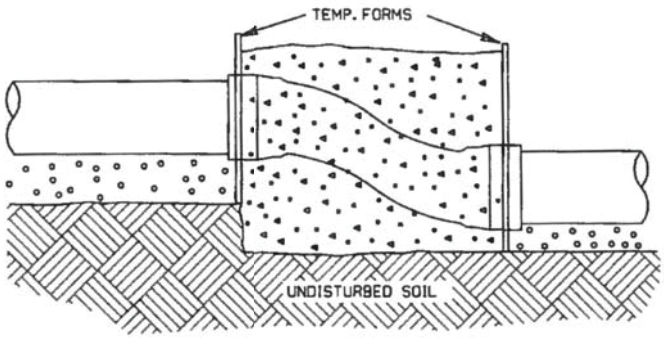
VERTICAL BEND



SECTION A-A

REQUIRED BEARING AREA

	45° BEND									
DIA (mm)	100	150	200	250	300	350	400	450	500	600
AREA(m^2)	0.101	0.208	0.360	0.548	0.762	1.101	1.431	1.797	2.284	3.142
	22.5 BEND									
DIA (mm)	100	150	200	250	300	350	400	450	500	600
AREA(m^2)	0.051	0.106	0.183	0.275	0.389	0.561	0.738	0.916	1.123	1.582
	11.25 BEND									
DIA (mm)	100	150	200	250	300	350	400	450	500	600
AREA(m^2)	0.026	0.053	0.092	0.138	0.195	0.282	0.367	0.468	0.564	0.805

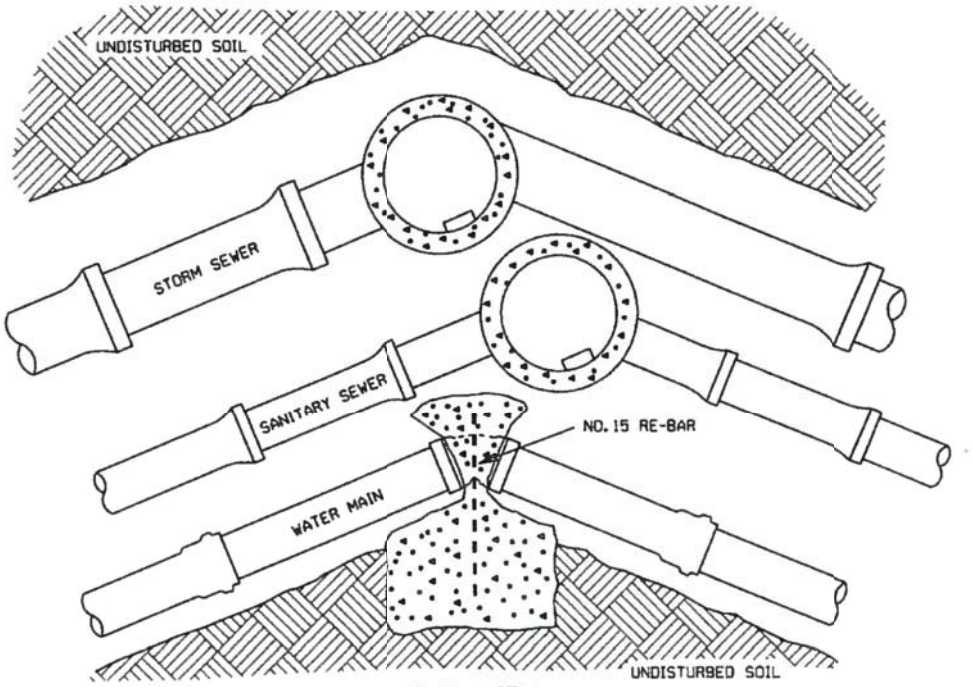


VERTICAL OFFSET

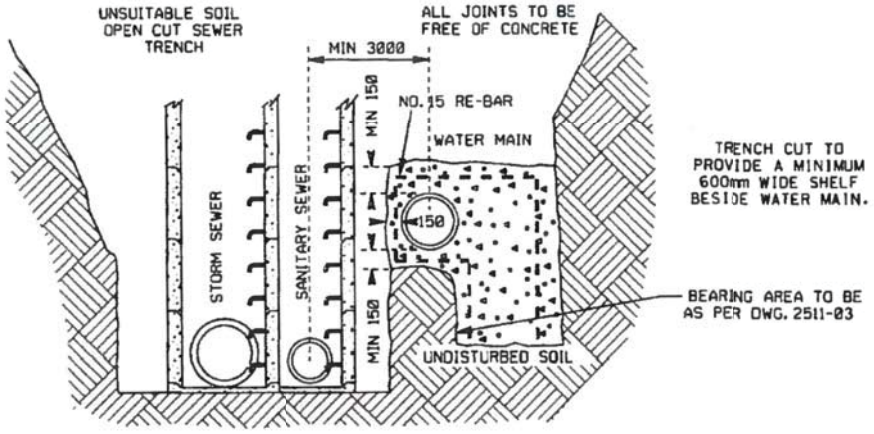
NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. DESIGN BASIS:
   a. HYDRAULIC PRESSURE 1035kPa (150 psi)
   b. SOIL BEARING CAPACITY 72kPa (1500 lb/sq.ft) (MEDIUM SOFT CLAY)
3. TEMPORARY BLOCKING MUST BE APPROVED BY THE ENGINEER.
4. CONCRETE STRENGTH SHALL BE 25MPa AT 28 DAYS.
5. CONCRETE TO BE SULPHATE RESISTANT ACCORDING TO CSA-A3000-13.
6. CONCRETE TO BE CLEAR OF BELLS AND PIPE.
7. CONCRETE TO BE PLACED UNDER ALL FITTINGS.
8. CONCRETE THRUST BLOCK REQUIRED FOR ALL FITTINGS.
9. BEARING SURFACE MUST BE ON UNDISTURBED SOIL.

SCALE: N.T.S.	VERTICAL BEND AND OFFSET THRUST BLOCK DETAIL	Whitecourt
DATE: DECEMBER 2019		
APPD:		



PLAN VIEW



CROSS SECTION

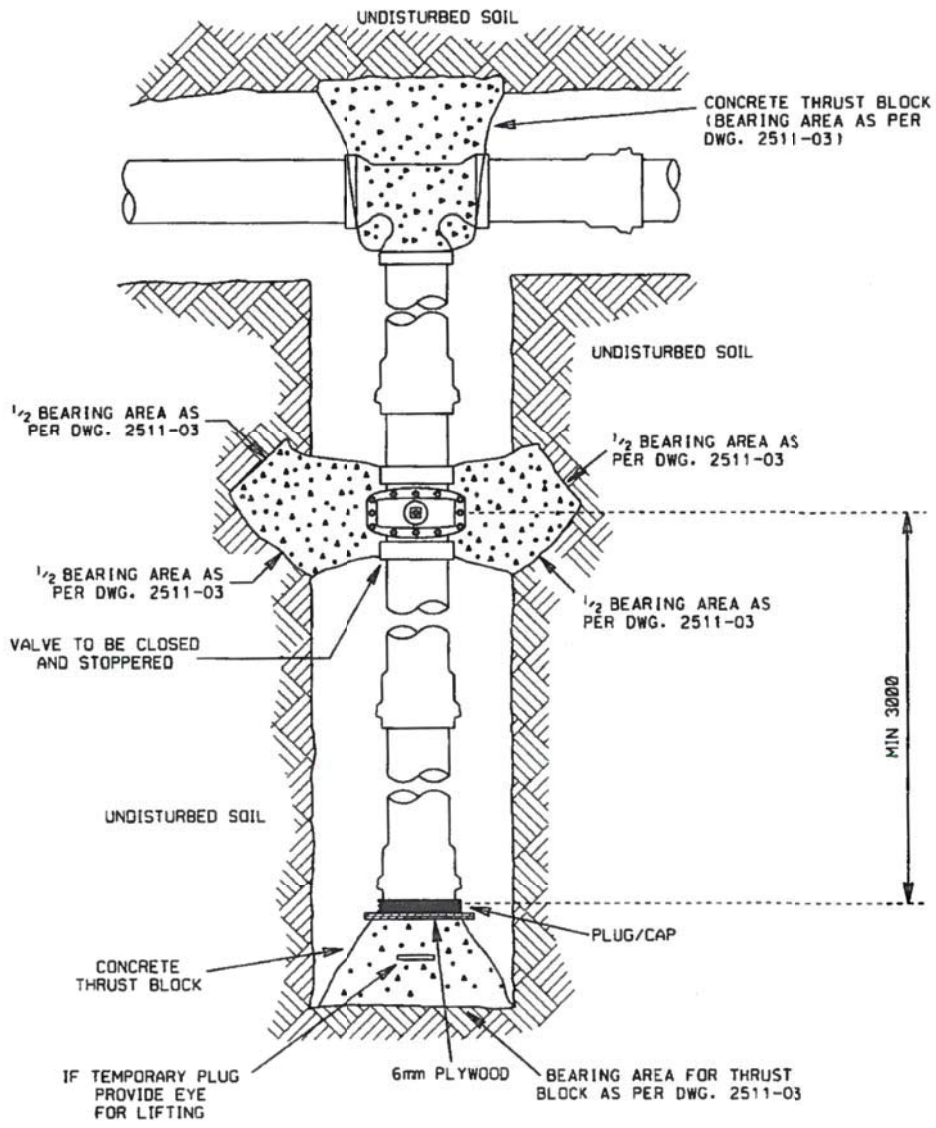
NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. DESIGN BASIS:
   a. HYDRAULIC PRESSURE 1035kPa (150 psi)
   b. SOIL BEARING CAPACITY 72kPa (1500 lb/sq.ft.) (MEDIUM SOFT CLAY)
3. TEMPORARY BLOCKING MUST BE APPROVED BY THE ENGINEER.
4. CONCRETE STRENGTH SHALL BE 25MPa AT 28 DAYS.
5. CONCRETE TO BE SULPHATE RESISTANT ACCORDING TO CSA-A3000-13.
6. CONCRETE TO BE CLEAR OF BELLS AND PIPE.
7. CONCRETE TO BE PLACED UNDER ALL FITTINGS.
8. CONCRETE THRUST BLOCK REQUIRED FOR ALL FITTINGS.
9. BEARING SURFACE MUST BE ON UNDISTURBED SOIL.

SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

SPECIAL THRUST BLOCK FOR DISTURBED AREAS

Whitecourt



PLAN VIEW

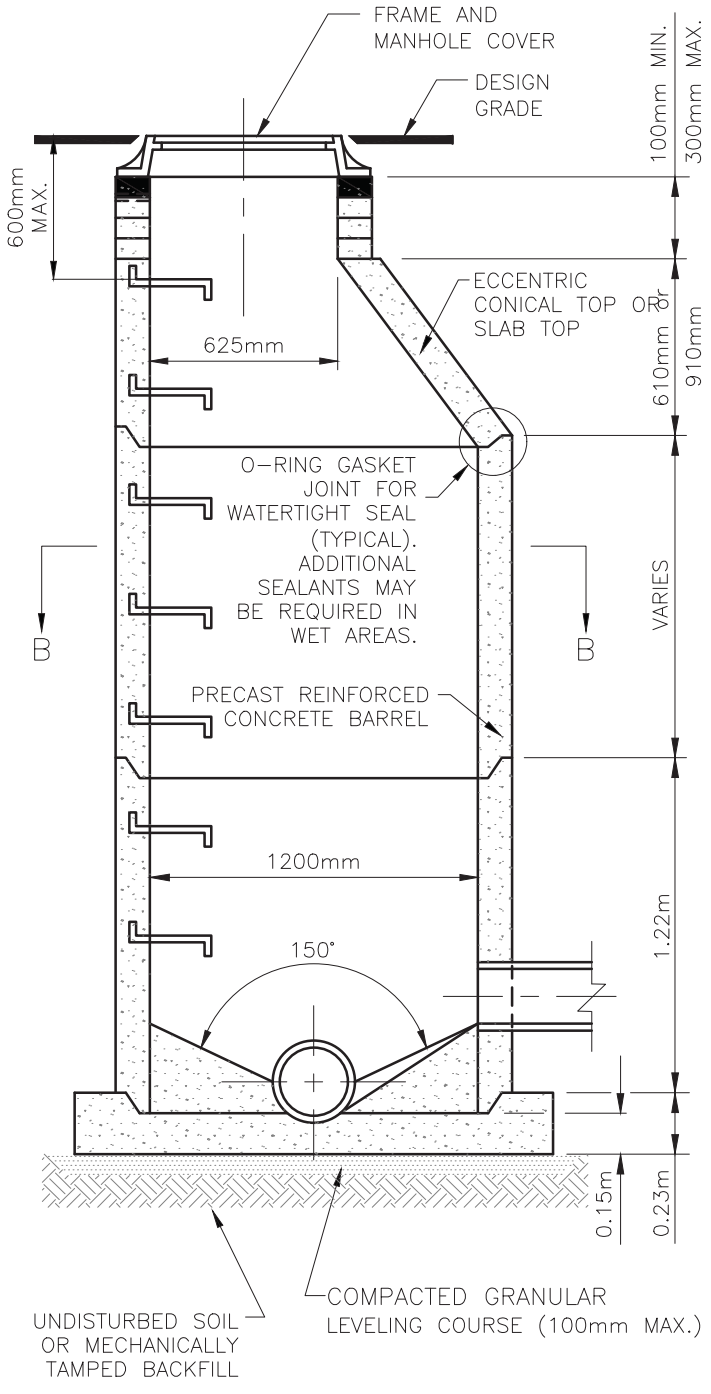
NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. DESIGN BASIS:
   a. HYDRAULIC PRESSURE 1035kPa (150 psi)
   b. SOIL BEARING CAPACITY 72kPa (1500 lb/sq.ft) (MEDIUM SOFT CLAY)
3. TEMPORARY BLOCKING MUST BE APPROVED BY THE ENGINEER.
4. CONCRETE STRENGTH SHALL BE 25MPa AT 28 DAYS.
5. CONCRETE TO BE CLEAR OF BELLS.
6. CONCRETE TO BE PLACED UNDER ALL FITTINGS.
7. CONCRETE THRUST BLOCK REQUIRED FOR ALL FITTINGS.
8. BEARING SURFACE MUST BE ON UNDISTURBED SOIL.
9. CONCRETE TO BE SULPHATE RESISTANT ACCORDING TO CSA-A3000-13.

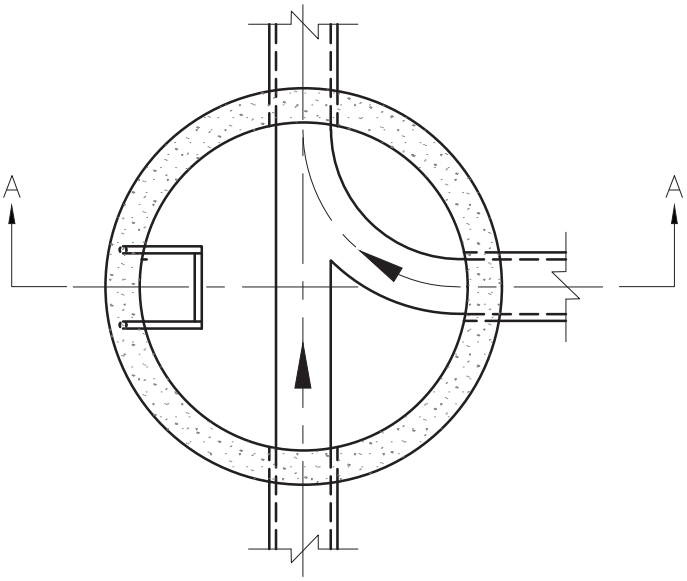
SCALE: N.T.S.	TYPICAL DEAD END UP TO 300mm	Whitecourt
DATE: DECEMBER 2019		
APPD:		

TOWN OF WHITECOURT

A-08



SECTION A–A



SECTION B–B

NOTES:

1. CAST–IN–PLACE CONCRETE BASE MAY BE USED. CAST–IN–PLACE CONCRETE TO BE TYPE 50 25MPa IN 28 DAYS. CAST–IN–PLACE CONC. BASE TO BE MIN. 1700x1700x200mm THICK WITH 10M BARS AT 300mm SPACING EACH WAY.

2. PRECAST RINGS, CONES AND BARRELS TO MEET CURRENT ASTM C478 STANDARDS. STORM MH JOINTS TO BE SEALED WITH CEMENT MORTAR, OR CONFINED O–RING GASKET. SANITARY MH JOINTS TO BE SEALED WITH A CONFINED O–RING GASKET, ASTM C445. AND MORTOR CONNECTION OF PIPES TO MH TO BE A MANUFACTURED SEAL.

3. INLET AND OUTLET PIPES TO USE INTEGRAL GASKET FOR WATERTIGHT COUPLING BETWEEN MANHOLE AND PVC PIPE. PIPE TO BE MADE FLUSH WITH INSIDE MANHOLE WALL. CHANNELING AND BENCHING TO BE FINISHED TO TROWEL SMOOTHNESS. BENCHING TO BE TYPE 50 WITH MAXIMUM 30MPA COMPRESSIVE STRENGTH.

4. SAFETY STEP SPACING TO BE EQUALLY SPACED AT A MAX. OF 410mm APART TO WITHIN 300mm BELOW COVER AND TO WITHIN 600mm OF THE BASE OR BENCHING. STEPS TO BE EPOXY COATED EXTRUDED 30mm ALUMINUM FORGED OR APPROVED EQUAL.

5. PRECAST INLINE TEE MH's ARE ACCEPTABLE FOR SEWERS 900mmø AND LARGER. CONCRETE BEDDING REQUIRED TO SPRINGLINE OF MANHOLE TEE.

6. NF–39 FRAME AND COVER (No.146) IN LANDSCAPED AREAS.
NF–80 FRAME AND COVER IN HARD SURFACE AREAS.
NF–90 GASKETED FRAME AND COVER AT SAGS.
NF–39 SLOTTED (No.112) ON CBMH IN HARD SURFACED AREAS.
NF–38 SLOTTED (No.112) ON CBMH IN LANDSCAPED AREAS.

7. SLAB TOP TO BE USED WHERE RIM TO INVERT DISTANCE IS LESS THAN 2.5 METERS.

8. SPECIAL BASE DESIGN IS REQUIRED WHERE RIM TO INVERT EXCEEDS 9m.

9. INSTALL VERTICAL SIDE OF CONICAL MANHOLE ON UPSTREAM SIDE.

10. SAFETY PLATFORMS REQUIRED ON ALL MANHOLES OVER 6m DEEP. PLATFORM LOCATED 2m ABOVE PIPE.

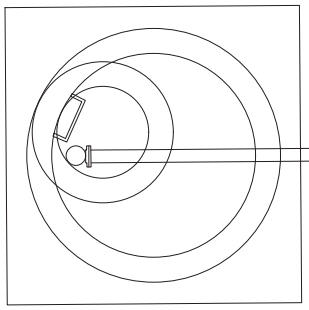
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

1200mmØ STANDARD MANHOLE (PIPES LESS THAN 600mmØ)

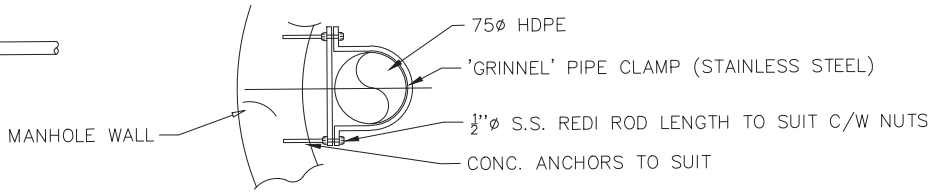
Whitecourt

TOWN OF WHITECOURT

A-09

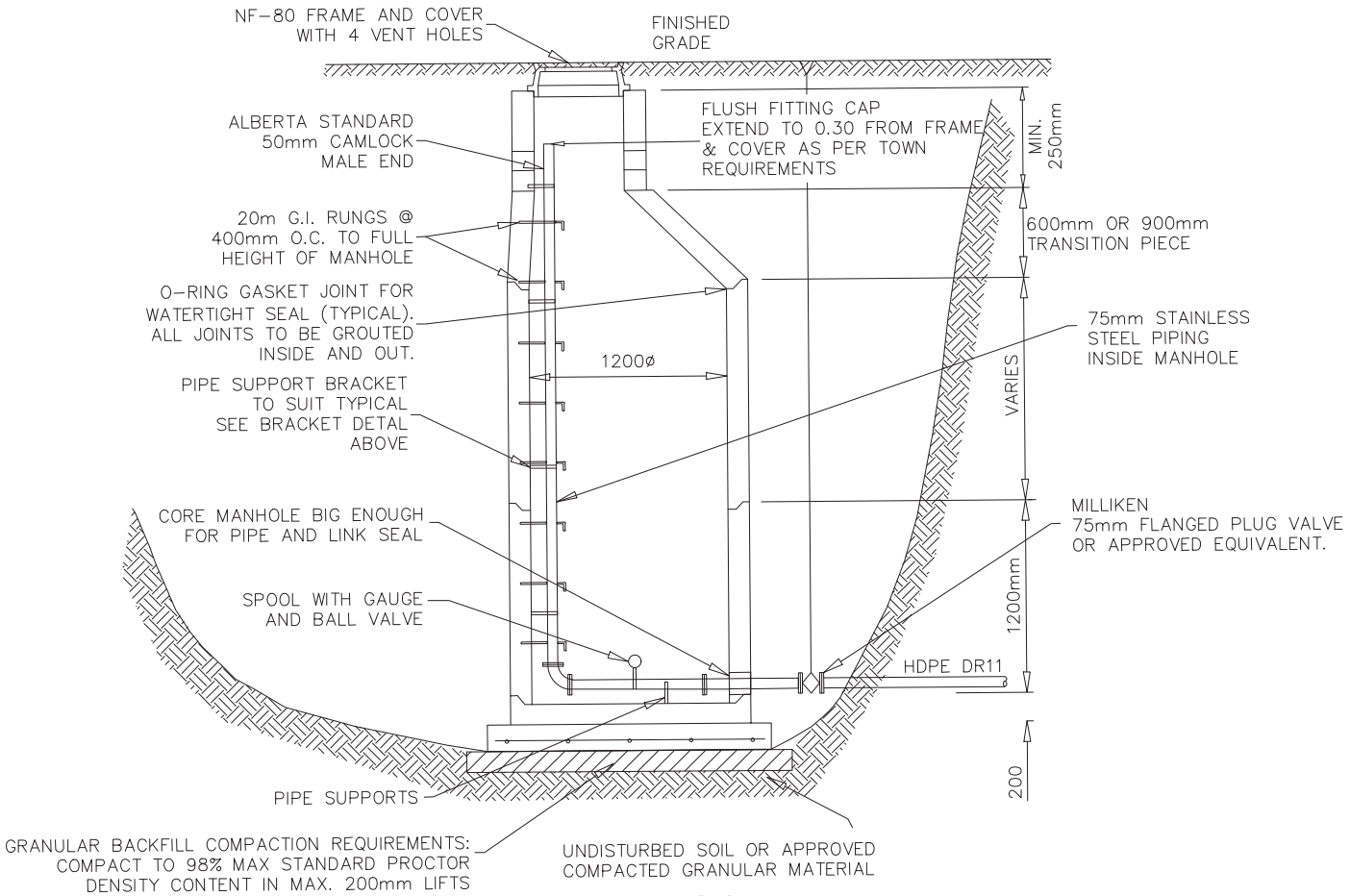


PLAN



PIPE SUPPORT BRACKET DETAIL

NTS



SECTION

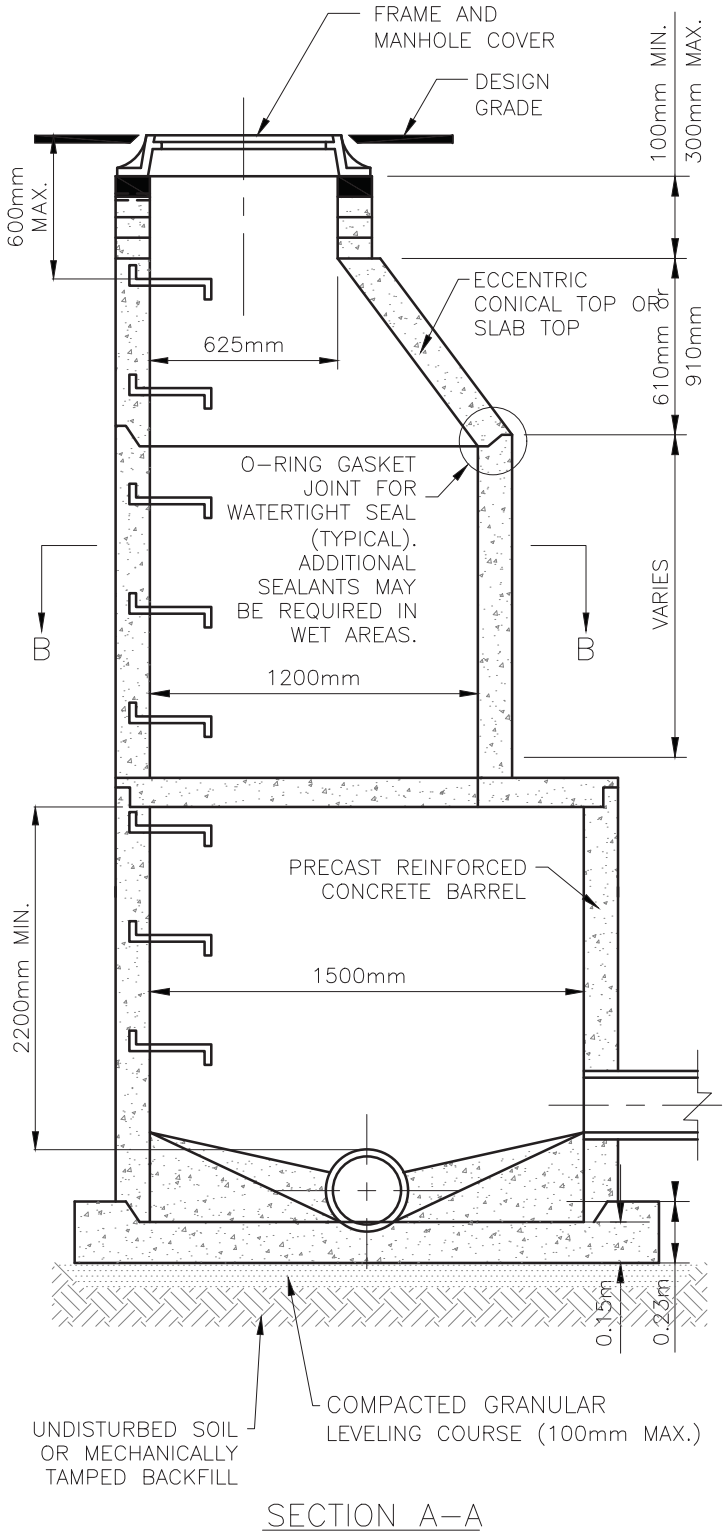
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

SANITARY TERMINAL CLEANOUT MANHOLE

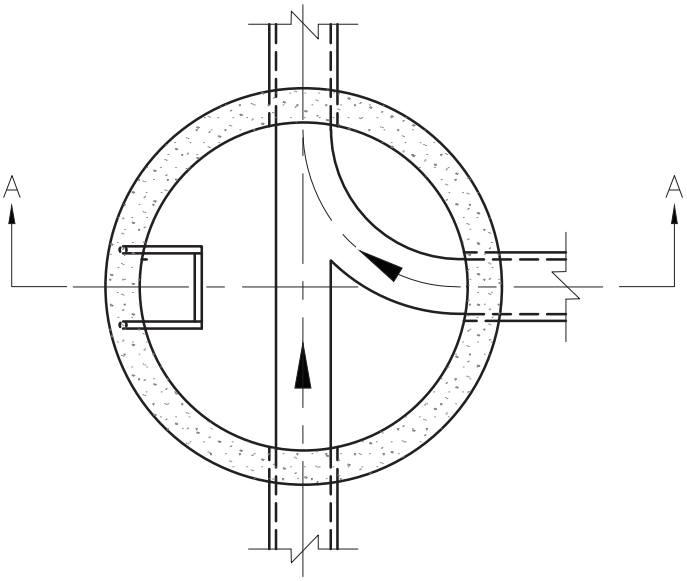
Whitecourt

TOWN OF WHITECOURT

A-10



SECTION A–A



SECTION B–B

NOTES:

1. CAST–IN–PLACE CONCRETE BASE MAY BE USED. CAST–IN–PLACE CONCRETE TO BE TYPE 50 25MPa IN 28 DAYS. CAST–IN–PLACE CONC. BASE TO BE MIN. 1700x1700x200mm THICK WITH 10M BARS AT 300mm SPACING EACH WAY.

2. PRECAST RINGS, CONES AND BARRELS TO MEET CURRENT ASTM C478 STANDARDS. STORM MH JOINTS TO BE SEALED WITH CEMENT MORTAR, OR CONFINED O–RING GASKET. SANITARY MH JOINTS TO BE SEALED WITH A CONFINED O–RING GASKET, ASTM C445. AND MORTOR CONNECTION OF PIPES TO MH TO BE A MANUFACTURED SEAL.

3. INLET AND OUTLET PIPES TO USE INTEGRAL GASKET FOR WATERTIGHT COUPLING BETWEEN MANHOLE AND PVC PIPE. PIPE TO BE MADE FLUSH WITH INSIDE MANHOLE WALL. CHANNELING AND BENCHING TO BE FINISHED TO TROWEL SMOOTHNESS. BENCHING TO BE TYPE 50 WITH MAXIMUM 30MPA COMPRESSIVE STRENGTH.

4. SAFETY STEP SPACING TO BE EQUALLY SPACED AT A MAX. OF 410mm APART TO WITHIN 300mm BELOW COVER AND TO WITHIN 600mm OF THE BASE OR BENCHING. STEPS TO BE EPOXY COATED EXTRUDED 30mm ALUMINUM FORGED OR APPROVED EQUAL.

5. PRECAST INLINE TEE MH's ARE ACCEPTABLE FOR SEWERS 900mmø AND LARGER. CONCRETE BEDDING REQUIRED TO SPRINGLINE OF MANHOLE TEE.

6. NF–39 FRAME AND COVER (No.146) IN LANDSCAPED AREAS.
NF–80 FRAME AND COVER IN HARD SURFACE AREAS.
NF–90 GASKETED FRAME AND COVER AT SAGS.
NF–39 SLOTTED (No.112) ON CBMH IN HARD SURFACED AREAS.
NF–38 SLOTTED (No.112) ON CBMH IN LANDSCAPED AREAS.

7. SLAB TOP TO BE USED WHERE RIM TO INVERT DISTANCE IS LESS THAN 2.5 METERS.

8. SPECIAL BASE DESIGN IS REQUIRED WHERE RIM TO INVERT EXCEEDS 9m.

9. INSTALL VERTICAL SIDE OF CONICAL MANHOLE ON UPSTREAM SIDE.

10. SAFETY PLATFORMS REQUIRED ON ALL MANHOLES OVER 6m DEEP. PLATFORM LOCATED 2m ABOVE PIPE.

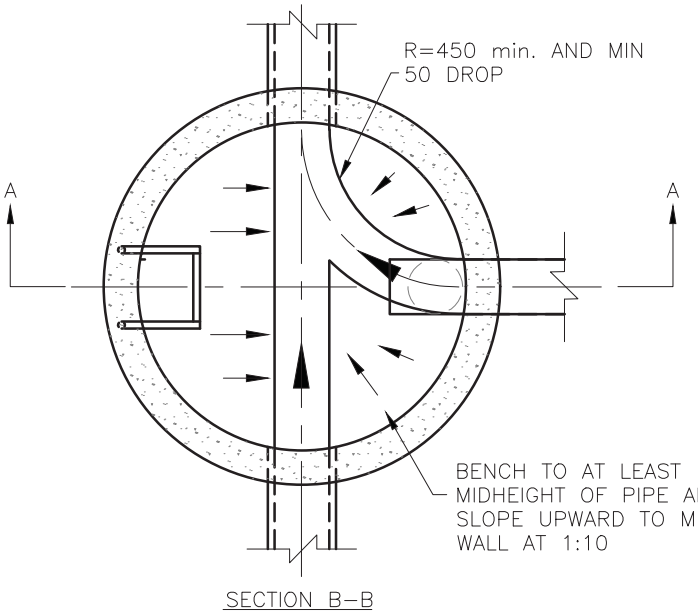
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

OVERSIZED MANHOLE (PIPES 600mm - 900mmØ)

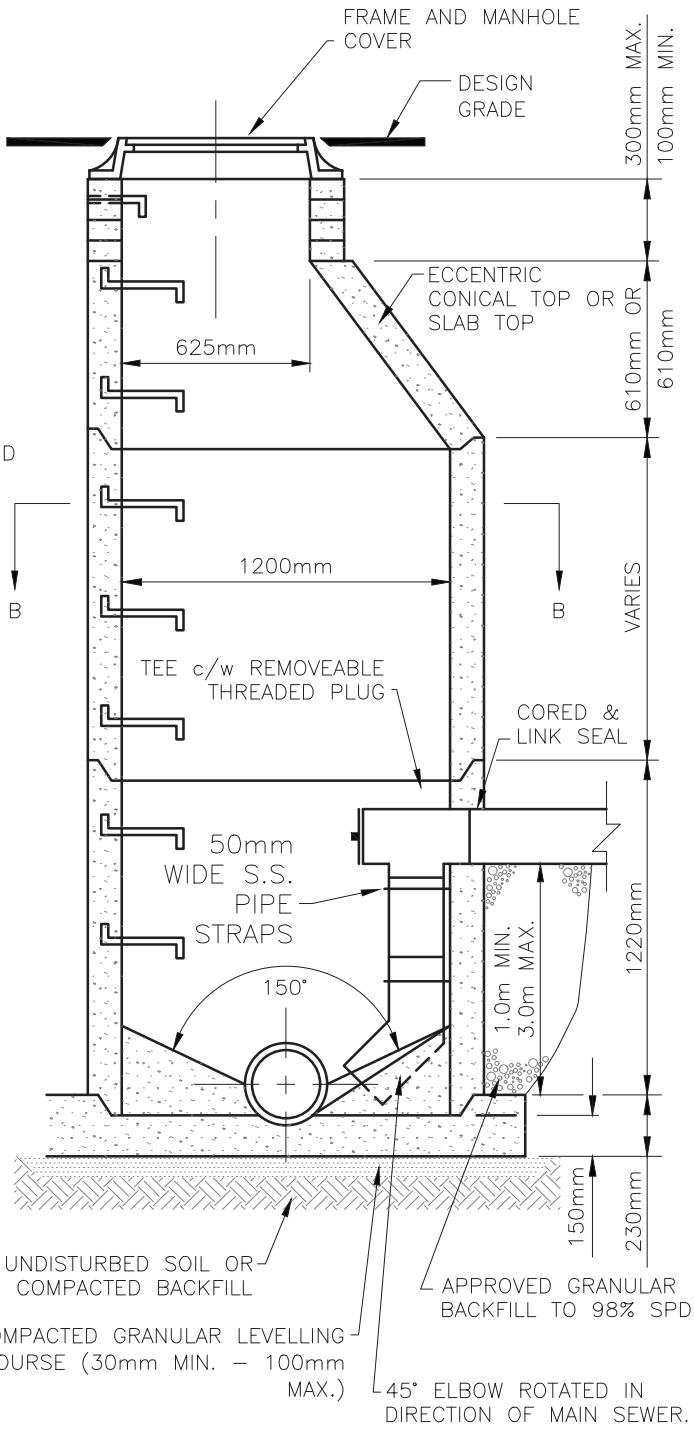
Whitecourt

TOWN OF WHITECOURT

A-11



SECTION B–B



NOTES:

1. PRECAST RINGS, CONES AND BARRELS TO MEET CURRENT ASTM C478 STANDARDS.

2. SANITARY MH JOINTS TO BE SEALED WITH A CONFINED O–RING GASKET,ASTM C445.

3. CONNECTION OF PIPES TO MH TO BE SEALED WITH A MANUFACTURED SEAL

4. OUTLET PIPES TO BE GROUTED FLUSH WITH WALL.

5. CHANNELING AND BENCHING TO BE FINISHED TO TROWEL SMOOTHNESS.

6. SAFETY STEP SPACING TO BE EQUALLY SPACED AT A MAX. OF 410mm APART TO WITHIN 300mm BELOW COVER AND TO WITHIN 600mm OF THE BASE OR BENCHING.

7. COMPACT BACKFILL AROUND MH TO A MIN. OF 95% STANDARD PROCTOR DENSITY.

8. PROVIDE CONCRETE SUPPORT FOR ELBOW AND BENCH TO MIDHEIGHT FORMING SMOOTH FLOW CHANNEL INTO MAIN SEWER.

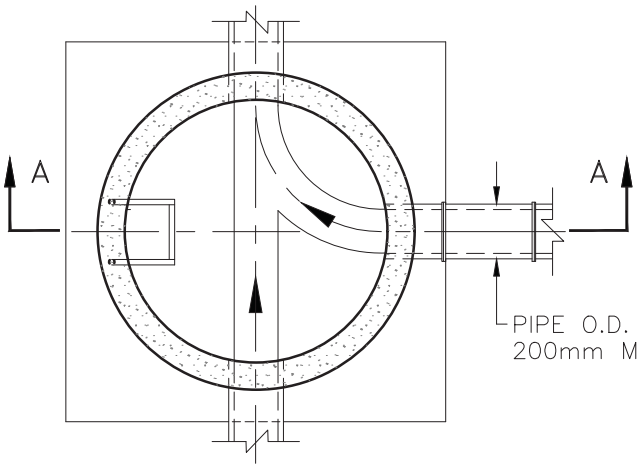
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

INTERNAL DROP MANHOLE

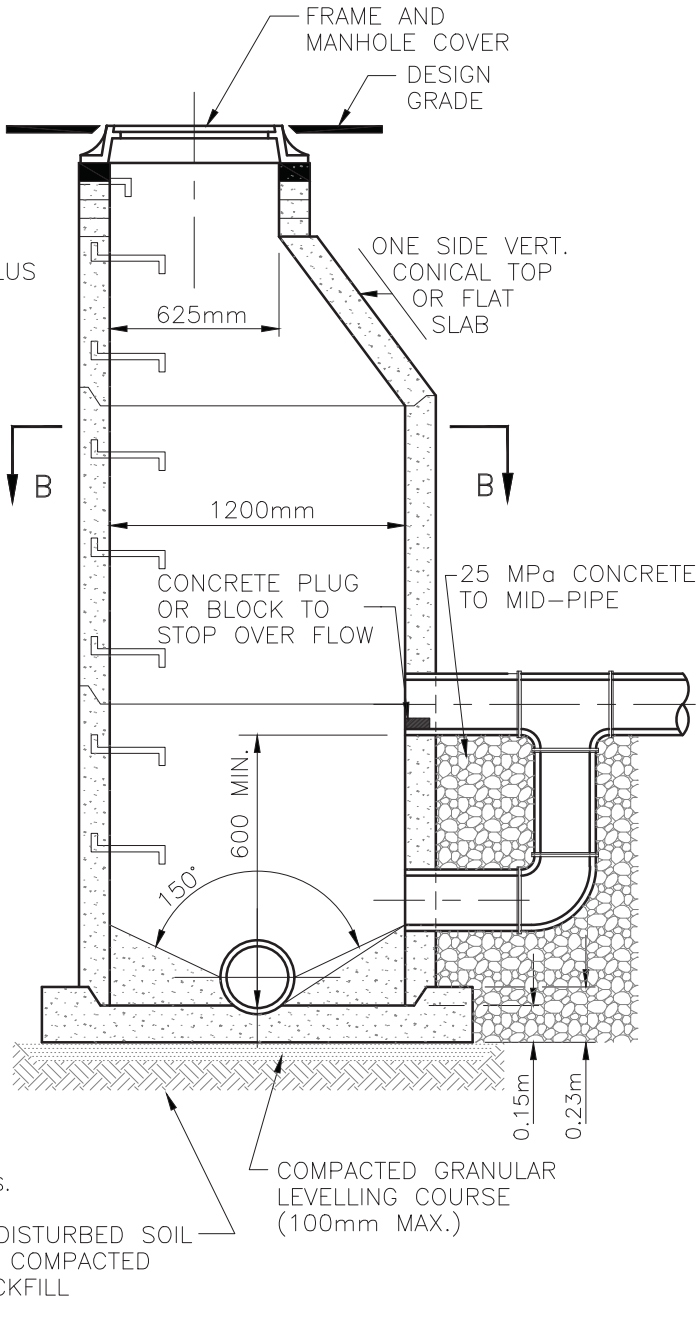
Whitecourt

TOWN OF WHITECOURT

A-12



SECTION B – B



SECTION A – A

NOTES:

1. CAST–IN–PLACE CONCRETE BASE MAY BE USED. CAST–IN–PLACE CONCRETE TO BE TYPE 50 25MPa IN 28 DAYS. CAST–IN–PLACE CONC. BASE TO BE MIN. 1700x1700x200mm THICK WITH 10M BARS AT 300mm SPACING EACH WAY.
2. PRECAST RINGS, CONES AND BARRELS TO MEET CURRENT ASTM C478 STANDARDS. STORM MH JOINTS TO BE SEALED WITH CEMENT MORTAR, OR CONFINED O–RING GASKET. SANITARY MH JOINTS TO BE SEALED WITH A CONFINED O–RING GASKET, ASTM C445. AND MORTOR CONNECTION OF PIPES TO MH TO BE A MANUFACTURED SEAL
3. INLET AND OUTLET PIPES TO BE GROUTED FLUSH WITH WALL. CHANNELING AND BENCHING TO BE FINISHED TO TROWEL SMOOTHNESS.
4. SAFETY STEP SPACING TO BE EQUALLY SPACED AT A MAX. OF 410mm APART TO WITHIN 300mm BELOW COVER AND TO WITHIN 600mm OF THE BASE OR BENCHING. STEPS TO BE EPOXY COATED EXTRUDED ALUMINUM OR GALVANIZED METAL.
5. PRECAST INLINE TEE MH's ARE ACCEPTABLE FOR SEWERS 900mm ø AND LARGER. CONCRETE BEDDING REQUIRED TO SPRINGLINE OF MANHOLE TEE.
6. NF–39 FRAME AND COVER (No.146) IN LANDSCAPED AREAS. NF–80 FRAME AND COVER IN HARD SURFACE AREAS. NF–90 GASKETED FRAME AND COVER AT SAGS.
7. SLAB TOP TO BE USED WHERE RIM TO INVERT DISTANCE IS LESS THAN 2.5 METRES.

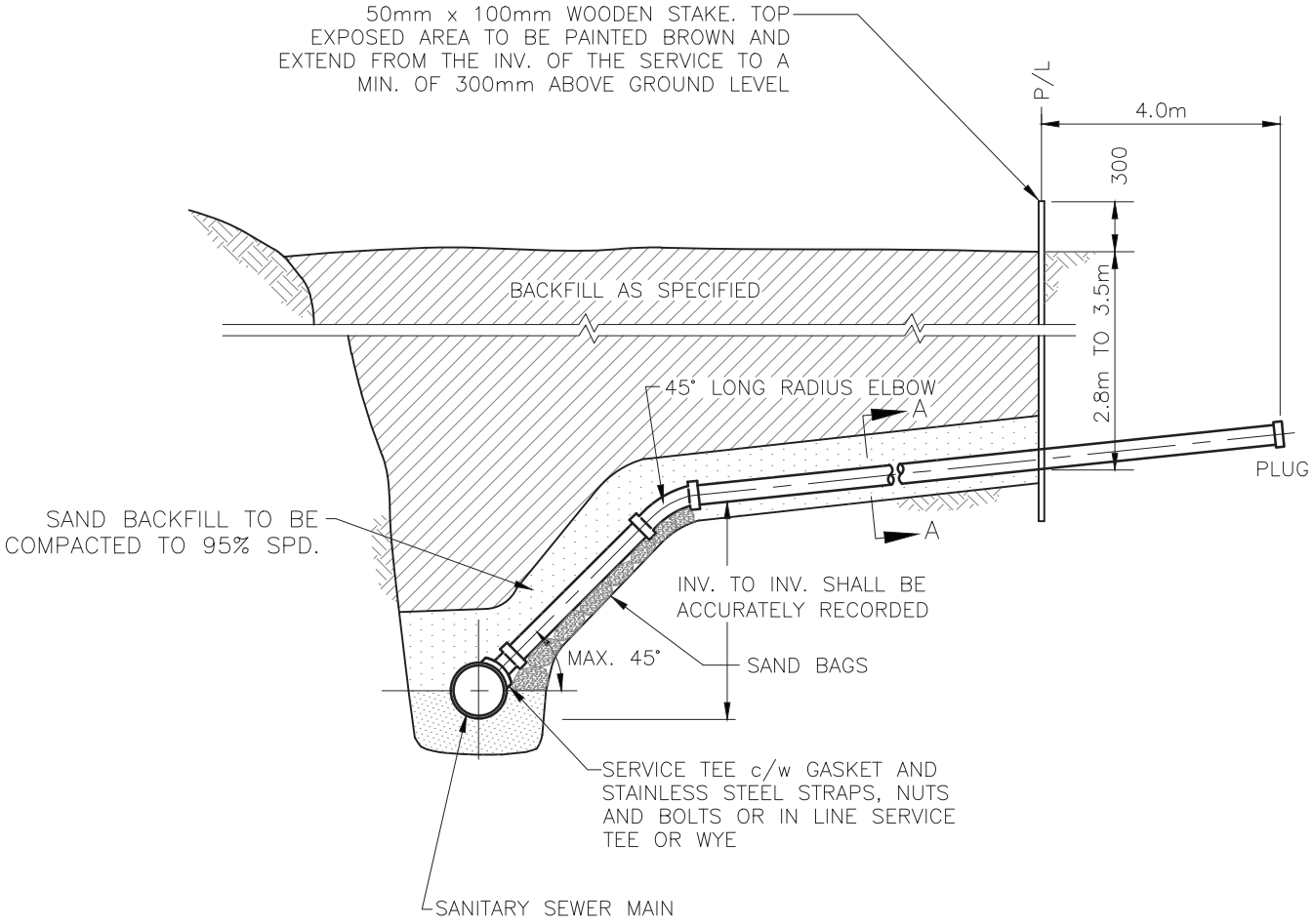
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

EXTERNAL DROP MANHOLE

Whitecourt

TOWN OF WHITECOURT

A-13



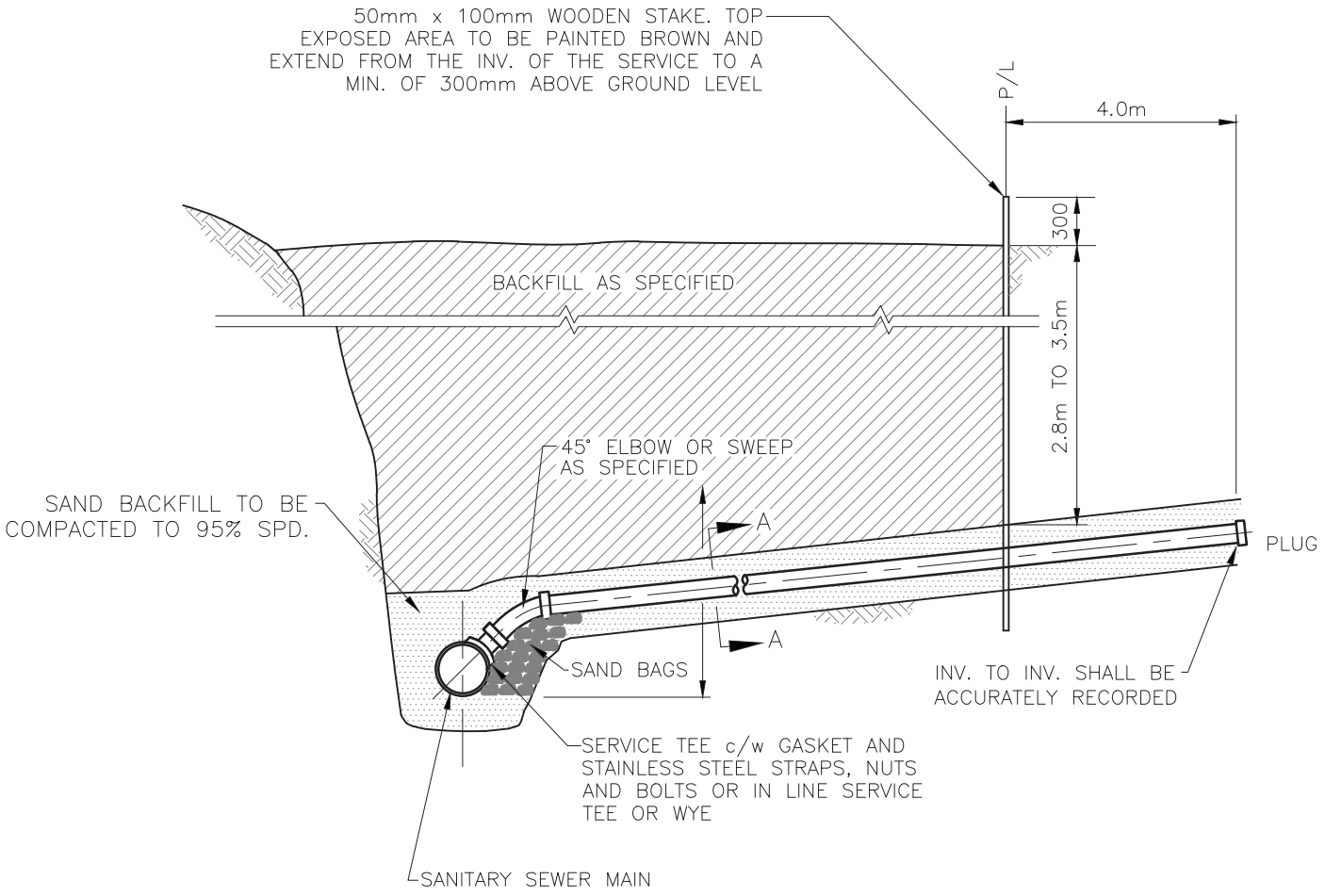
NOTES:

1. MIN. SLOPE IS 1% FOR 150mm SERVICE AND 2% FOR 100mm SERVICE.
2. SERVICE CONNECTIONS SHALL BE MINIMUM 100mm DIA. SDR 35 PVC.
3. TOWN TO INSPECT ALL RISER INSTALLATIONS PRIOR TO BACKFILLING.
4. SEE ALSO WATER AND SEWER SERVICE LINE LOCATION DETAIL SHEET.
5. SERVICE CONNECTIONS TO BE MADE BETWEEN THE 10:00 AND 2:00 POSITION.

SCALE: N.T.S.	SANITARY DEEP SERVICE CONNECTION RISER TYPE	Whitecourt
DATE: DECEMBER 2019		
APPD:		

TOWN OF WHITECOURT

A-14



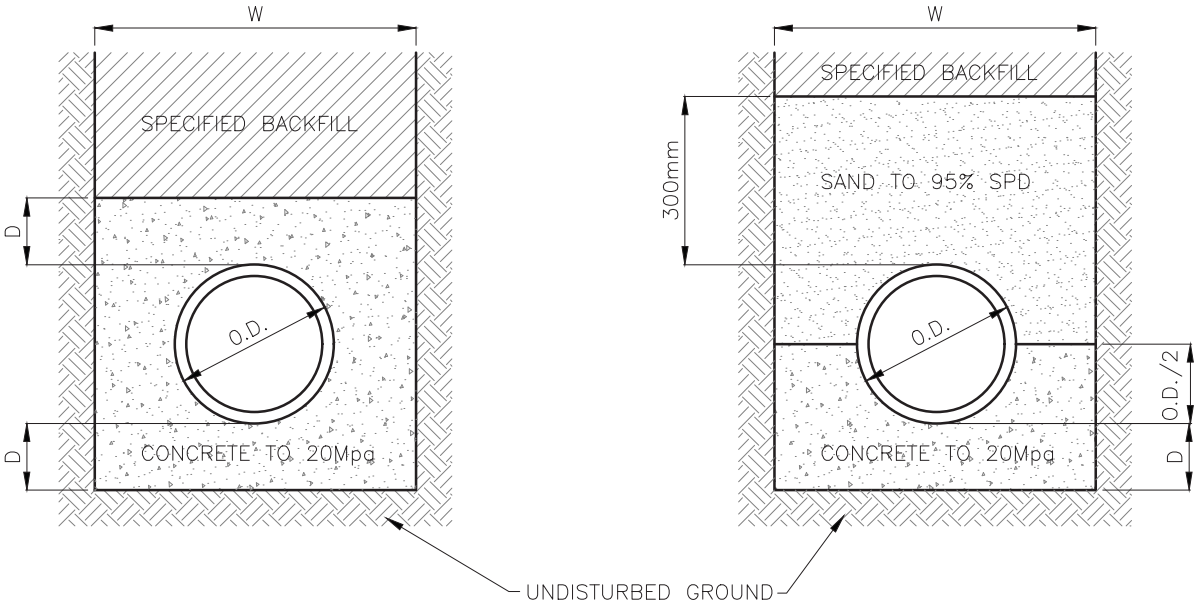
NOTES:

1. MIN. SLOPE IS 1% FOR 150mm SERVICE AND 2% FOR 100mm SERVICE.
2. SERVICE CONNECTIONS SHALL BE MINIMUM 100mm DIA. SDR 35 PVC.
3. TOWN TO INSPECT ALL RISER INSTALLATIONS PRIOR TO BACKFILLING.
4. SEE ALSO WATER AND SEWER SERVICE LINE LOCATION DETAIL SHEET.
5. SERVICE CONNECTIONS TO BE MADE BETWEEN THE 10:00 AND 2:00 POSITION.

SCALE: N.T.S.	SANITARY SERVICE CONNECTION NON-RISER TYPE	Whitecourt
DATE: DECEMBER 2019		
APPD:		

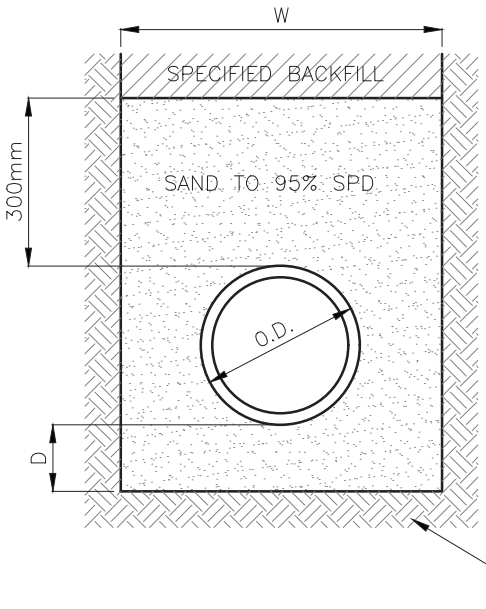
TOWN OF WHITECOURT
DEEP UTILITY

A-15



CLASS A

CLASS A1



CLASS B

PIPE SIZE	D MIN.
675mmø OR SMALLER	75mm
750mmø TO 1500mmø	100mm
1650mmø AND LARGER	150mm
W MIN.	2xO.D.

LEGEND:

D = DEPTH OF BEDDING MATERIAL BELOW PIPE
W = TRENCH WIDTH
O.D. = OUTSIDE DIAMETER OF PIPE

NOTE: ADD 100mm TO D IN ROCK EXCAVATION

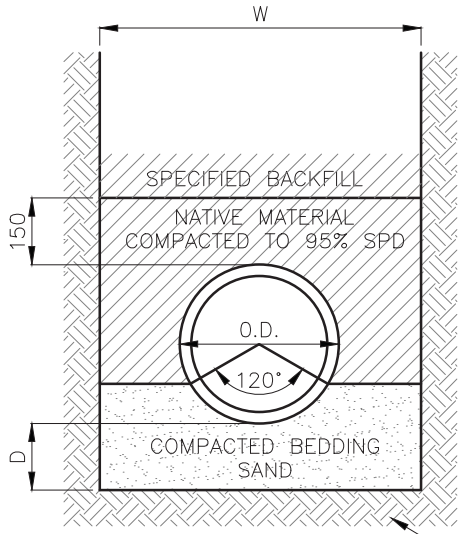
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

PIPE ZONE BEDDING DETAILS
(CLASS A, A1, B)

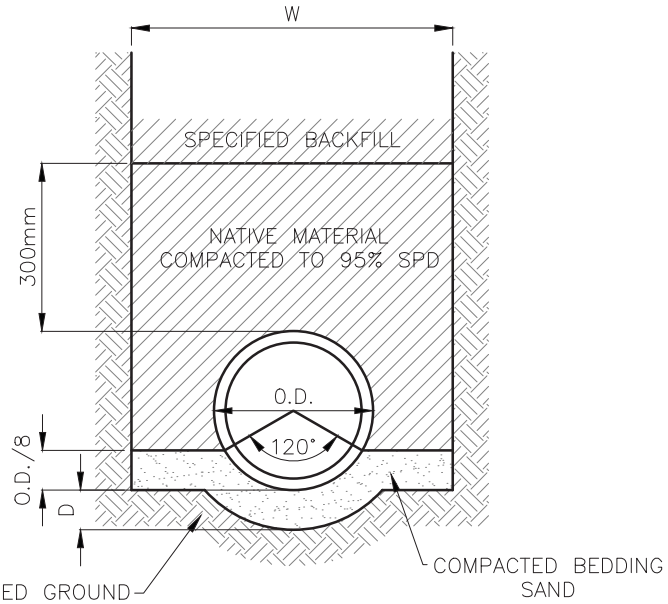
Whitecourt

TOWN OF WHITECOURT
DEEP UTILITY

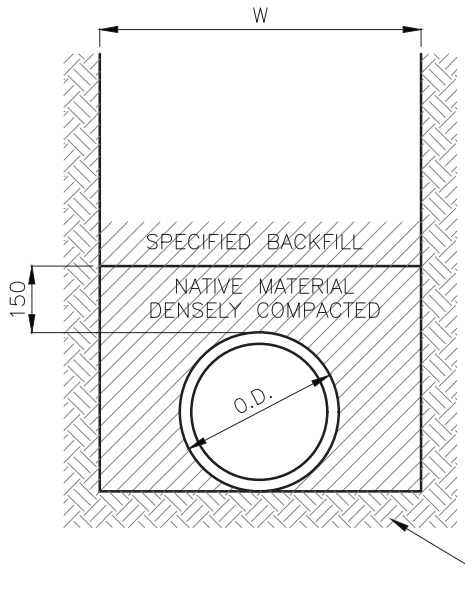
A-16



CLASS C



CLASS C1



CLASS D

PIPE SIZE	D MIN.
675mmø OR SMALLER	75mm
750mmø TO 1500mmø	100mm
1650mmø AND LARGER	150mm
W MIN.	2xO.D.

LEGEND:

D = DEPTH OF BEDDING MATERIAL BELOW PIPE
W = TRENCH WIDTH
O.D. = OUTSIDE DIAMETER OF PIPE

NOTE: ADD 100mm TO D IN ROCK EXCAVATION

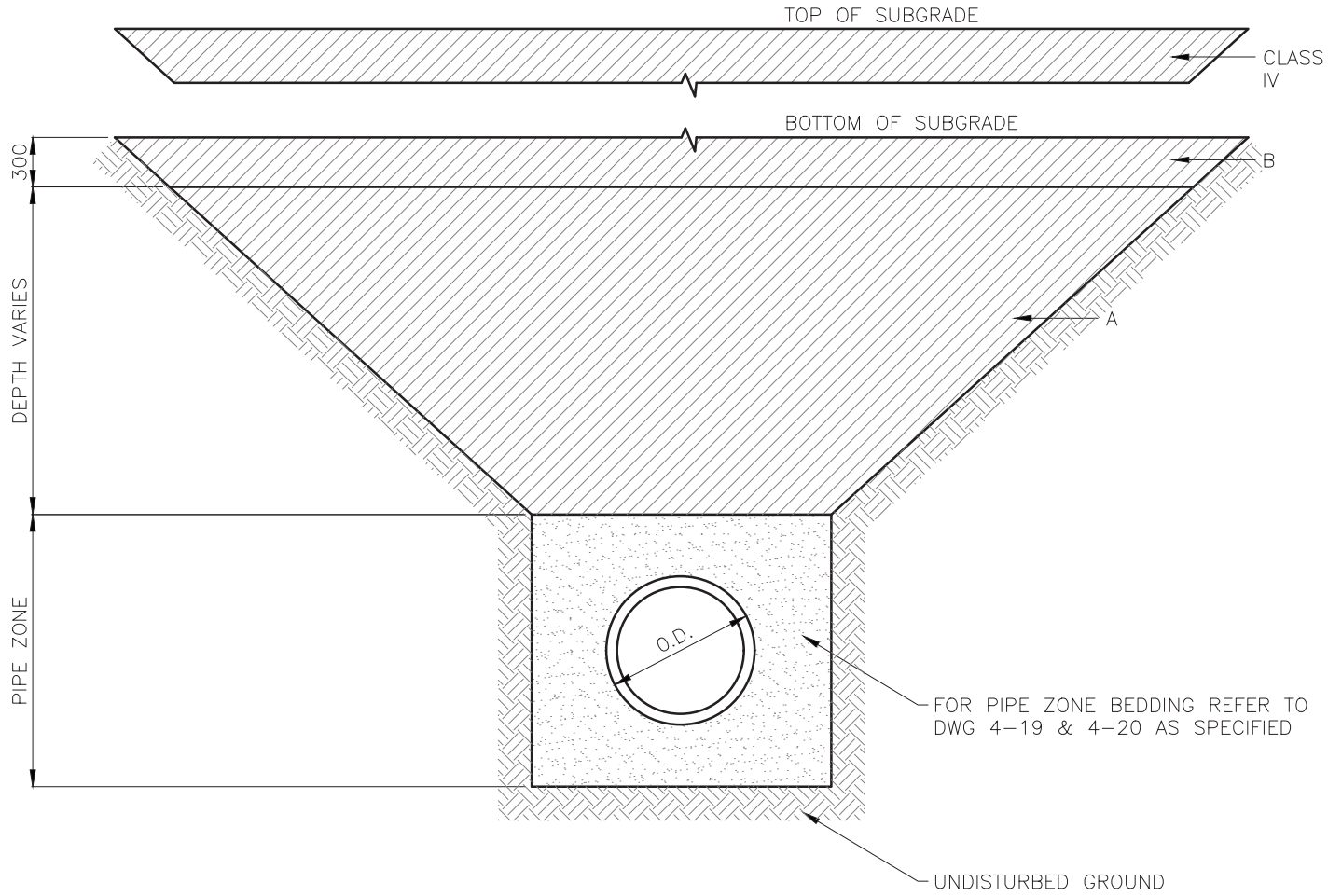
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

PIPE ZONE BEDDING DETAILS
(CLASS C, C1, D)

Whitecourt

TOWN OF WHITECOURT
DEEP UTILITY

A-17



CLASS A

NOTES:

1. ALL TRENCH WALLS SHALL BE SLOPED OR SHORED IN ACCORDANCE WITH THE OCCUPATIONAL HEALTH AND SAFETY REGULATIONS CURRENT STANDARD.

2. SUBGRADE TO SPECIFIED IN ROADWAY STRUCTURE DESIGN PREPARED BY A GEOTECHNICAL ENGINEERING CONSULTANT.

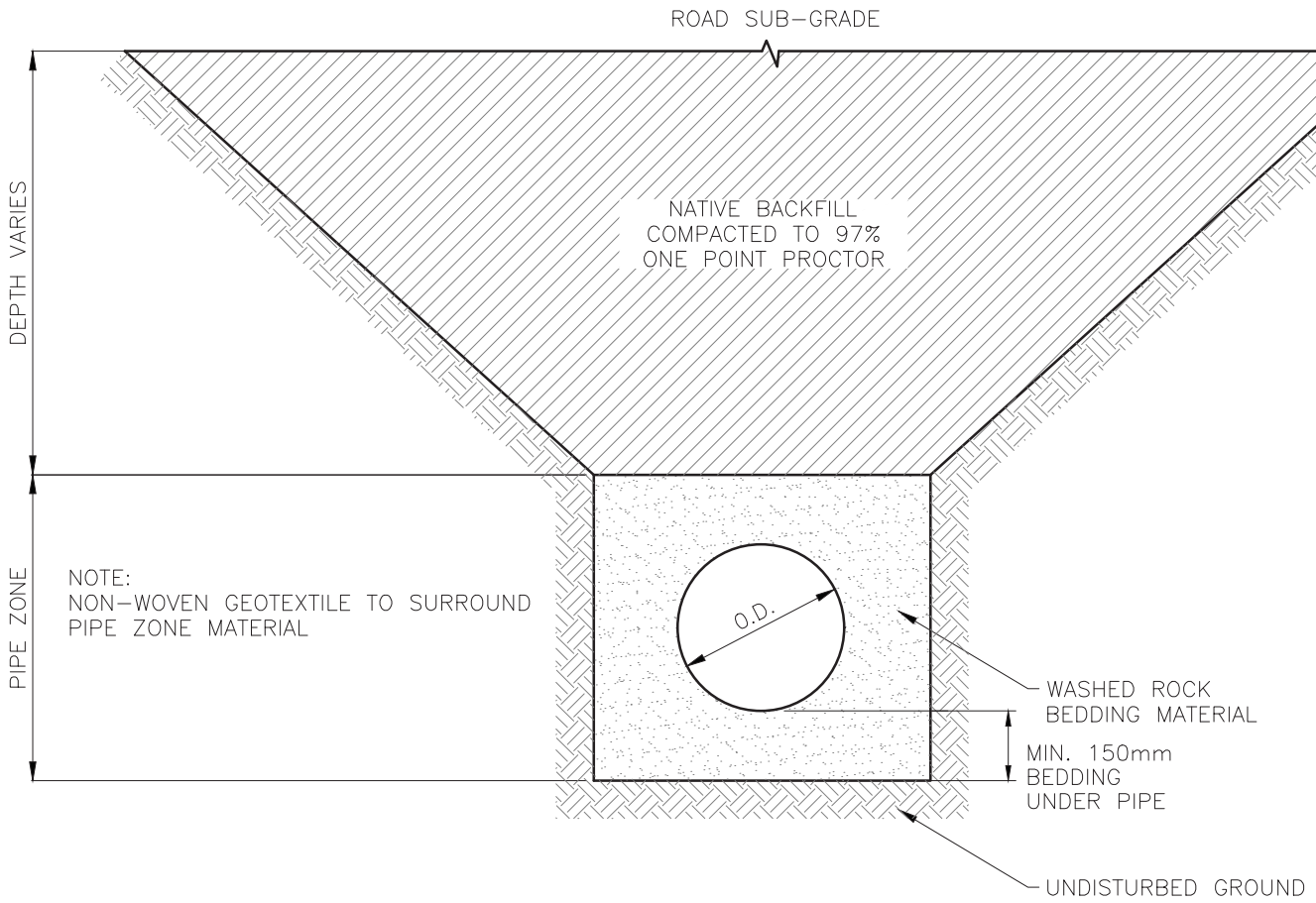
3. SURFACE DRAINAGE TO BE RECTIFIED FOR IMMEDIATE AREA IF CLASS IV BACKFILL IS USED.

CLASS	A			B		
	MATERIAL	MAX. LIFT	% SPD	MATERIAL	MAX. LIFT	% SPD
I	GRANULAR	200	97	GRANULAR	150	100
II	NATIVE	200	97	NATIVE	150	100
III	NATIVE	200	95	NATIVE	200	95
IV	NATIVE	300	95	NATIVE	300	95

SCALE: N.T.S.	TRENCH BACKFILL NEW CONSTRUCTION	Whitecourt
DATE: DECEMBER 2019		
APPD:		

TOWN OF WHITECOURT
DEEP UTILITY

A-18



NOTES:

1. ALL TRENCH WALLS SHALL BE SLOPED OR SHORED IN ACCORDANCE WITH THE OCCUPATIONAL HEALTH AND SAFETY REGULATIONS CURRENT STANDARD.

2. SUBGRADE TO SPECIFIED IN ROADWAY STRUCTURE DESIGN PREPARED BY A GEOTECHNICAL ENGINEERING CONSULTANT.

3. SURFACE DRAINAGE TO BE RECTIFIED FOR IMMEDIATE AREA IF CLASS IV BACKFILL IS USED.

PIPE SIZE	TRENCH WIDTH	
	MAXIMUM	MINIMUM
UP TO 525mm dia.	1050mm	O.D.+200mm

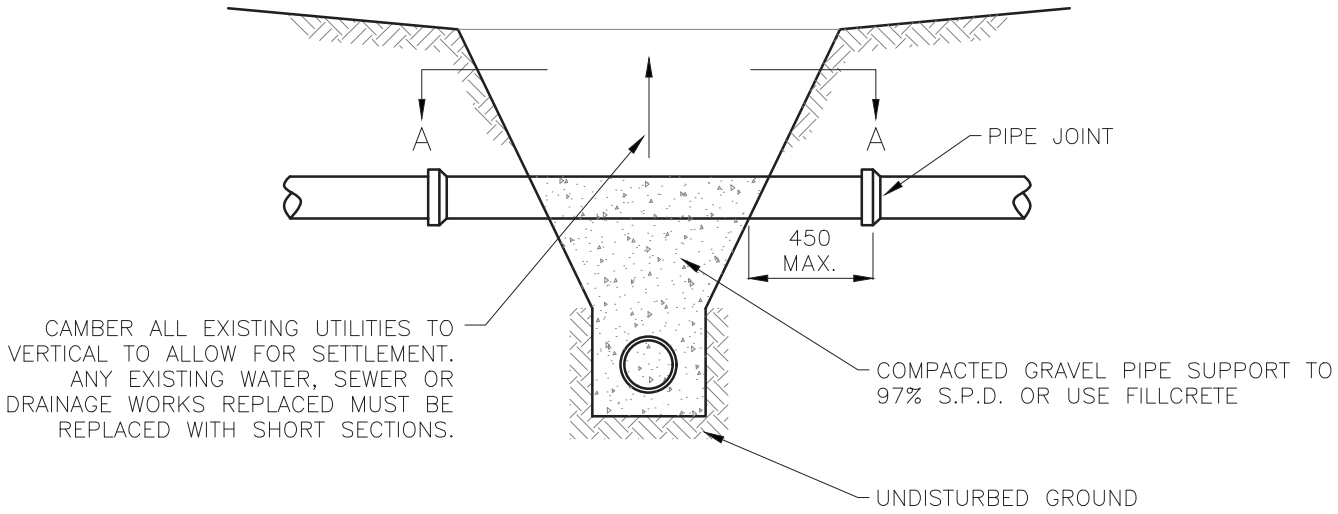
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

TRENCH BACKFILL FOR NEW CONSTRUCTION IN HIGH WATER TABLES

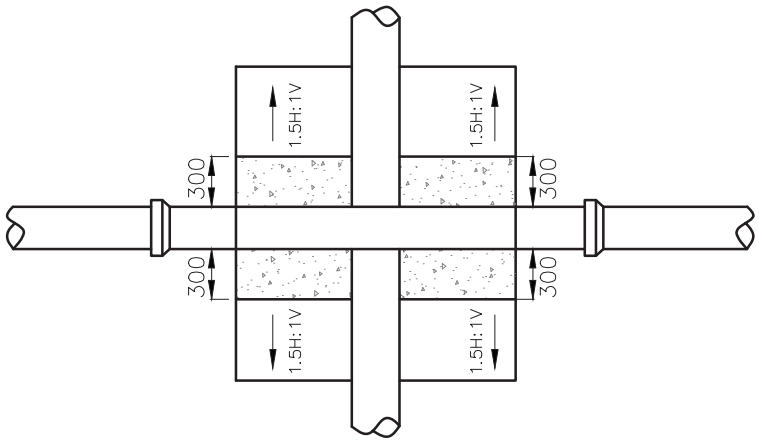
Whitecourt

TOWN OF WHITECOURT

A-19



SECTION VIEW



SECTION A–A

SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

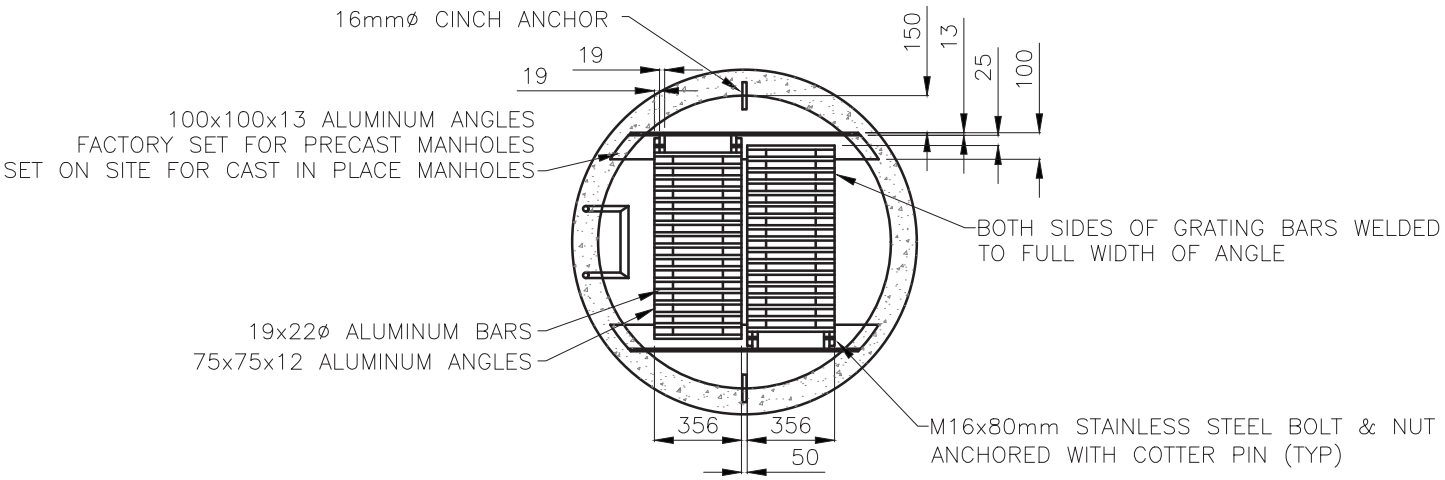
PIPE SUPPORT DETAIL

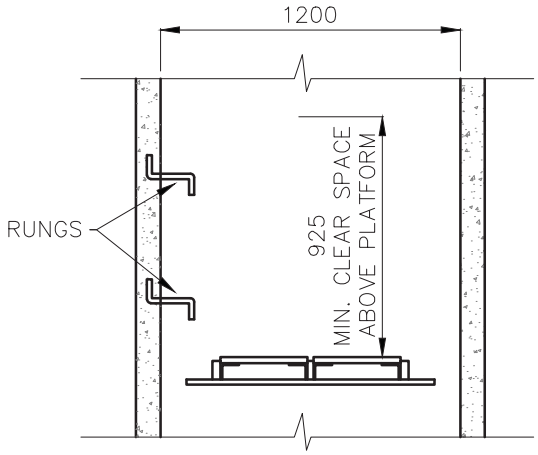
Whitecourt

TOWN OF WHITECOURT

SANITARY AND STORM SEWER

A-20





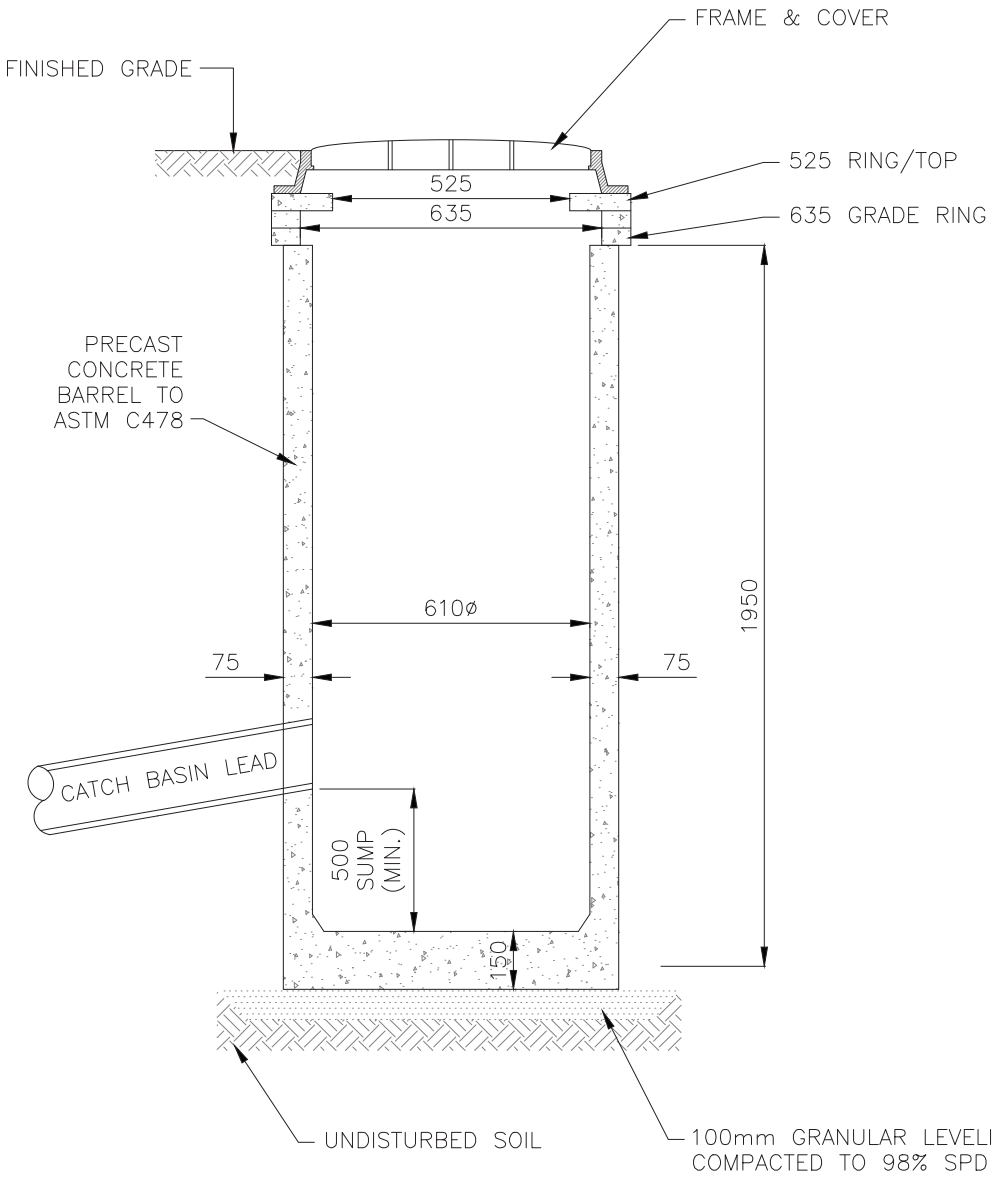
NOTES:

1. PLATFORMS TO BE INSTALLED IN ALL MANHOLES OVER 6.0m IN DEPTH (MEASURED FROM FINISHED GRADE TO INVERT).

SCALE: N.T.S.	SAFETY PLATFORM	Whitecourt
DATE: DECEMBER 2019		
APPD:		

TOWN OF WHITECOURT

A-21



NOTES:

1. CAST–IN–PLACE CONC. BASES MAY BE USED. CAST–IN–PLACE CONCRETE TO BY TYPE 50 CEMENT, 25MPA @ 28 DAYS. CONC. BASE TO BE MIN. 150mm THICK AND CONSTRUCTED ON UNDISTURBED SOIL.

2. RINGS, CONES AND BARRELS TO MEET CURRENT ASTM C478 SPECIFICATIONS.

3. JOINTS TO BE SEALED WITH CEMENT MORTAR OR CONFINED O–RING GASKET.

4. PIPES CONNECTION TO BARREL TO BE SEALED WITH CEMENT MORTAR OR CONFINED O–RING GASKET.

5. PIPES TO BE FLUSH WITH INSIDE OF BARREL WALL.

6. MIN. 1.20m COVER ON CATCH BASIN LEAD.

7. CASTINGS SHALL BE TRUE TO PATTERN AND FREE FROM CRACKS, GAS HOLES, FLAWS AND EXCESSIVE SHRINKAGE.

8. CASTING SURFACES SHALL BE FREE FROM BURNT ON SAND AND SHALL BE SMOOTH.

9. CAST ON PIECES SUCH AS RUNNERS AND FINS SHALL BE REMOVED.

10. CASTING SHALL NOT ROCK AFTER INSTALLATION.

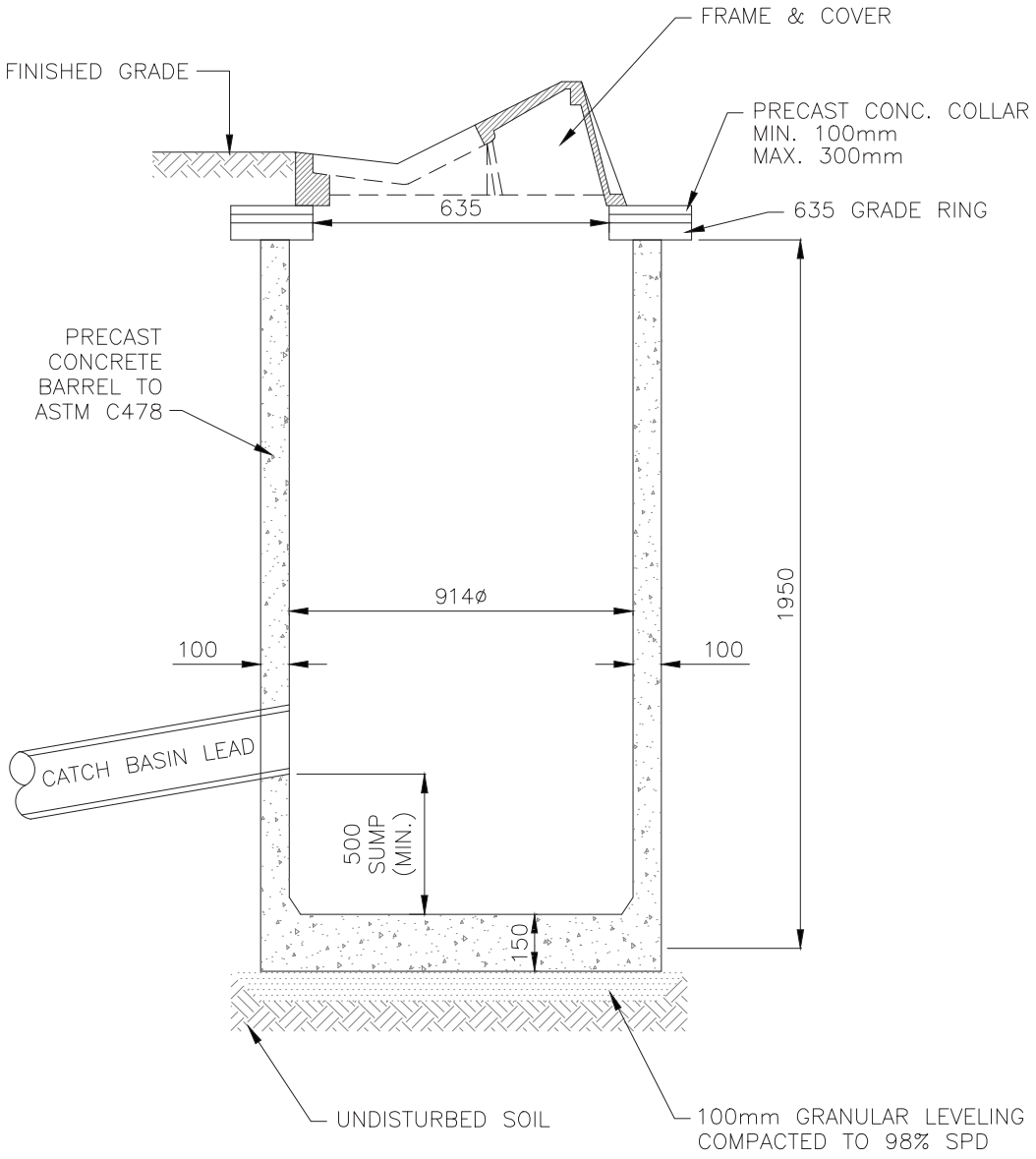
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

600mmØ CATCH BASIN (F38 FRAME & COVER)

Whitecourt

TOWN OF WHITECOURT

A-22



NOTES:

1. CAST–IN–PLACE CONC. BASES MAY BE USED. CAST–IN–PLACE CONCRETE TO BY TYPE 50 CEMENT, 25MPA @ 28 DAYS. CONC. BASE TO BE MIN. 150mm THICK AND CONSTRUCTED ON UNDISTURBED SOIL.

2. RINGS, CONES AND BARRELS TO MEET CURRENT ASTM C478 SPECIFICATIONS.

3. JOINTS TO BE SEALED WITH CEMENT MORTAR OR CONFINED O–RING GASKET.

4. PIPES CONNECTION TO BARREL TO BE SEALED WITH CEMENT MORTAR OR CONFINED O–RING GASKET.

5. PIPES TO BE FLUSH WITH INSIDE OF BARREL WALL.

6. MIN. 1.20m COVER ON CATCH BASIN LEAD.

7. CASTINGS SHALL BE TRUE TO PATTERN AND FREE FROM CRACKS, GAS HOLES, FLAWS AND EXCESSIVE SHRINKAGE.

8. CASTING SURFACES SHALL BE FREE FROM BURNT ON SAND AND SHALL BE SMOOTH.

9. CAST ON PIECES SUCH AS RUNNERS AND FINS SHALL BE REMOVED.

10. CASTING SHALL NOT ROCK AFTER INSTALLATION.

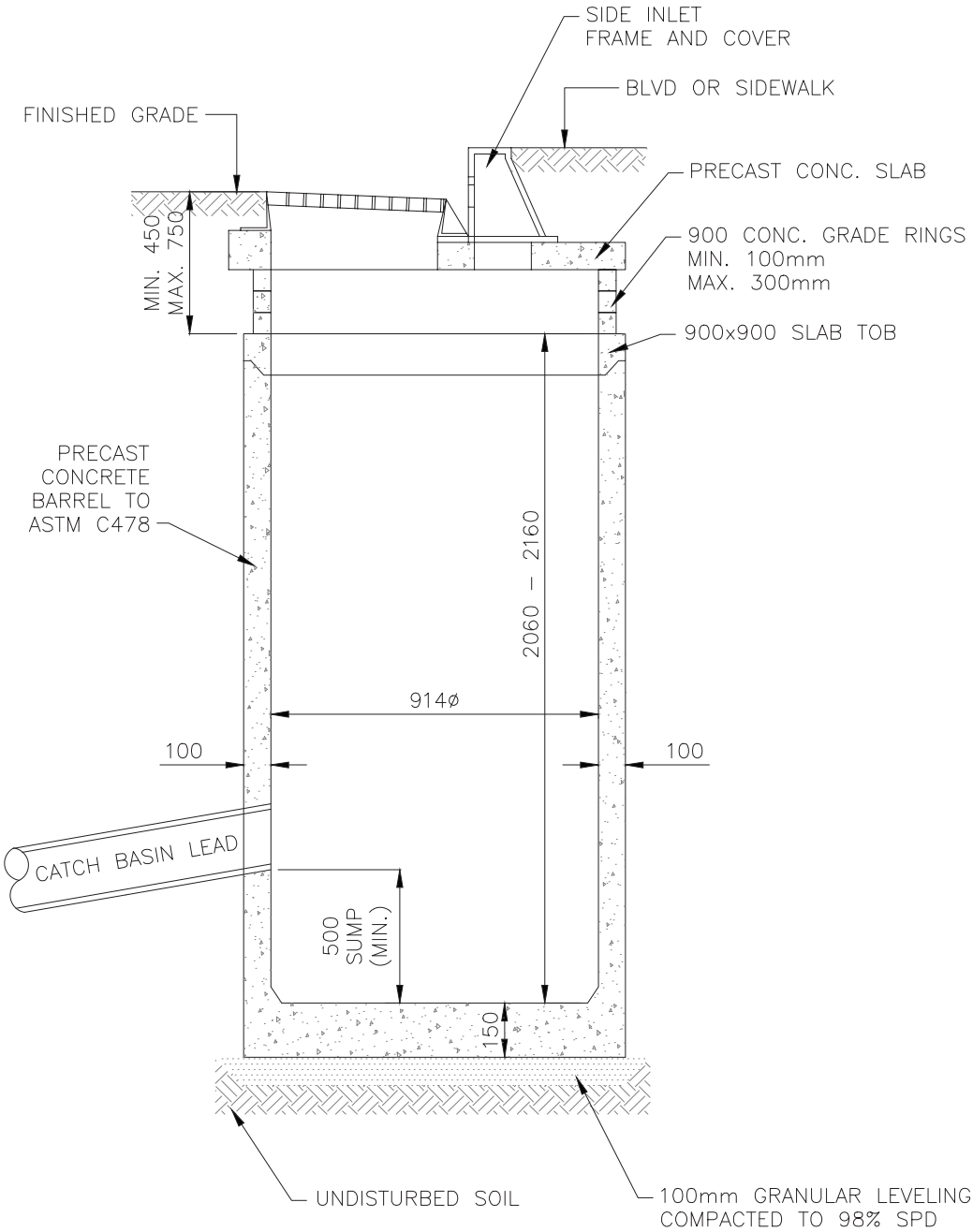
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

900mmØ CATCH BASIN (F33 FRAME & COVER)

Whitecourt

TOWN OF WHITECOURT

A-23



NOTES:

1. CAST–IN–PLACE CONC. BASES MAY BE USED. CAST–IN–PLACE CONCRETE TO BY TYPE 50 CEMENT, 25MPA @ 28 DAYS. CONC. BASE TO BE MIN. 150mm THICK AND CONSTRUCTED ON UNDISTURBED SOIL.

2. RINGS, CONES AND BARRELS TO MEET CURRENT ASTM C478 SPECIFICATIONS.

3. JOINTS TO BE SEALED WITH CEMENT MORTAR OR CONFINED O–RING GASKET.

4. PIPES CONNECTION TO BARREL TO BE SEALED WITH CEMENT MORTAR OR CONFINED O–RING GASKET.

5. PIPES TO BE FLUSH WITH INSIDE OF BARREL WALL.

6. MIN. 1.20m COVER ON CATCH BASIN LEAD.

7. CASTINGS SHALL BE TRUE TO PATTERN AND FREE FROM CRACKS, GAS HOLES, FLAWS AND EXCESSIVE SHRINKAGE.

8. CASTING SURFACES SHALL BE FREE FROM BURNT ON SAND AND SHALL BE SMOOTH.

9. CAST ON PIECES SUCH AS RUNNERS AND FINS SHALL BE REMOVED.

10. CASTING SHALL NOT ROCK AFTER INSTALLATION.

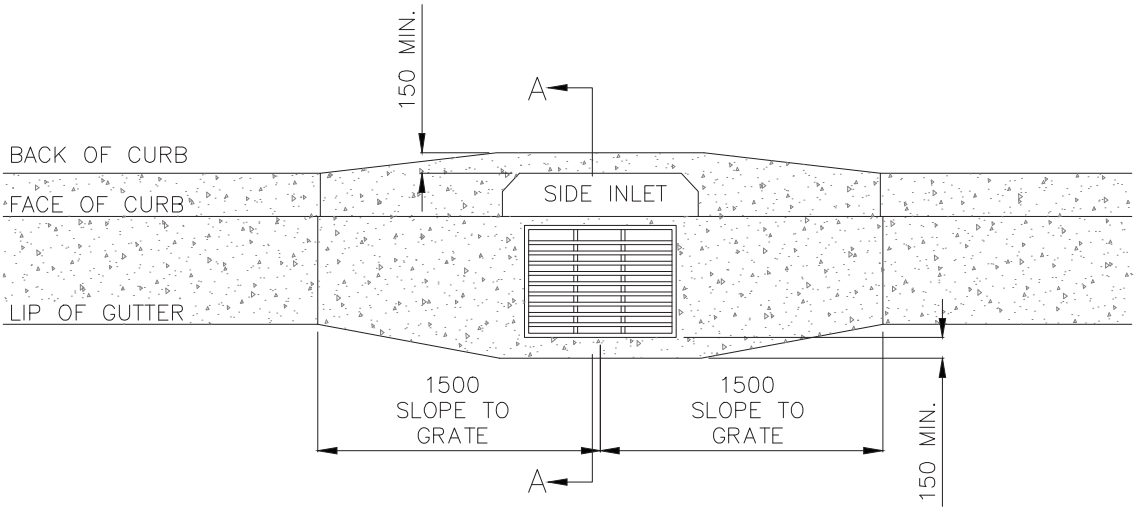
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

900mmØ CATCH BASIN (F51 SIDE INLET FRAME & COVER)

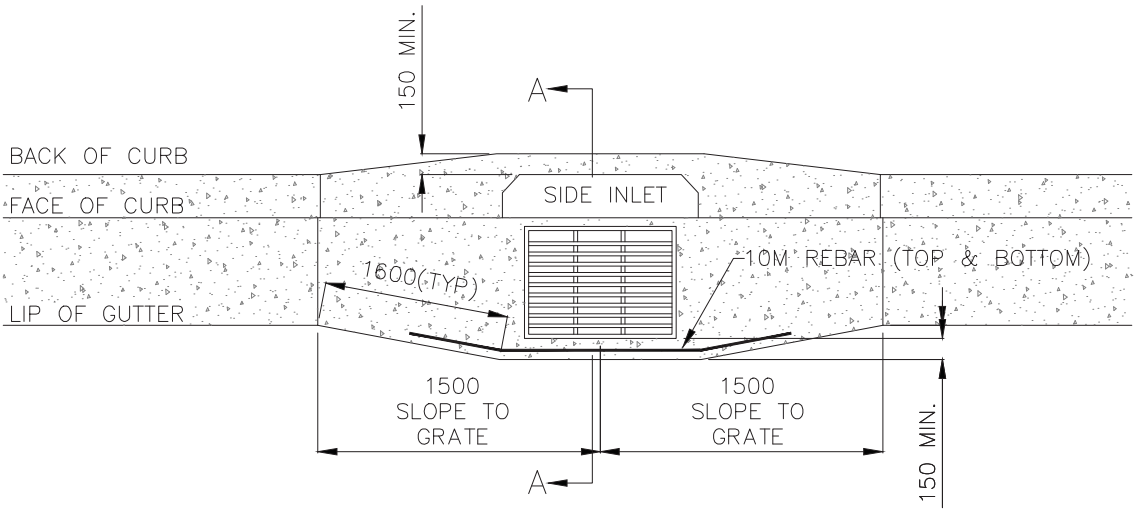
Whitecourt

TOWN OF WHITECOURT

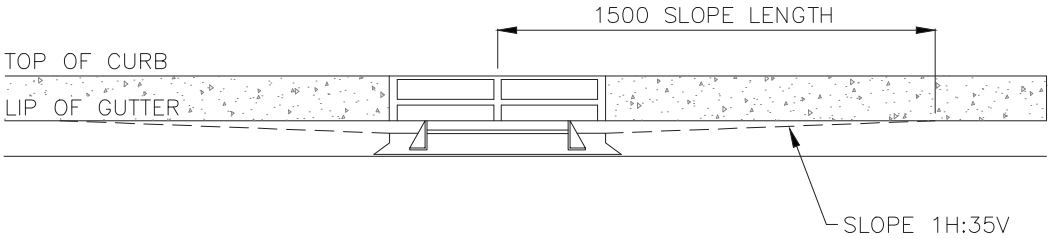
A-24



F51 CATCH BASIN CURB TREATMENT (500 GUTTER) – PLAN VIEW



F51 CATCH BASIN CURB TREATMENT (250 GUTTER) – PLAN VIEW



SECTION A–A

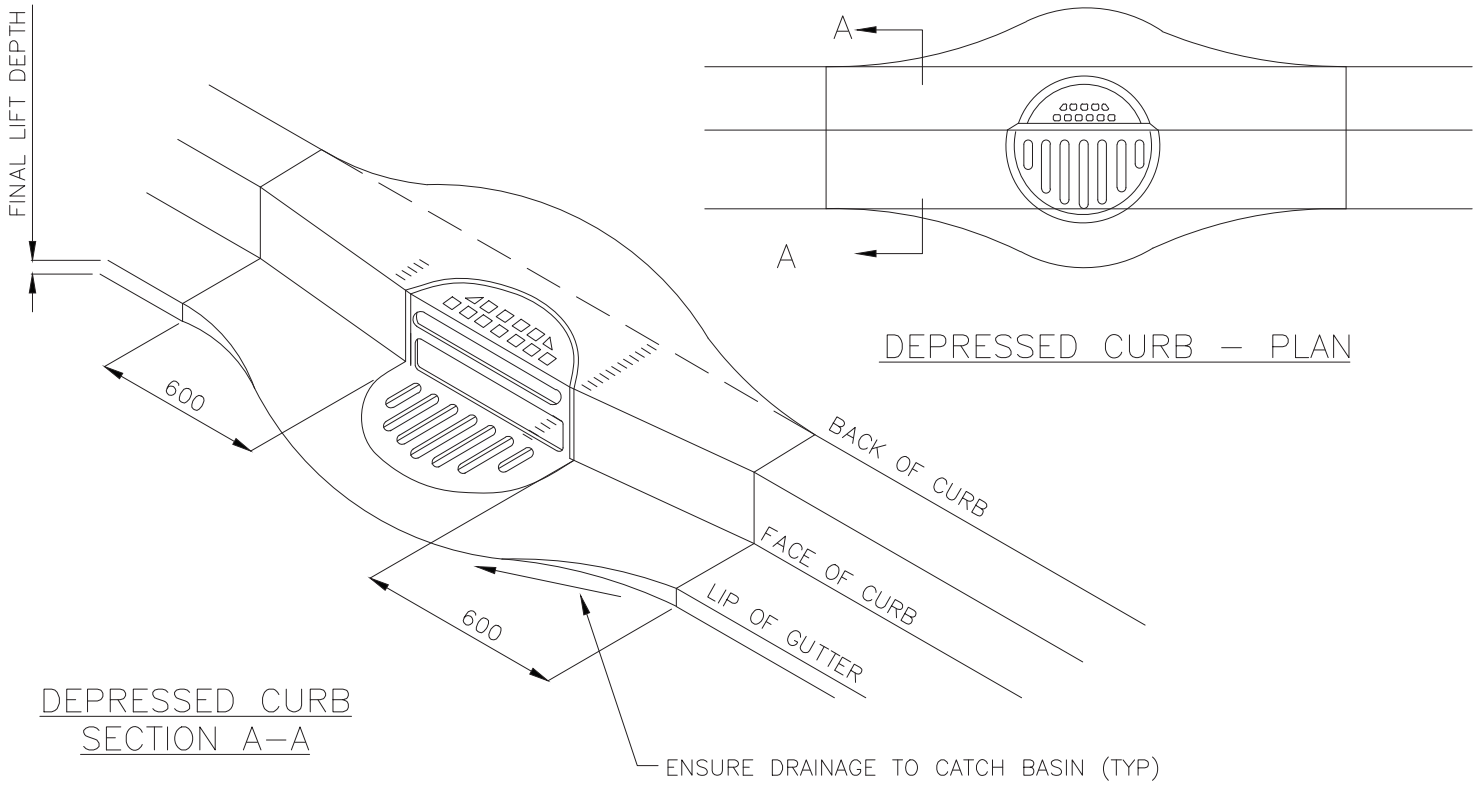
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

TYPE F-51 CATCH BASIN CURB TREATMENT

Whitecourt

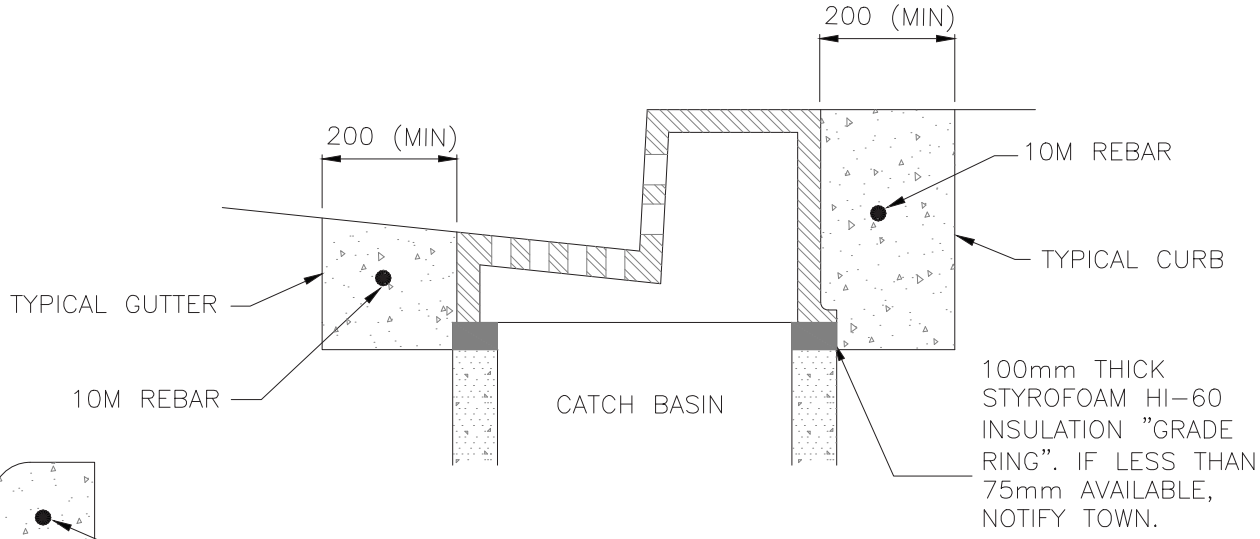
TOWN OF WHITECOURT

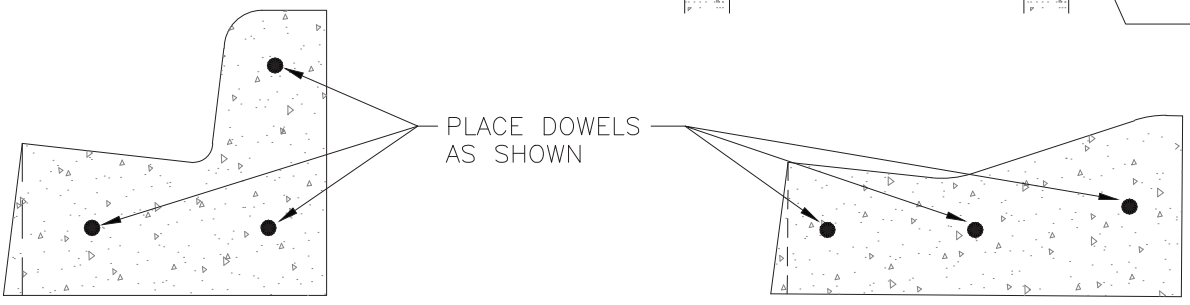
A-25



DEPRESSED CURB SECTION A–A

DEPRESSED CURB – PLAN





STRAIGHT FACE

ROLLED FACE

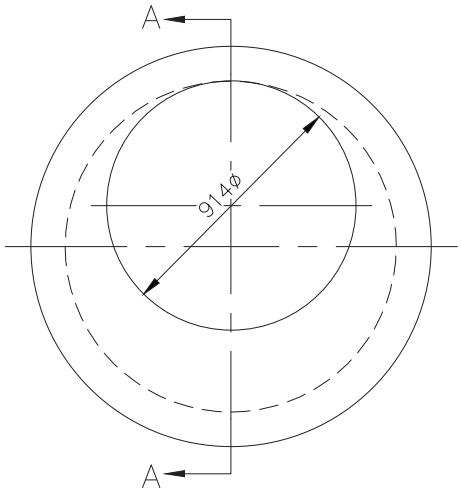
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

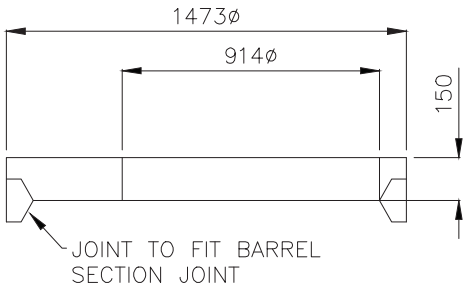
DEPRESSED CURB AT CATCH BASIN LOCATIONS

Whitecourt

TOWN OF WHITECOURT

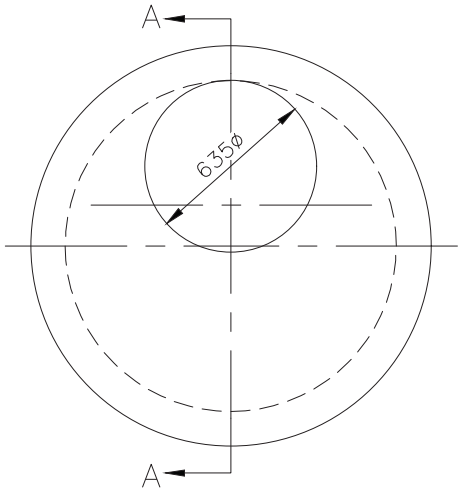
A-26

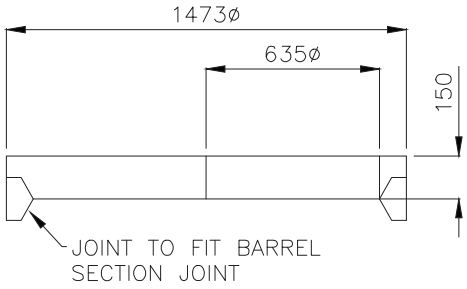




SECTION A–A

1200x900 SLAB TOP





SECTION A–A

1200x635 SLAB TOP

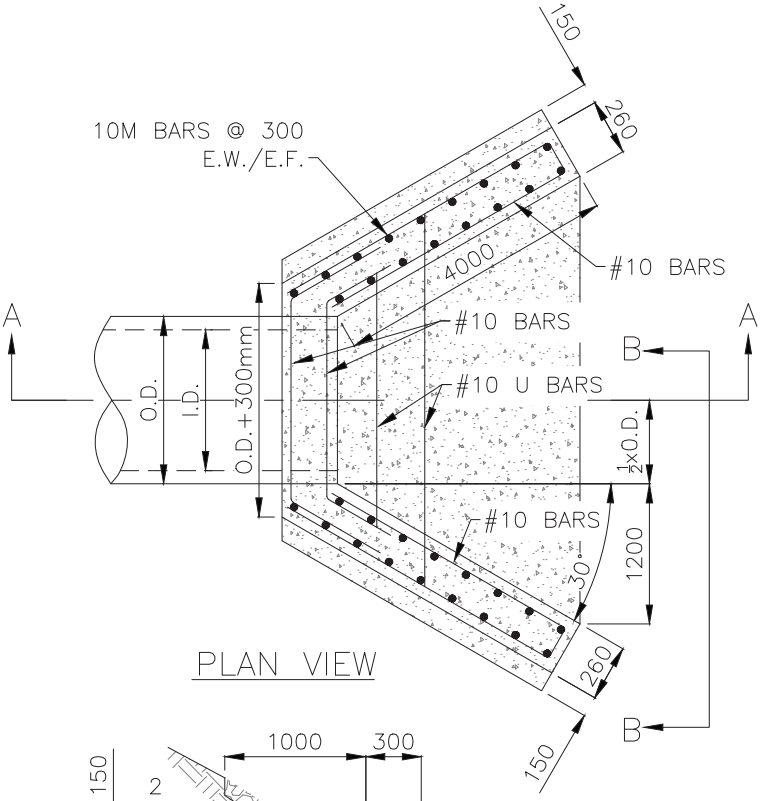
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

SLAB TOPS FOR 1200mmØ MANHOLE

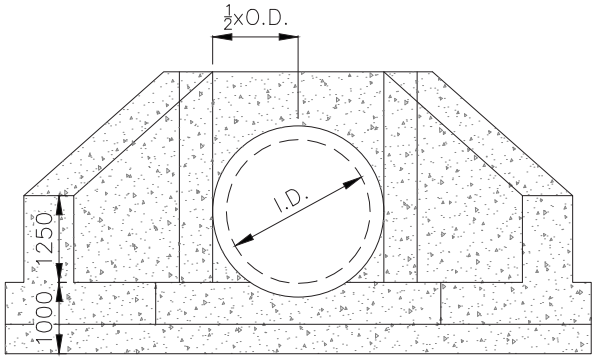
Whitecourt

TOWN OF WHITECOURT

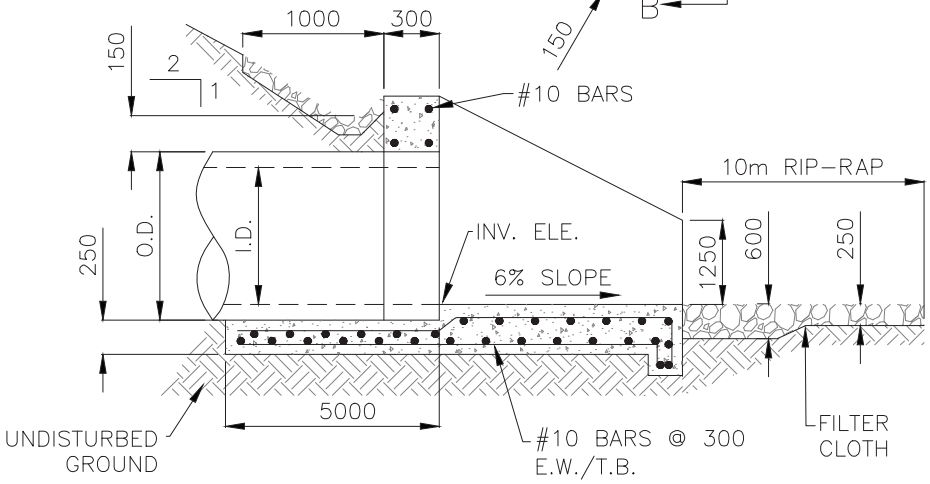
A-27



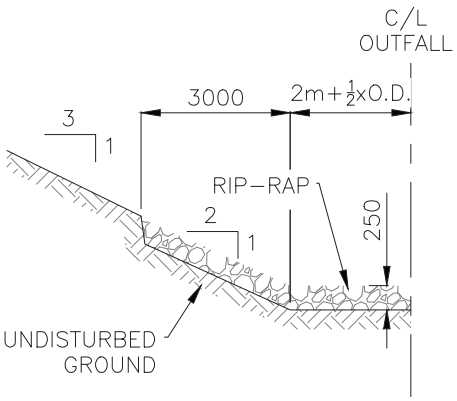
PLAN VIEW



END VIEW



SECTION A–A



SECTION B–B

NOTES:

1. CONCRETE TO HAVE A COMPRESSIVE STRENGTH OF 30mPa @ 28 DAYS.
2. CLEAR COVER FOR REBAR ON EARTH FACE SHALL BE 75mm, 50mm ELSEWHERE.
3. A STILLING BASIN SHALL BE REQUIRED FOR HIGH VELOCITY FLOWS.
4. ALL FILTER CLOTH JOINTS TO OVERLAP BY 100mm AND HEAT SEALED.
5. FILTER CLOTH TYPE AS PER TOWN REQUIREMENTS.
6. SEE DRAWING A–28 FOR OUTFALL SCREENING DETAILS,
7. RIP–RAP TO BE GABION MAT OR SACKED CONCRETE.

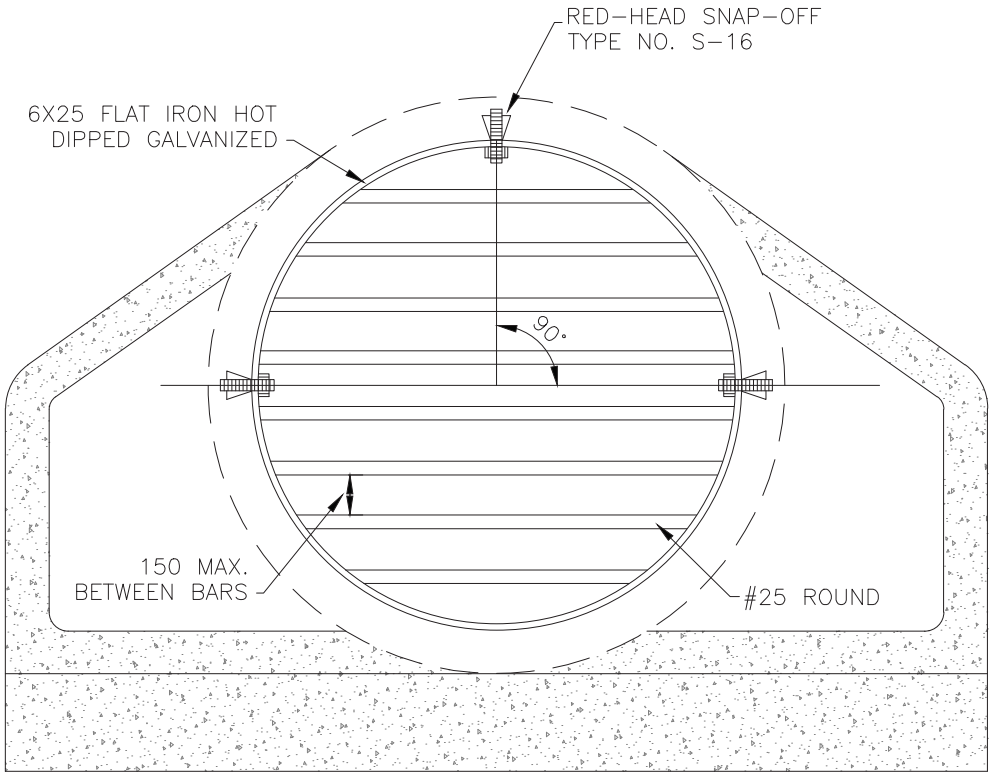
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

CONCRETE OUTFALL STRUCTURE

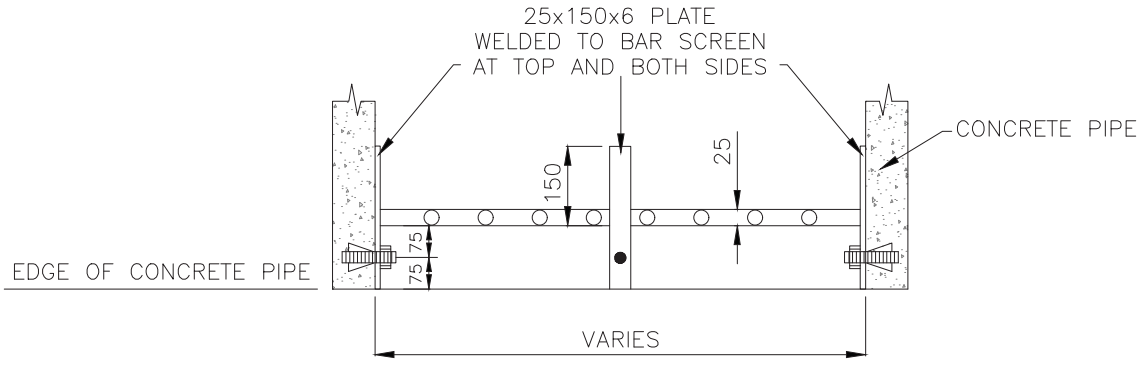
Whitecourt

TOWN OF WHITECOURT

A-28



FRONT VIEW



TOP VIEW

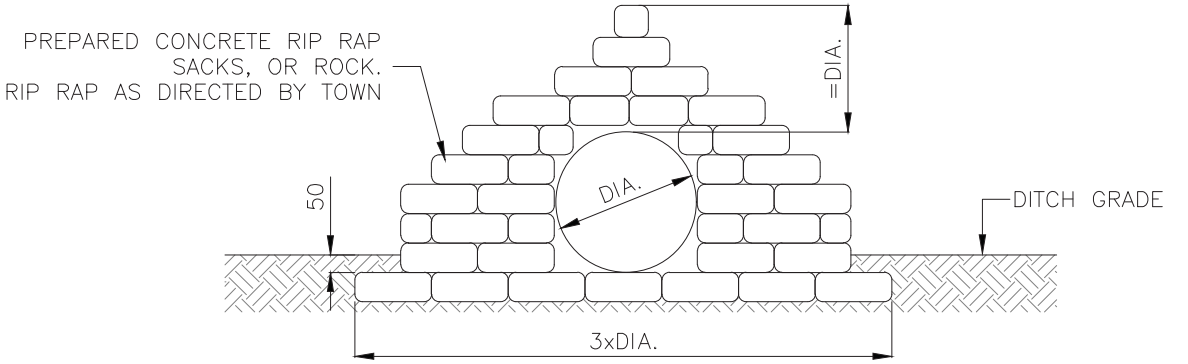
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

SCREENING FOR INLET/OUTFALL STRUCTURE

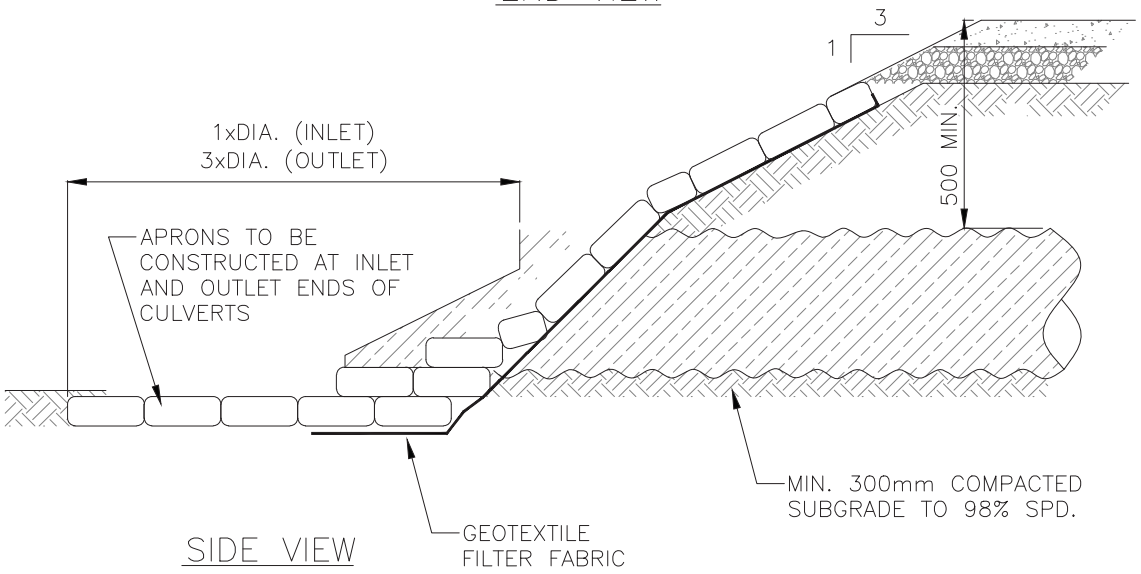
Whitecourt

TOWN OF WHITECOURT

A-29



END VIEW



SIDE VIEW

NOTES:

1. SACK SHALL BE FILLED $\frac{2}{3}$ FULL WITH 20 MPA CONCRETE AND SECURELY SEWN OR STAPLED TO FORM A STRAIGHT–EDGE CLOSURE.

2. THE PREPARED SACKS SHALL BE IMMEDIATELY PLACED ON THE PREPARED SURFACE AND SHALL BE RAMMED AND PACKED AGAINST ONE ANOTHER TO FORM A CLOSE MOULDED AND UNIFORM SURFACE AVERAGING 125MM IN THICKNESS.

3. STAGGER ROWS,

4. SACKS TO OVERLAP IN DIRECTION OF FLOW OF WATER. APRONS TO BE CONSTRUCTED AT INLET AND OUTLETS OF CULVERT.

ROCK RIP–RAP

1. ROCKS AND BOULDERS SHALL BE SELECTED AS NEARLY CUBICAL IN FORM AS PRACTICABLE AND OF A SIZE GREATER THAN 200mm AS SPECIFIED.

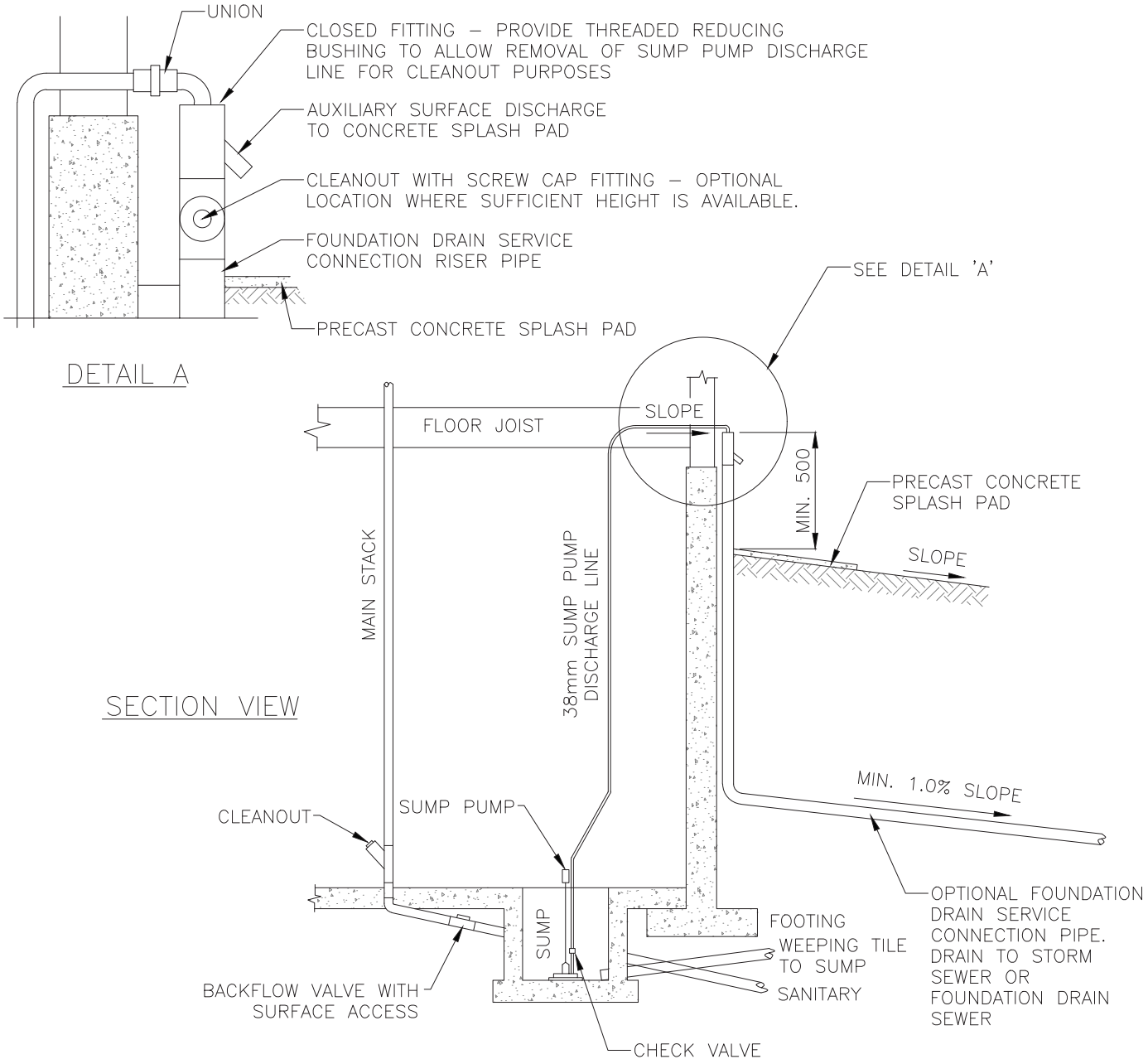
2. THE STONES SHALL BE PLACED WITH THEIR LONGEST DIMENSION PARALLEL TO THE SLOPE. LARGER STONES TO BE USED ON THE BOTTOM COURSES WITH SMALLER STONES AT THE TOP.

3. STONES SHALL BE LAID IN CLOSE CONTACT WITH STAGGERED JOINTS AND IN SUCH A MANNER THAT THE WEIGHT OF THE STONE IS CARRIED BY THE UNDERLYING EARTH AND NOT BY ADJACENT STONES.

SCALE: N.T.S.	CULVERT END TREATMENT	Whitecourt
DATE: DECEMBER 2019		
APPD:		

TOWN OF WHITECOURT

A-30



NOTES:

1. ROOF LEADERS (DOWNSPOUTS) OR ANY OTHER STORM WATER SOURCE MUST *NOT* BE CONNECTED TO THE FOUNDATION DRAIN DISCHARGE COLLECTION SYSTEM.

2. THE AUXILIARY SURFACE DISCHARGE MUST BE INSTALLED TO PROVIDE AN OVERFLOW IN THE EVENT THAT THE STORM DRAINAGE SYSTEM CANNOT ACCOMMODATE FLOWS DUE TO BLOCKAGE OR OTHER PROBLEMS.

3. EVERY PART OF THE PLUMBING SYSTEM SHALL BE PROTECTED FROM FREEZING THROUGH THE USE OF AN APPROVED METHOD.

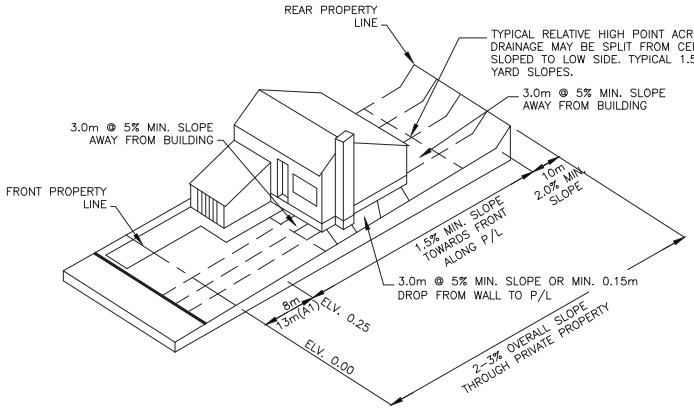
4. WEEPING TILES SHALL NOT BE CONNECTED TO THE SANITARY SYSTEM.

5. BACKFLOW VALVEE SHALL BE INSTALLED BY LOT OWNERS ON ALL SANITARY SERVICES.

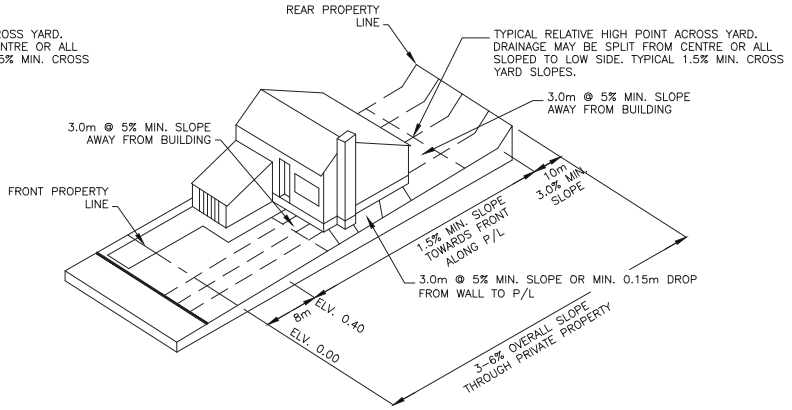
SCALE: N.T.S.	WEEPING TILE DISCHARGE	Whitecourt
DATE: DECEMBER 2019		
APPD:		

TOWN OF WHITECOURT

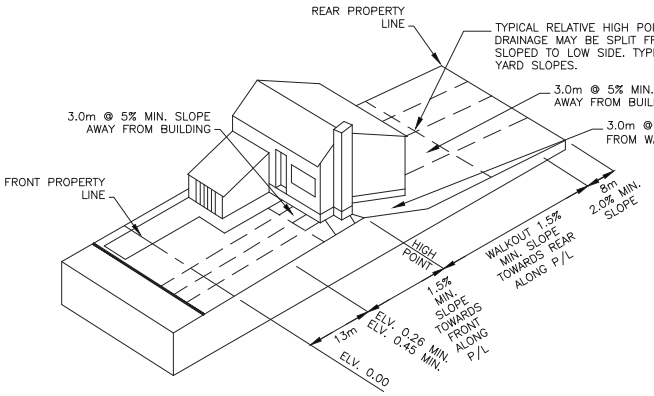
A-31



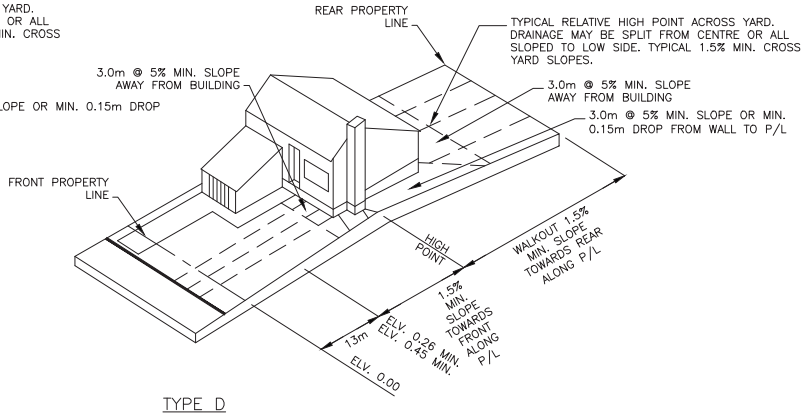
2–3% OVERALL LOT SLOPE
TYPE A & TYPE A1
REAR TO FRONT DRAINAGE



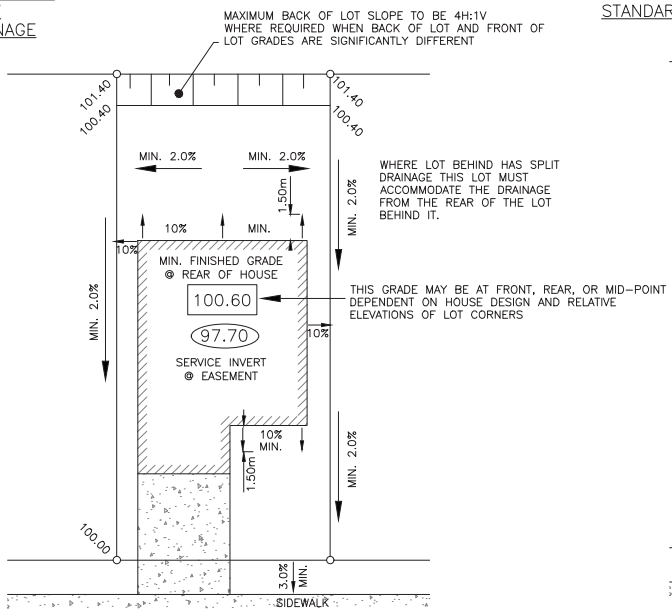
3–6% OVERALL LOT SLOPE
TYPE B
REAR TO FRONT DRAINAGE



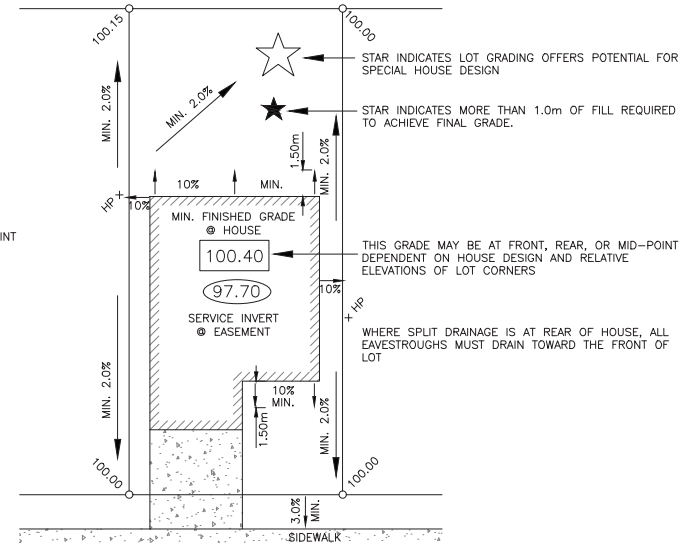
WALKOUT BASEMENT
TYPE W
SPLIT DRAINAGE



TYPE D
STANDARD SPLIT DRAINAGE



BACK TO FRONT DRAINAGE



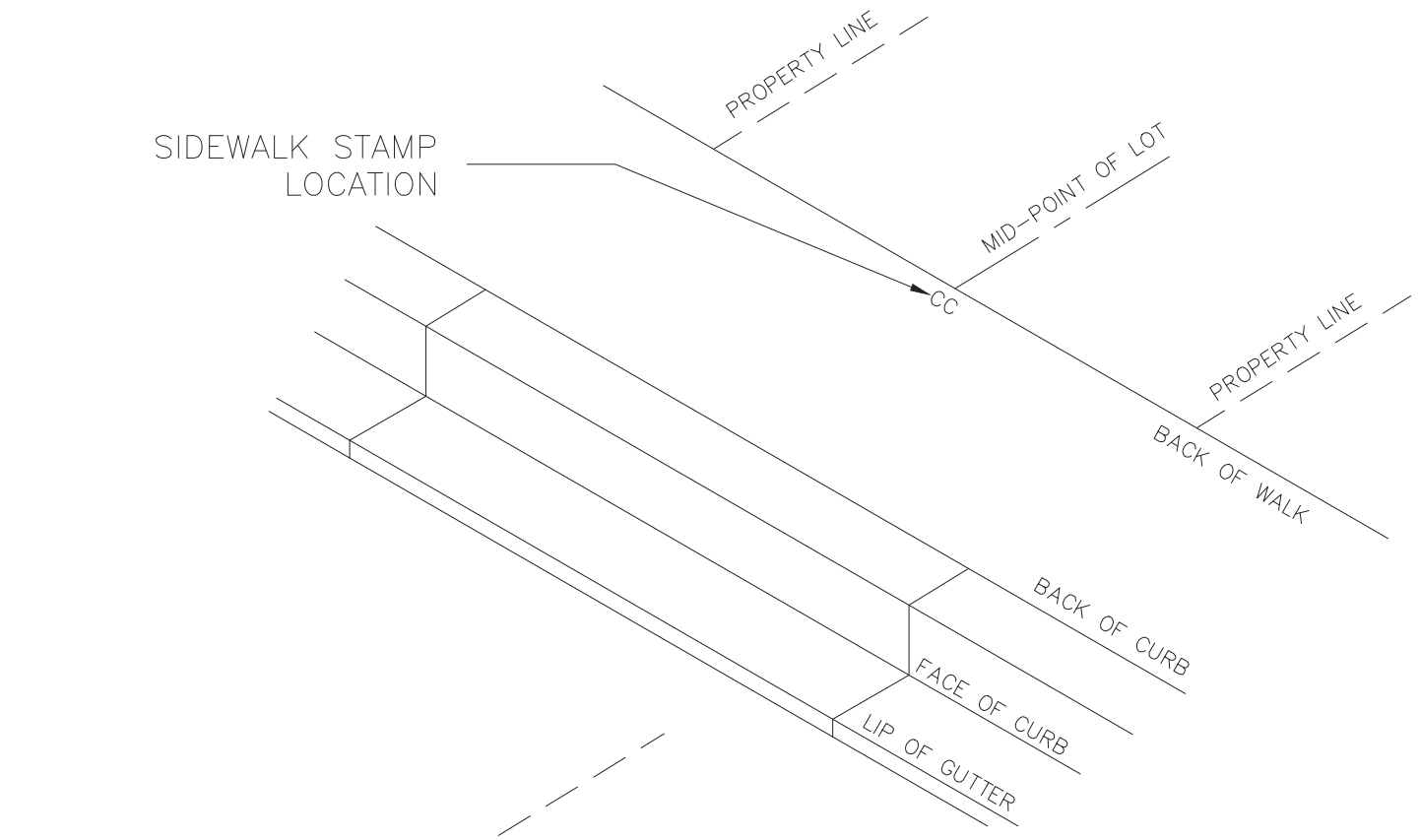
SPLIT DRAINAGE

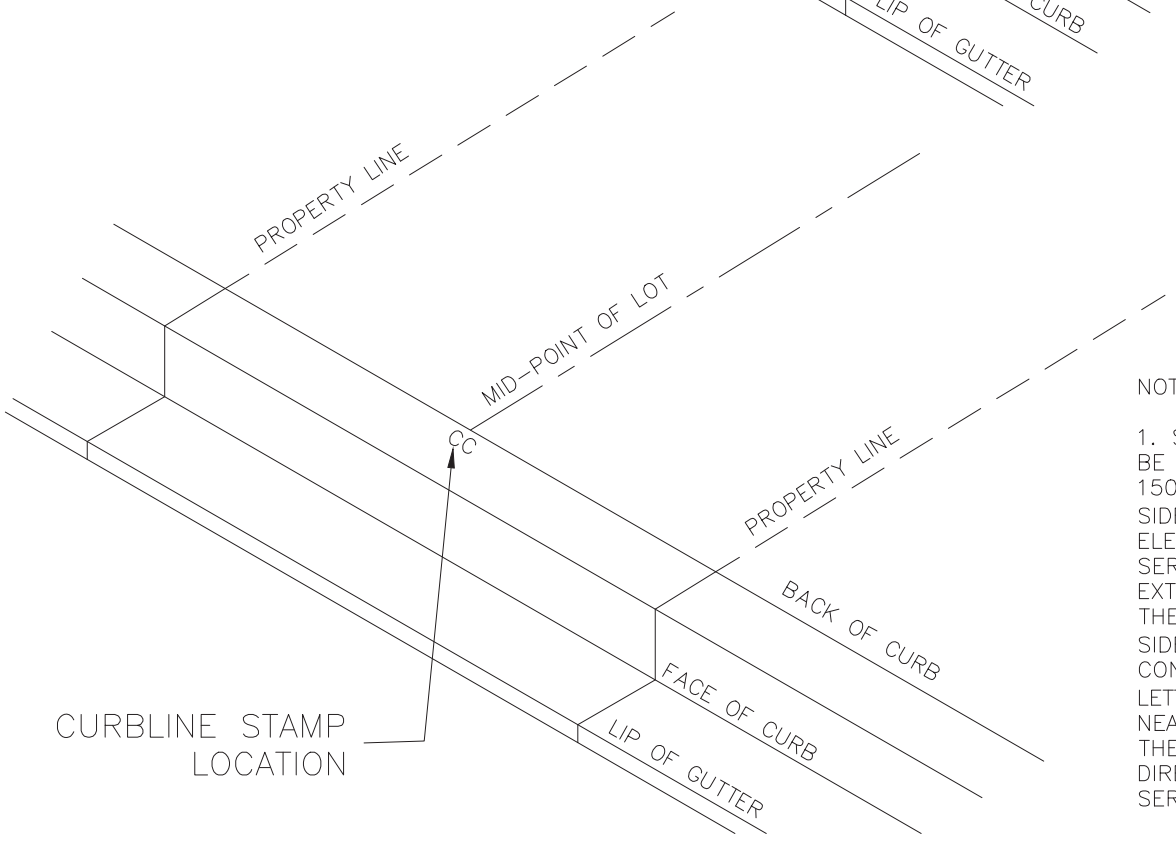
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

LOT GRADING DETAILS

TOWN OF WHITECOURT

A-32





NOTES:

1. SERVICE BOXES SHALL BE SET VERTICAL, 150mm ABOVE THE SIDEWALK/CURB ELEVATION WHEN THE SERVICE BOX IS IN THE EXTENDED POSITION. AT THE TIME OF SIDEWALK/CURB CONSTRUCTION THE LETTERS "CC" SHALL BE NEATLY MARKED INTO THE MOIST CONCRETE DIRECTLY OPPOSITE THE SERVICE BOX.

SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

"CC" STAMP LOCATION

Whitecourt

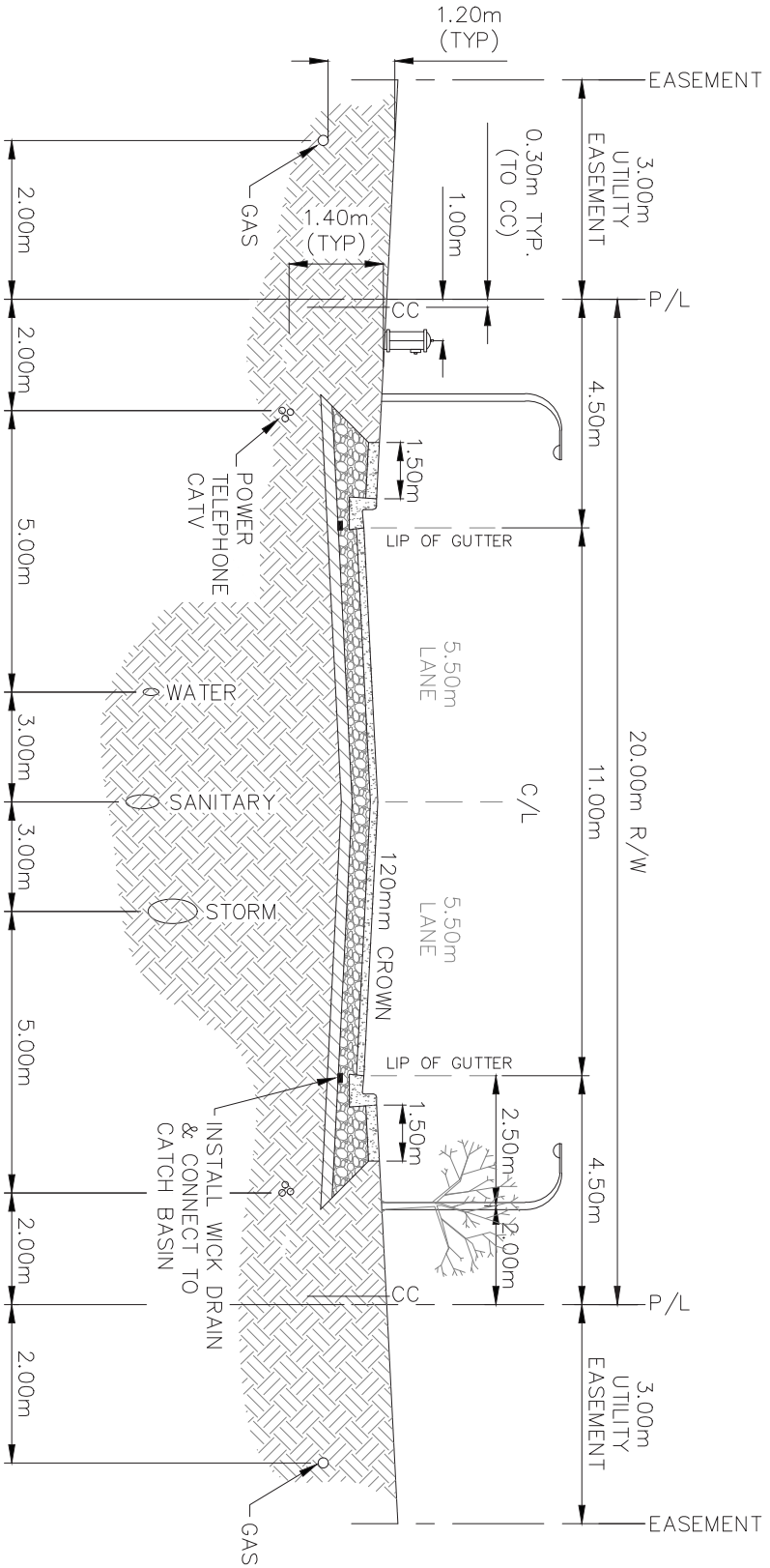
TOWN OF WHITECOURT

A-33

NOTES:

1. CARRIAGEWAY WIDTH IS MEASURED TO LIP OF GUTTER

2. SHALLOW UTILITY ALIGNMENT IS TO BE CONFIRMED AND APPROVED BY THE TOWN OF WHITECOURT ON EACH PROJECT



SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

LOCAL STREET RESIDENTIAL

Whitecourt

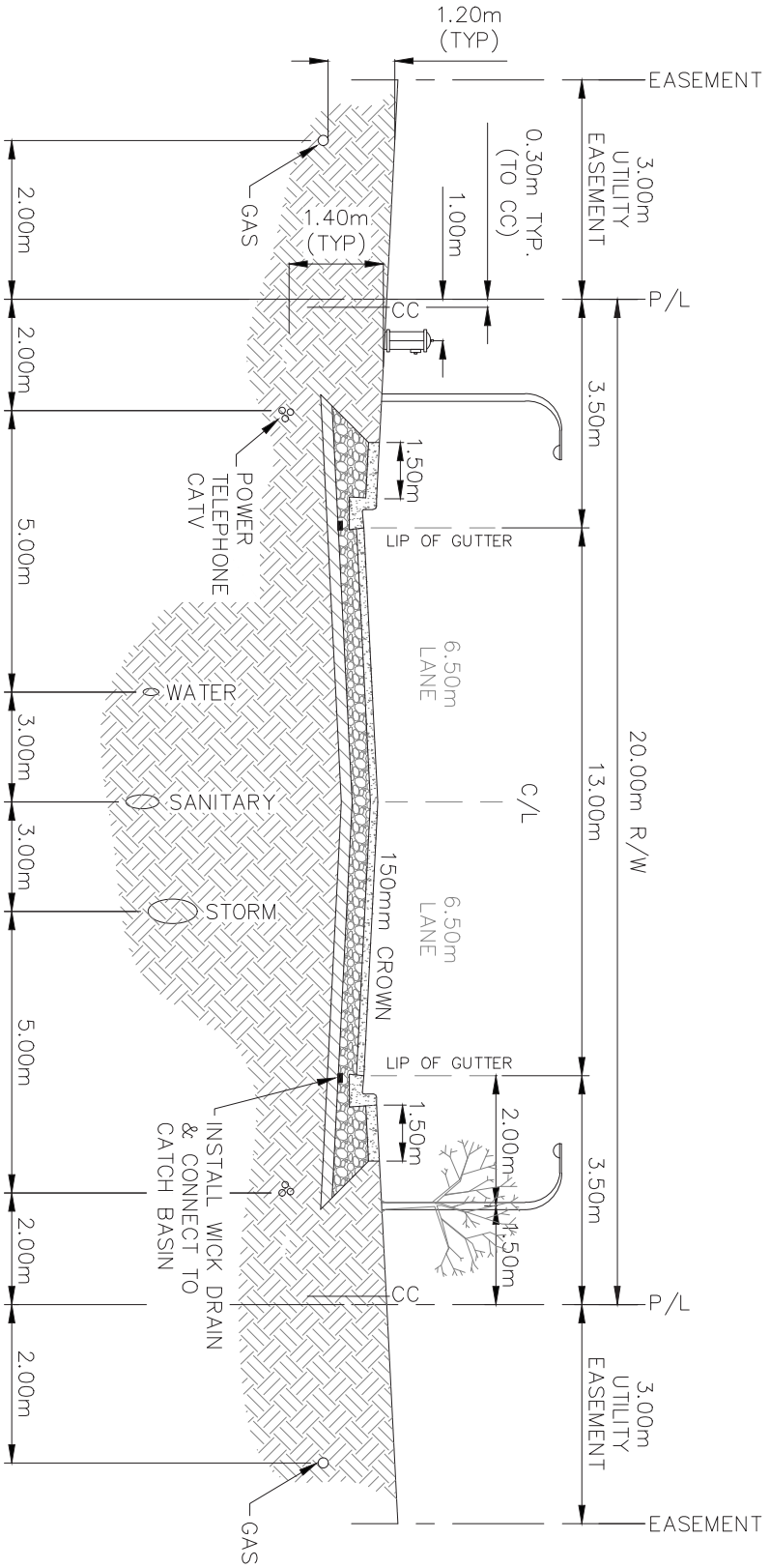
TOWN OF WHITECOURT

A-34

NOTES:

1. CARRIAGEWAY WIDTH IS MEASURED TO LIP OF GUTTER

2. SHALLOW UTILITY ALIGNMENT IS TO BE CONFIRMED AND APPROVED BY THE TOWN OF WHITECOURT ON EACH PROJECT



SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

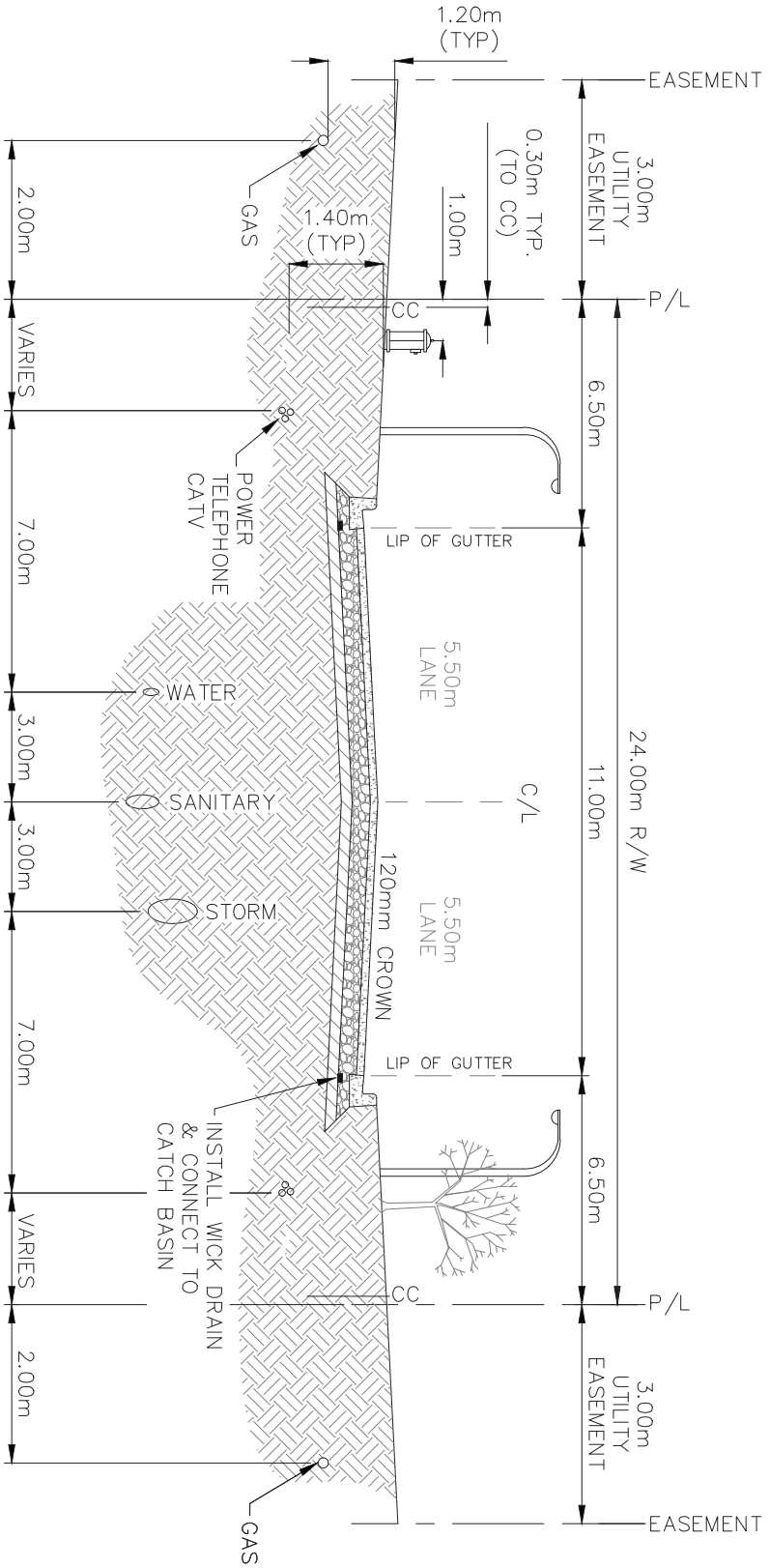
COLLECTOR STREET RESIDENTIAL

TOWN OF WHITECOURT

A-35

NOTES:

1. CARRIAGEWAY WIDTH IS MEASURED TO LIP OF GUTTER
2. SHALLOW UTILITY ALIGNMENT IS TO BE CONFIRMED AND APPROVED BY THE TOWN OF WHITECOURT ON EACH PROJECT
3. WALKWAYS IN COMMERCIAL AREAS ARE DEPENDANT ON LOCATION, TO BE CONFIRMED WITH TOWN OF WHITECOURT PER PROJECT.



SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

LOCAL STREET
COMMERCIAL / INDUSTRIAL

Whitecourt

TOWN OF WHITECOURT

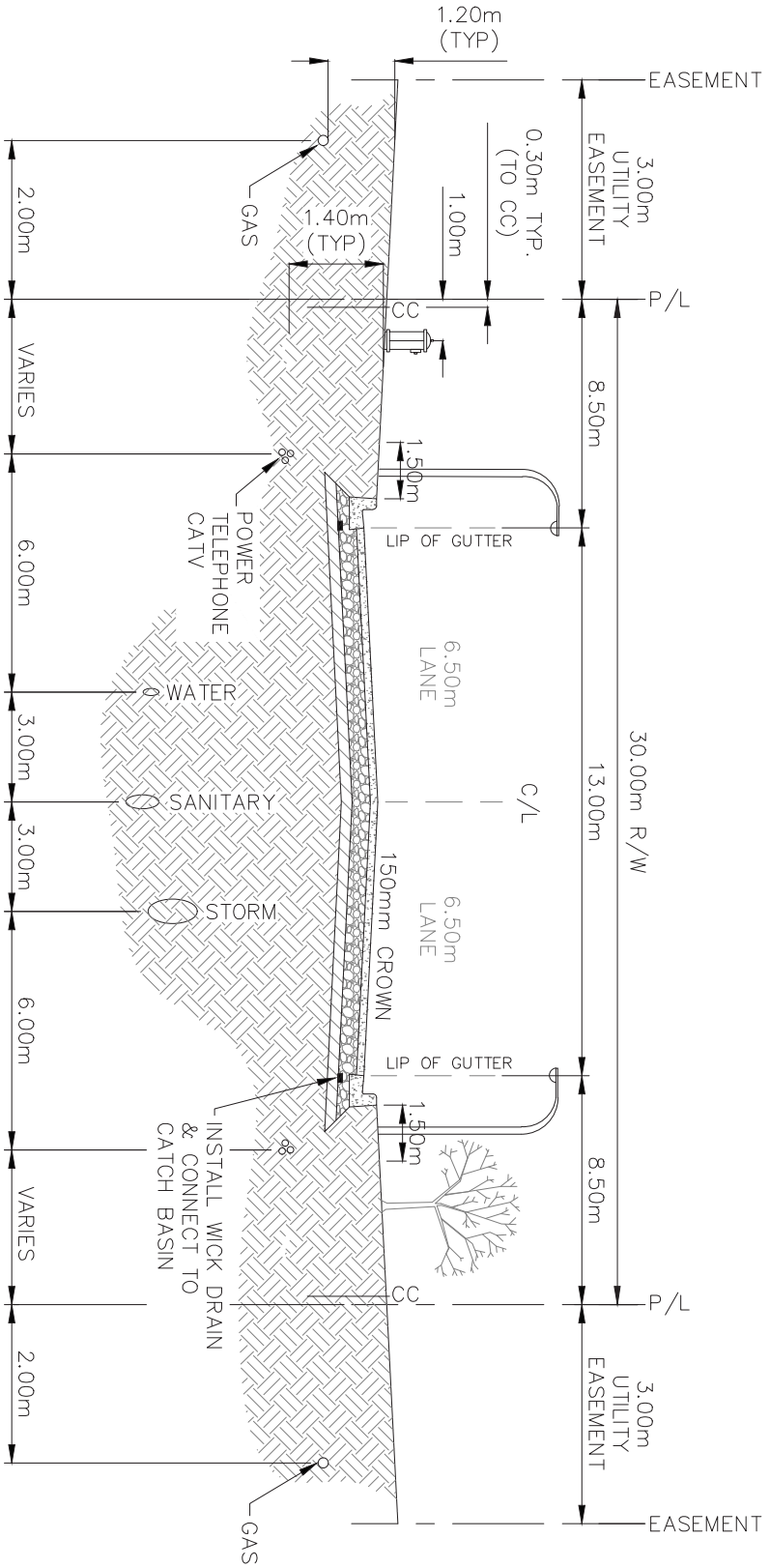
A-36

NOTES:

1. CARRIAGEWAY WIDTH IS MEASURED TO LIP OF GUTTER

2. SHALLOW UTILITY ALIGNMENT IS TO BE CONFIRMED AND APPROVED BY THE TOWN OF WHITECOURT ON EACH PROJECT

3. WALKWAYS IN COMMERCIAL AREAS ARE DEPENDANT ON LOCATION, TO BE CONFIRMED WITH TOWN OF WHITECOURT PER PROJECT.



SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

COLLECTOR STREET
COMMERCIAL / INDUSTRIAL

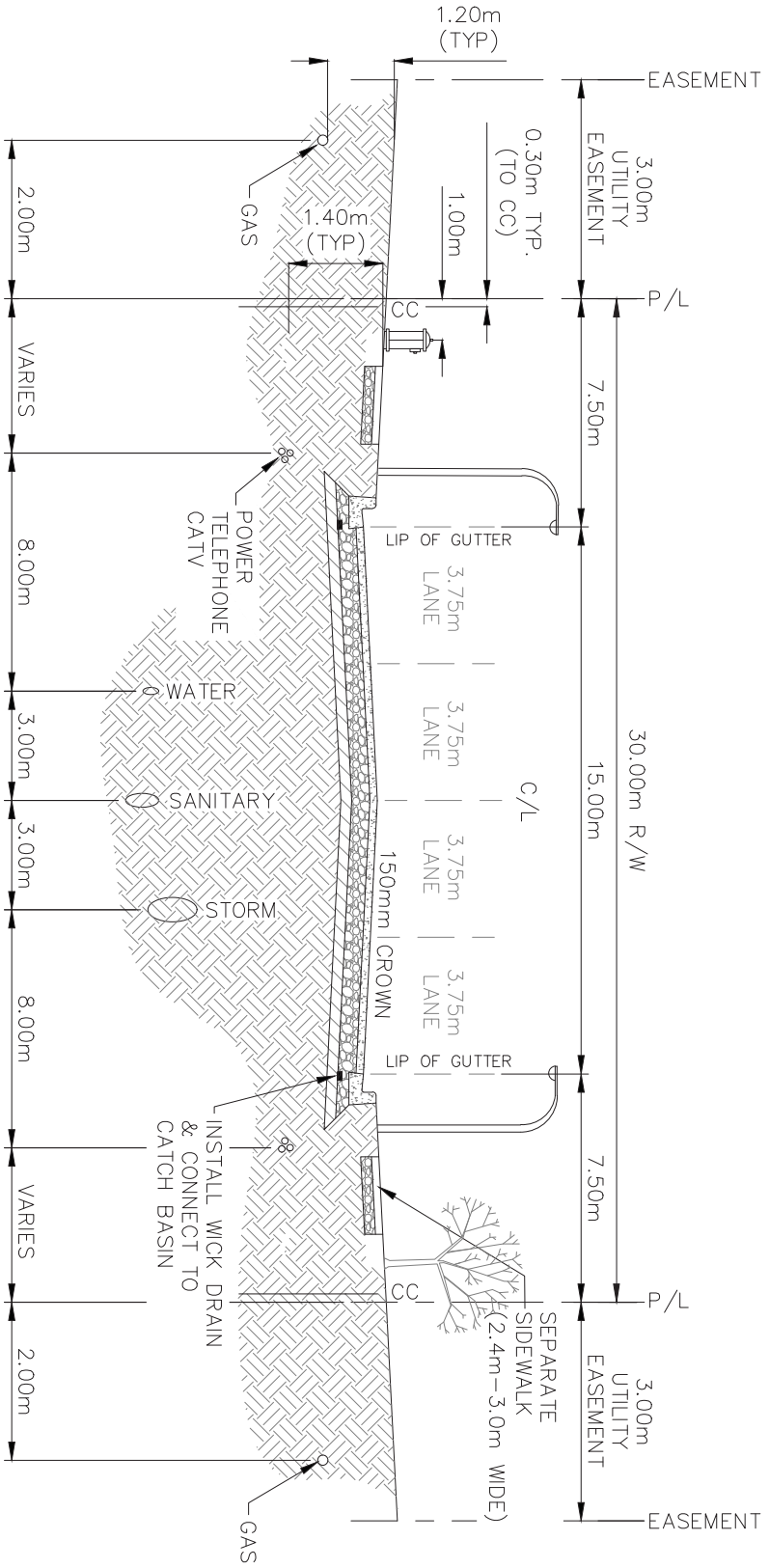
Whitecourt

TOWN OF WHITECOURT

A-37

NOTES:

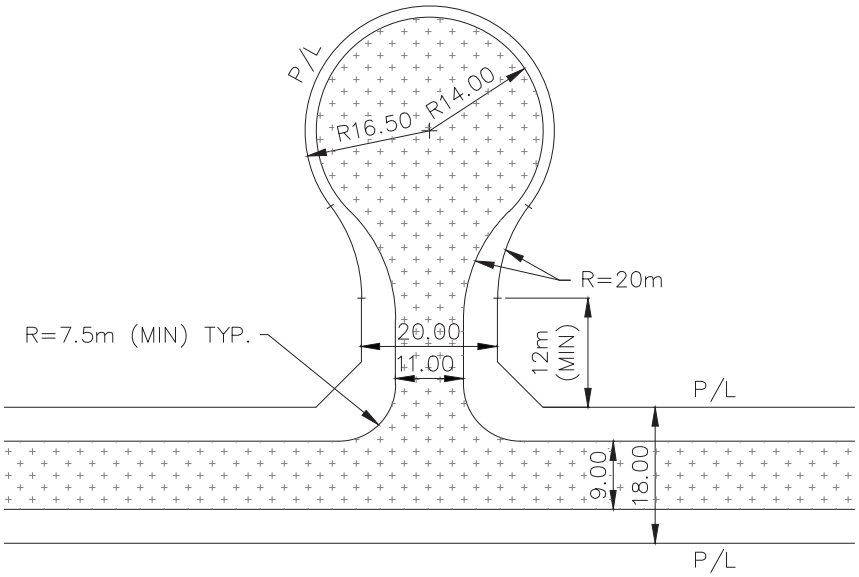
1. CARRIAGEWAY WIDTH IS MEASURED TO LIP OF GUTTER
2. SHALLOW UTILITY ALIGNMENT IS TO BE CONFIRMED AND APPROVED BY THE TOWN OF WHITECOURT ON EACH PROJECT
3. SEPARATE SIDEWALK(S) ARE REQUIRED ON ARTERIAL ROADWAYS



SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

ARTERIAL ROADWAY

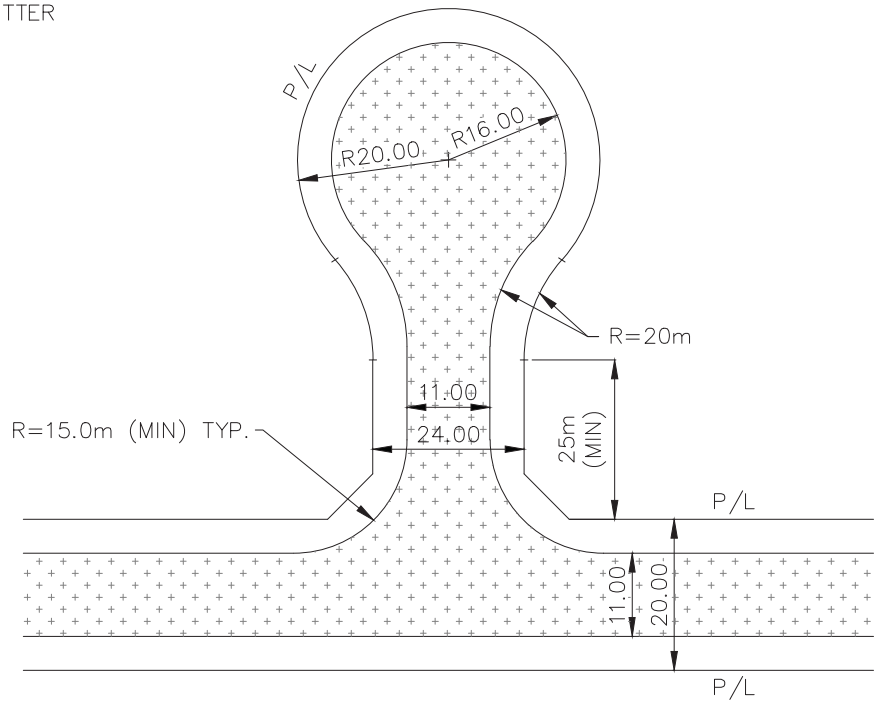
Whitecourt



RESIDENTIAL

NOTES:

1. CARRIAGEWAY DIMENSIONS ARE SHOWN TO LIP OF GUTTER



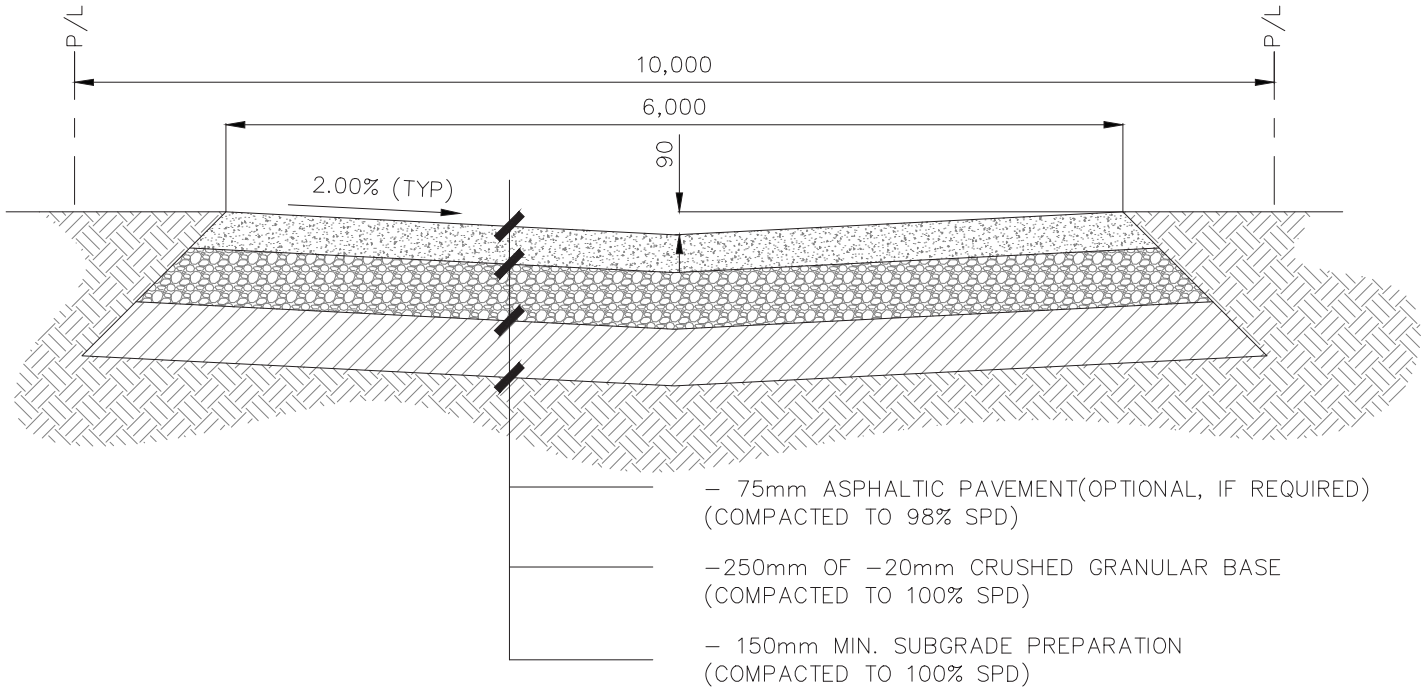
COMMERCIAL / INDUSTRIAL

SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

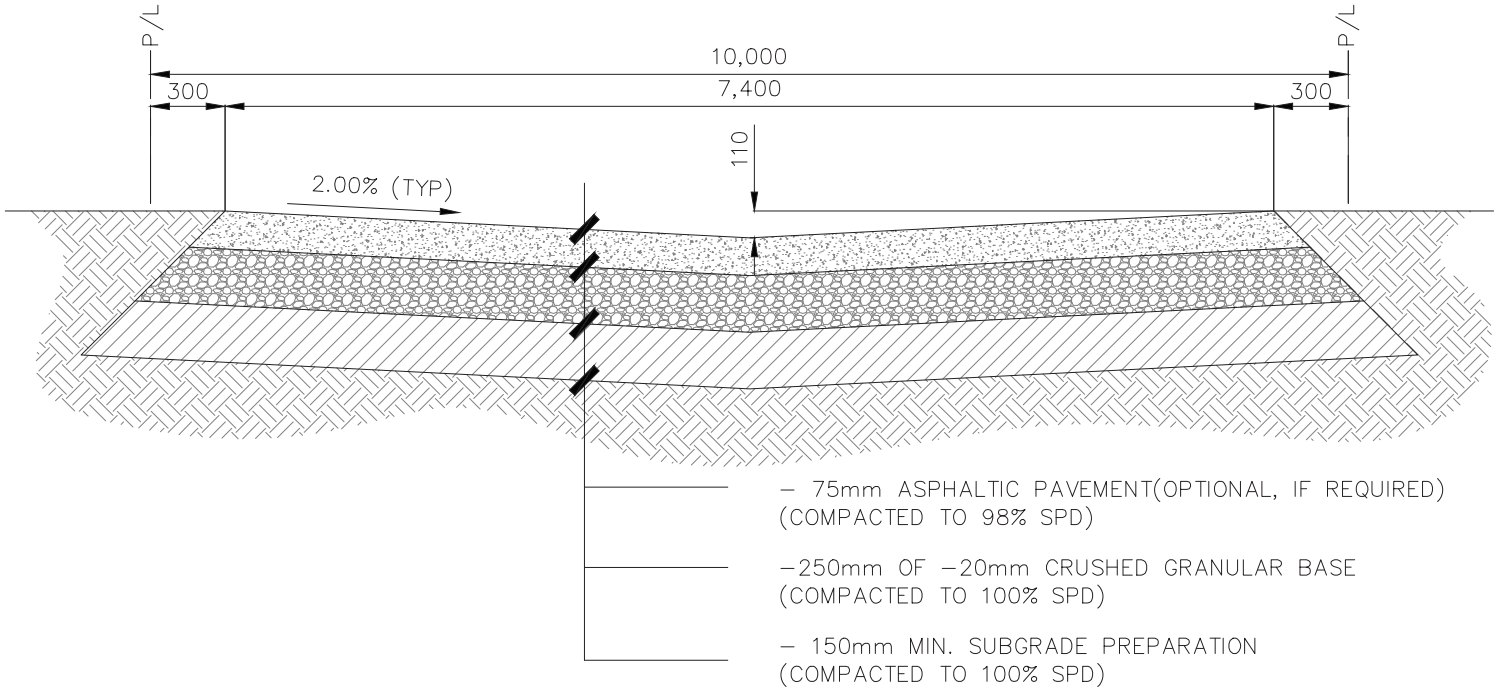
CUL-DE-SAC LAYOUT

TOWN OF WHITECOURT

A-39



6.0m LANE R/W



7.4m LANE R/W

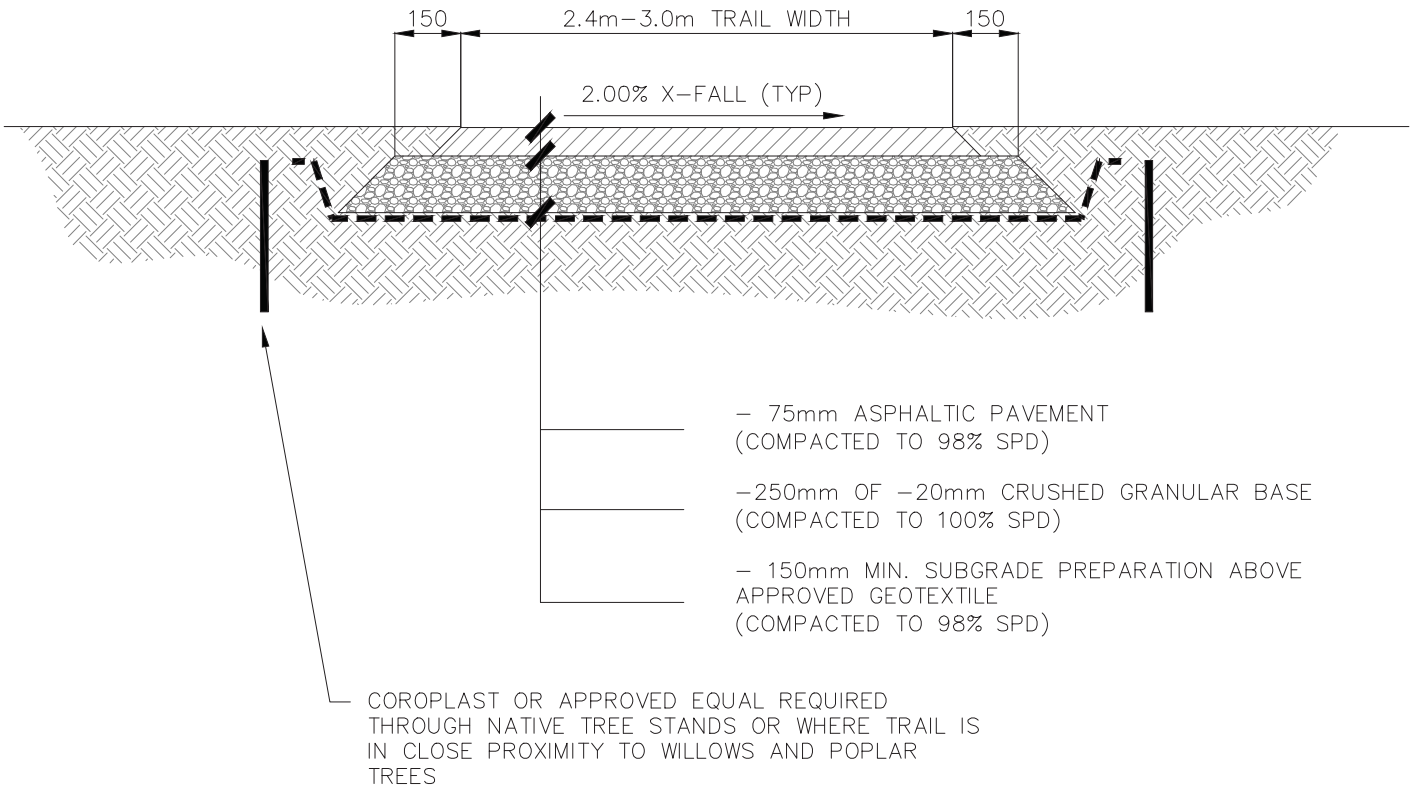
NOTES:

1. A CROWNED SURFACE MAY BE USED IF DRAINAGE CONDITIONS DICTATE
2. A MINIMUM LONGITUDINAL GRADE OF 1.00% SHALL BE USED

SCALE: N.T.S.	LANE SECTIONS	Whitecourt
DATE: DECEMBER 2019		
APPD:		

TOWN OF WHITECOURT

A-40



NOTES;

1. SUBGRADE SHOULD BE FREE OF STUMPS, ROOTS LARGE ROCKS AND DEBRIS.

2. GRANULAR BASE TO EXTEND 150mm BEYOND EXTENT OF ASPHALT WHERE ALLOWABLE.

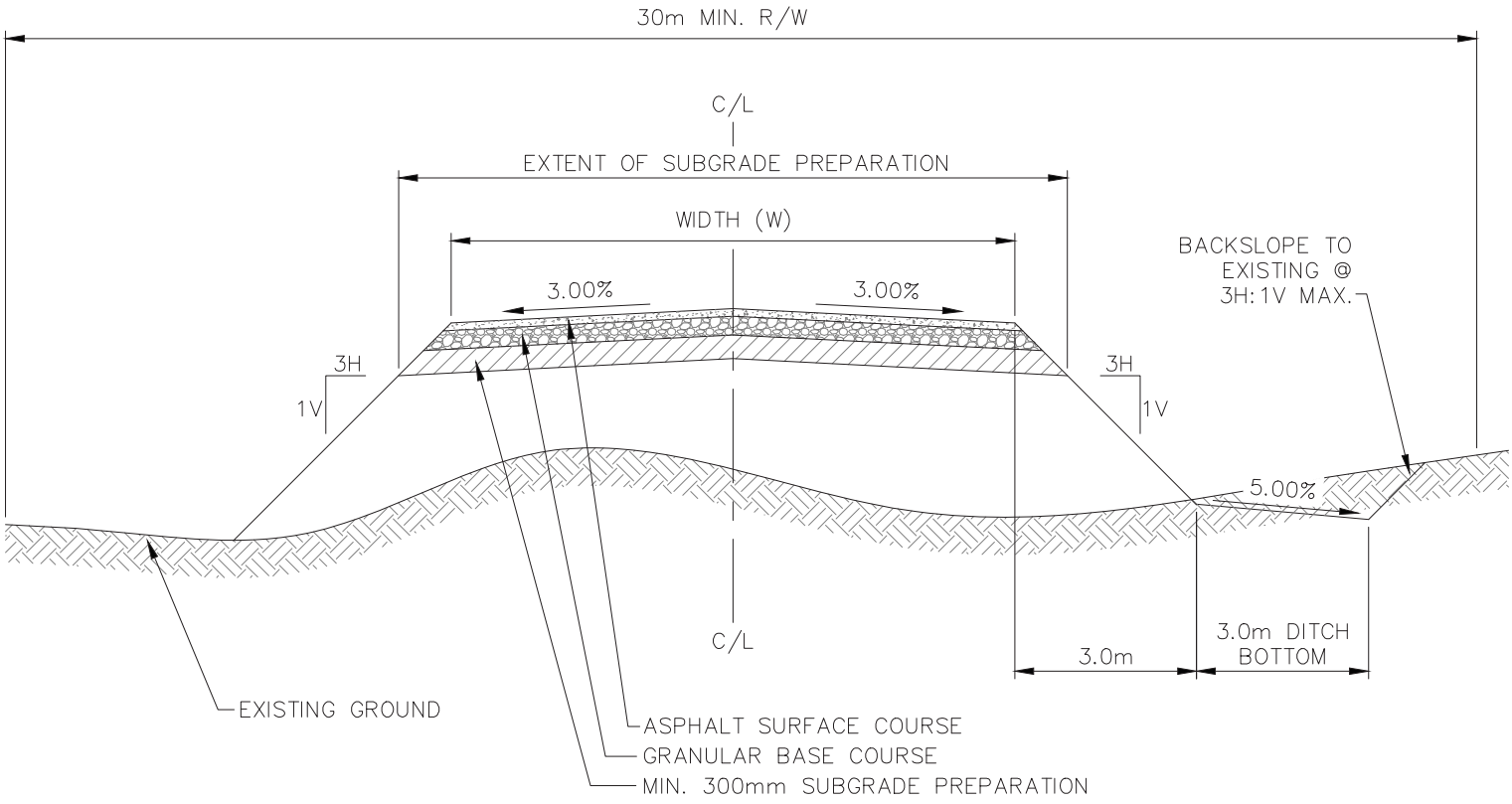
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

STANDARD TRAIL

Whitecourt

TOWN OF WHITECOURT

A-41



FILL SLOPE TABLE	SLOPE
0 – 3.5m	3H:1V
3.5m – 4.5m	2.5H:1V
4.5m AND GREATER	2H:1V

ROAD CLASSIFICATION	WIDTH (W)
RESIDENTIAL LOCAL	11.0m
RESIDENTIAL COLLECTOR	11.0m
COMMERCIAL / INDUSTRIAL LOCAL	11.0m
COMMERCIAL / INDUSTRIAL COLLECTOR	13.0m

NOTES:

1. ALL BACKSLOPES TO BE MAX. 3H:1V UNLESS OTHERWISE APPROVED BY THE TOWN OF WHITECOURT.

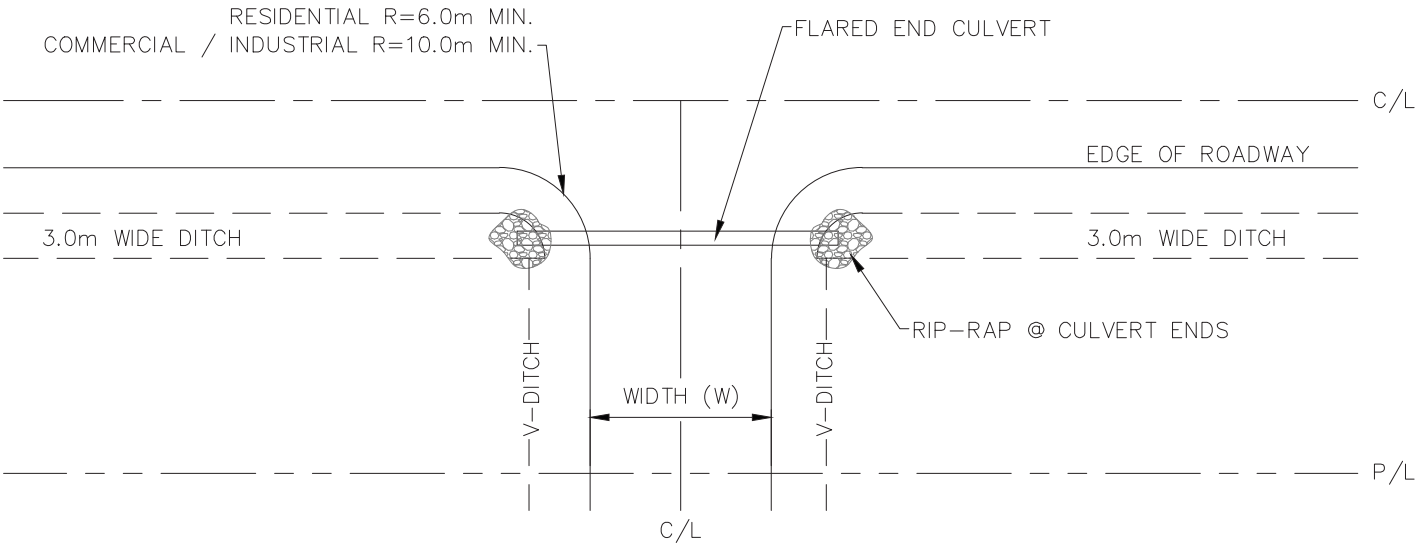
2. SLOPES EXCEEDING 3H:1V REQUIRE 1.0m SHOULDER WIDENING & GUARD RAIL INSTALLATION.

3. PAVEMENT STRUCTURES AS PER THE TOWN OF WHITECOURT ENGINEERING STANDARDS.

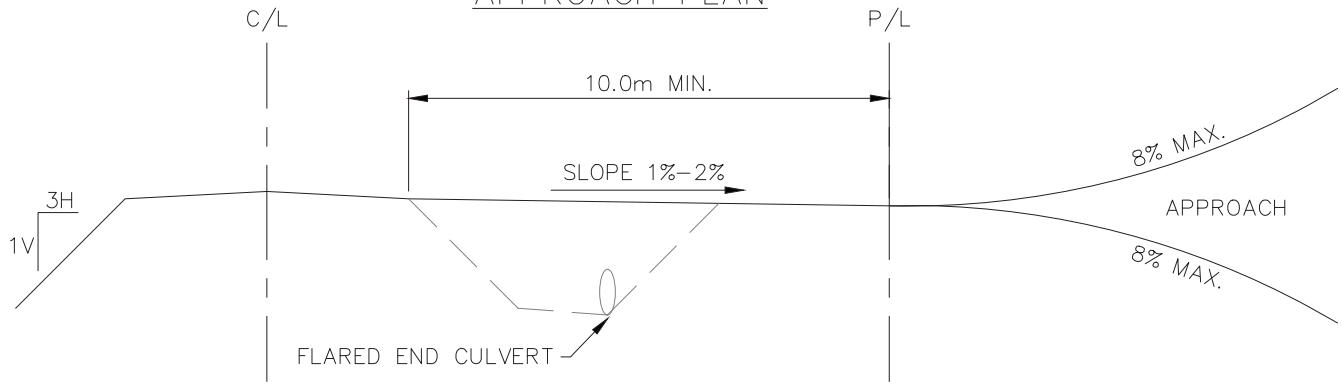
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

TYPICAL RURAL CROSS SECTION

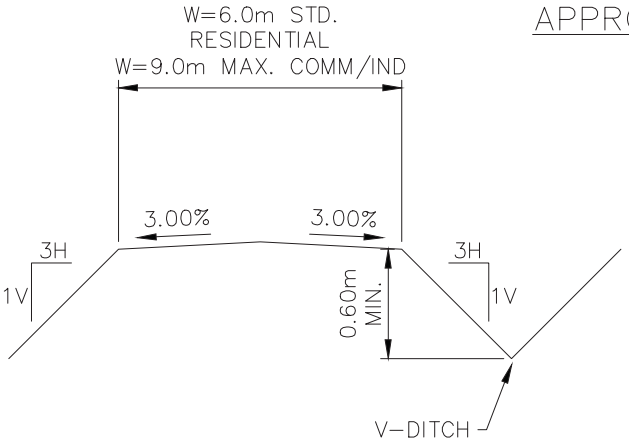
Whitecourt



APPROACH PLAN



APPROACH SECTION



APPROACH SECTION

NOTES:

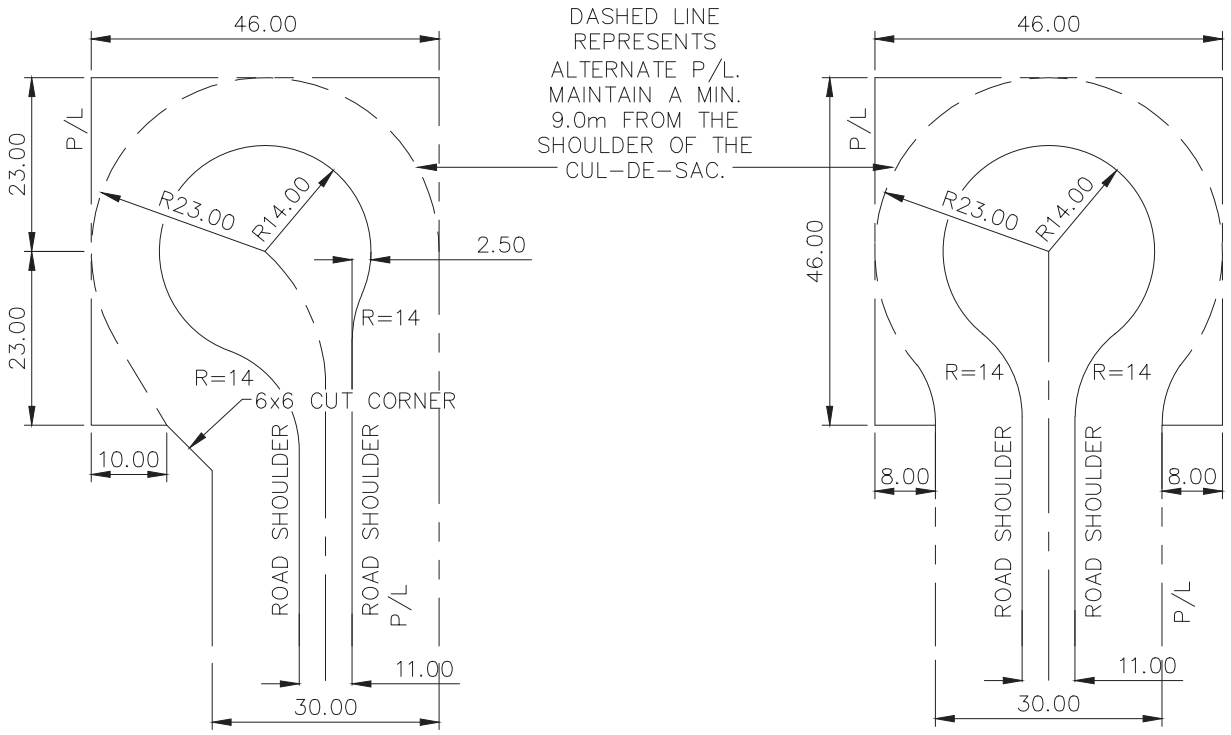
1. WHERE CULVERTS ARE REQUIRED THEY MUST BE CSP TYPE.

2. CULVERTS TO BE PLACED AT THE TOE OF BACKSLOPE.

3. ALL APPROACHES MUST AT LEAST EXTEND TO PROPERTY LINE.

4. MIN CULVERT DIAMETERS:
   - 400mm IN RESIDENTIAL
   - 500mm IN COMMERCIAL / INDUSTRIAL

SCALE: N.T.S.	TYPICAL RURAL APPROACH	Whitecourt
DATE: JANUARY 2019		
APPD:		



NOTES:

1. MIN. 4.00% CROSSFALL WITHIN EXTENT OF CUL-DE-SAC.

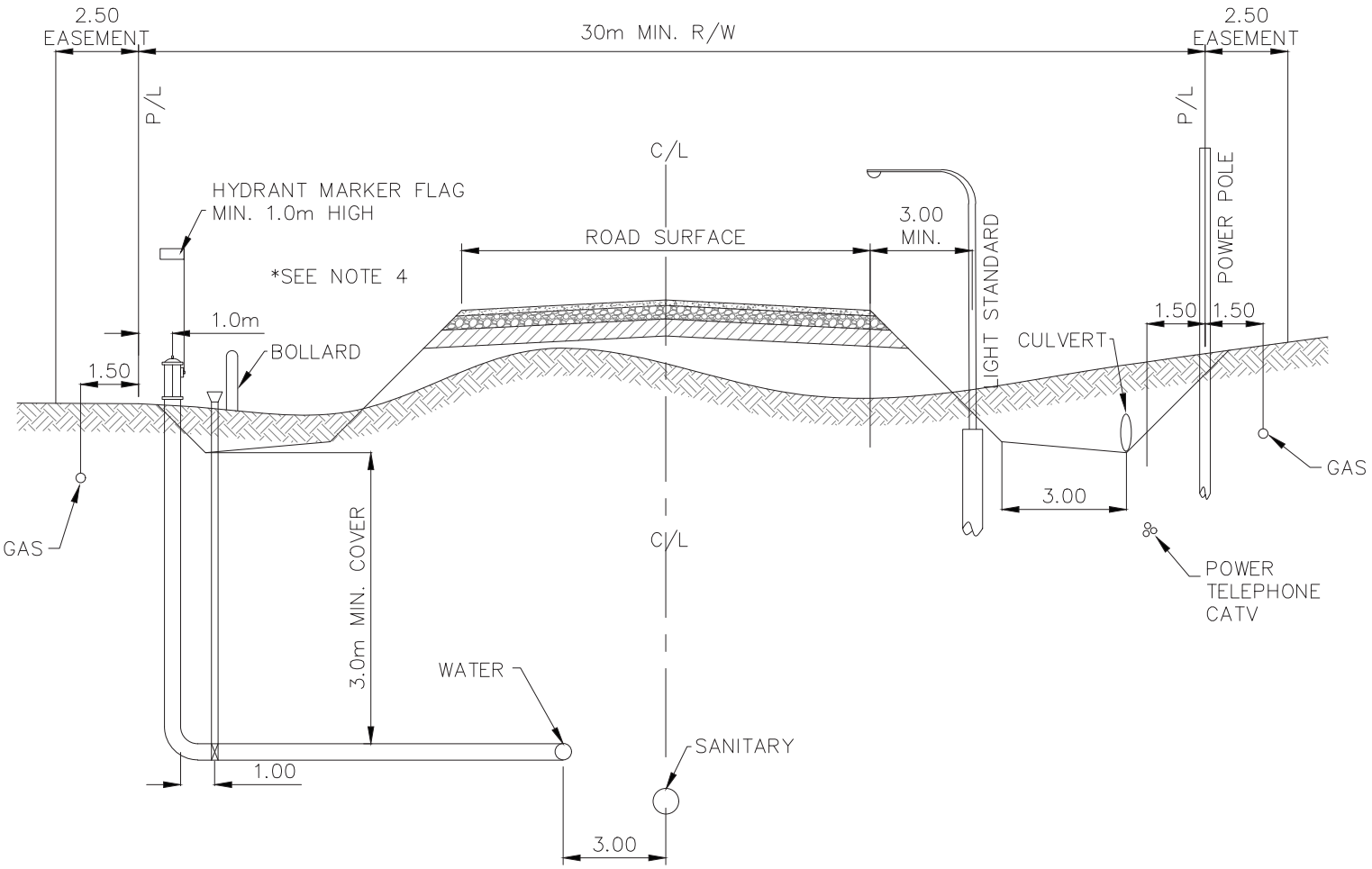
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

TYPICAL RURAL CUL-DE-SAC

Whitecourt

TOWN OF WHITECOURT

A-43



NOTES:

1. WATER MAINS AND HYDRANTS CAN BE LOCATED ON EITHER SIDE OF ROADWAY.

2. UNDERGROUND POWER OR POWER POLES WITH STREET LIGHTS TO BE LOCATED OPPOSITE SIDE OF WATER MAINS.

3. LUMINARY SUPPORTS TO BE OF THE FRANGIBLE BASE, SLIP BASE OR FRANGIBLE COUPLING TYPE.

4. REFER TO DRAWING A–44 FOR TYPICAL HYDRANT RURAL APPROACH AND PROTECTION.

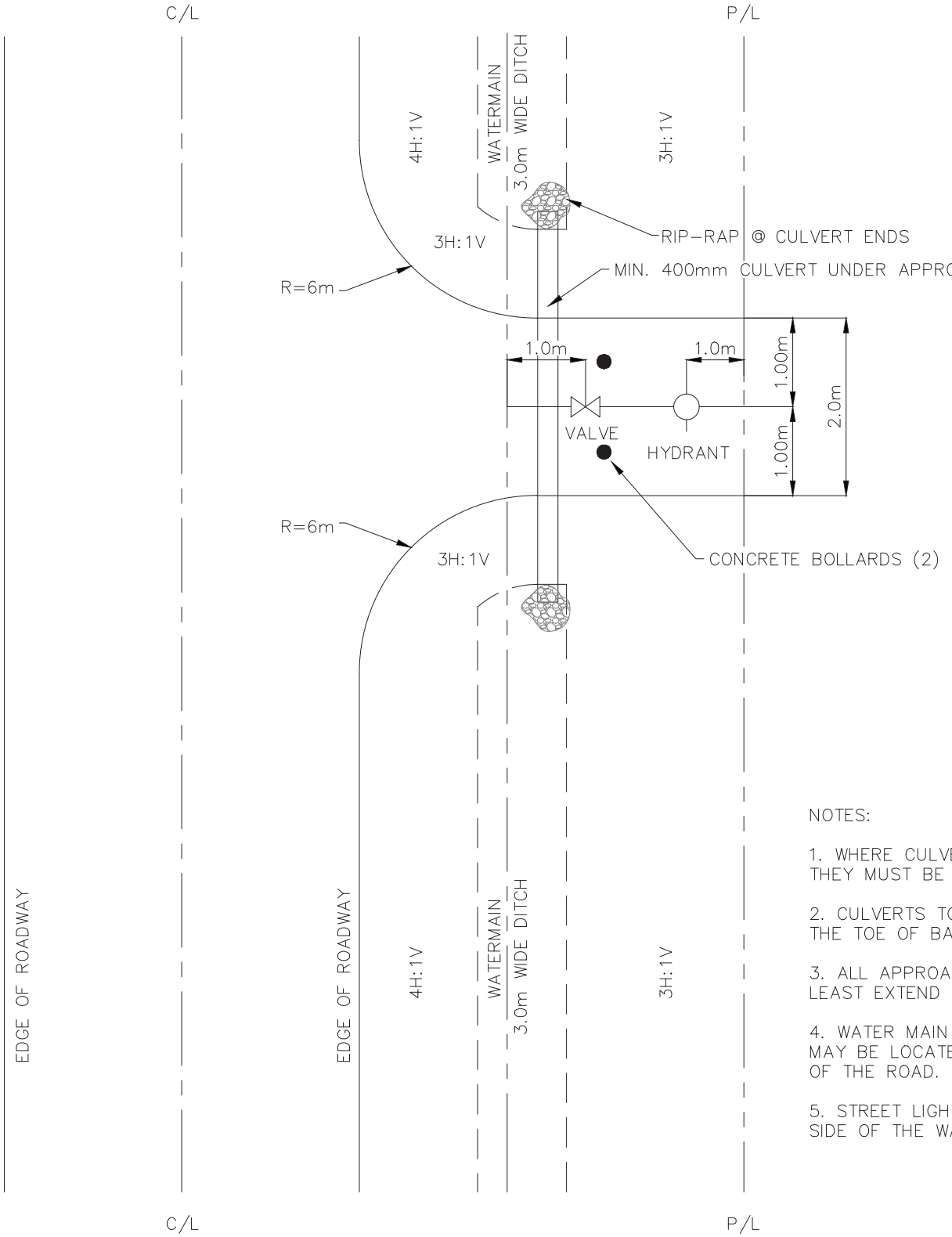
SCALE:	N.T.S.
DATE:	JANUARY 2019
APPD:	

TYPICAL RURAL UTILITY LAYOUT

Whitecourt

TOWN OF WHITECOURT

A-44



NOTES:

1. WHERE CULVERTS ARE REQUIRED THEY MUST BE CSP TYPE.

2. CULVERTS TO BE PLACED AT THE TOE OF BACKSLOPE.

3. ALL APPROACHES MUST AT LEAST EXTEND TO PROPERTY LINE.

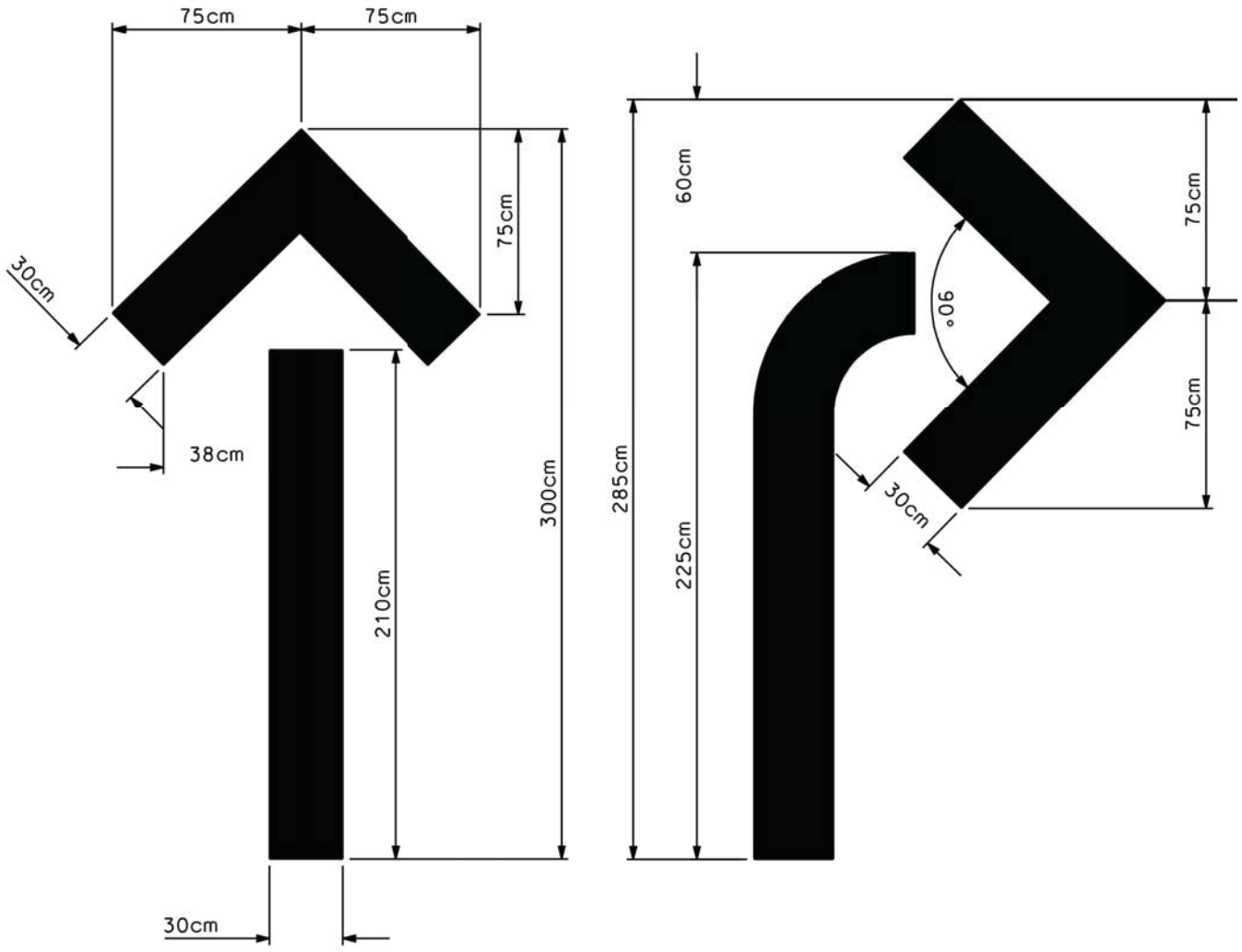
4. WATER MAIN AND HYDRANTS MAY BE LOCATED ON EITHER SIDE OF THE ROAD.

5. STREET LIGHTS TO BE OPPOSITE SIDE OF THE WATER MAIN.

SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

TYPICAL RURAL HYDRANT APPROACH LAYOUT

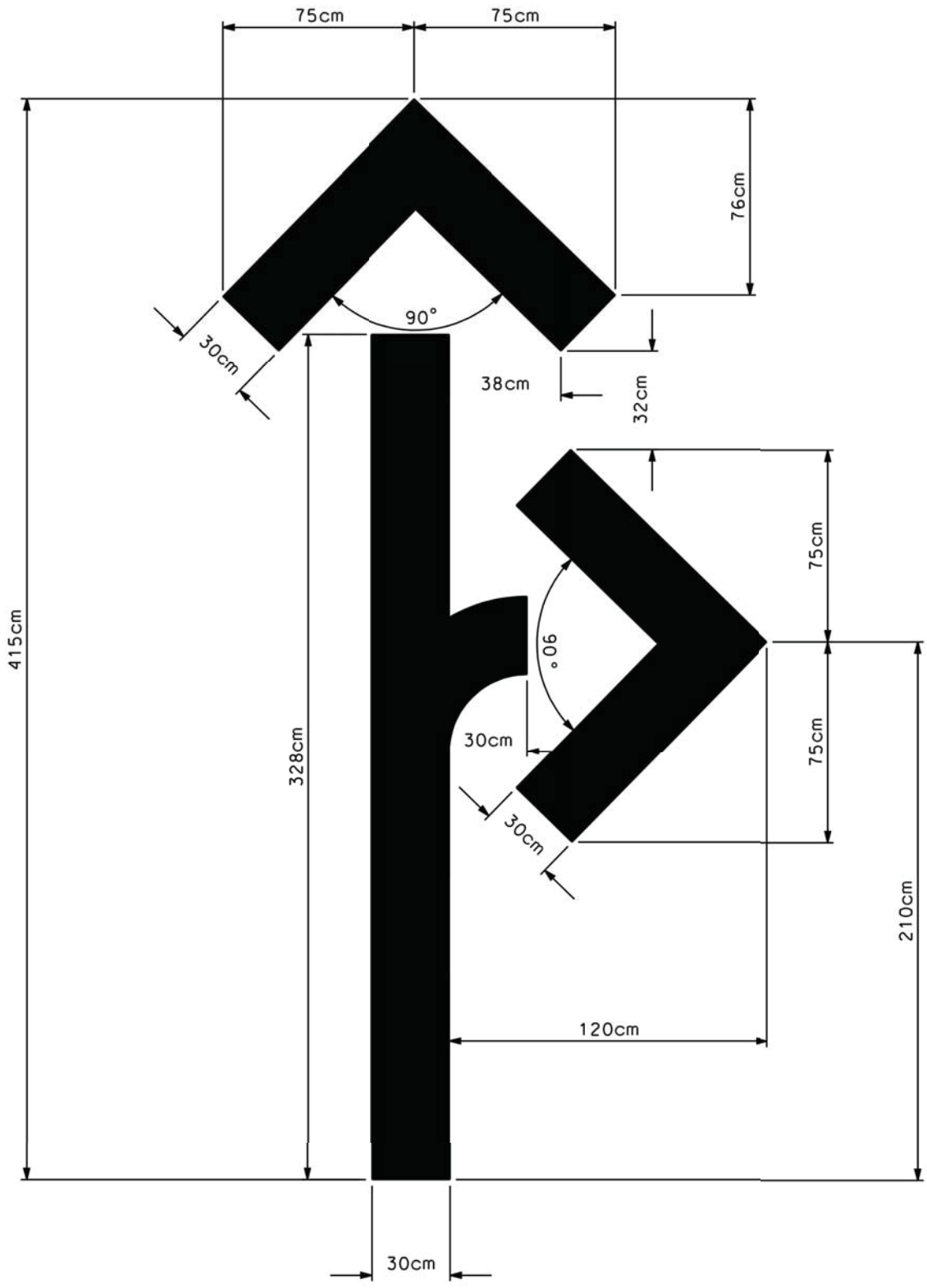
Whitecourt



SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

DIMENSIONS FOR SINGLE ARROW

Whitecourt



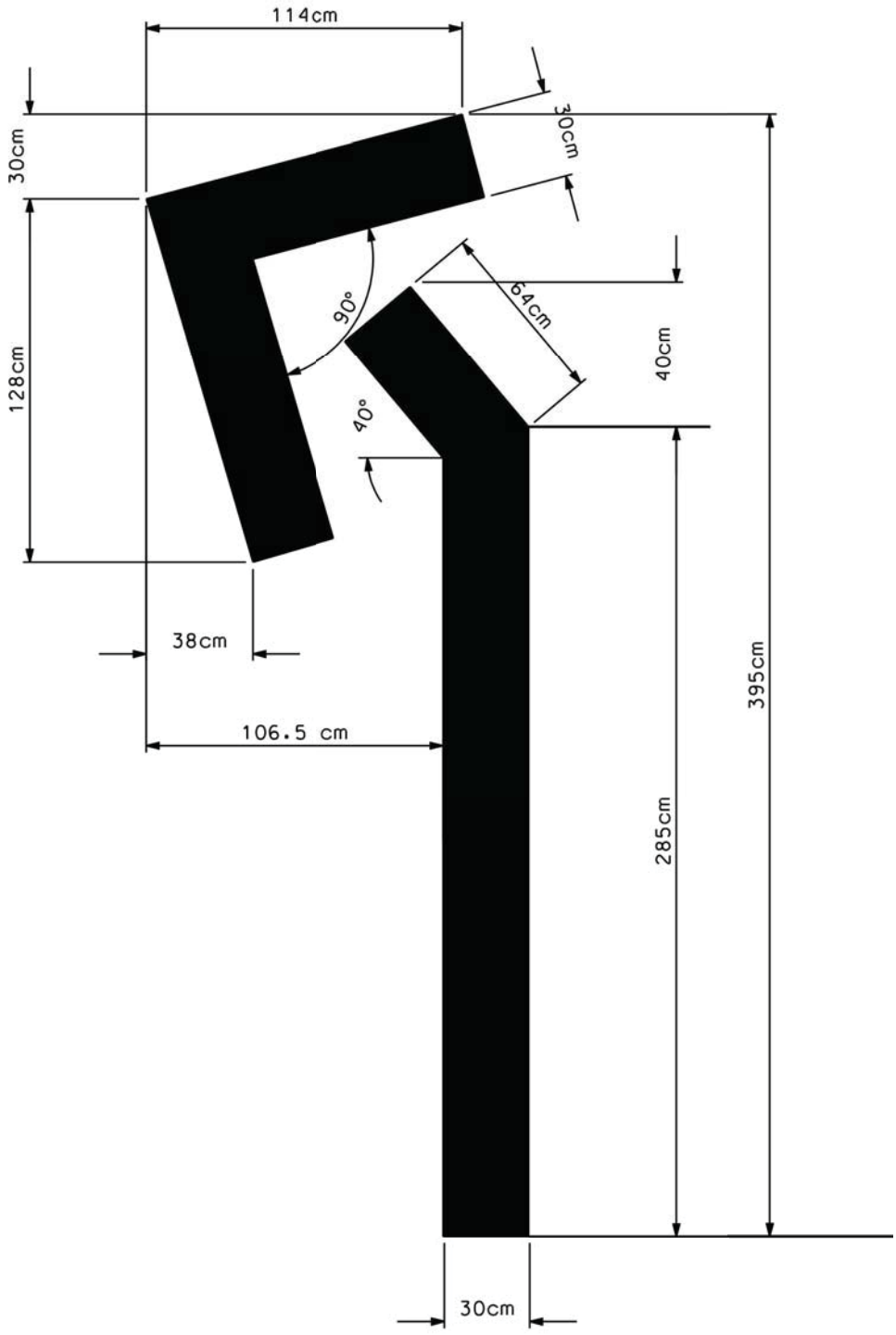
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

DIMENSIONS FOR DOUBLE ARROW

Whitecourt

TOWN OF WHITECOURT

A-47



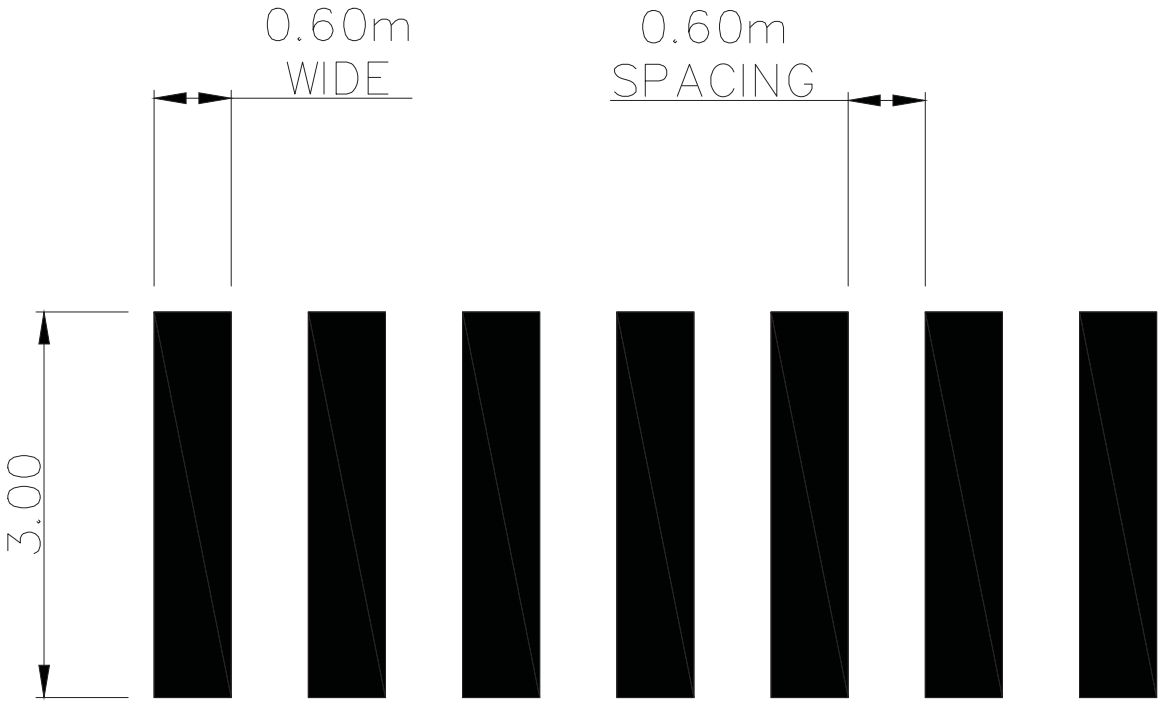
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

DIMENSIONS FOR MERGE ARROW

Whitecourt

TOWN OF WHITECOURT

A-47A



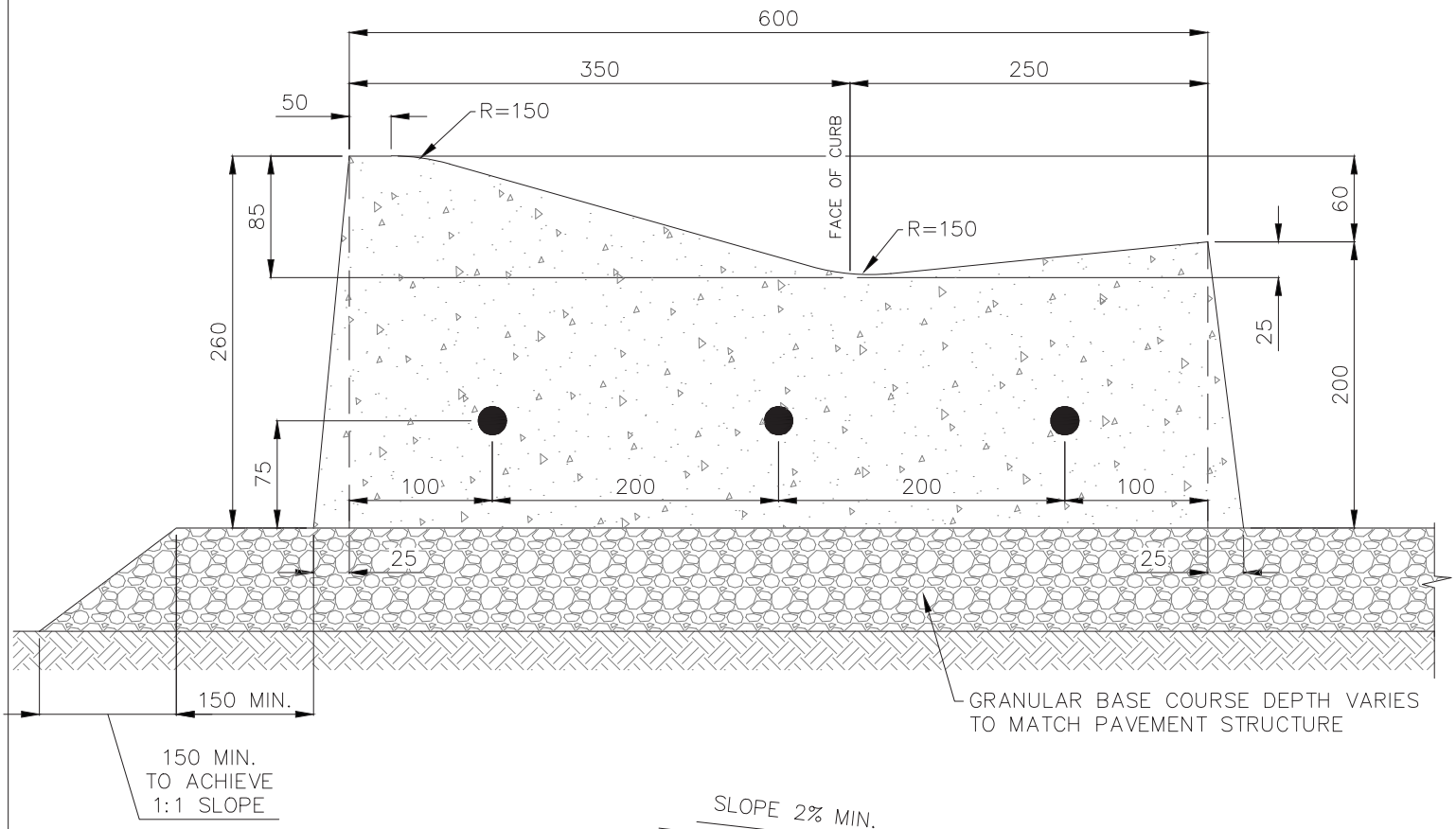
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

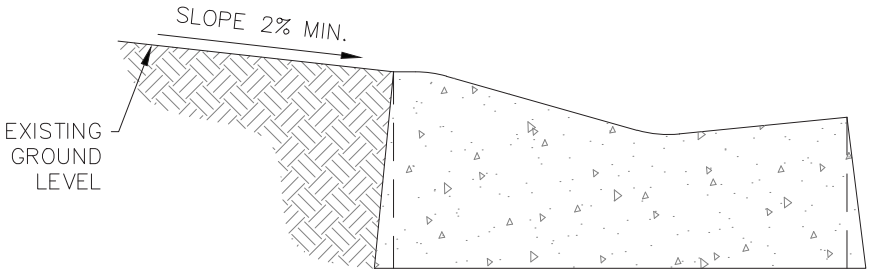
TYPICAL ZEBRA LINE CROSSING

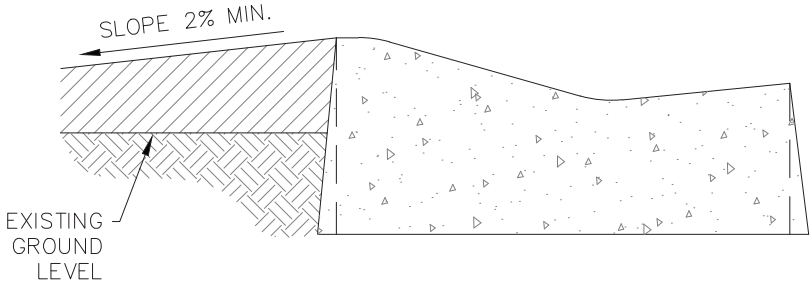
Whitecourt

TOWN OF WHITECOURT

A-48







NOTES:

1. 3–10M REINFORCING BARS AT ALL LANES, PARARAMPS AND COMMERCIAL, INDUSTRIAL AND PRIVATE DRIVEWAY ENTRANCES.

2. CONCRETE TO BE TYPE 50, 30MPa COMPRESSIVE STRENGTH AT 28 DAYS WITH 5–8% AIR ENTRAINMENT.

3. CURB RETURNS REQUIRES AT ALL CROSSINGS.

4. COMPACT BACKFILL TO 98% FOR 500mm FROM BACK OF CURB AND PROVIDE POSITIVE DRAINAGE OVER THE TOP OF CURB.

5. MAXIMUM SLOPE BEHIND CURB TO BE DETERMINED BY FIELD ENGINEER.

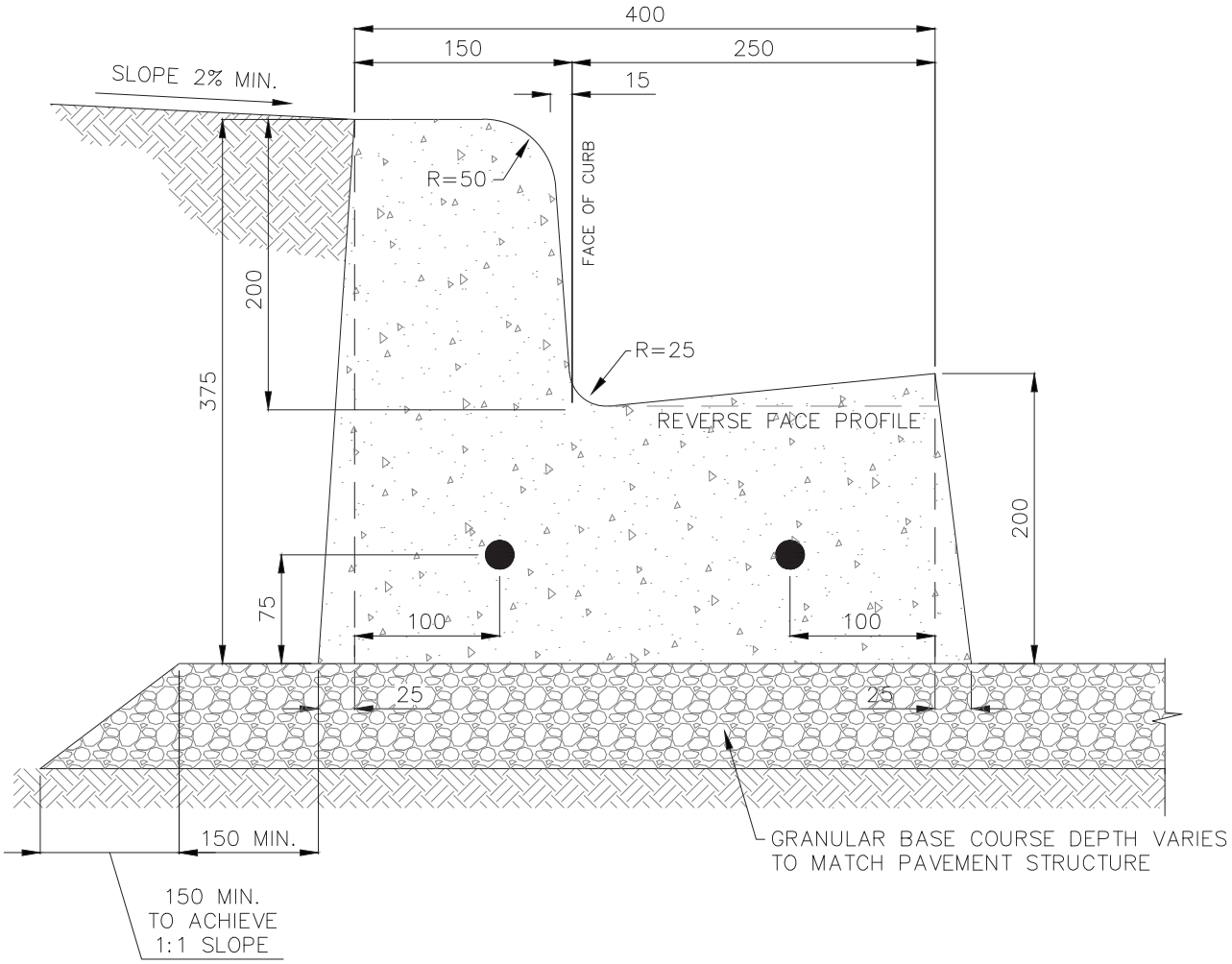
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

ROLLED CURB & GUTTER

Whitecourt

TOWN OF WHITECOURT

A-49



NOTES:

1. 2–10M REINFORCING BARS AT ALL LANES, PARARAMPS AND COMMERCIAL, INDUSTRIAL AND PRIVATE DRIVEWAY ENTRANCES.

2. CONCRETE TO BE TYPE 50, 30MPa COMPRESSIVE STRENGTH AT 28 DAYS WITH 5–8% AIR ENTRAINMENT.

3. CURB RETURNS REQUIRES AT ALL CROSSINGS.

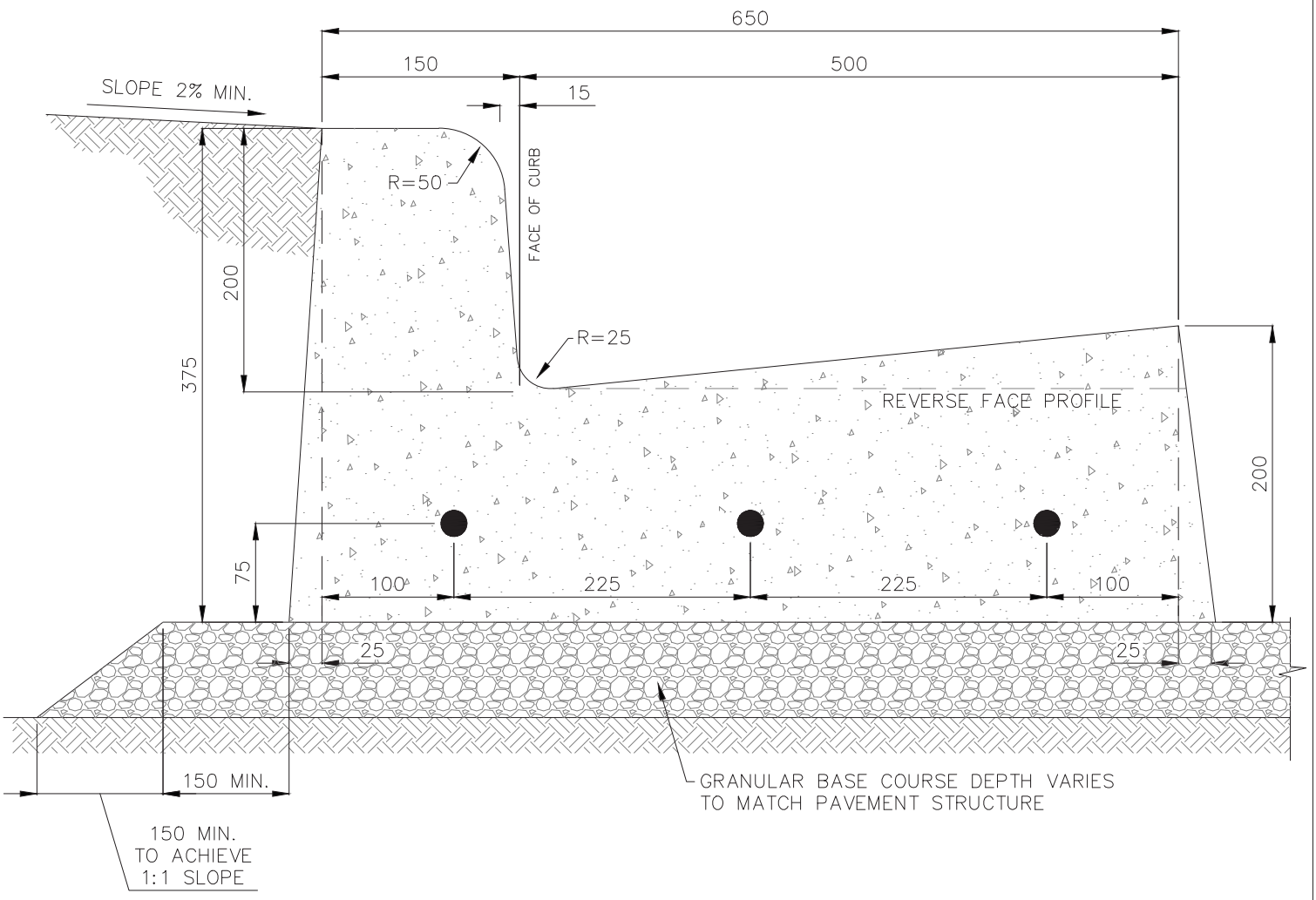
4. COMPACT BACKFILL TO 98% FOR 500mm FROM BACK OF CURB AND PROVIDE POSITIVE DRAINAGE OVER THE TOP OF CURB.

5. MAXIMUM SLOPE BEHIND CURB TO BE DETERMINED BY FIELD ENGINEER.

SCALE: N.T.S.	STRAIGHT FACED CURB & GUTTER (250mm)	Whitecourt
DATE: DECEMBER 2019		
APPD:		

TOWN OF WHITECOURT

A-50



NOTES:

1. 2–10M REINFORCING BARS AT ALL LANES, PARARAMPS AND COMMERCIAL, INDUSTRIAL AND PRIVATE DRIVEWAY ENTRANCES.

2. CONCRETE TO BE TYPE 50, 30MPa COMPRESSIVE STRENGTH AT 28 DAYS WITH 5–8% AIR ENTRAINMENT.

3. CURB RETURNS REQUIRES AT ALL CROSSINGS.

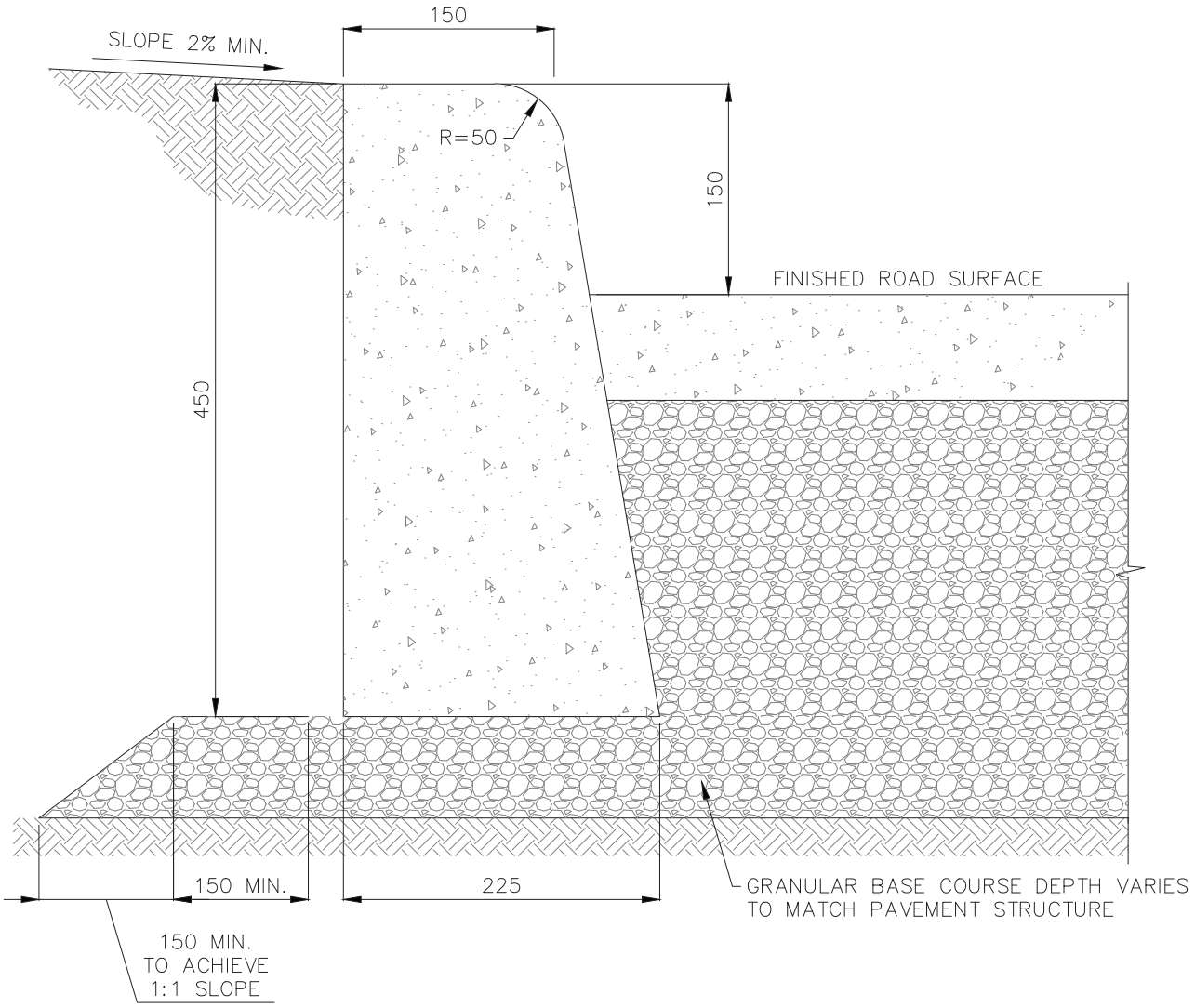
4. COMPACT BACKFILL TO 98% FOR 500mm FROM BACK OF CURB AND PROVIDE POSITIVE DRAINAGE OVER THE TOP OF CURB.

5. MAXIMUM SLOPE BEHIND CURB TO BE DETERMINED BY FIELD ENGINEER.

SCALE: N.T.S.	STRAIGHT FACED CURB & GUTTER (500mm)	Whitecourt
DATE: DECEMBER 2019		
APPD:		

TOWN OF WHITECOURT

A-51



NOTES:

1. CONCRETE TO BE TYPE 50, 30MPa COMPRESSIVE STRENGTH AT 28 DAYS WITH 5–8% AIR ENTRAINMENT.

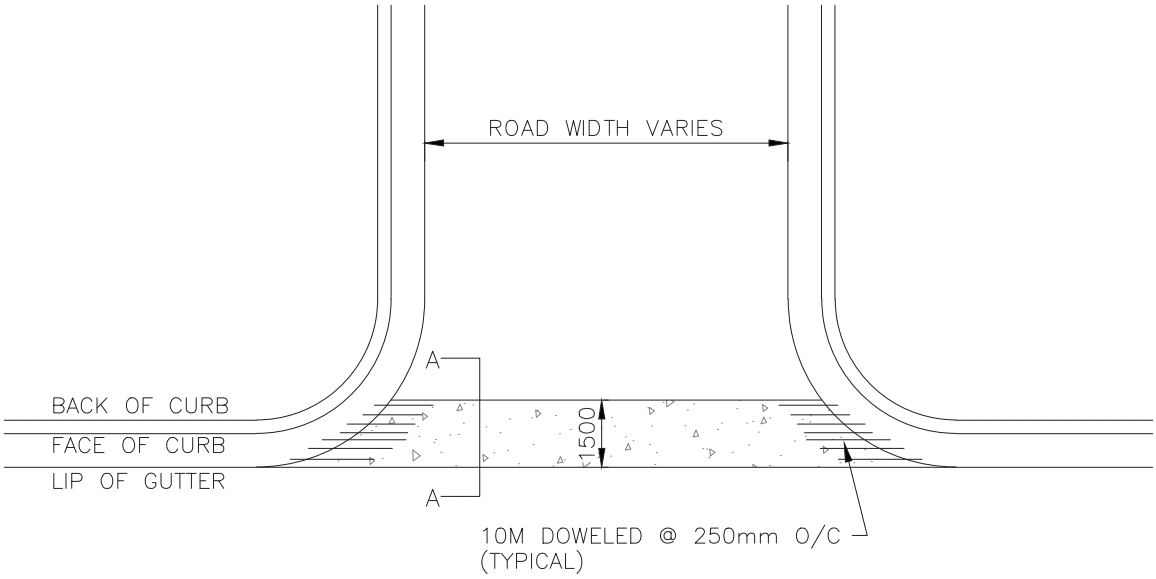
2. COMPACT BACKFILL TO 98% FOR 500mm FROM BACK OF CURB AND PROVIDE POSITIVE DRAINAGE OVER THE TOP OF CURB.

3. MAXIMUM SLOPE BEHIND CURB TO BE DETERMINED BY FIELD ENGINEER.

SCALE: N.T.S.	STANDARD BARRIER CURB	Whitecourt
DATE: DECEMBER 2019		
APPD:		

TOWN OF WHITECOURT

A-52



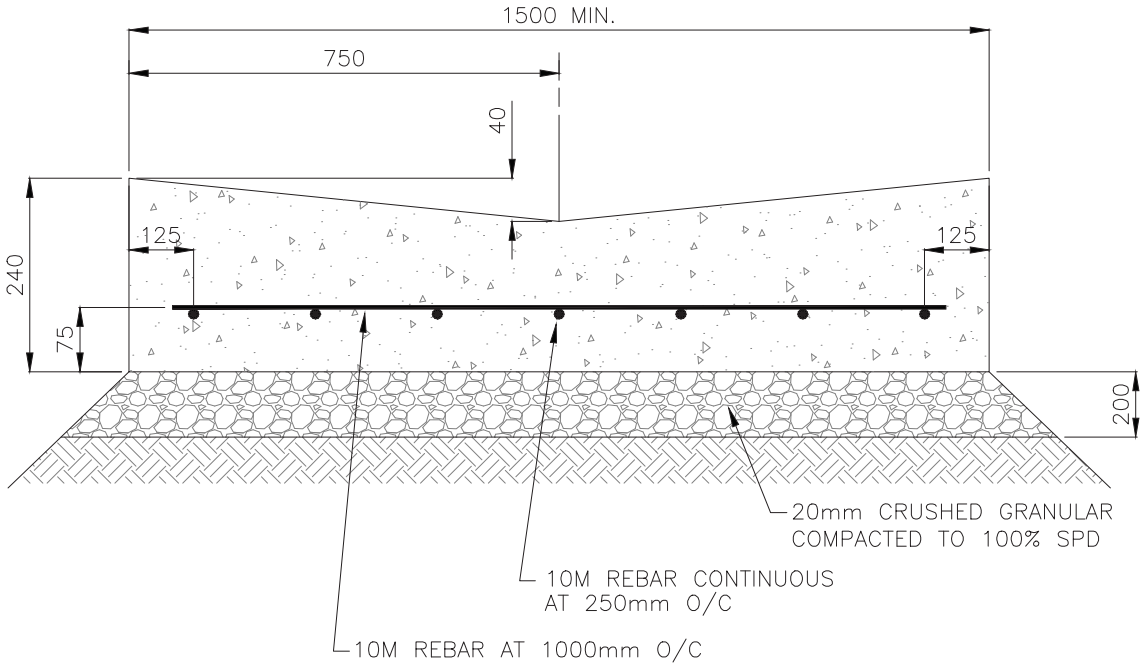
PLAN VIEW

NOTES:

1. EDGE OF SWALE TO MATCH GUTTER EDGE.

2 ROLL DOWN UPSTREAM GUTTER PAN TO ALLOW WATER TO DRAIN.

3. CONCRETE TO BE TYPE 50, 30MPa COMPRESSIVE STRENGTH AT 28 DAYS WITH 5–8% AIR ENTRAINMENT.



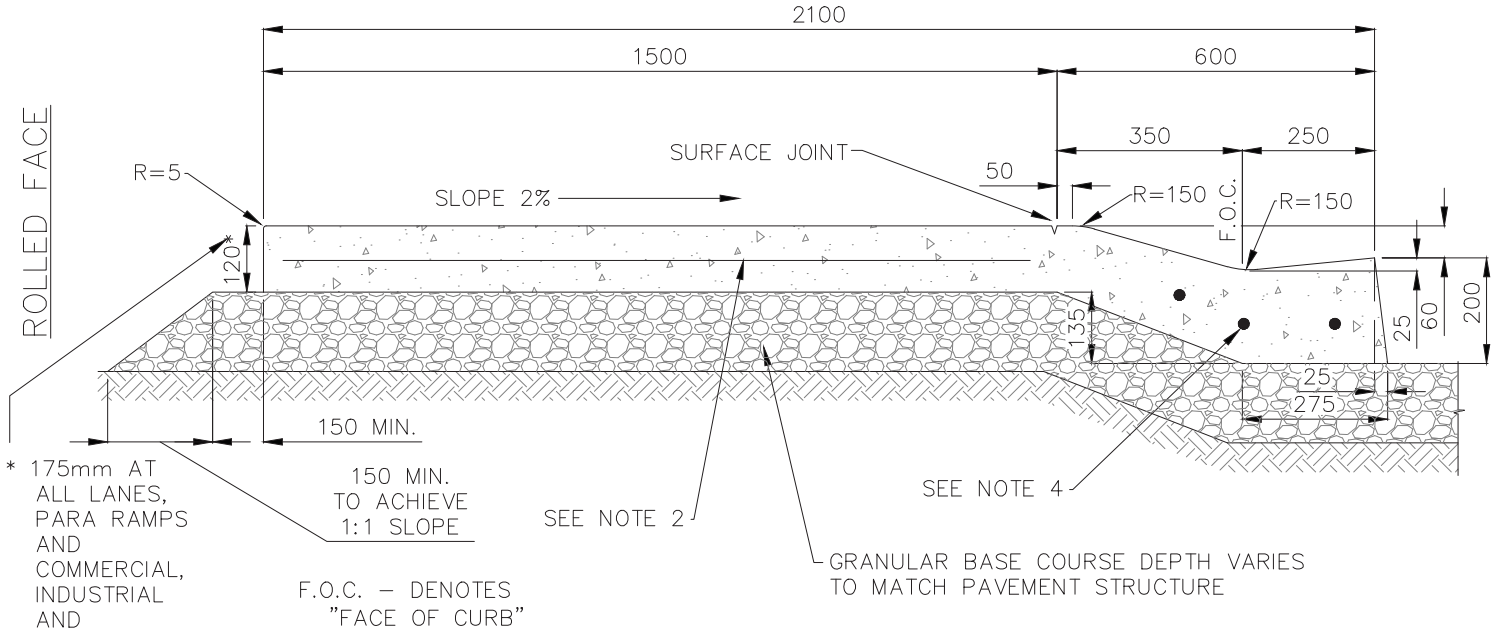
ELEVATION

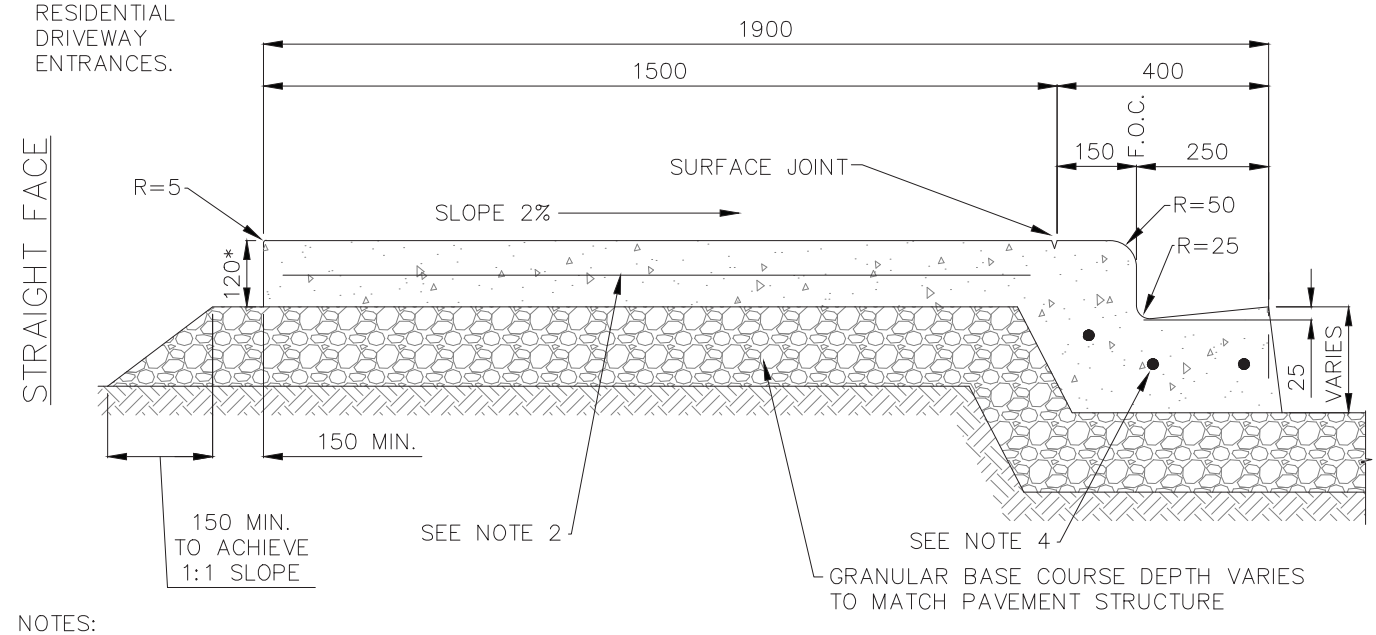
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

CONCRETE SWALE

TOWN OF WHITECOURT

A-53





NOTES:

1. 15mm EXTRUDED BATTER AT BACK OF WALK FOR EXTRUDED SECTIONS.

2. 152x152 MW47.6xMW47.6 WIRE MESH TO BE PLACED IN SIDEWALK PRIOR TO PLACING CONCRETE ACROSS ALL LANES, PARA RAMPS AND COMMERCIAL, INDUSTRIAL AND RESIDENTIAL DRIVEWAY ENTRANCES.

3. CONCRETE TO BE TYPE 50, 30Mpa. COMPRESSIVE STRENGTH AT 28 DAYS WITH 5–8% AIR ENTRAINMENT.

4. 3–10M REINFORCEMENT BARS ALL LANES AND RESIDENTIAL DRIVEWAY ENTRANCES.

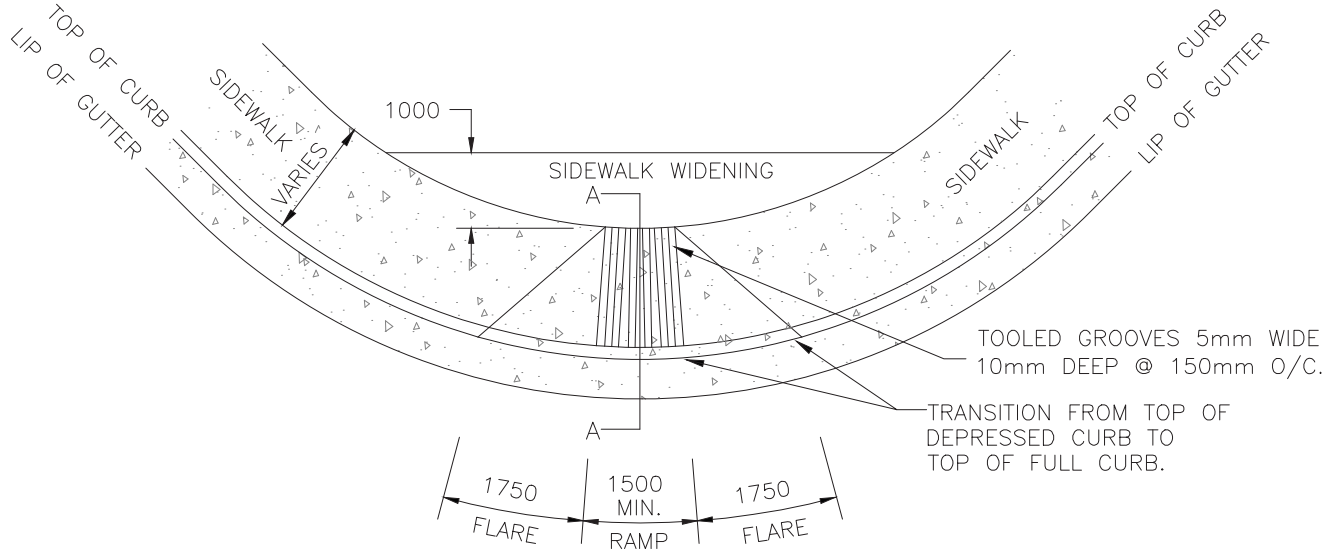
5. COMPACT BACKFILL TO 98% FOR 500mm FROM BACK OF WALK.

6. PROVIDE POSITIVE DRAINAGE OVER TOP OF WALK.

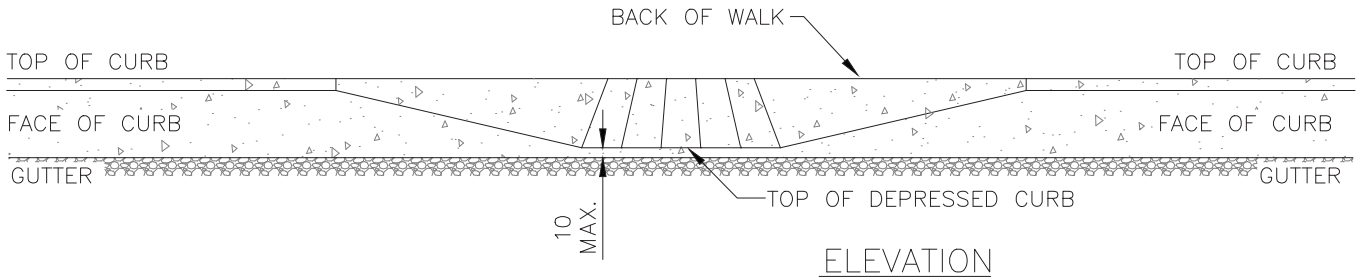
SCALE: N.T.S.	MONOLITHIC CURB, GUTTER & SIDEWALK	Whitecourt
DATE: DECEMBER 2019		
APPD:		

TOWN OF WHITECOURT

A-54



PLAN VIEW



ELEVATION

NOTES:

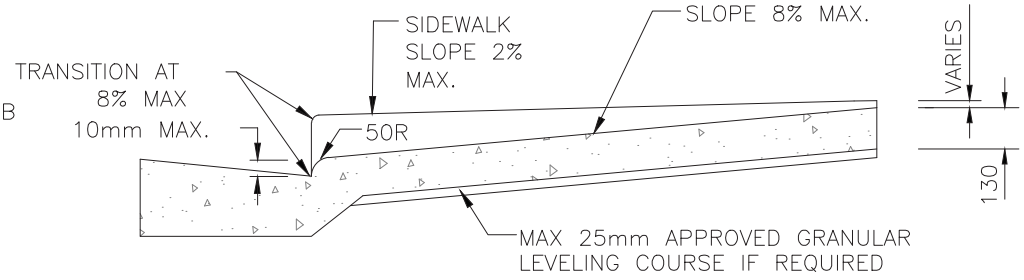
1. POUR CURB AND RAMP MONOLITHICALLY.

2. TRANSITION DISTANCE FROM TOP OF DEPRESSED CURB TO TOP OF FULL CURB VARIES WITH SIDEWALK DEPTH OR CURB HEIGHT.

3. RAMPS FOR USERS OF WHEELCHAIRS/BICYCLES SHOULD BE LOCATED AT ALL JUNCTIONS OF CROSSWALKS AND SIDEWALKS. RAMP MUST BE LOCATED WITHIN A CROSSWALK.

4. GROOVES ON SIDEWALK RAMPS ARE TO ALERT PERSONS WHO ARE VISUALLY IMPAIRED OF THE CURB–CUT AND A STREET CROSSING.

5. WHERE CROSSWALKS ARE CONTROLLED BY SIGNALS WITH A PUSH–BUTTON SYSTEM, THE SIDEWALKS AND RAMPS MUST ALLOW ACCESS BY WHEELCHAIR TO THE PUSH–BUTTON.



SECTION A–A

6. WHERE RIGHT–OF–WAY IS AVAILABLE, THE SIDEWALK IS TO BE WIDENED AT CORNER LOCATIONS AS SHOWN SO THAT AT LEAST A 1.0m WIDTH OF FLAT SIDEWALK IS PROVIDED ADJACENT TO THE RAMP.

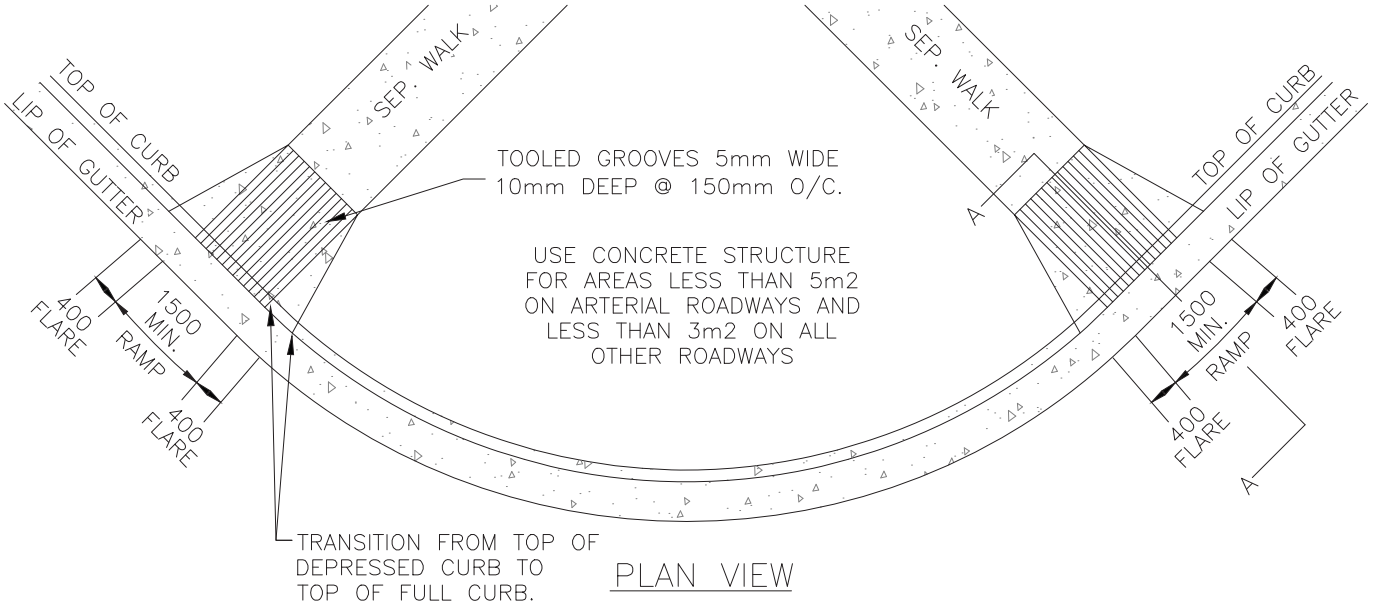
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

PARA RAMP ON CORNER TYPE 'A'

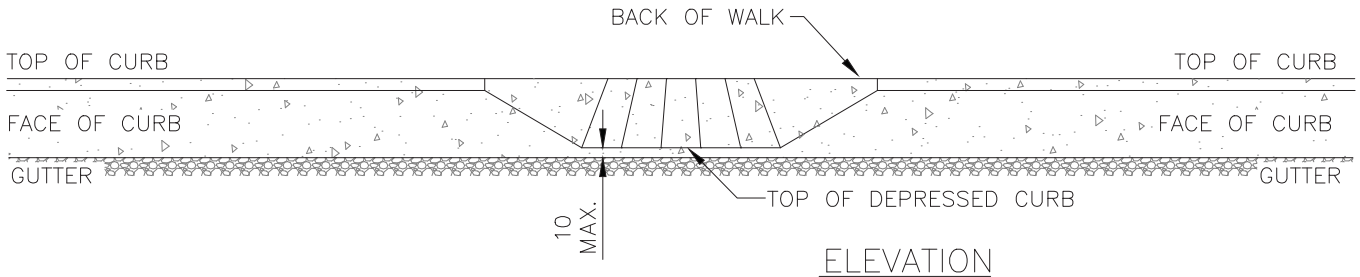
Whitecourt

TOWN OF WHITECOURT

A-55



PLAN VIEW



ELEVATION

NOTES:

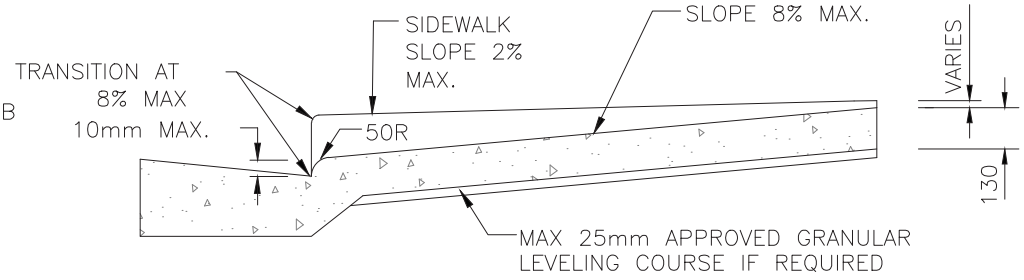
1. POUR CURB AND RAMP MONOLITHICALLY.

2. TRANSITION DISTANCE FROM TOP OF DEPRESSED CURB TO TOP OF FULL CURB VARIES WITH SIDEWALK DEPTH OR CURB HEIGHT.

3. RAMPS FOR USERS OF WHEELCHAIRS/BICYCLES SHOULD BE LOCATED AT ALL JUNCTIONS OF CROSSWALKS AND SIDEWALKS. RAMP MUST BE LOCATED WITHIN A CROSSWALK.

4. GROOVES ON SIDEWALK RAMPS ARE TO ALERT PERSONS WHO ARE VISUALLY IMPAIRED OF THE CURB–CUT AND A STREET CROSSING.

5. WHERE CROSSWALKS ARE CONTROLLED BY SIGNALS WITH A PUSH–BUTTON SYSTEM, THE SIDEWALKS AND RAMPS MUST ALLOW ACCESS BY WHEELCHAIR TO THE PUSH–BUTTON.



SECTION A–A

6. WHERE RIGHT–OF–WAY IS AVAILABLE, THE SIDEWALK IS TO BE WIDENED AT CORNER LOCATIONS AS SHOWN SO THAT AT LEAST A 1.0m WIDTH OF FLAT SIDEWALK IS PROVIDED ADJACENT TO THE RAMP.

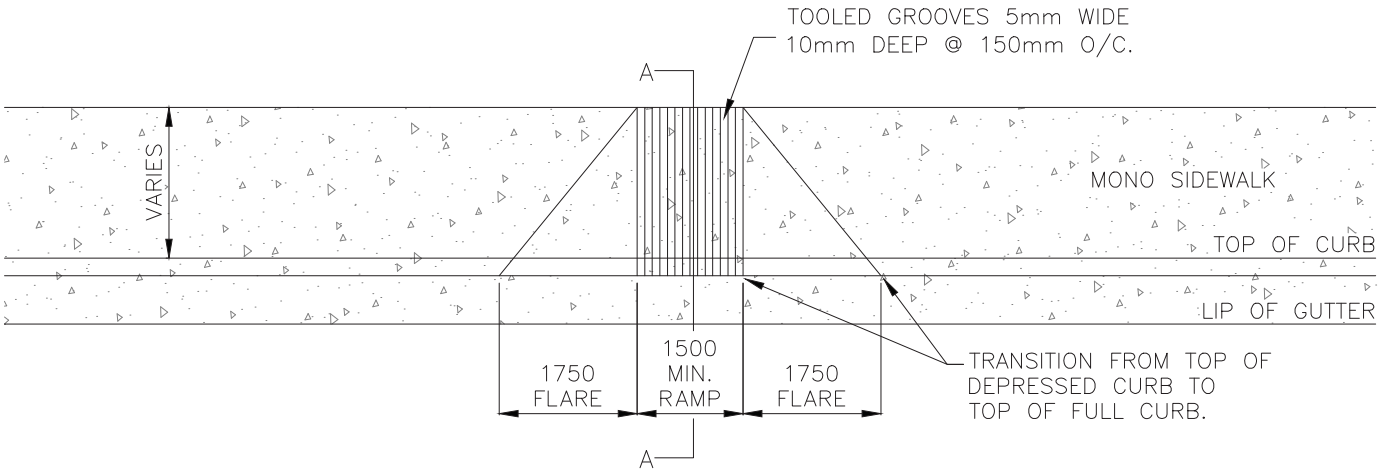
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

PARA RAMP ON CORNER TYPE 'B'

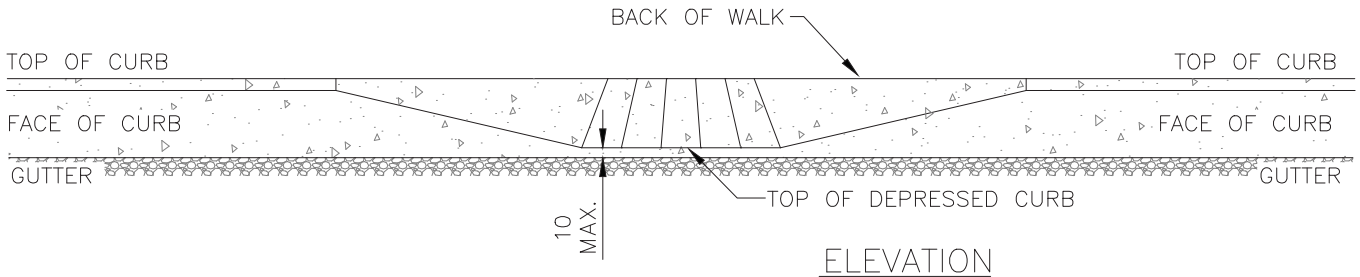
Whitecourt

TOWN OF WHITECOURT

A-56



PLAN VIEW



ELEVATION

NOTES:

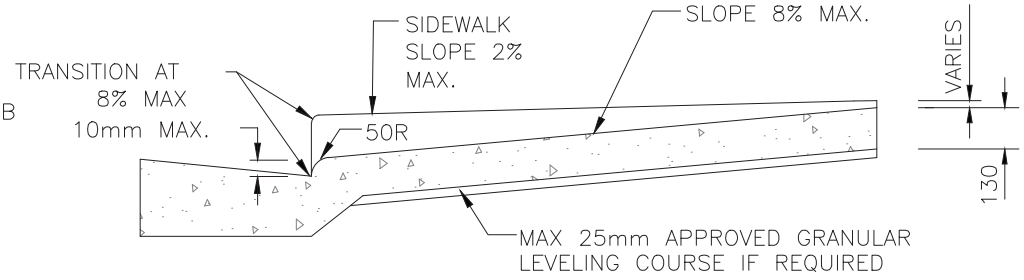
1. POUR CURB AND RAMP MONOLITHICALLY.

2. TRANSITION DISTANCE FROM TOP OF DEPRESSED CURB TO TOP OF FULL CURB VARIES WITH SIDEWALK DEPTH OR CURB HEIGHT.

3. RAMPS FOR USERS OF WHEELCHAIRS/BICYCLES SHOULD BE LOCATED AT ALL JUNCTIONS OF CROSSWALKS AND SIDEWALKS. RAMP MUST BE LOCATED WITHIN A CROSSWALK.

4. GROOVES ON SIDEWALK RAMPS ARE TO ALERT PERSONS WHO ARE VISUALLY IMPAIRED OF THE CURB–CUT AND A STREET CROSSING.

5. WHERE CROSSWALKS ARE CONTROLLED BY SIGNALS WITH A PUSH–BUTTON SYSTEM, THE SIDEWALKS AND RAMPS MUST ALLOW ACCESS BY WHEELCHAIR TO THE PUSH–BUTTON.



SECTION A–A

6. WHERE RIGHT–OF–WAY IS AVAILABLE, THE SIDEWALK IS TO BE WIDENED AT CORNER LOCATIONS AS SHOWN SO THAT AT LEAST A 1.0m WIDTH OF FLAT SIDEWALK IS PROVIDED ADJACENT TO THE RAMP.

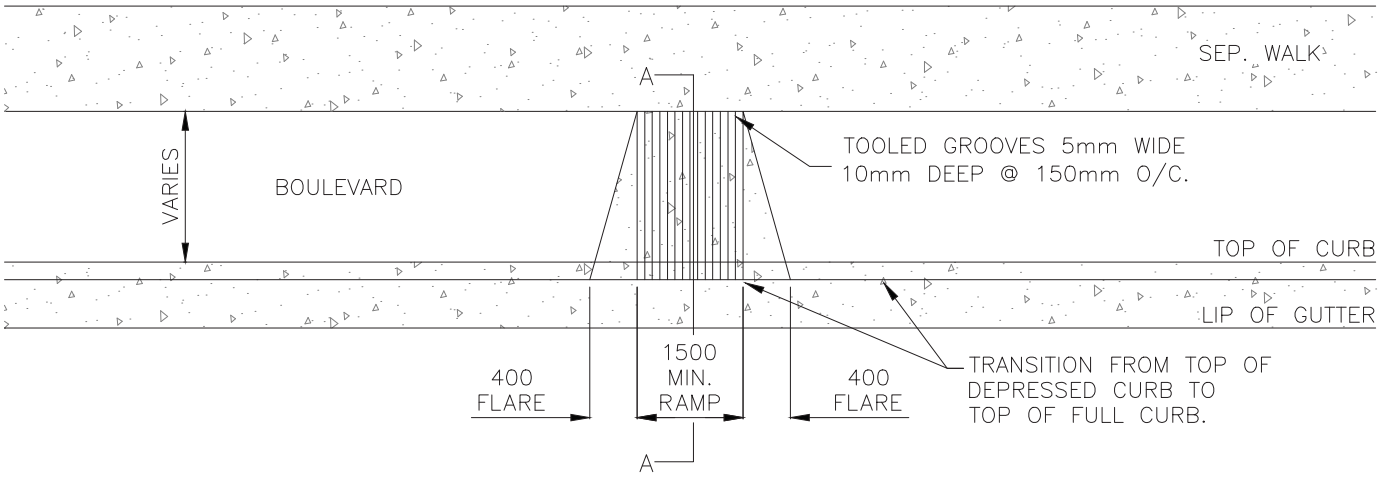
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

PARA RAMP ON TANGENT TYPE 'C'

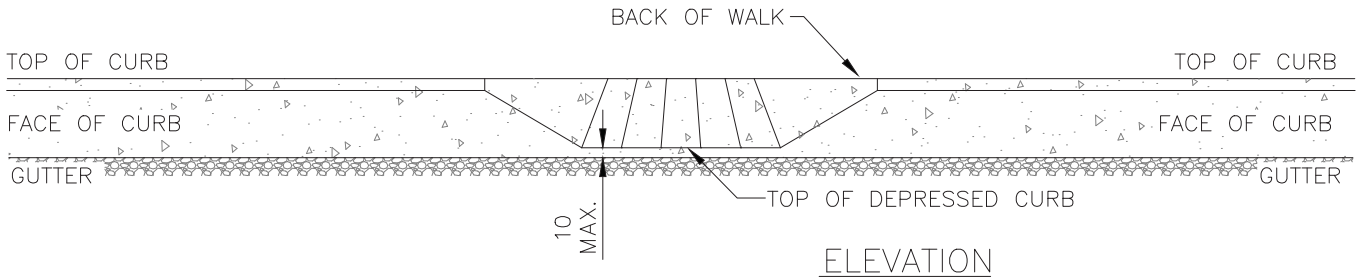
Whitecourt

TOWN OF WHITECOURT

A-57



PLAN VIEW



ELEVATION

NOTES:

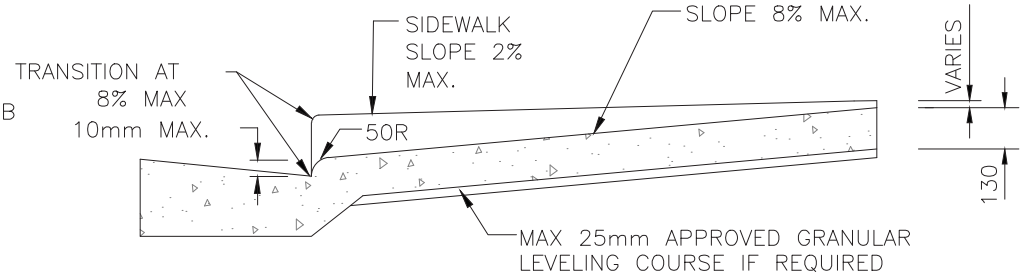
1. POUR CURB AND RAMP MONOLITHICALLY.

2. TRANSITION DISTANCE FROM TOP OF DEPRESSED CURB TO TOP OF FULL CURB VARIES WITH SIDEWALK DEPTH OR CURB HEIGHT.

3. RAMPS FOR USERS OF WHEELCHAIRS/BICYCLES SHOULD BE LOCATED AT ALL JUNCTIONS OF CROSSWALKS AND SIDEWALKS. RAMP MUST BE LOCATED WITHIN A CROSSWALK.

4. GROOVES ON SIDEWALK RAMPS ARE TO ALERT PERSONS WHO ARE VISUALLY IMPAIRED OF THE CURB–CUT AND A STREET CROSSING.

5. WHERE CROSSWALKS ARE CONTROLLED BY SIGNALS WITH A PUSH–BUTTON SYSTEM, THE SIDEWALKS AND RAMPS MUST ALLOW ACCESS BY WHEELCHAIR TO THE PUSH–BUTTON.



SECTION A–A

6. WHERE RIGHT–OF–WAY IS AVAILABLE, THE SIDEWALK IS TO BE WIDENED AT CORNER LOCATIONS AS SHOWN SO THAT AT LEAST A 1.0m WIDTH OF FLAT SIDEWALK IS PROVIDED ADJACENT TO THE RAMP.

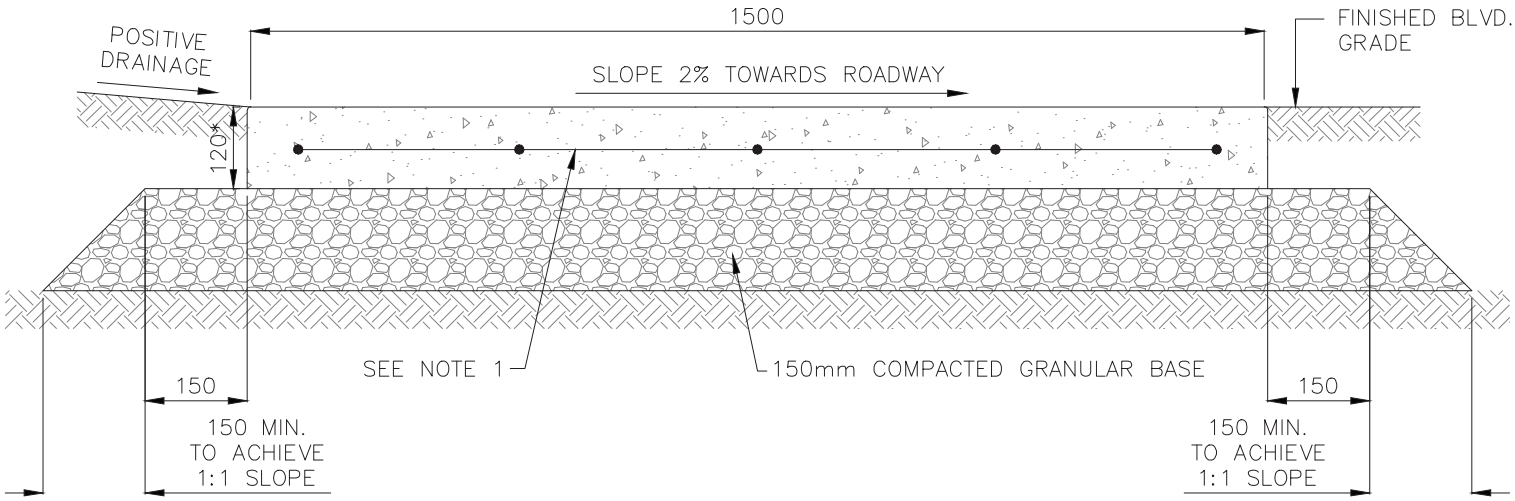
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

PARA RAMP ON TANGENT TYPE 'D'

Whitecourt

TOWN OF WHITECOURT

A-58



* 175mm AT ALL LANES, PARA RAMPS AND COMMERCIAL, INDUSTRIAL AND RESIDENTIAL DRIVEWAY ENTRANCES.

NOTES:

1. 152x152 MW47.6xMW47.6 WIRE MESH TO BE PLACED IN SIDEWALK PRIOR TO PLACING CONCRETE ACROSS ALL LANES, PARA RAMPS AND COMMERCIAL, INDUSTRIAL AND RESIDENTIAL DRIVEWAY ENTRANCES.

2. CONCRETE TO BE TYPE 50, 30Mpa. COMPRESSIVE STRENGTH AT 28 DAYS WITH 5–8% AIR ENTRAINMENT.

3. ELEVATION AT FRONT OF WALK TO BE SET SUCH THAT A MIN. SLOPE OF 2% IS ACHIEVED ACROSS BOULEVARD.

4. COMPACT BACKFILL TO 98% FOR 500mm FROM BACK OF WALK.

5. PROVIDE POSITIVE DRAINAGE OVER TOP OF WALK.

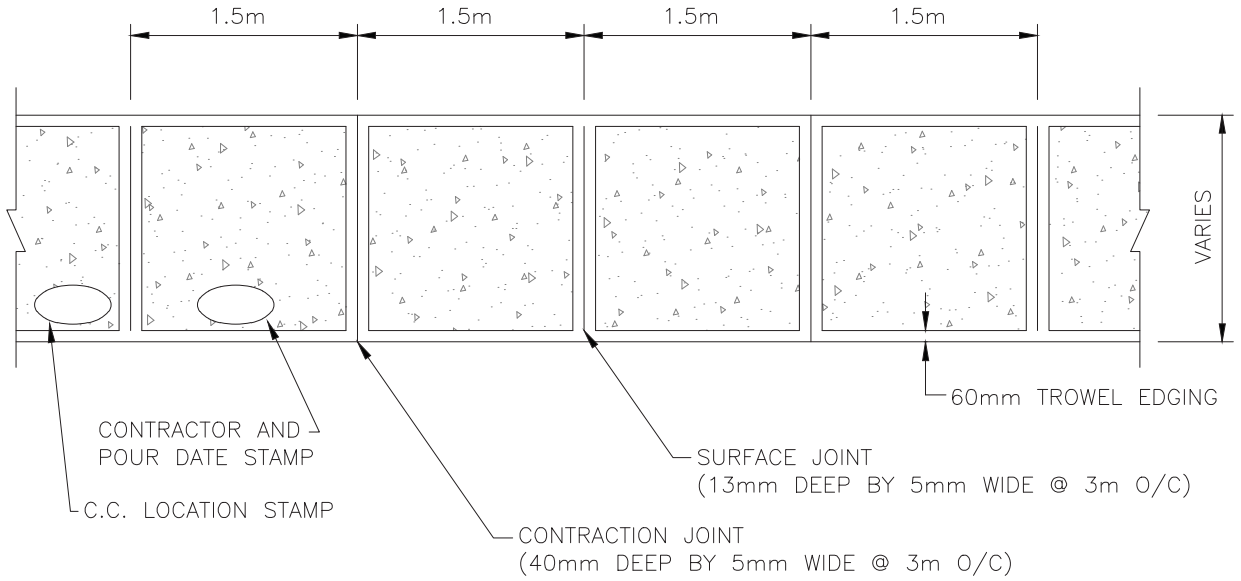
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

1.5m SEPARATE SIDEWALK

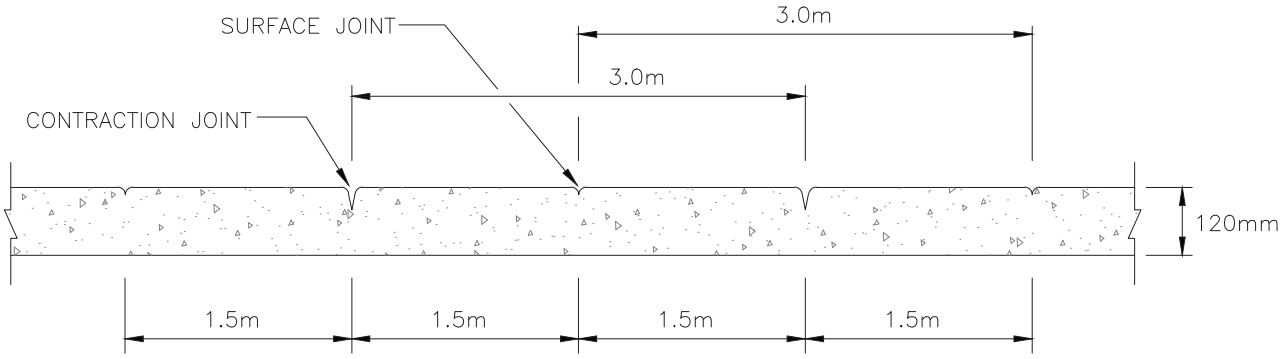
Whitecourt

TOWN OF WHITECOURT

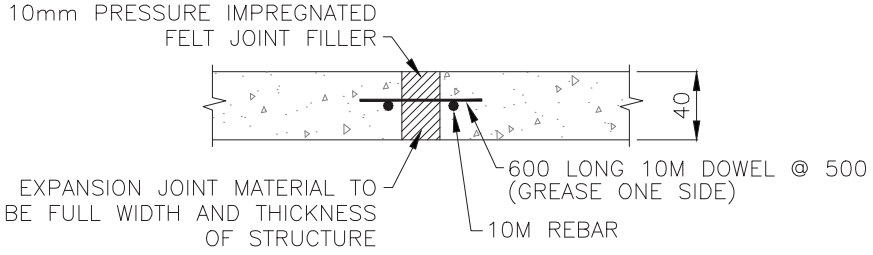
A-59



PLAN



ELEVATION



EXPANSION JOINT DETAIL

NOTES:

1. SIDEWALK JOINTS TO LINE UP WITH CURB AND GUTTER JOINTS IN MONOLITHIC SECTIONS.

2. 60mm TROWELED EDGING REQUIRED ONLY IN SEPARATE WALK CONSTRUCTION.

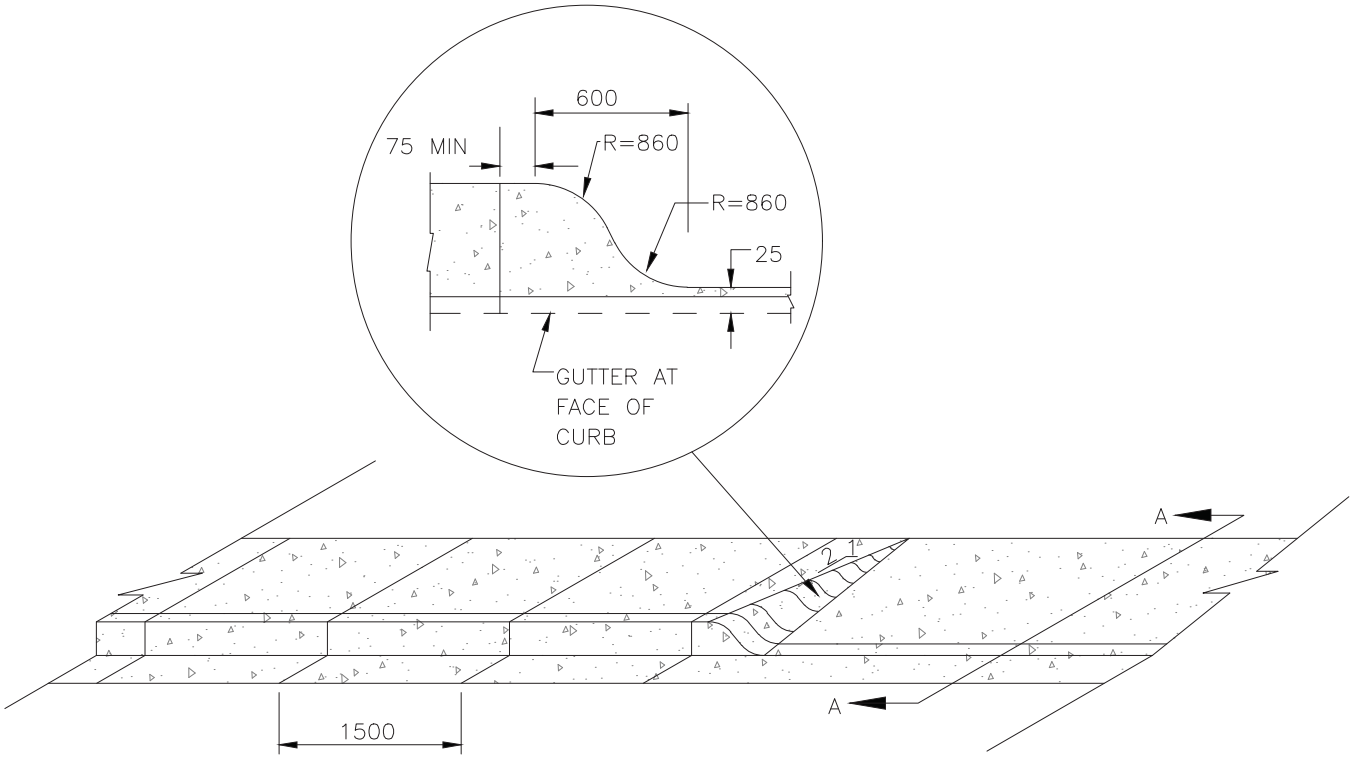
SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

SIDEWALK JOINT AND FINISHING DETAILS

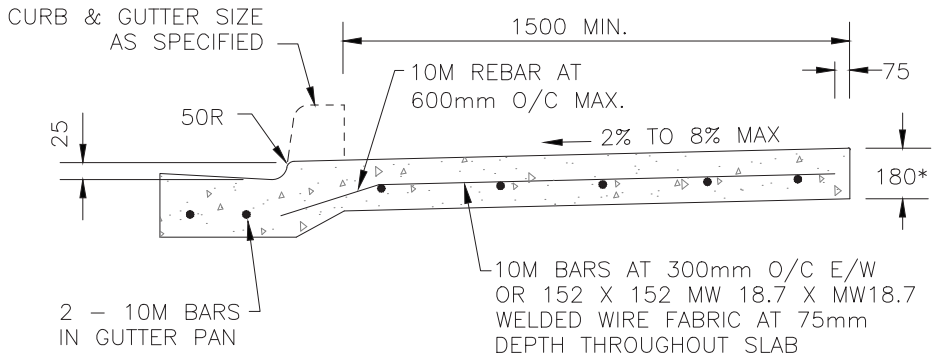
Whitecourt

TOWN OF WHITECOURT

A-60



PLAN



SECTION A–A

* 150 RESIDENTIAL
* 175 COMMERCIAL/LANE

NOTES:

1. 152x152 MW47.6xMW47.6 WIRE MESH TO BE PLACED IN SIDEWALK PRIOR TO PLACING CONCRETE ACROSS ALL LANES, PARA RAMPS AND COMMERCIAL, INDUSTRIAL AND RESIDENTIAL DRIVEWAY ENTRANCES.

2. CONCRETE TO BE TYPE 50, 30Mpa. COMPRESSIVE STRENGTH AT 28 DAYS WITH 5–8% AIR ENTRAINMENT.

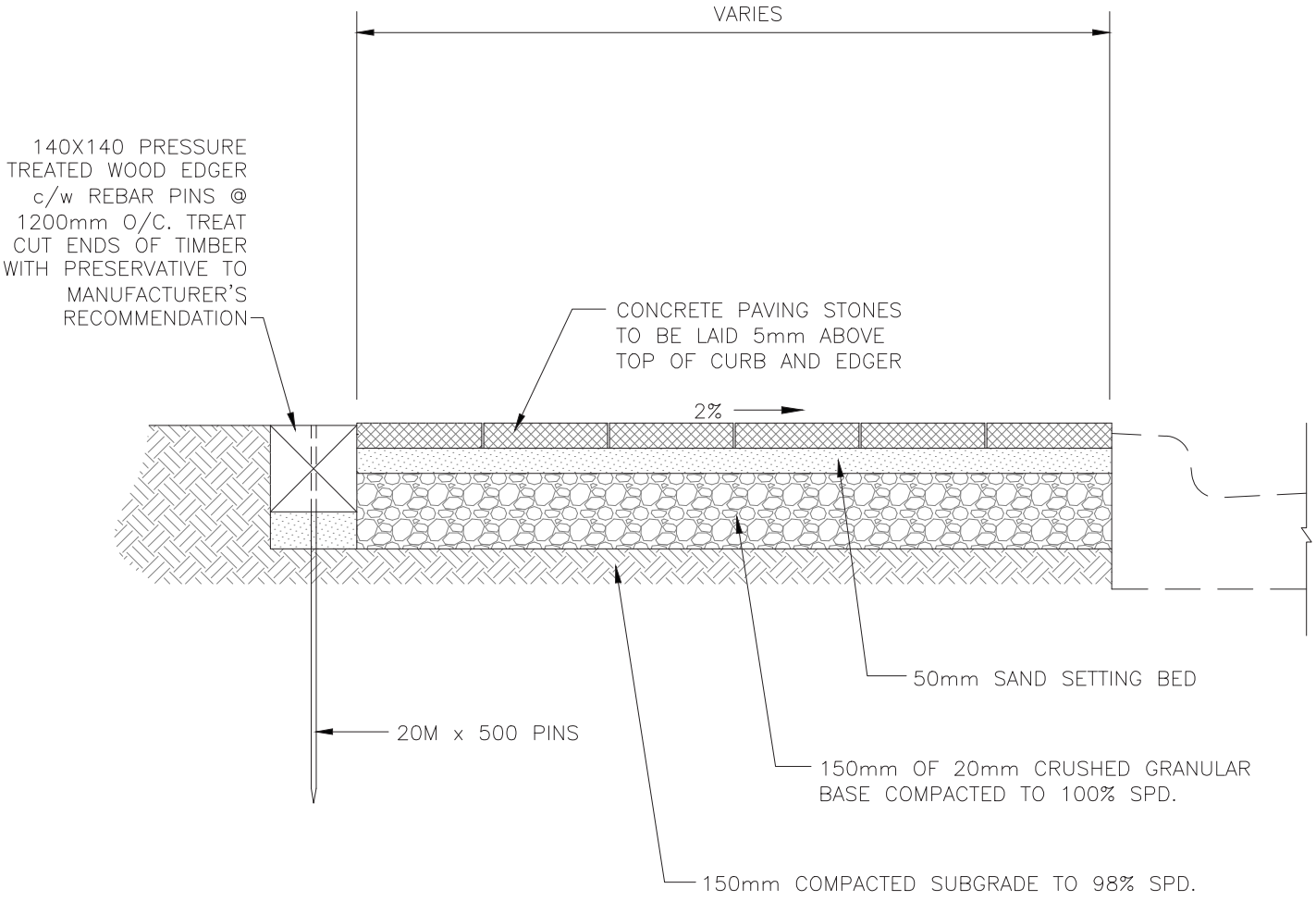
3. 3–10M REINFORCEMENT BARS ALL LANES AND RESIDENTIAL DRIVEWAY ENTRANCES.

4. COMPACT BACKFILL TO 98% FOR 500mm FROM BACK OF WALK.

SCALE: N.T.S.	CONCRETE LANE ACCESS DETAILS	Whitecourt
DATE: DECEMBER 2019		
APPD:		

TOWN OF WHITECOURT

A-61



SCALE:	N.T.S.
DATE:	DECEMBER 2019
APPD:	

CONCRETE PAVING STONES

Whitecourt

APPENDIX B1 FORM
Construction Completion Certificate

PROJECT: _____ AGREEMENT DATED: _____
DEVELOPER: _____ PHASE: _____
CONSULTING ENGINEER: _____ CONTRACTOR: _____
UTILITY: _____ SUBCONTRACTOR: _____
BOUNDARY OF AREA: _____ APPLICATION DATE: _____

CONSULTING ENGINEERS CERTIFICATE

Pursuant to The Town of Whitecourt Development agreement, Subdivision file –W0_____

I, _____ , Professional Engineer am employed as the Consulting Engineer who is engaged by the Developer to design and inspect the construction and installation of the utilities and improvements, I do hereby certify that the utilities or the improvements noted within the area shown on the attached plan have been constructed, installed and inspected in conformance in all respects to the Municipality's specifications and approved designs, or as otherwise required by the Town and that all defects and deficiencies in the work and materials have be reported to the developer and the Municipality and have been remedied by the Developer.

_____
Engineer's Inspector

_____
Consulting Engineer

(permit to practice) (seal)

Acknowledgment of
Receipt of Consulting
Engineer's Certificate Date: _____ _____
Town Engineer

Acknowledgment of
Receipt of Consulting
Engineer's Certificate Date: _____ _____
Town of Whitecourt

Projected Earliest Maintenance Period Expiry Date: _____

Rejection of Consulting
Engineer's Certificate Date: _____ _____
Town Engineer

Cause for Rejection: _____

I hereby certify the items listed as the cause for rejection have now been corrected.

_____
Consulting Engineer

Acknowledgment of
Receipt of Consulting
Engineer's Certificate Date: _____ _____
Town of Whitecourt

Projected Earliest Maintenance Period Expiry Date: _____

Appendix B-1 (i)

Town of Whitecourt

CONSTRUCTION COMPLETION CERTIFICATE (CCC) CHECKLIST

Project: _____ Date: _____

Subdivision: _____

- ☐ As Built Record Drawings – three (3) sets
- ☐ Construction Completion Certificate – three (3) copies
- ☐ Digital PDF & AutoCAD Files of As-Built Record Drawings
- ☐ Inspection Report including detailed deficiency list, if any, and agreed to correction commitments
- ☐ Concrete Compressive Strength test results (including air content, slump, and sieve analysis) for all sidewalks, curbs, and gutters
- ☐ Compaction test results (Moisture Density Curves, Sieve Analysis, and Field Densities) for all trenches, sub-grade, construction, granular sub-base and granular base course
- ☐ Asphalt Marshall Mix Design, Sieve Analysis, and Core test results for density and thickness
- ☐ Colour CCTV video and inspection report for all sanitary mains, storm sewer mains, and catch basin leads
- ☐ Hydrostatic Pressure test results for all water mains
- ☐ Bacteriological and Chlorine Residual test results for all water mains
- ☐ Hydrant flow tests
- ☐ Sanitary low pressure test results
- ☐ Copy of crossing agreements with any oil/gas or shallow utility company
- ☐ Copy of all Alberta Environment Approvals including any submitted documentation, including but not limited to:
  - ○ Written notification for extension to a waterworks, wastewater, or storm drainage system (see Appendix B-1 (ii).
  - ○ Authorization for an amendment to Town of Whitecourt water, waste-water, and storm drainage permit.
- ☐ Copy of any other applicable Provincial or Federal approval including any submitted documentation (i.e. Alberta Transportation, Water Act, Public Lands, Historical Resources Act, Fisheries and Oceans, etc.)

Town of Whitecourt

CONSTRUCTION COMPLETION CERTIFICATE (CCC) CHECKLIST

Asphalt

- ☐ No Segregation, rutting, bleeding, cracking, etc.
- ☐ Transition to existing
- ☐ Transition at gutter
- ☐ No ponding
- ☐ Gutter lines at intersection

Concrete/Signage

- ☐ No segregation, cracking, spalling, etc.
- ☐ Sidewalk
- ☐ Curb & Gutter
- ☐ Swales
- ☐ Commercial/Lane Crossings
- ☐ Signage & Traffic Signals
- ☐ Street lights

Catch Basins/Manholes

- ☐ Grouting around pipes, rings, and rim
- ☐ Clean of debris
- ☐ Pipes/Connections in good order
- ☐ Elevation at grade
- ☐ Location per design
- ☐ Rim Elevations
- ☐ Benching

Fire Hydrant

- ☐ Hydrant Elevation
- ☐ Pumper connection facing towards street
- ☐ Valve at correct elevation and location
- ☐ Rock guard depth
- ☐ Location

Water Main Valves

- ☐ Elevation at grade
- ☐ Rock guard depth
- ☐ Turns freely
- ☐ Location per design

Curb Cock (CC)

- ☐ Raised (elevation)
- ☐ Turns freely
- ☐ Location per design
- ☐ Accessibility

Landscaping

- ☐ Grade/slope
- ☐ Amenities
- ☐ Seed/Sod established to 2nd cut & Free of weeds
- ☐ Trees/shrubs
- ☐ Mulch, planting beds

TOWN APPROVAL BY: _____DATE: _____

Alberta Environment

APPENDIX B-1 (ii)

Extend water distribution, wastewater collection, and storm drainage systems

Information requirements

October 2003

Approval or Registration Holders, or their authorized agents (such as developers or consultants) must provide certain information to Alberta Environment, **prior to construction**, as part of the written notice required when extending or replacing watermains, sanitary sewers and/or storm sewers.

INFORMATION THAT MUST BE PROVIDED

- ❑ The Approval or Registration number for the facility/facilities
- ❑ The location of the project (i.e. name of the municipality/development, subdivision name, street, etc)
- ❑ The type of project (i.e. water, sanitary sewer, storm sewer, etc.)
- ❑ Confirmation **stamped and signed** by a professional engineer that the increased flows associated with the extension are within the design capacity of the existing distribution or collection system
- ❑ Confirmation **stamped and signed** by a professional engineer that the additional loading as a result of the extension is within the design capacity of the system supplying treatment
- ❑ Confirmation that all aspects of the design meet Alberta Environment's *Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems*
- ❑ Any other pertinent information

The Approval or Registration Holder must also meet the specific requirements of their Approval.

The Director (at Alberta Environment) must authorize any waterworks system being extended to a new development that is not serviced by a wastewater system authorized under the *Environmental Protection and Enhancement Act* (EPEA).

The Director must be satisfied that the wastewater produced as a result of supplying water can be satisfactorily handled by other means.

Construction may proceed on projects where the Director or inspector has requested to review the plans and specifications.

IF THE DESIGN DOES NOT MEET STANDARDS

If all aspects of the design do not meet Alberta Environment's *Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems*, the project **cannot proceed until the Director has issued written authorization.**

The Approval or Registration Holder must indicate why the standards cannot be met and justify the alternative proposed design.

For projects that include new storm water ponds and/or outfall(s) to a water body or drainage course, the Approval or Registration Holder must also obtain an additional authorization or registration as required by EPEA and its associated regulations.

A separate application under the *Water Act* may also be required for projects involving storm water pond(s) and/or outfall(s). Check with your regional district office of Alberta Environment.

RANDOM COMPLIANCE INSPECTIONS

As part of an ongoing compliance inspection program, Alberta Environment may conduct random, unannounced inspections of construction activity.

Extensions to water distribution and wastewater collection and storm drainage systems that do not meet Alberta Environment's *Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems* may be subject to enforcement action.

For more information, contact your regional district Alberta Environment office.

Alberta Environment Regional Offices

Northern Region
Grande Prairie
Box 24, Room 1701
Provincial Building
10320 - 99 Street
Grande Prairie AB T8V 6J4
Ph: (780) 538-5351
Fax: (780) 538-5336

Edmonton
Twin Atria
111, 4999 - 98 Avenue
Edmonton, AB T6B 2X3
Ph: (780) 427-5296
Fax: (780) 427-7824

Central Region
Stony Plain
52322 Golf Course Road
Stony Plain, AB T7Z 2K9
Ph: (780) 963-6131
Fax: (780) 963-4651

Red Deer
304, Provincial Building
4920 - 51 Street
Red Deer, AB T4N 6K8
Ph: (403) 340-7052
Fax: (403) 340-5022

Southern Region
Calgary
200, 3115 - 12 Street NE
Calgary, AB T2E 7J2
Ph: (403) 297-6582
Fax: (403) 297-5944

Lethbridge
2nd Flr, Provincial Building
200 - 5 Avenue South
Lethbridge, AB T1J 4L1
Ph: (403) 381-5296
Fax: (403) 381-5337

APPENDIX B2 FORM
Final Acceptance Certificate

PROJECT: _____ AGREEMENT DATED: _____
DEVELOPER:_____ PHASE: _____
CONSULTING ENGINEER: _____ CONTRACTOR: _____
IMPROVEMENT_____SUBCONTRACTOR:_____
BOUNDARY OF AREA: _____ APPLICATION DATE: _____

CONSULTING ENGINEERS CERTIFICATE

Pursuant to The Town of Whitecourt Development agreement, Subdivision file –W0_____

I _____, of the firm_____ employed as the Consulting Engineer who is engaged by the Developer to design and inspect the construction and installation of the municipal improvements, I do hereby certify that municipal improvements noted within the area shown on the attached plan meets all the requirements for Final Acceptance as specified in the Development Agreement and Construction Standards, I hereby recommend this Municipal Improvement for Final Acceptance by The Town of Whitecourt

_____
Engineer's Inspector

_____
Consulting Engineer

(Permit to practice) (seal)

Acknowledgment of
Receipt of Consulting
Engineer's Certificate Date:_____ _____
Town Of Whitecourt

Acknowledgment of
Receipt of Consulting
Engineer's Certificate Date:_____ _____
Town of Whitecourt

Rejection of Consulting
Engineer's Certificate Date:_____ _____
Town of Whitecourt

Cause for Rejection: _____

I hereby certify the items listed as the cause for rejection have now been corrected.

_____
Consulting Engineer

Acknowledgment of
Receipt of Consulting
Engineer's Certificate Date:_____ _____
Town of Whitecourt

Projected Earliest Maintenance Period Expiry Date: _____

APPENDIX B3 FORM

Development Revision Request Form

To: Planning and Development Dept. Date: _____

Town of Whitecourt

From: Representative Name: _____

Company Name: _____ Phone: _____

Mailing Address: _____ Email: _____

_____

Signature: _____ Date: _____

Date of IFC Dwgs: _____ Subdivision WO- _____ Dwg No: _____

Revision Complies with Town of Whitecourt Municipal Design Standards:

☐ Yes, per Section: _____

☐ NO

- ☐ B-4 Design Revision Request Form Attached

☐ Proposed Design revision attached as redline marking to issued for construction drawing no. _____

Revision request description and reasoning:

_____

_____

_____

_____

_____

_____

TO BE COMPLETED BY THE TOWN

Reviewed By: _____ Title: _____

Signature: _____ Date: _____

Revision Request: Accepted: ☐ Rejected: ☐ Revision Request No. _____

Reason for Rejection (attach additional pages if necessary): _____

_____

_____

Town Engineer Signature: _____ Date: _____

Revision Request Process:

1) The following information must be provided with this request form:

Town Consultant

☐ ☐ One (1) copy of any pertinent standard, regulation, guideline, or other information supporting the revision request.

2) Incomplete submissions, including any revision request with insufficient supporting documentation, will be returned to the applicant without review. The Town shall not be responsible for conducting industry research or conducting other work to support an incomplete revision request. The onus is on the applicant to provide a complete submission which fully supports the revision request.

3) The Town shall review the revision request and provide a response within 20 business days of receipt. Depending on the nature of the revision request, the Town's response may require additional review time; in such situations, the Town will advise the applicant of the extended review period necessary.

4) If the revision request is accepted, the applicant will be advised with instructions on how the change may be applied to an ongoing or pending project.

5) If the revision request is denied, the applicant will be advised with the Town's reasons for rejection. The applicant may elect to resubmit the revision request, provided the Town's reasons for initial rejection are fully addressed in the subsequent submission.

For more information:

General Inquires: Planning and Development at 780-778-2273

APPENDIX B4 FORM

Design Standards Revision Request Form

To: Planning and Development Dept.
Town of Whitecourt

Date: _____

From: Representative Name: _____

Company Name: _____ Phone: _____

Mailing Address: _____ Email: _____

_____ Signature: _____

_____ Date: _____

Municipal Design Standards Section No: _____ Page No.: _____

Revision Request Description:

_____

_____

_____

_____

_____

TO BE COMPLETED BY THE TOWN

Reviewed By: _____ Title: _____

Signature: _____ Date: _____

Revision Request: Accepted: ☐ Rejected: ☐ Revision Request No.: _____

Reason for Rejection (attach additional pages if necessary): _____

_____

_____

_____

Town Engineer Signature: _____ Date: _____

Revision Request Process:

1) The following information must be provided with this request form: One (1) copy of any pertinent standard, regulation, guideline, or other information supporting the revision request.
2) Incomplete submissions, including any revision request with insufficient supporting documentation, will be returned to the applicant without review. The Town shall not be responsible for conducting industry research or conducting other work to support an incomplete revision request. The onus is on the applicant to provide a complete submission which fully supports the revision request.
3) The Town shall review the revision request and provide a response within 20 business days of receipt. Depending on the nature of the revision request, the Town's response may require additional review time; in such situations, the Town will advise the applicant of the extended review period necessary.
4) If the revision request is accepted, the applicant will be advised with instructions on how the change may be applied to an ongoing or pending project.
5) If the revision request is denied, the applicant will be advised with the Town's reasons for rejection. The applicant may elect to resubmit the revision request, provided the Town's reasons for initial rejection are fully addressed in the subsequent submission.

For more information:

General Inquires: Planning and Development at 780-778-2273

APPENDIX C

INFRASTRUCTURE SUMMARY TABLES

APPENDIX C

YEAR:	DATE:	DEVELOPER:	
CONTRACTOR:			NO OF LOTS:
SUBDIVISION:			Area: ha
PHASE/STAGE #:	LEGAL DESCRIPTION:		Plan:
DATE CCC/FAC APPROVED:			

SURFACE IMPROVEMENTS:

ROADS:

CLASSIFICATION	description	center line road length (m)	concrete sidewalk length (m)	curb & gutter length (m)
Collector:				
Residential:	**minor - 11m width**			
	SUB-TOTAL			
Residential:	**major - 12m width**			
	SUB-TOTAL			
Industrial:	**12m width**			
	SUB-TOTAL			
Local:				
Residential:	**9m width**			
	SUB-TOTAL			
Industrial:	**11m width**			
	SUB-TOTAL			
	GRAND TOTAL ALL ROADS			

Concrete Drainage Swale:	**TOTAL LENGTH (m)**	
Pararamps	**# OF**	

YEAR: DATE:
DEVELOPER:
CONSULTANT:
SUBDIVISION:
PHASE/STAGE # : NO OF LOTS:
LEGAL DESCRIPTION: Plan: - Blk: _____ Lot: C _ Area: ha

WATER SYSTEM IMPROVEMENTS:

WATERMAINS:

Pipe Dia. (mm)		length (m)	No of main line valves	No of PRV valves	No of Tees	No of Crosses	No of Reducers	No of Plugs
150								
200								
250								
300								
375								
450								
Totals								

No of FH's	

No of cc's	

YEAR:	DATE:
DEVELOPER:	
CONSULTANT:	
SUBDIVISION:	
PHASE/STAGE # :	NO OF LOTS:
LEGAL DESCRIPTION: Plan: - Blk: _____Lot: C __	Area: ha

SANITARY IMPROVEMENTS:

SANITARY SEWERS:				
Pipe Dia. (mm)		**Length (m)**	**No of Manholes**	**Vert. m of Manholes**
200				
250				
300				
375				
450				
525				
600				
	Totals			

YEAR: DATE:
DEVELOPER:
CONSULTANT:
SUBDIVISION:
PHASE/STAGE # : NO OF LOTS:
LEGAL DESCRIPTION: Lot: Blk: Plan: - Area: Ha

STORM SEWER IMPROVEMENTS:

STORM DRAINAGE:

Pipe Dia. (mm)	LENGTH (m) Pipe Material		150 mm 3rd Pipe (m)	No of Manholes	Vert. m of Manholes	No of Catch Basin Manholes	Vert. m of CB Manholes	No of Outfalls
	Conc(A)	PVC(B)						
150								
250								
300								
375								
450								
525								
600								
675								
750								
825								
900								
1050								
1200								
1350								
1500								
1800								
Totals								
Total A + B								

YEAR:			DATE:			
DEVELOPER:						
CONSULTANT:						
SUBDIVISION:						
PHASE/STAGE # :					NO OF LOTS:	
LEGAL DESCRIPTION:	Lot:	Blk:	Plan:	- Area:		Ha

STORM SEWER IMPROVEMENTS:

CATCH BASINS:	
Type of Frame/cover	**Number of CB's**
F- 36	
F-38	
F-39	
F-51	
K-7(single)	
K-7(double)	
Total	

CB LEADS:	
Pipe Dia. (mm)	**LENGTH** (m)
250	
300	
375	
Total	

CLEAN OUTS:	
Dia mm	**# of CO's**
150	

UNDERGROUND IMPROVEMENTS		
Oil & Grit Separator ®		
MODEL NO.	**NO. OF** EA.	**CAPACITY** (gal)
Model		
STC 300		300
STC 750		750
STC 1000		1000
STC 1500		1500
STC 2000		2000
STC 3000		3000
STC 4000		4000
STC 5000		5000
STC 6000		6000
STC 9000		9000
STC 10000		10000
STC 14000		14000
Total		

YEAR: DATE:
DEVELOPER:
CONSULTANT:
SUBDIVISION:
PHASE/STAGE # : NO OF LOTS:
LEGAL DESCRIPTION: Lot: Blk: Plan: - Area: Ha

LANDSCAPE IMPROVEMENTS:

BOULEVARDS:		**NUMBER OF TREES**							
Street Name:	Blvd Area (sq.m)	Black Ash	Green Ash	Schubert Choke-Cherry	Oak	Mayday	Other (name?) ( )	Other (name?) ( )	Total Trees
Totals									

YEAR:			DATE:		
DEVELOPER:					
CONSULTANT:					
SUBDIVISION:					
PHASE/STAGE # :				NO OF LOTS:	
LEGAL DESCRIPTION:	Lot:	Blk:	Plan:	- Area:	Ha

LANDSCAPE IMPROVEMENTS:

BUFFERS:	Buffer	**NUMBER OF TREES**							
Street Name:	Area (sq.m)	Black Ash	Green Ash	Schubert Choke-cherry	Oak	Mayday	Other (name?) ( )	Other (name?) ( )	Total Trees
Totals									

YEAR:			DATE:		
DEVELOPER:					
CONSULTANT:					
SUBDIVISION:					
PHASE/STAGE # :				NO OF LOTS:	
LEGAL DESCRIPTION:	Lot:	Blk:	Plan:	- Area:	Ha

LANDSCAPE IMPROVEMENTS:

PARKS:			Area of		Area of	Naturalized	Naturalized		
Environmental	Area	No of	shrub		Naturalized Planting (m^2)	Trees	Shrubs	Sidewalk(m)	
Reserve(ER)	(Sq.m)	Trees	Beds(sq.m)			Planted (#)	Planted (#)	length	width
lot # :									
lot # :									
lot # :									
lot # :									
Total (ER)									
Mun. Reserve(MR)									
lot # :									
lot # :									
lot # :									
lot # :									
Total (MR)									

PUL'S:	Area (m^2)	Length (m)	Sidewalk(m)	
			length	width
lot #:				
lot #:				
lot #:				
lot #:				
lot #:				
lot #:				
Totals PUL's				

Island planting:	Area (m^2)
Location (street name)	
total	

YEAR:			DATE:		
DEVELOPER:					
CONSULTANT:					
SUBDIVISION:					
PHASE/STAGE # :				NO OF LOTS:	
LEGAL DESCRIPTION:	Lot:	Blk:	Plan:	- Area:	Ha

LANDSCAPE IMPROVEMENTS:

List names and numbers of trees and shrubs (in MR) below:

Name	No	Name	No	Name	No

List names and numbers of trees and shrubs in island plantings below:

Name	No	Name	No	Name	No

APPENDIX D

3 STEPS TO TREE PRESERVATION

3 STEPS TO TREE PRESERVATION

Step 1) Plan Ahead

To incorporate tree preservation in the design process, you will need to hire a Certified Arborist to perform a site and tree evaluation. An Arborist will be able to tell you which trees have the best chance to survive during and after construction.

Construction around trees can be done successfully when it is a part of the design process. Not all trees are worthy of saving especially if they may become liabilities for future homeowners. Your Certified Arborist will assist you with these decisions. It may be more desirable in the long run to remove trees prior to construction and plant new trees after construction is completed. However, when valuable mature trees are present, the effort and expense to preserve them is worthwhile. Mature trees take many years to grow and their environmental benefits are exponential in comparison to smaller trees.

Step 2) Design Your Project to Accommodate Tree Preservation

Some things to consider when evaluating the site and its trees include:

Protect the Critical Root Zone (CRZ)

The best way to protect trees on a construction site is to avoid disturbing the roots within the critical root zone (CRZ). The CRZ of a tree extends well beyond the spread of its branches. The CRZ is a function of tree size, health, and how the species responds to construction damage. For example, the critical root zone of a young, vigorous red maple (tolerant to construction damage) is much smaller than that of an old, declining yellow poplar (low tolerance for construction damage).

Generally, the CZR can be calculated as 1.5 X the diameter at breast height (DBH) of the tree. For example, a 20-inch DBH tree would require 30 feet of area of no disturbance. The size of the critical root zone should be adjusted according to the specific tree and site factors. The tree preservation fence must protect the CRZ.

Root Prune trees are to be preserved

Root prune along the CRZ where there is construction activity such as grade changes should be preserved. Roots are cut with a specialized machine that provides for a cleaner cut than with a backhoe. When roots greater than 2 inches in diameter are exposed, they should be further pruned by hand using a sharp hand saw. New roots will regenerate at the point of this cut.

Groups of trees

Preserving stands of trees or tree save islands is encouraged because groups of trees often tolerate construction disturbance better than individual trees.

Transplanting trees

If a good quality tree needs to be removed because it is located where construction activities are planned, look for opportunities to transplant it to another location on the site. This works best for small trees less than 10 inches diameter at breast height.

Step 3) Protect Trees During Construction

Construction activities such as trenching, slope cut, soil compaction, grade changes and stock piling of materials damage trees. Please note the following protection measures:

Install Tree Preservation Fencing

Tree preservation fencing is the most effective technique to preserve the existing conditions around the tree. Fencing types can be 48 inches high 14-guage welded wire secured on 2-inch metal posts or a 6-foot high chain link fence on moveable blocks. Fencing must be installed prior to the entrance of any equipment on the site. Securing "Keep Out, Tree Save Area" signs onto the fencing alerts workers that the location is off limits. Plan in advance locations for storage of excavated soils and parking. Activities that one would think would never occur such as burning of materials and dumping of toxic fluids (paint thinner, gas) routinely happen next to the trunk in the shade of a tree's canopy.

Don't Trench the Roots

Great damage may occur when trenching for utilities and foundations or where grade lowering is performed close to the trunk of the tree. Each root that is cut reduces the tree's ability to supply water and nutrients to the leaves. Trenching within a few feet of the trunk of the tree can reduce the functional support system of the tree and create a hazard or high risk tree. Reroute utilities outside of the critical root zone (CRZ) or require them to be tunneled. If trees cannot be safely preserved then they should be removed prior to construction.

Don't Change the Grade

When soil is cut away near a tree, portions of the tree's roots are cut away as well. Likewise, if fill is added near a tree, portions of the tree's roots are smothered (tree roots need oxygen too). Changes in grade also may influence the water table and the amount of water available to the tree. Retaining walls are often the best way to preserve larger amounts of existing grade around trees. Retaining walls can be used whether the area next to the tree is excavated or filled.

Don't compact the soil

Soil compaction occurs when equipment passes over the soil and squeezes out the air spaces leaving no source of oxygen for the roots below and no pore space for water. In dense compacted soil, roots cease to function and die. Where construction traffic cannot be avoided, a layer of 10 -16 inches of wood chips topped with heavy, non-skid, surfaced plywood or chain link fencing panels can be placed in the area to be compacted.

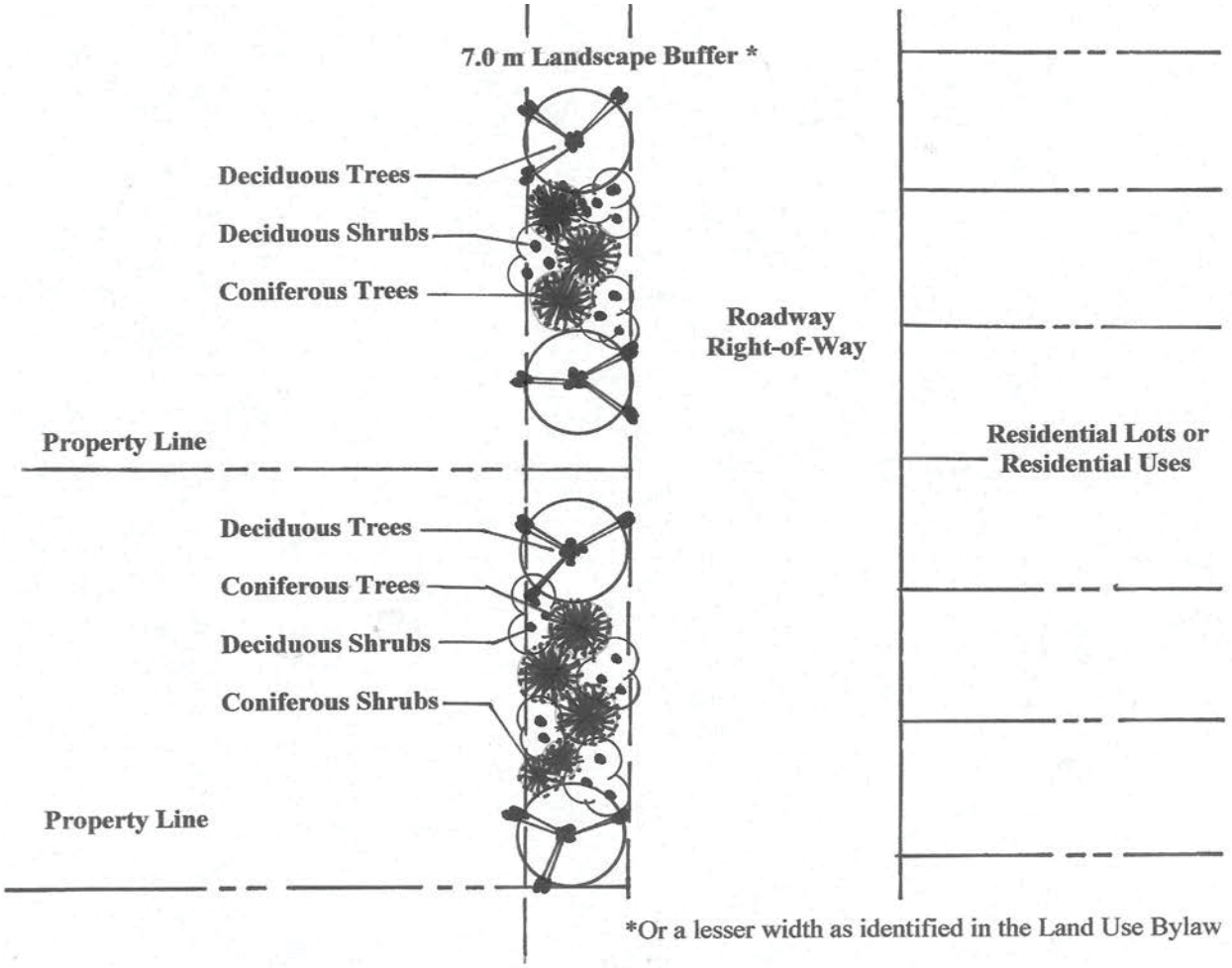
For information on selecting a Certified Arborist in your area go to the International Society of Arboriculture (ISA) website @http://www.isa-arbor.com and click on “Find an Arborist.”

APPENDIX E

LANDSCAPING TEMPLATES FOR BUFFERS AND PERIMETER PLANTING ON INTERIOR LOTS

The required landscaped buffer shall include a mix of 40 % deciduous and 60% coniferous trees and shrubs, and shall be designed to sufficiently screen the commercial or industrial development from adjacent uses or district.

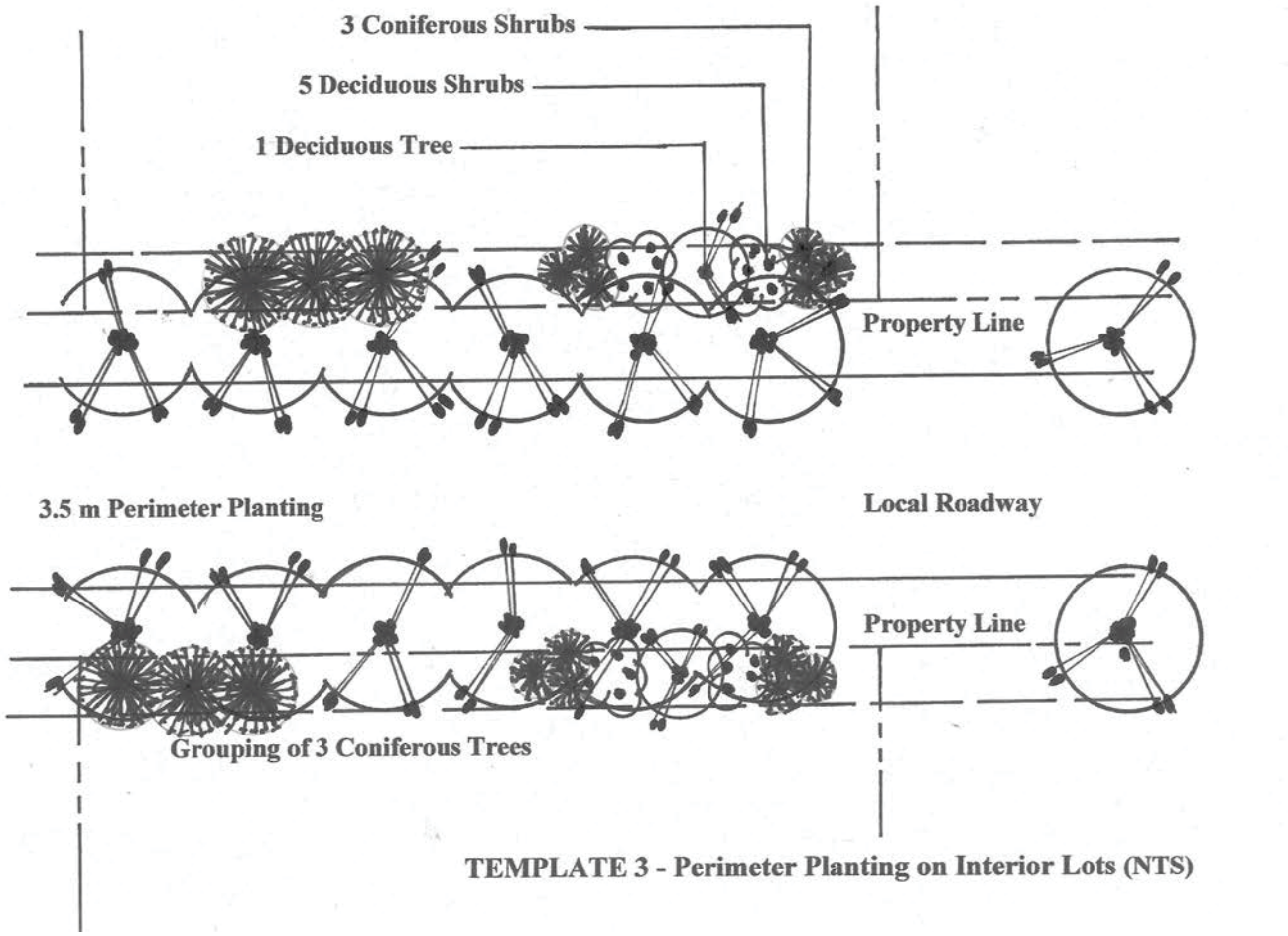
Within this buffer the property owner may choose or be directed by conditions in the Development Permit to include a 1.0 metre high berm. The berm shall be incorporated into the design with trees and shrubs planting. Ground cover plant material may also be used in this landscape buffer.



TEMPLATE 2 - Landscaped Buffer - Lots Adjacent to Residential Lots or a Residential Use (NTS)

3.3 Perimeter Landscaping -Interior Lots

Following the Town of Whitecourt Land Use Bylaw, the *Landscape Templates* require that commercial or industrial lots that adjoin a public roadway except a Jane shall have perimeter landscaping. The perimeter landscaping shall be at least 3.5 metres around the perimeter of a private lot adjacent to the public roadway. Trees must be located a minimum of 2.0 metres from the property line. All trees shall be planted at regular intervals. If coniferous trees are use they shall be planted in groupings of three (3) trees. A minimum of 60 mm caliper size for deciduous trees is required at the time of planting for all the trees. All trees selected shall have a minimum 6.0 metre height at maturity. Ground cover plant material may be used in this landscape buffer. Wood mulch shall be used at a minimum depth of l00mm.



TEMPLATE 3 - Perimeter Planting on Interior Lots (NTS)

APPENDIX F

WATERMAIN TESTING

PROVIDING MORE

Construction Standards

Section 02517
Guidelines for
Acceptance Testing

March 2017

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1. INTRODUCTION

1.1 BACKGROUND

The consulting engineer and contractor are responsible for pressure testing and disinfecting new water mains in the City of Edmonton. Bacteriological sampling for total coliforms is performed by the engineer or contractor and the samples are submitted to the Provincial Laboratory of Public Health for analysis. The results are then forwarded to EPCOR through Alberta Health Services, Edmonton Region before the water main can be placed in service.

Water main acceptance testing is required to ensure that new water infrastructure is able to perform to acceptable standards and provide clean drinking water to EPCOR customers. For proper acceptance testing of new water mains, the parties involved should do the following:

- design the water network to incorporate appurtenances which can be used for acceptance testing as well as routine maintenance later;
- obtain proper authorization and follow applicable procedures before operating boundary valves separating the new construction from the existing water network;
- follow proper pressure testing and leakage determination procedures;
- understand the requirements for preparing water mains for disinfection;
- distribute chlorine uniformly in newly disinfected water-mains;
- follow proper sampling protocol for chlorine and bacteriological analysis;
- understand the limitations of chlorine field test kits; and
- perform testing with properly trained and experienced personnel.

The purpose of these guidelines is to provide a uniform set of acceptance testing criteria and procedures which are presented in a way which is easily understood and can be readily used in the field. The guidelines are organized into five main sections:

1. An introduction to the pipe materials and associated specifications which are in use in The City of Edmonton
2. Pressure and leakage testing specifications and procedures
3. Disinfection specifications and procedures
4. Boundary valve operation
5. Design guidelines

2. PIPE MATERIALS IN THE CITY OF EDMONTON

To understand the requirements for pressure and leakage testing, it is important to know the range of pipe materials, which are approved for use in the water network.

2.1 DISTRIBUTION PIPES

Distribution water mains include all pipes less than 450 mm in diameter. Materials approved for use in Edmonton are shown in Table 1.

Table 1 Distribution water main materials.

Material	Standard
Polyethylene (PE)[1]	AWWA C906
Polyvinyl Chloride (PVC)	AWWA C900/C905
Ductile iron[1] (DI)	AWWA C151
High Density Polyethylene (HDPE) [1]	AWWA C906
Fusible Polyvinyl Chloride (FPVC)	AWWA C900/C905

[1] On a project specific basis only

2.2 TRANSMISSION PIPES

Transmission water mains include all pipes greater than or equal to 450 mm in diameter. Materials approved for use in Edmonton are shown in Table 2.

Table 2 Transmission water main materials.

Material	Standard
High Density Polyethylene (HDPE)[1]	AWWA C906
Polyvinyl Chloride (PVC)	AWWA C905
Concrete Steel Cylinder[1]	AWWA C303/C301
Steel	AWWA C200

[1] On a project specific basis only

3. FILLING AND FLUSHING STRATEGIES

3.1 SUBMISSIONS

3.1.1 A Filling Strategy is required for all projects. The purpose of a Filling Strategy is to create an agreed upon plan for the staging and direction of fill for a new water main.

3.1.2 A Flushing Strategy is required for all projects. The purpose of a Flushing Strategy is to create an agreed upon plan for the staging and direction and rate of flow of water for flushing a water main prior to commissioning.

3.1.3 Filling and Flushing strategies must be signed and sealed by a Professional Engineer.

3.1.4 Filling and Flushing strategies may be submitted separately or together. Submit these strategies to wpddocs@epcor.com.

3.2 REQUIREMENTS FOR FILLING AND FLUSHING STRATEGIES

3.2.1 All source water must come from a clean potable source.

3.2.2 There must be only one source valve for each stage of fill.

3.2.3 Valves should be planned such that uni-directional flows are achieved. The water should not loop back on itself.

3.3 SPECIFIC REQUIREMENTS FOR FILLING STRATEGIES

3.3.1 The Filling Strategy must consist of a drawing indicating the following:

3.3.1.1 Air release locations;

3.3.1.2 High points on transmission mains;

3.3.1.3 Water source for each fill;

3.3.1.4 Staging of fill:

- Current fill highlighted
- Completed fill highlighted

3.3.1.5 All valve positions are to be indicated for each stage; and

3.3.1.6 Legend clearly indicating the symbology on the drawing.

3.3.2 Air release locations should be at or near the high point of the water main.

3.3.3 A copy of the Approved Filling Strategy must be on site during filling activities.

3.4 SPECIFIC REQUIREMENTS FOR FLUSHING STRATEGIES

3.4.1 Flushing runs must be less than 450 m in length. The ideal flushing run length is 200 m.

3.4.2 Water mains less than or equal to 300 mm in diameter should have a flush velocity of 1.5 m/s.

3.4.3 Water mains greater than 300 mm in diameter should have a flush velocity of 0.9 m/s.

3.4.4 Water must be exchanged a minimum of five times to achieve a completed flush. Water quality sampling reports must confirm a completed flush.

3.4.5 During a flush, the source water should flow from larger pipe to smaller pipe, whenever possible.

3.4.6 The Flushing Strategy should include:

3.4.6.1 A written flushing procedure

3.4.6.2 A spreadsheet indicating:

- Order of flushing segments;

- Water supply (source valve);
- Discharge location;
- All valve positions for each flushing segment;
- Pipe details for each flushing segment;
- Required discharge volume (to achieve five times the volume of the flushing segment);
- Ideal flow velocity for the size of the water main;
- Ideal flow rate to achieve the velocity;
- Type and size of ports to discharge the water;
- Number of ports;
- Estimated flow rate; and
- Required flush time.

3.4.6.3 A drawing indicating the following:

- Water supply (source);
- Current flush;
- Completed flush;
- Opened Valve;
- Closed Valve;
- Discharge Location; and
- Legend clearly indicating the symbology on the drawing.

3.4.6.4 Each flushing segment should have its own drawing.

3.4.7 Use the table below to find the number of ports required to achieve the requisite velocity. (Source AWWA C651-14).

Table 3: Number of ports required to achieve velocity for flushing

Pipe Diameter (mm)	Required flow (L/s) For 0.9 m/s Velocity	Hydrant nozzles required		Required flow (L/s) For 1.5 m/s Velocity	Hydrant nozzles required	
		Assumes Residual Pressure of 280kPa			Assumes Residual Pressure of 280kPa	
		2.5"	4.5"		2.5"	4.5"
100	7.1	1	N/A	11.8	1	N/A
150	15.9	1	N/A	26.5	1	N/A
200	28.3	1	N/A	47.1	1	N/A
250	44.2	1	N/A	73.6	2	1
300	63.6	1	1	106.0	2	1
350	86.6	2	1	N/A	N/A	N/A
400	113.1	2	1	N/A	N/A	N/A
450	143.1	2	1	N/A	N/A	N/A
With 280kPa residual pressure a hydrant flowing to atmosphere will discharge 63 L/s from a 2.5" nozzle and 158 L/s from a 4.5" steamer (Source: After AWWA C651-14)						

4. GUIDELINES FOR PRESSURE AND LEAKAGE TESTING

4.1 PURPOSE

The purpose of pressure and leakage testing a new water main is to determine if the installation is capable of withstanding ordinary operating transient pressure conditions without failure or excessive leakage at the joints and service connections. The two tests are related and are usually performed at the same time. The guidelines are intended to provide the performance criteria and testing protocol necessary for routine pressure and leakage testing to ensure that the new water-main installation meets the design specifications.

4.2 METHODS

4.2.1 Pressure Testing

Pressure testing consists of slowly charging a new section of water main to the distribution system pressure from a boundary main. The valves are then closed on the test section. A tank of water and a purpose-specific pump are used to pressurize the main to the specified test pressure. The main is typically left in this condition for 1 to 3 hours. The pressure is normally measured at the lowest elevation on the section of water main being tested.

4.2.2 Leakage Testing

Leakage testing is normally conducted at the same time as pressure testing using the same apparatus. The test is conducted for 2 h during which time the pump is periodically operated to maintain the pressure at the specified level. The volume of water added to the water main from the tank is presumed to be equal to that which has leaked from the water main during the test. Figure 1 illustrates the conceptual layout of the apparatus required for pressure and leakage testing.

Portland cement based materials such as asbestos-cement, concrete, or cement-lined ductile iron pipes are porous and absorb water during the initial charging of the water main. Consequently, it is usual to require 24 to 48 h of soaking to ensure that apparent water leakage is due to joints and service leakage, not the absorption of water by the pipe material.

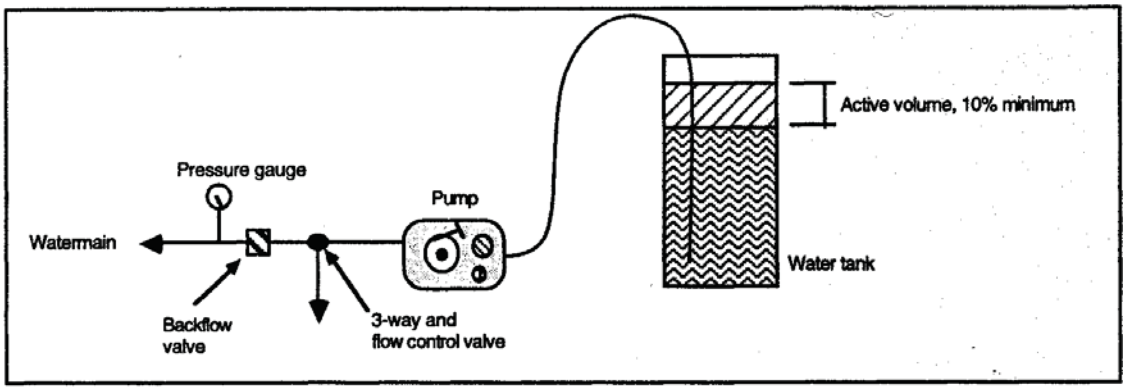


Figure 1 Apparatus for Pressure and Leakage Testing

4.2.3 Required Equipment

The equipment requirements are straightforward; however, it must be dedicated for only one purpose; pressure and leakage testing. The recommended specification is as follows:

a) ANSI Standard B40.1-1974 Grade A, or equivalent, Bourdon tube pressure gauge, range of 0 to 1 400 kPa, with an accuracy of 1% of the full-scale reading, 7 kPa divisions, a minimum diameter of 90mm, and a scale which can be read in an arc of 270° (Walski, 1984). The pressure gauge calibration shall be certified by the consulting engineer.

b) Hand or motor-powered pump capable of meeting required test pressures including necessary plumbing accessories for preventing backflow and for enabling the flow rate to be controlled (City of Edmonton, 1988). The pump should be provided with a pressure relief valve or should have an upper pressure limit of 1

400 kPa. The pump will be dedicated to water-main pressure testing and will not be used for other construction activities.

c) Water storage tanks will be of non-corrosive material dedicated to water main testing. The volume of the tank shall not be more than 10 times the allowable leakage for the duration of the test. A depth gauge will be attached to the inside of the tank and will be calibrated for the volume of the tank.

5. PROCEDURE FOR HYDROSTATIC PRESSURE AND LEAKAGE TESTING

The procedures for pressure and leakage testing are outlined in the following sections and are organized into two parts:

1. General Procedures (independent of pipe material and size) and
2. Procedures that are influenced by the pipe material and size

If there are transitions within the project between pipe materials, pressure and leakage of each pipe material must be tested separately prior to connection with other materials, excepting PVC to steel spool pieces for valve assemblies. Fused PVC and jointed PVC are not considered like materials for the purposes of pressure and leakage testing.

5.1 GENERAL PROCEDURES (INDEPENDENT OF PIPE MATERIAL AND SIZE)

1. Install all water services, air relief services, and blowoffs.

2. Partially or completely backfill the excavation before testing

3. Wait for concrete thrust blocks to cure: minimum of 3 days in the case of high early strength concrete or a minimum of 7 days in the case of normal concrete.

4. Ensure that main stops are open and curb stops are closed.

5. Inform EPCOR inspectors of the date, time, and location of the hydrostatic tests at least 24 h prior to the test time. **Failure to notify inspectors may result in the tests being unacceptable.**

6. Open all main valves in the test section.

7. Open all hydrant control valves in the test section and be sure hydrants are closed. (All hydrants should be inspected prior to pressure testing to ensure that they are properly installed and that nipples are threaded or locked in place.)

8. Inform other construction crews or contractors and check that no valves are being operated during the test.

9. Test duration will be 2 h.

10. Maximum length of distribution water main test sections will be 450m unless otherwise directed by EPCOR.

11. Maximum length of transmission water main test sections will be 80 0 m unless otherwise directed by EPCOR.

12. Ensure air is expelled from the section of water main by exhausting trapped air at high points and dead-ends. Air content can be minimized through the following procedure:

    a. lay the pipeline to grade when possible
    b. air relief valves should be provided at all high points
    c. bleed air from the pipe slowly
    d. fill the water-main at a velocity of less than 0.6 m /s
    e. the diameter of the air relief valve should be such that d / D is 0.01 to 0.1 where d is the diameter of the air relief valve and D is the diameter of the pipe.

    Air relief valves are essential at high points on mains larger than 450mm in diameter (Figure 2). Hydrants are not useful for removing all of the air (Figure 3).

Figure 2 Air relief valve arrangement

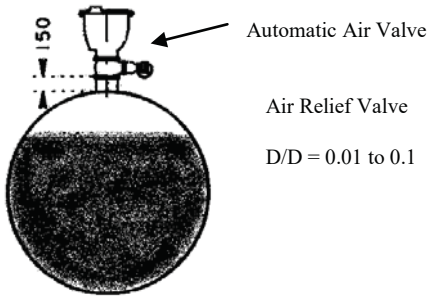
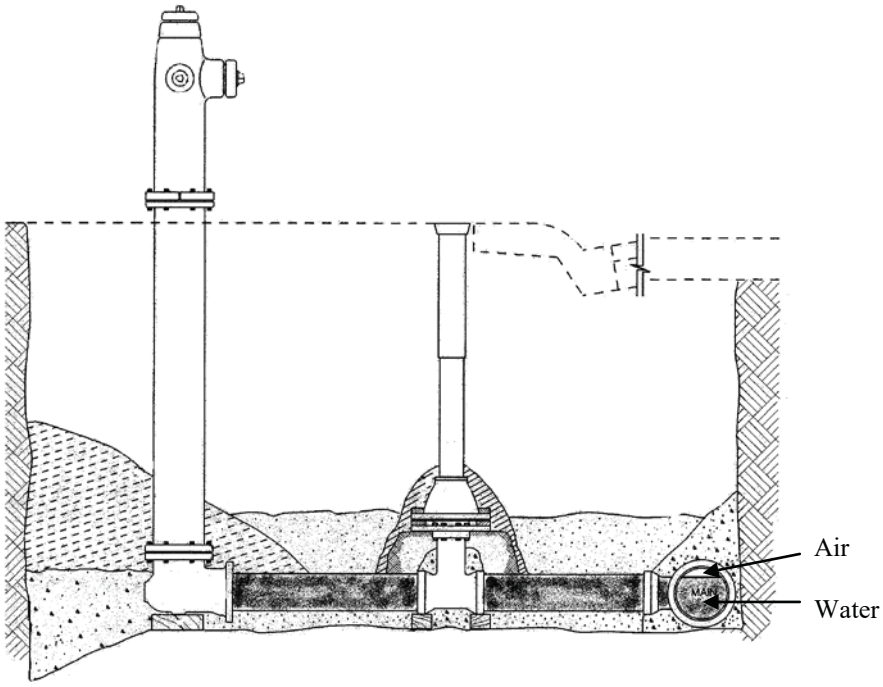


Figure 3 Hydrants Act as Poor Air Relief Devices



13. Raise the water-main pressure to the appropriate test pressure (see the section for the appropriate pipe material) using either a hand or motor-powered pump located at a hydrant or approved blow-off. The hydrant valve will be completely opened and the flow rate will be controlled by the valve at the pump.

14. Mark the gauge and the level of water in the storage barrel at the beginning of the test. Take care in these marks since it is the basis for calculating water loss.

15. Maintain the test pressure within ± 20 kPa of the specified test pressure for the duration of the test.

16. Pump the test section back to the test pressure at the end of the first 30 min. If the allowable leakage is exceeded, air may be trapped. Remove trapped air and repeat the test.

17. During the test, walk along the test section and check for signs of leakage or distress at all exposed appurtenances or fittings.

18. No allowance can be made for services or in-line valves. (Water main renewal projects may be exempt under some circumstances.)

19. When testing against closed metal-seated valves, add an additional leakage allowance of :

$$\frac{0.0012\ \text{L}}{\text{h•mm of valve size}}.$$

20. Calculate the allowable leakage and record this with the observed leakage on the standard pressure and leakage testing form (see Appendix A).

5.2 DUCTILE IRON

AWWA Standard C600 contains the AWWA specifications for pressure and leakage testing of ductile iron water-mains and appurtenances including distribution and transmission pipelines. Specific procedures for ductile iron pipe and appurtenances include all of the General Procedures (Section 5.1) plus the following:

1. Fill cement mortar lined pipes with water 24 h prior to hydrostatic testing.

2. Test the water main at a pressure of greater than 125% of the working pressure at the highest point in the test section. The maximum test pressure will be 150% of the working pressure measured at the lowest elevation.

3. Do not operate valves in either direction when the differential pressure exceeds the rated pressure of the valve. Consult AWWA C500 for rated pressures of valves that conform to AWWA standards.

4. The test pressure cannot exceed the rated valve pressure (see AWWA C500) when resilient-seated gate valves or butterfly valves are at the pressure boundary.

5. The allowable leakage can be calculated from the following equation:

$$\text{Allowable leakage, } L_m = \frac{HSD\sqrt{P}}{715{,}317}$$

where:

L_m = testing allowance (make up water), L/h
S = length of pipe tested, m
D = nominal diameter of the pipe, mm
P = average test pressure, kPa
H = test duration in hours

This formula is based on a testing allowance of 11.65 gpd/mi/in. (1079 L/d/km/mm) of nominal diameter at a pressure of 150 psi (1,034 kPa).

5.3 POLYVINYL CHLORIDE

Refer to AWWA standard C605 and AWWA manual M23 for information on pressure and leakage testing.

Pressure capacity of PVC pipe involves of two types of pressure: internal hydrostatic pressure; and pressure transients during operation. Temperature greatly influences the ability of PVC pipe to contain hydrostatic pressure. The AWWA C900 and C905 specifications are based on 23°C. Temperatures lower than this increase the hydrostatic pressure capacity. Alternatively, temperatures greater than 23°C decrease the pressure capacity. PVC differs from other materials in that it can resist momentary excessive pressures better than sustained long-term excessive pressures.

Specific procedures for PVC pipe include all of the General Procedures (Section 5.1) plus the following:

1. Test pressure will be 150% of the working pressure or 1036 kPa, whichever is greater, at the point of test but not less than 125% of normal working pressure at the highest elevation on the test section (AWWA, M23).

2. Allowable leakage will be calculated from the following formula:

Allowable leakage $$Lm = \frac{HJD\sqrt{P}}{128300}$$

where: J = number of joints
D = diameter of the pipe in mm
P = average test pressure, kPa
H= test duration in hours

5.4 STEEL

AWWA C206 for field welding of steel water pipe addresses hydrostatic pressure testing of new steel water mains for both distribution and transmission applications. However, no specific details are given except that leaks are not permitted. Steel pipe has a very high capacity to resist hoop stresses and can withstand high operating pressures. Therefore, a conservative test pressure in steel water mains could be 120% of the design operating pressure. Cement mortar lined steel pipes need to be filled with water 24 h prior to hydrostatic testing.

Butt-welded joints can be tested with a vacuum "look box" which involves placing a soap solution on the joint and then placing a vacuum box over the joint. Bubbles indicate a leak.

Double-welded lap joints can be tested by shop-drilling and tapping a 1 /8" or 1/4" NPT hole in the lap or bell end of the pipe and applying 280 kPa of air or other suitable gas to the joint between the two fillet welds. Apply a soap solution to the joint and look for bubbles caused by escaping gas.

Do not pneumatically test the pipeline since compressed air can be very hazardous to testing personnel.

5.5 CONCRETE

AWWA C300, C301, C302, and C303 are the applicable AWWA standards relating to concrete pressure pipe. These standards refer to an AWWA Manual M9 for additional information regarding the design and construction of concrete pressure pipe. The information on pressure and leakage testing is not as specific as the information on ductile iron and AC pressure pipe.

Specific procedures for concrete pressure pipe include all of the General Procedures (Section 5.1) plus the following:

1. Fill the water main with water 24 h prior to hydrostatic testing.

2. Test pressure will be 120% of the working pressure.

3. The allowable leakage can be calculated from the following equation:

Allowable leakage $$Lm = \frac{HLD\sqrt{P}}{2.16 \times 10^6}$$

where: L = length of test section in m
D = diameter of the pipe in mm
P = average test pressure in kPa
H = test duration in hours

5.6 HDPE

1. Pressure the pipe section to 1.5 times the pressure class. Vent and bleed off trapped air as needed.
2. Initial Expansion: Maintain 1.5 times the pressure class for 4 hours and add water as needed. Do not measure this volume. Hydrostatic pressure expands pipe.
3. Begin Test: Reduce pressure to 10psi (70kPa) below 1.5 times pressure class. Monitor pressure for 1 hour.
4. The pipe is acceptable if the pressure drop over 1 hour is 5% or less.

5.7 FIRE HYDRANTS

EPCOR normally prefers that pressure and leakage tests be performed against the hydrant valve with the main shutoff valve open. However, in cases where the hydrant shutoff valves are closed during hydrostatic testing of the pipeline, it is necessary to test the hydrants for leaks and mechanical defects separately. Consult the AWWA manual M17 for details on hydrant installation, testing, and maintenance. Hydrant pressure and leakage testing is described as follows:

1. Remove the highest nozzle cap and open the hydrant valve a few turns and allow the water to rise in the barrel to the bottom of the nozzle.
2. Replace the nozzle cap securely, but leave it loose. Continue to fill the hydrant slowly, expelling the air through the loose cap.
3. Tighten the nozzle cap when all of the air has been expelled.
4. Open the hydrant valve completely. Failing to so do will cause significant water flow through the drain holes, undermining the performance of the hydrant.
5. Check visually for leakage at the flanges, nozzles, operating stem, and at any joints on the hydrant body. Also use a listening device to detect any leaks below grade.
6. No leaks are permitted. Repair all faults.

5.8 REPORTING PROCEDURES AND RECORD KEEPING

The pressure and leakage testing results will be recorded at the location using the EPCOR standard form shown in Appendix A. This form will be certified by the consulting engineer and the contractor before submitting to the EPCOR inspector.

5.9 HINTS & TIPS

1. Always check that the pipe is restrained before filling.
2. Always check that all valves are open in the test section.
3. Always use a pressure gauge that is accurate and precise.
4. Calibrate the pressure gauge regularly.
5. Have an appropriately sized water reservoir and accurate depth gauge.
6. Obtain the design pressure or normal operating pressure before the test.
7. Always watch the pressure gauge during the test.

8. Be sure to use air relief valves at high points and at dead-ends.

9. Always notify inspectors in advance of the test.

10. Never backfill the water-main excavation until it has been inspected.

11. Never backfill until concrete thrust blocks have cured.

12. Never operate boundary valves without proper training.

13. Never fill water-mains from boundary mains without notifying the Inspector and EPCOR Water Dispatch (780 412 6800) (two calls are required).

14. Never fill water main at rates exceeding 0.6 m/s.

15. Never fill water mains so as to trap air – fill slowly from one valve, carefully and thoroughly vent air.

16. Never leave air in dead-ends or house services.

17. Never use water pumps used for draining excavations, pumping sewage, *etcetera* to pressurize a potable water main.

18. Do not use a 200 L barrel if the allowable leakage is less than 20 L.

19. Never use a damaged or un-calibrated pressure gauge.

20. Never use a pressure gauge with a range greater than 0 to 1400 kPa.

21. Never continue to increase pressure during a test if large quantities of water are required.

22. Never operate valves in either direction when the differential pressure exceeds the rated pressure of the valve.

5.10 CITED LITERATURE

AWWA, Concrete pressure pipe. Manual M9, American Water Works Association, Denver, CO.

AWWA, Installation, operation, and maintenance of fire hydrants. Manual M17, American Water Works Association, Denver, CO.

AWWA, PVC pipe - design and installation. Manual M23, American Water Works Association, Denver, CO.

Uni-Bell, Handbook of PVC pipe, design and construction, Uni-Bell Plastic Pipe Association, Dallas, TX.

Walski, T.M., 1984. Analysis of water distribution systems. Van Nostrand Reinhold Company, New York, NY.

6. GUIDELINES FOR DISINFECTION

6.1 PURPOSE

The purpose of disinfection is to destroy pathogenic microorganisms, which may occupy the water main after construction is complete. Chlorine is usually used as the disinfectant either as a c ompressed gas, calcium hypochlorite tablets/solution, or as a sodium hypochlorite (bleach) solution.

6.2 DISINFECTION SPECIFICATION

A performance criterion for water main disinfection has been specified using the American Water Works Association (AWWA) Standard C651. This standard comprehensively describes the minimum procedures to be followed when preparing a water main for disinfection, disinfecting the water main, testing for chlorine residual, and conducting bacteriological sampling. It refers to the latest edition of Standard Methods for the Examination of Water and Wastewater for detailed methods for testing water quality and chlorine residual.

6.3 PROCEDURES

Disinfection consists of the following four tasks:

1. Preventing contamination of the new pipe during shipping, storage, and construction;

2. Flushing the water main to remove loose debris and dirt which may have entered the water-main during construction. (**Do not** flush if hypochlorite tablets have been placed);

3. Chlorination of the water main to destroy pathogenic microorganisms; and

4. Bacteriological testing of the disinfected water to ensure that the microbiological water quality is adequate.

6.3.1 Water-main preparation

Water main flushing is the most common form of preparation for disinfection except where hypochlorite tablets have been used. The flushing flow rate should be sufficient to achieve a minimum velocity of 0.8 m/s. Table 1 summarizes the flow conditions required to achieve this velocity for various pipe sizes.

Table 4 Required flow and number of openings to flush water mains.**

Pipe diameter (mm)	Required flow (L/s) for 0.8 m/s velocity	Size of tap, mm					Number of nozzles (2.5")*
		20	30	40	50		
		Number of taps					
50	1.6	1					NA
100	6.5	NA	1			**OR**	1
150	13	NA	NA	1			1
200	26	NA	NA	2	1		1
250	38	NA	NA	3	2		1
300	57	NA	NA	NA	3		2
450	100	NA	NA	NA	4		2

Source: (After AWWA C651-86)

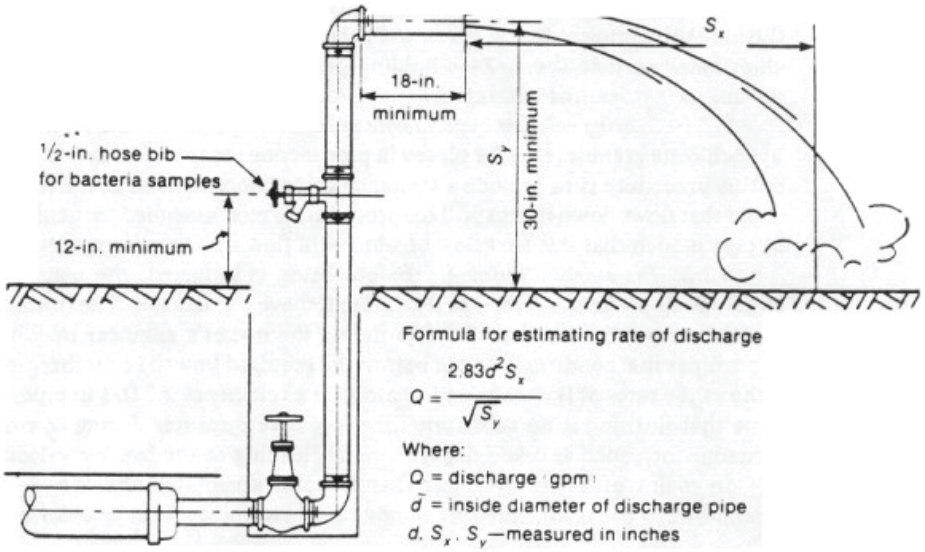
NOTES for Table 1:
NA not applicable
* With 280 kPa residual pressure, a hydrant flowing to atmosphere will discharge 63 L/s from a 2.5" nozzle and 158 L/s from a 4.5" steamer nozzle.
* * Assumes 280 kPa residual main pressure.

The discharge from the flushing pipe can be quickly estimated (±3 L/s) from the following equation (see Figure 4):

$$Q = \frac{5.5 \times 10^{-5} d^2 S_x}{\sqrt{Sy}}$$

where;

Q	= discharge, L/s
d	= discharge nozzle inside diameter, mm
S_x	= the horizontal distance of discharge, mm
S_y	= the vertical distance from the ground to centre of nozzle, mm



Note: This figure applies to pipes up to and including 8 in (200 mm) diameter.
Source: (AWWAC651-99)

Figure 4 Estimating discharge from a hydrant or blowoff

Water mains larger than 600 mm can be broom swept as an alternative to flushing. Care must be taken in removing the sweepings from the pipe before filling.

When care has been exercised in the shipping, storage, and construction of new water mains, the above procedures will normally remove contaminants, which remain in the pipe. However, on occasion, flushing will not be satisfactory and a more thorough cleaning method will be required. This will typically involve foam swabbing of the water main.

A foam swab is a bullet-shaped piece of polyurethane foam, available in a variety of densities, which is cut approximately 50 mm larger in diameter than the pipe to be cleaned. The swab is usually launched through hydrant leads and pushed through the new water main hydraulically. The soft foam gently scours the walls of the pipe, removing stubborn contaminants. It should be determined that the swab is not compressing contaminants into the pipe joints. The equipment and procedure for foam swabbing is somewhat specialized and should only be undertaken by properly trained personnel. Some authorities require foam swabbing prior to acceptance of new water mains.

6.3.2 Occupational Health and Safety

Comply with all applicable Occupational Health and Safety requirements including the Workplace Hazardous Materials Information System (WHMIS). The storage and handling of chlorine compounds requires due diligence and careful attention. Chlorine is very toxic to living organisms. Chlorine gas can be produced very easily if the wrong chemicals come into contact with chlorine compounds. WHMIS requires that Material Safety Data Sheets (MSDS's) be supplied with the chemical. The MSDS's describe in detail the hazards associated with the chemical, safe storage requirements, PPE, handling procedures and first aid for each specific chemical compound.

The responsibility for the implementation of WHMIS lies with the employer. However, all workers and all persons involved with supervising workers handling hazardous materials should be aware of their roles and responsibilities.

6.3.3 Chlorination

The choice of chemical to use for chlorination is limited to sodium hypochlorite or calcium hypochlorite. Free chlorine is the most potent form of chlorine in water. It is formed when hypochlorite is added to water. When hypochlorite is added in the presence of ammonia, combined chlorine is formed. Combined chlorine is much slower acting than free chlorine.

There are three accepted methods for adding the chlorine chemicals to new water mains (AWWA C651-99):

1. Calcium hypochlorite tablets placed during construction. This method provides an average dose of 25 mg/L.

2. Continuously fed sodium or calcium hypochlorite solution. This method provides a minimum chlorine residual of 10 mg/L for 24 h

3. A slug of high concentration chlorine solution. This method provides a high concentration of chlorine, 100 mg/L, for a contact time of greater than 3h.

Calcium hypochlorite tablets
Calcium hypochlorite tablets are placed in the water main during construction. The tablets are usually 5 g and are placed at the beginning of the new main, at 150 m intervals, at each hydrant lead, in each hydrant, and at other appurtenances. The required number of 5 g tablets can be calculated from:

$$\text{No. of tablets} = 6.28 \times 10^{-6} D^2 L$$

where; D = pipe diameter, mm
L = length of pipe being disinfected, m

The tablet method cannot be used with solvent-welded plastic or screwed-joint steel since the joint chemicals are incompatible with calcium hypochlorite.

The water main is slowly filled after construction keeping the velocity below 0.3 m/s to prevent disturbing the tablets. Removal of air from the water main requires particular care as was noted in the section on pressure and leakage testing. The contact time should be 24 h at water temperatures greater than 5°C, and should be increased to 48 h when the water temperature is less than 5°C.

Continuous-feed
A solution of calcium hypochlorite or liquid bleach (sodium hypochlorite) may be continuously fed as the water-main is discharged at the end of the section being disinfected. The objective is to fill the water main with a uniform concentration of chlorine so that at the end of 24 h, a minimum chlorine residual of 10 mg/L remains. The usual dose to achieve this residual is 25 to 30 mg/L.

The following equipment is required when performing continuous-feed hypochlorination:

1. A gasoline or electrical chemical-feed pump designed for feeding chlorine solutions. The usual type is a positive-displacement diaphragm pump that is available in two styles; mechanically or hydraulically actuated. The chemical feed rate can be adjusted by altering either the stroke length or stroke speed.

   Maintenance of chlorine feed equipment is important since the high pH, which characterizes hypochlorite solutions causes valve seats to fail from scaling, hardening, or swelling. Calcium carbonate scale (lime) can be removed from the equipment by passing 5% hydrochloric (muriatic) acid through equipment. **Be sure to flush chlorine from equipment with water first since HIGHLY TOXIC CHLORINE GAS can be produced.**

2. All hose and fittings should be constructed of material, which is oxidant resistant and strong enough to withstand the maximum pressure of the chemical-feed pump.

3. A high concentration chlorine test kit should be used to make chlorine residual determinations at the discharge end of the water main being tested.

The chlorination procedure consists of the following steps:

1. Calcium hypochlorite tablets may be placed in the water main during construction as an option. This permits a strong chlorine solution to flow down the pipe during filling, penetrating annular spaces at pipe joints. See the above section for the procedure for placing calcium hypochlorite tablets.

2. Prepare 1% chlorine feed solution from dry calcium hypochlorite or sodium hypochlorite bleach solution. Refer to Table 2 for information on the amounts of solution which are required for various pipe sizes. Wear protective clothing, face shield, and filter facemask. **CHLORINE IS EXTREMELY HAZARDOUS**. Do not store chlorine near acid or petroleum products. **EXPLOSION HAZARD.**

Table 5 Chlorine required to produce 25 mg/L concentration in 100 m of water main

Pipe diameter, mm	100% chlorine, g/100 m‡	1% chlorine solution, L/100 m*‡
50	5	0.5
100	20	2.0
150	45	4.5
200	81	8.1
250	130	13
300	180	18
450	323	33

Source: (After AWWAC65 1-86)

* 1.5 kg $Ca(OCl)^2$ per 100 L

‡adjust for available chlorine of chemical used (see Appendix C for details)

3. **Ensure all boundary valves are closed**. Use a water distribution system drawing to highlight all valves and pipes involved in the area to be disinfected.

4. Set-up chlorination equipment in such a way that the feed point is not more than 3 m downstream from the beginning of the new water main.

5. **DO NOT** use fire hydrants for chemical feed. The high concentration chlorine solution will damage the hydrant.

6. Notify the EPCOR Water Inspector 48 hours prior to commencing activities. Under the supervision of the Inspector, open the discharge point and one boundary valve permitting water from the distribution system or other approved source to flow through the new water main at a constant, measured rate. Use a pitot gauge, a container of known volume and stop watch, or the approximate method shown in Figure 4 to calculate the rate of discharge. Valves 350 mm and larger can only be operated by EPCOR Water Operations Staff. The EPCOR Water Inspector must be contacted a minimum of 48 hours in advance to make arrangements for the operation of these valves. More notice may be required on a case by case basis.

7. Adjust the chemical feed pump rate to produce a chlorine dose of 25 mg/L free chlorine. For example, if the water flow rate in the water-main is 40 L/min., the chemical feed pump should be set to deliver 1.0 g/min. (100 mL/min. if a 1% solution is being used).

8. Frequently monitor the discharge location for chlorine residual using an approved field test kit.

9. Once the 25 mg/L residual has been achieved, stop the flow and chlorine feed. Retain the chlorinated water in the test section for 24 h or more.

10. Operate all valves and hydrants in the test section to ensure they are disinfected.

11. After 24 h check the free chlorine residual. If the residual is less than 10 mg/L, flush and re-chlorinate.

Slug

The slug method involves slowly flowing a slug of high concentration chlorine, 100 mg/L, through the water main, exposing all surfaces to the chlorine for a minimum time of 3 h.

The procedure for slug chlorination is as follows:

1. During construction, place calcium hypochlorite tablets in the water main. This permits a strong chlorine solution to flow down the pipe during filling, penetrating annular spaces at pipe joints. See the section on calcium hypochlorite tablets for details.

2. **Ensure all boundary valves are closed**. Use a water distribution system drawing to highlight all valves and pipes involved in the area to be disinfected.

3. Set-up chlorination equipment in such a way that the feed point is not more than 3 m downstream from the beginning of the new water main.

4. **DO NOT** use fire hydrants for chemical feed. The high concentration chlorine will damage the hydrant.

5. Notify the EPCOR Water Inspector 48 hours prior to commencing activities. Under the supervision of the Inspector, open the discharge point and one boundary valve permitting water from the distribution system or other approved source to flow through the new water main at a constant, measured rate. Use a pitot gauge, a container of known volume and stop watch, or the approximate method shown in Figure 4 to calculate the rate of discharge. Valves 350 mm and larger can only be operated by EPCOR Water Operations Staff. The EPCOR Water Inspector must be contacted a minimum of 48 hours in advance to make arrangements for the operation of these valves. More notice may be required on a case by case basis.

6. Adjust the chemical feed pump rate to produce a chlorine dose of 100 mg/L free chlorine. For example, if the water flow rate in the water main is 10 L/min., the chemical feed pump should be set to deliver 1.0 g/min. (100 mL/min. if a 1% solution is being used).

7. The flow of the slug, which moves along the water main, should be controlled so that the pipe and appurtenances are exposed to 100 mg/L for 3 h.

8. Frequently monitor the free chlorine residual in the slug using an approved field test kit. If it falls below 50 mg/L, move the chlorination equipment to the head of the slug and start the flow again, increasing the concentration to 100 mg/L.

9. Operate all valves and hydrants as the slug passes to ensure they are disinfected.

6.3.4 Sampling

The purpose of sampling a water main is to obtain information on the water quality in the pipe. The underlying assumption which is important is that the sample is **representative** of the water in the water main. Good sampling procedures are intended to provide the best opportunity for obtaining a representative sample.

Chlorine

Sampling for chlorine residual includes two basic tests: high concentration chlorine residual at the beginning and end of the primary disinfection period; and sampling for low concentration chlorine residual once the water main has been flushed. The best location for sampling residual chlorine during the primary disinfection period is at the discharge blowoff and at the service connections intended for bacteriological sampling. Low level chlorine can be determined at the bacteriological sampling locations, at an approved blowoff, and, as a last resort, at fire hydrants.

Hach Water Quality Test Strips

Procedure

1. Dip the Test Strip into your sample.
2. Wait for the colour to develop.
3. Compare the colour of the reagent pad to the colour component chart on the package label for results.

Shelf Life

Each bottle bears an expiration date. Test strips average a shelf life of 24 months from the manufacture date. Test strips should be discarded once the expiration date on the bottle is reached to ensure reliable results. Available chlorine test strips are described below in Table 6.

Table 6 Available Chlorine Test Strips

Parameter	Range	Steps	Qty	Cat No.
Total Chlorine	0 - 10 ppm	0,0.5,1.0,2.0,4.0,10.0 ppm	50	27552-50
Free Chlorine	0 - 10 ppm	0,0.5,1.0,2.0,4.0,10.0 ppm		

Suppliers

PrairieChem Inc.

11750 180 St.
Edmonton, Alberta
T5S 1N7
Tel: 780 452-6000
Fax: 780 452-4600
Web: www.prairiechem.com

Anachemia Science

15006 116 Ave.
Edmonton, Alberta
T5M 3T4
Tel: 780 451-0665
Fax: 780 452-2478
Web: www.anachemia.com

Bacteriological

Bacteriological samples in the City of Edmonton are normally collected 16 h after the chlorine test is passed. This requirement may be waived under special circumstances.

Sampling for bacteriological water quality parameters requires a great deal of care since it is very easy to contaminate a sample. Of utmost importance is to recognize that bacteria are organisms which live everywhere including air, soil, water, clothing, and all parts of the human body. Therefore, good sampling protocol is necessary to ensure reliable results. The following procedure will ensure reliable results are obtained in the laboratory (Standard Methods for the Examination of Water and Wastewater):

1. Obtain approved bacteriological sample bottles from the Provincial Laboratory of Public Health or the local Health Unit.

2. Keep the bottles closed until immediately prior to obtaining the sample. These bottles are sterilized and contain a tablet of dechlorination reagent. **NEVER** rinse the sample bottles.

3. **DO NOT** sample from fire hydrants. Use a service connection or blowoff especially designed for sampling the new water-main. Sample taps should be one-piece brass without aerators or other types of screens.

4. Flow the sample line at high rate for a minimum of 5 min. to flush the line thoroughly before sampling.

5. While the sample line is flowing, complete the Provincial Laboratory of Public Health Form PH 108 (example shown in Appendix A).

6. Reduce the flow rate in the sample line, but maintain a water flow.

7. Carefully break the seal on the sample bottle cap and unscrew. Take great care not to contaminate the cap or the neck of the bottle with fingers or dirt.

8. Avoiding splashes, cut the water stream with the sample bottle and fill it until there is a head-space of approximately 20 mm in the sample bottle (roughly to the shoulder of the sample bottle). Replace the cap securely.

9. Shake the bottle 5 times to help the dechlorination reagent to dissolve.

10. Remove the sample identification number from the Provincial Laboratory of Public Health Form PH 108 and attach it to the sample bottle.

11. Bacteriological samples cannot be stored. If the sample cannot be delivered to the Provincial Laboratory within 1 h of sampling, use an iced cooler for storage during transport. In no case, should the samples be delivered to the Provincial Laboratory more than 6 h after the sample was collected. **NEVER** leave sample bottles in the sunshine or expose them to elevated temperatures.

6.4 REPORTING PROCEDURES AND RECORD KEEPING

The chlorination and bacteriological test results for the section of water-main being tested will be recorded using the form shown in Appendix A. A sketch should be provided indicating the following locations:

- chlorine application point;
- chlorine sampling points; and
- bacteriological sampling points.

The information recorded on the form includes the total and free chlorine residuals obtained at the beginning and end of the disinfection period and the final results of the bacteriological testing. The form will be completed and stamped by the engineer or professional technologist responsible for disinfection and bacteriological sampling.

Complete Provincial Laboratory of Public Health Form PH 108, shown in Appendix A, at the same time as the bacteriological sample is taken. This form should accompany the bacteriological samples, which are submitted to the Provincial Laboratory. The results will be forwarded to Alberta Health Services, Edmonton Region and from there to EPCOR inspectors. EPCOR will provide a water main Construction Completion Certificate if pressure, leakage, and bacteriological tests have been satisfactory.

6.5 HINTS & TIPS

1. Always use a new sample bottle for each sample.
2. Always flow the sample line at high rate for a minimum of 5 min.
3. Never leave bacteriological samples exposed to sunshine or elevated temperatures.
4. Sample from fire hydrants only if other sampling points are unavailable.
5 Never rinse sample bottles.
6. Never reuse sample bottles.
7. Never touch the cap or inside of the sample bottle.

6.6 CITED LITERATURE

AWWA, C651. Disinfecting for Water Mains. American Water Works Association, Denver, CO.

AWWA, 1999. Maintaining distribution-system water quality. American Water Works Association, Denver, CO.

Burman, N.P., 1987. Distribution systems. Journal of Environmental Pathology, Toxicology, and Oncology, 7(5/6): 279-302.

Gordon, G., Cooper, W.J., Rice, R.G., and Pacey, G.E. 1988. Methods of measuring disinfectant residuals. Journal of the American Water Works Association 80(9)::94-108.

Greenberg, A.E., L.S. Clesceri, and A.D. Eaton editors. 1992. *Standard Methods for the Examination of Water and Wastewater.* 18th edition. Washington, DC: American Public Health Association, American Water Works Association, Water Environment Federation.

Health and Welfare Canada. Sixth Edition 1996. Guidelines for Canadian drinking water. Ottawa, Ontario.

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7. DECHLORINATION

7.1 GENERAL

Water discharged from the water distribution system and released to water bodies, either directly or indirectly (e.g., via the storm-water sewer system), is to be dechlorinated at the point of discharge in accordance with the applicable federal legislation. This includes dechlorination of water released due to main breaks once the risks to public safety and property damage have been controlled. For water disposed to the sanitary sewer system, there are limits on the chlorine concentration and volume of water discharged as set by the City of Edmonton.

Refer to Chapter 2 of the Design Standards for applicable regulations.

The Canadian Water Quality Guidelines for the Protection of Aquatic Life (Canadian Council of Ministers of the Environment, 1999) sets a guideline residual chlorine concentration of 0.5 micrograms per litre (µg/L), which is below the reliable limits of detection (i.e., chlorine should be neutralised to the point where no chlorine is detected). Depending on the method of dechlorination, the chemicals used may impact on the dissolved oxygen concentration of receiving waters, which may be a concern for the aquatic health of receiving wetlands and/or creeks[1].

The Developer and their Agents, Engineers and Contractors, are responsible for the water quality impacts of water discharged during construction activities, including dechlorination of water disposed as part of acceptance tests and disinfection.

Refer to AWWA C655 for information on standard industry practices. The methods described are provided for guidance only.

7.2 DECHLORINATION METHODS

Dechlorination may be performed by adding a neutralizing chemical to the chlorinated water as it is discharged.

Two common methods for applying the neutralising chemicals are:

- Continuous-feed, where neutralising chemicals are applied at the point of water discharge; or
- Dechlorination tank, where chlorinated water is discharged to a tank then treated to dechlorinate. The tank may be mounted on a mobile trailer.

The table below provides general information on various chlorine-neutralizing chemicals that can be used as guidance in the field. Note that the chemical reaction time may be temperature-dependent. The choice and amount of dechlorination chemical will be impacted by project or site specific issues such as water release, temperatures, strength of chlorine, volume of water release and distance from receiving waters. Dechlorination must always be verified through field sampling of discharge waters.

Follow all manufacturer's recommendations and safe work procedures when handling dechlorination chemicals. Adhere to all applicable safety regulations including: Workplace Hazardous Materials Information System (WHMIS), Occupational Health and Safety (OH&S) and Transportation of Dangerous Goods (TDG).

[1] The Canadian Water Quality Guidelines for the Protection of Aquatic Life (Canadian Council of Ministers of the Environment, 1999) set a lowest acceptable concentration of dissolved oxygen in cold water of 9.5 milligrams per litre (mg/L) to protect aquatic life in their early life stages.

Table 7 – Summary of Dechlorination Chemicals

Name of Chlorine-neutralising chemical	Chemical formula	Approximate parts of chemical required to neutralize 1 part of chlorine	Comments*
Sulfur dioxide	**SO_2**	1.1	▫ Reducing agent; may deplete dissolved oxygen in the water. ▫ Can reduce the pH of the water significantly. ▫ Extremely irritating gas. ▫ Best suited for use in treatment plants and pumping stations, not field use.
Sodium bisulfite	**$NaHSO_3$**	1.5	▫ Reducing agent; depletes dissolved oxygen in the water. ▫ Available as a white powder, granule or clear liquid solution. ▫ Highly corrosive, and a skin, eye and respiratory tract irritant.
Sodium sulfite	**Na_2SO_3**	1.8	▫ Reducing agent; may deplete dissolved oxygen in the water. ▫ Available in powder/crystalline and tablet form. ▫ Dechlorination tablets are effective for constant, low flow rate chlorinated releases. ▫ Currently used by EPCOR (LPD-CHLOR tablets). ▫ Suitable for chlorine concentrations of less than 4 mg/L.
Sodium thiosulfate	**$Na_2S_20_3$**	2.0 Varies with pH	▫ Reducing agent; may deplete dissolved oxygen in the water. ▫ Skin, eye, nose and throat irritant. ▫ Low toxicity to aquatic species (USEPA toxicity study) ▫ May react slowly and requires more time for dechlorination. ▫ Over-dechlorination can encourage bacterial growth in the receiving streams.
Ascorbic acid	**$C_60_8H_6$**	2.5	▫ No known impact on dissolved oxygen. ▫ May decrease pH of water. ▫ Available in tablet form. ▫ Skin, eye and lung irritant. ▫ Store in a dry state and prepare solution at the time of use.
Sodium Meta-bisulfite	**$Na_2S_20_5$**	1.4	▫ Reducing agent; depletes dissolved oxygen in the water. ▫ Available as crystal, powder or solution form. ▫ Eye, throat, skin and lung irritant. ▫ Used by EPCOR to neutralize super-chlorinated water during the commissioning of a 1500 mm transmission main at EL Smith.
Calcium thiosulfate	**CaS_20_3**	Varies with pH	▫ No known impact on pH or dissolved oxygen. ▫ Not toxic to aquatic species. ▫ Over-dechlorination can cause high turbidity and encourage bacterial growth in the receiving streams. ▫ Dechlorination reactions require nearly 5 minutes for complete neutralization. ▫ Currently used by EPCOR for high chlorine concentrations (CAPTOR, 20 to 300 mg/L)

*Information sources: Tikkanen et al., Guidance Manual for Disposal of Chlorinated Water and AWWA C655

7.3 CURRENT EPCOR PRACTICE

EPCOR Water dechlorinates all discharge waters that result from its construction, operations and maintenance activities. To dechlorinate water discharged from hydrants, EPCOR uses sodium sulfite tablets inserted into a dechlorinating diffuser hydrant attachment. For large quantities of water discharge, EPCOR uses a 33% solution of sodium metabisulfite ($Na_2S_2O_5$) injected into the discharge stream at an approximate rate of 1.4 parts of sodium metabisulfite to neutralize 1 part of free chlorine.

7.4 FIELD SAMPLING

Verify that the water discharge stream is sufficiently dechlorinated to meet applicable legislation and bylaws via field sampling of residual chlorine concentration.

8. GUIDELINES FOR BOUNDARY VALVE OPERATION

8.1 PURPOSE

Boundary valves are valves which isolate new water-main construction from existing water-mains serving people with potable water. These valves protect the public from accidental contamination of their drinking water caused by backflow from contaminated water-mains or mains which have excessive residual chlorine concentrations. In addition, boundary valves prevent excessive hydrostatic pressure being applied to domestic water services during pressure testing of new water-mains. Care must be taken when opening and closing boundary valves to ensure that the water serving houses remains safe for consumption and that the customer is not inconvenienced.

Boundary valves may be on existing City property or in the new development. In some cases, the boundary valve may be one or more valves away from the development. Regardless of the boundary valve location, boundary valves should not be turned unless the operator fully understands the location and function of the valves.

OPERATING RULES

1. Have only one boundary valve open at one time to prevent backflows.

2. The Engineer is responsible for the operation of boundary valves in both new developments and renewal projects.

3. Water-main design drawings should have all boundary valves clearly marked prior to construction.

4. Prior to construction, the Engineer will designate a site representative who will be responsible for ensuring that operation of boundary valves, pressure and leakage testing, and disinfection are properly performed. This individual must be competent and demonstrate knowledge of the water distribution system in the vicinity of the construction.

5. Boundary valves will be closed and stoppered before construction starts as per the approved engineering drawings and the EPCOR Water Inspector must be onsite.

6. Valves 300 mm in diameter and smaller must be operated under the supervision of an EPCOR Water Inspector. The EPCOR Water Inspector must be contacted a minimum of 48 hours in advance. Valves 350 mm in diameter and larger must be operated by EPCOR Water Operations Staff. The EPCOR Water Inspector must be contacted a minimum of 48 hours in advance to make arrangement for the operation of these valves. Additional notice may be required on a case by case basis.

7. Boundary valves will be closed and stoppered until new water-mains are accepted except for the following construction activities:

   - filling water-mains for wet-tapping of services;
   - pressure and leakage testing; and
   - disinfection and subsequent flushing.

   48 hour notice must be provided to the EPCOR Water Inspector prior to the commencement of these activities. Boundary valve management in accordance with Item 6 must be completed.

8. The consulting engineer is responsible for obtaining approval from the EPCOR Water Inspector to operate and change the status of any boundary valves. The Inspector must be onsite to witness any operation or changes in status.

8.2 TAPPING VALVES AND SLEEVES (TVS)

A common form of connection for new developments is by means of a tapping valve and sleeve arrangement whereby the contractor will make a wet tap into an existing potable water-main which is servicing customers.

This operation is the responsibility of the contractor and the supervising consulting engineer. The contractor or responsible party must follow the notification policies and procedures for a tapping valve and sleeve connection, outlined in Chapter 3.8.1 – 3.8.2 of Section 02511 – Water Mains.

EPCOR does not take responsibility of tapping valves until the warranty period expires. Improper use of any boundary valves before or after the warranty period can result in system wide problems and therefore care in operation of these valves should be consistent.

Installation of TVS's should follow good water works practices including swabbing the pipe at the tapping location, tapping valve, and tapping sleeve with 1% chlorine bleach solution prior to assembling the TVS. Support for the tapping sleeve and thrust blocks should be provided as per the Engineer's specification.

8.3 HINTS & TIPS

1. Always appoint a knowledgeable site representative to oversee water-main testing and boundary valve operation.

2 Always mark the boundary valves on design drawings.

3. Always close all boundary valves and install stoppers before construction starts.

4. Always notify EPCOR Water Dispatch (780 412 6800) of any changes in boundary valve status.

5. Never have more than one valve open at one time.

6. Never operate boundary valves during construction except when filling water mains for service tapping, pressure and leakage testing, or disinfection.

9. DESIGN GUIDELINES FOR ACCEPTANCE TESTING OF NEW WATER MAINS

9.1 OBJECTIVES

The objective of the design guidelines is to help designers consider the means of achieving effective acceptance testing procedures during the construction of new water mains. Many times designers are most interested in the most economical layout of new water mains without any consideration for subsequent testing and long-term, routine maintenance. The following sections are design requirements for new developments in the City of Edmonton. Following these guidelines will help speed the approval process, reduce delays during construction, and will help prevent accidents from occurring which could adversely affect the quality of water supplied to the residents of Edmonton.

9.2 GENERAL CONSIDERATIONS

Test locations need to be identified early in the design stage to permit the proper appurtenances to be incorporated into the water network design. Experienced field personnel will be able to quickly identify appropriate locations. Pressure and leakage testing apparatus can be used at the same location as chlorination equipment. However, because of the corrosive nature of chlorine, the location of pressure and leakage testing will be determined by the disinfection constraints. Suggested considerations include the following:

1. Clearly identify all boundary valves on the overall water-main plan. Identify boundary valves that are to be operated for acceptance testing of the new water mains.

2. On the overall water-main plan, tentatively identify areas to be pressure and leakage tested and disinfected at one time. If the whole project can be done at one time, identify this on the drawing notes. Clearly identify the incoming and the outgoing water points.

3. Locate a suitable main stop and service connection within 3 m of the boundary valve from which the water will flow into the new system. This service connection will carry the chlorine solution into the water main to be disinfected. This can be a temporary main stop and can be abandoned at the discretion of EPCOR after the water main has been successfully tested. The copper should be crimped and soldered and the main stop closed.

4. Locate a hydrant or blowoff near the end of each section to be disinfected. Large areas of a new water distribution system can be disinfected at one time provided there are enough sampling points to determine the uniformity of the chlorine residual over the area. By operating the valves carefully, the entire area can be flowed through one hydrant. A hydrant will also be able to provide the wide range of flow rates required to flush the water-main (see Table 1). If it is not possible to provide a hydrant or blowoff as the outlet, refer to Table 1 for the required type of outlets on a water main to achieve an adequate flushing velocity.

5. Provide air relief valves at the high points of water mains greater than or equal to 450 mm in diameter. For water mains less than or equal to 300 mm diameter, locate a hydrant near the high point. These appurtenances will provide relief of trapped air and will also provide a location for pressure testing the water-main in accordance with the guide-lines in Section 3.

6. Identify service connections that can double as pressure test points and chlorine and bacteriological sampling points in the area to be tested.

7. Remember that hydrants cannot be used for adding chlorine or for bacteriological sampling.

8. Identify the location of dechlorination points considering where the flushed water will go.

9.3 DEAD-ENDS

Permanent

Permanent dead-ends can be the most significant routine maintenance problem that a water utility can deal with. In addition, available fire flows are greatly reduced when hydrants are only fed from one direction. During the planning and pre-engineering phases of development every effort should be made to have a looped water distribution system which provides the best fire protection and facilitates routine maintenance. However, modern land use planning techniques inevitably result in permanent dead-end water-main sections. These pose a challenge for the designer since they need to be flushed, pressure and leakage tested, and disinfected to the same standard as looped mains. The designer can evaluate the following suggestions:

1. Refer to Table 1 for the required outlets on a water-main to achieve an adequate flushing velocity.

2. Locate the proper size outlet on the dead-end main. Since many dead-end mains are 150 or 200 diameter, a minimum single 40 mm or 50 mm copper service will be adequate, respectively. In situations where a 50 mm dead-end is provided, a 20 mm blowoff is necessary. Permanent blowoffs are an asset for future maintenance needs. Use a chamber, self-draining riser, or bury the blowoff in a landscaped area for future use. Refer to EPCOR Standard Drawings for Flush Point and Blowoff arrangements.

At Limits of Construction

Frequently, new construction is bounded by undeveloped property or property which is owned by others. This situation involves the design of temporary dead ends which may be linked to other water mains in the near or very distant future. These dead ends require the same attention to acceptance testing as do permanent ones. The major difference is that they are not necessarily permanent. Good design can involve leaving a boundary valve and hydrant at the limits of construction. Otherwise, the same suggestions apply as for the permanent dead ends above.

Never service a lot from a temporary dead-end that cannot be isolated from new construction by a boundary valve.

9.4 DRAWING NOTES

While contract specifications contain references to the appropriate AWWA standards, it is rare that field personnel have access to these. Important information regarding the construction of new water mains is generally placed on the contract drawings. The overall plan of the water distribution system is an ideal place to have special notes regarding the requirements for acceptance testing of new water mains. Minimum notes that should be attached include:

1. The pressure and leakage testing specifications for the pipe materials used in the project.

2. Design operating pressure at the low point and high point of the system. This information will be obtained from the required network analysis for distribution mains. For transmission lines, the pressures will be available from EPCOR.

3. The need for dechlorination during flushing should be noted.

10. APPENDICES

10.1 APPENDIX A - STANDARD FORMS FOR ACCEPTANCE TESTING

Water Pressure and Leakage Test Calculations

Sample Combined Water Pressure and Leakage Test

Sample Chlorine Residual and Bacterial Sampling Report

Sample Provincial Laboratory Bacteriological Sample Form PH 108

Water Pressure and Leakage Test Calculations

Project: ______________________________
Client: ______________________________
Prepared For: ______________________________

Allowable Leakage = Lm = (H*J*D*P^0.5) / 128300

Where: H= Test duration in hours; J= Number of joints; D = Pipe diameter (mm); P = Average test pressure in kPa

If test pressure is 1035 kPa and test duration is 2 hours then:

Lm =J*D/1994

[ ] mm C900 PVC Pipe — Number of Joints

Pipe [ ] /6m/joints = Round to the nearest integer [ ]

Fittings	Number	Joints/Fitting	
Plugs		* 1 =	
Bends		* 2 =	
Valves		* 2 =	
Tees		* 3 =	
Cross		* 4 =	
Hydrants		* 4 =	
		Total Joints	
		Allowable Leakage (Litres)	

[ ] mm C900 PVC Pipe — Number of Joints

Pipe [ ] /6m/joints = Round to the nearest integer [ ]

Fittings	Number	Joints/Fitting	
Plugs		* 1 =	
Bends		* 2 =	
Valves		* 2 =	
Tees		* 3 =	
Cross		* 4 =	
Hydrants		* 4 =	
		Total Joints	
		Allowable Leakage (Litres)	

[ ] mm C900 PVC Pipe — Number of Joints

Pipe [ ] /6m/joints = Round to the nearest integer [ ]

Fittings	Number	Joints/Fitting	
Plugs		* 1 =	
Bends		* 2 =	
Valves		* 2 =	
Tees		* 3 =	
Cross		* 4 =	
Hydrants		* 4 =	
		Total Joints	
		Allowable Leakage (Litres)	

Total Allowable Test Section leakage (Lm) = [ ]
Allowable Drop = Total allowable leakage /2.6 litres (cm) = [ ]

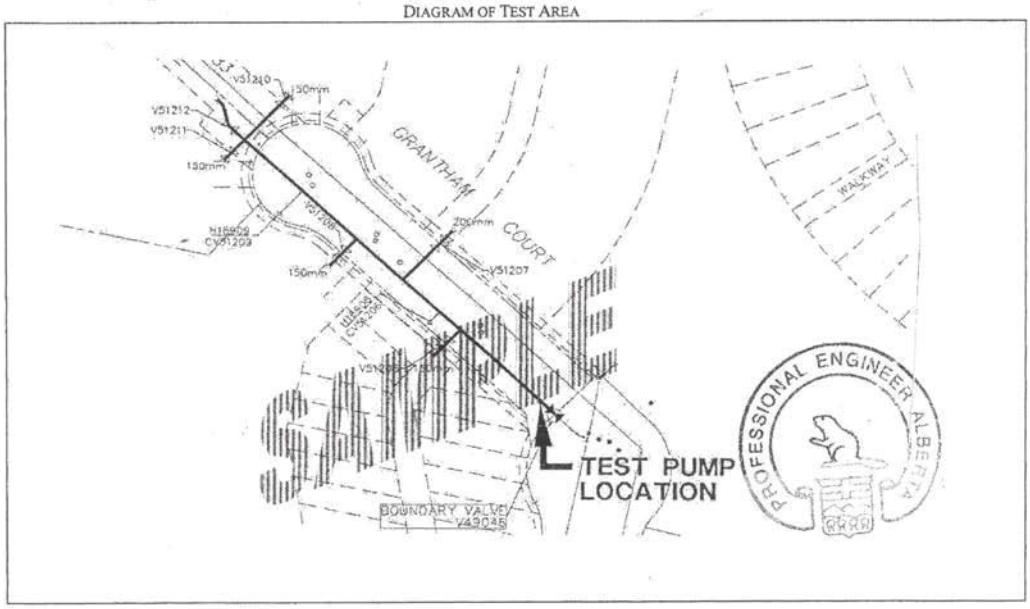
Sample Combined Water Pressure and Leakage Test

EPCOR

COMBINED WATER PRESSURE AND LEAKAGE TEST
FOR
EPCOR WATER SERVICES

DEVELOPER:	Grange Property Development	SUBDIVISION:	Glastonbury Stage 19
CONSULTANT:		DATE:	Oct-25-08
CONTRACTOR:		PUMP LOCATION:	Copper at Boundary Valves
LOCATION:	Glastonbury Stage 19		

DIAGRAM OF TEST AREA



	Time	Read	Pressure "P" (kPa)
Start	14:00	140	1035 kPa
Finish	16:00	148	1035 kPa
Millimeters Drop		8mm	
Total Actual Leakage (litres)		**2.19**	

Length (m)	Size "D" (mm)	Type	Number of Joints "J"	Leakage Allowed "L_M" (litres)
134	300	PVC	22 + 20 = 42	6.32
20	200	PVC	3 + 4 = 7	0.70
50	150	PVC	8 + 16 = 24	1.81
	50	Copper	0	0.00
2	150	Hydrant	8	0.60
			Total Allowable Leakage (litres)	**9.43**

CONTRACTOR'S REPRESENTATIVE: _____

CONSULTANT'S REPRESENTATIVE: _____

TEST TO BE WITNESSED BY CONSULTANT'S REPRESENTATIVE WITH RESULTS CERTIFIED BY A PROFESSIONAL ENGINEER

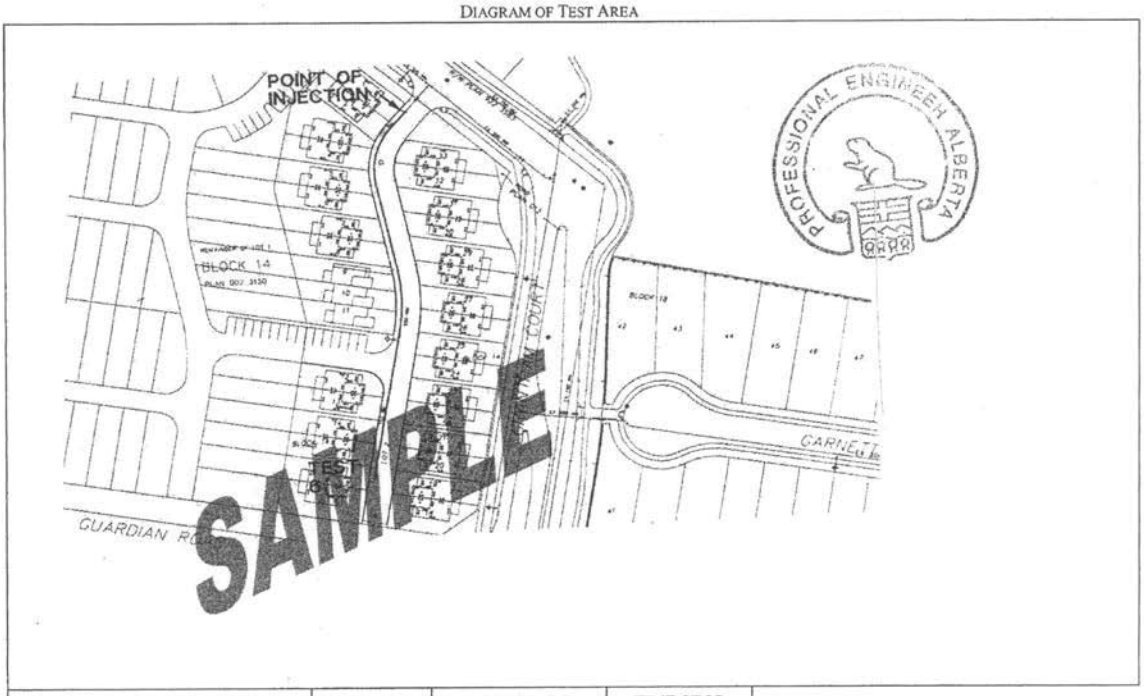
Sample Chlorine Residual and Bacteriological Sampling Report

EPCOR

CHLORINE RESIDUAL AND BACTERIOLOGICAL SAMPLING REPORT
FOR
EPCOR WATER SERVICES

DEVELOPER:	Grange Property Development	SUBDIVISION:	Glastonbury Stage 19
CONSULTANT:		REPORTING DATE:	Nov-13-08
CONTRACTOR:		PUMP LOCATION:	Copper at North Tie-in Valve
LOCATION:	Glastonbury Stage 19		

DIAGRAM OF TEST AREA



	DATE	TIME START	TIME STOP
CHLORINE INJECTION	OCT-29-08	14:37	16:42

LOCATION	INITIAL STRENGTH (HIGH RANGE) Cl_2 (mg/L)	24 HR RES. (HIGH RANGE) Cl_2 (mg/L)	TOTAL (LOW RANGE) Cl_2 (mg/L)	BACTI SAMPLE DATE	TOTAL COLIFORMS (per 100ml)	E.COLI (per 100ml)
6. Copper at Service	50	40	2.0	Nov-01-08	Absent	Absent

CHLORINATED WATER DISPOSED OF ACCORDING TO ALL LEGISLATIVE REQUIREMENTS?	(YES OR NO)

TEST TO BE WITNESSED BY CONSULTANT'S REPRESENTATIVE WITH RESULTS CERTIFIED BY A PROFESSIONAL ENGINEER

Sample Provincial Laboratory Bacteriological Sample Form PH 108

PLEASE WRITE OR PRINT PLAINLY AND FIRMLY

DETACH

Provincial Laboratory of Public Health
Division of Clinical Microbiology
Dept. of Medical Micro. & Infect. Diseases
University of Alberta Hospitals
Edmonton, Alberta T6G 2J2
Telephone: (780) 407-8925
Fax: (780) 407-8984

Trace Elements/Environmental Toxicology Laboratory
Division of Medical Biochemistry
Dept. of Laboratory Medicine and Pathology
University of Alberta Hospitals
Edmonton, Alberta T6G 2B7
Laboratory: (780) 407-8653
Fax: (780) 407-6267

REQUEST FOR MICROBIOLOGICAL / CHEMICAL ANALYSIS OF WATER

TO ORDER SAMPLE BOTTLES CONTACT THE DISTRIBUTION CENTRE AT 407-8971.

INSTRUCTIONS FOR COLLECTING WATER SAMPLES

1. Care should be taken to avoid touching the inside of the screw-cap or mouth of the bottle. Use **only** the special bottle(s) available from your Health Unit or this laboratory. **NOTE: THE MICROBIOLOGY BOTTLE IS STERILE AND CONTAINS A SMALL AMOUNT OF POWDER – DO NOT DISCARD.**
2. If water is collected from pump or tap allow water to flow for about five minutes before taking sample.
3. For microbiological examination, fill the appropriate bottle to line only. Replace cap.
4. For chemical analysis rinsing both the PET 500 bottle and cap with sample (two or three times) is strongly recommended. Submit drinking water sample from the primary residence **only.** Where water treatment or purification systems are used, submit **only** the raw water supply.
5. **DETACH THIS SHEET AND ATTACH CORRECT ID No. LABEL(S) BELOW TO THE CORRECT SPECIMEN BOTTLE(S).**
6. Complete the requisition including your telephone number, address and postal code. **LEGAL LAND DESCRIPTION MUST BE IDENTIFIED.**
7. For chemical analysis complete the PET 500 bottle label.

INSTRUCTIONS FOR DELIVERY OF WATER SAMPLES

1. Water samples are accepted at your Health Unit (Phone for days and times) or the Provincial Laboratory, University of Alberta Hospitals (114 Street and 83 Avenue) Edmonton, Monday to Friday.
2. Samples should be delivered to the Laboratory as soon as possible following collection. Where a delay of more than 6 hours is unavoidable, the sample should be chilled (not frozen) until it reaches the Laboratory. Do not add ice to the sample. Samples received more than 24 hours after collection are generally unsuitable for microbiological examination and may not be tested.

IF THE ABOVE INSTRUCTIONS ARE NOT CAREFULLY FOLLOWED THE SAMPLE(S) MAY NOT BE PROCESSED.

ID NO. N 840961 MICROBIOLOGICAL

– DETACH NUMBERED LABEL AT PERFORATIONS
– PEEL TAPE AND AFFIX LABEL TO PROPER BOTTLE

ID NO. N 840961 CHEMICAL

☐ Pool (6)
☐ Pool ≥ 30°C (7)
☐ Beach (8)
☐ Other _____

Free Cl_2 _____
Total Cl_2 _____
pH _____
Temperature _____

__ Raw __ Treated

RAW WATER / SEWAGE / EFFLUENT
☐ Sewage / Effluent Chlorinated (11)
☐ Sewage / Effluent Unchlorinated (12)
☐ River (13) ☐ Creek (14) ☐ Lake (9)
☐ Other _____

SOURCE (Check one only)
Well (90) ___ River (93) ___
Lake (96) ___ Dugout (91) ___
Creek (94) ___ Canal (97) ___
Cistern (92) ___ Spring (95) ___
Other (98) _____
Well Depth _____ feet
WELL DEPTH MUST BE SPECIFIED
Well ID No. _____

OTHER SAMPLE TYPES
☐ Distilled water (10) ☐ Deionized water (34)
☐ Other _____ (999)

REMARKS OR REQUESTS FOR SPECIAL TESTS
__ Resample (previous confluent growth)
__ Other (specify) _____

4.308.25 Nov 99

Laboratory number

WATER

Provincial Laboratory of Public Health **Division of Clinical Microbiology** **Dept. of Medical Micro. & Infect. Diseases** **University of Alberta Hospitals** **Edmonton, Alberta T6G 2J2** **Telephone: (780) 407-8925** **Fax: (780) 407-8984**	**Trace Elements/Environmental Toxicology Laboratory** **Division of Medical Biochemistry** **Dept. of Laboratory Medicine and Pathology** **University of Alberta Hospitals** **Edmonton, Alberta T6G 2B7** **Laboratory: (780) 407-8653** **Fax: (780) 407-6267**

ACCESS NUMBER

REQUEST FOR MICROBIOLOGICAL / CHEMICAL ANALYSIS OF WATER (Please print clearly)

ID NO. N 840961

Water supply for (NAME) _____

Address _____

City, Town, Village _____

Postal Code _____ Telephone _____

COLLECTION SITE _____

Legal land description MUST be identified

_____ ¼ Section ____ Township ____ Range ____ w of ____ th Meridian

Lot _____ Blk _____ Plan _____

Date and time of collection

DD MM YY

HOUR

Reason for sampling _____

LOCAL HEALTH UNIT / AGENCY AND ADDRESS IN FULL

SAMPLE COLLECTED BY:

Name

☐ **MICROBIOLOGICAL ANALYSIS**

SAMPLE TYPE:

DRINKING WATER

☐ Municipal ☐ Public ☐ Private

☐ Chlorinated ☐ Unchlorinated ☐ U.V. Sterilized

Total Cl_2 _____ Free Cl_2 _____

SOURCE OF DRINKING WATER (Check one only)

Well (90) ___ River (93) ___ Lake (96) ___

Dugout (91) ___ Creek (94) ___ Canal (97) ___

Cistern (92) ___ Spring (95) ___ Other (98) ___

☐ Distilled Drinking Water (10)

☐ Bottled Drinking Water (Finished Product) (5)

☐ Ice (26)

RECREATIONAL WATER

☐ Pool (6) Free Cl_2 _____

☐ Pool ≥ 30°C (7) Total Cl_2 _____

☐ Beach (8) pH _____

☐ Other_____ Temperature _____

RAW WATER / SEWAGE / EFFLUENT

☐ Sewage / Effluent Chlorinated (11)

☐ Sewage / Effluent Unchlorinated (12)

☐ River (13) ☐ Creek (14) ☐ Lake (9)

☐ Other _____

OTHER SAMPLE TYPES

☐ Distilled water (10) ☐ Deionized water (34)

☐ Other _____ (999)

☐ **CHEMICAL ANALYSIS OF DRINKING WATER FOR HUMAN CONSUMPTION**
(See Note on Reverse)

TEST REQUESTED

☐ Routine analysis

☐ Nitrate and Nitrite (only)

☐ Fluoride (only)

☐ Sodium (only)

Other tests require prior approval by lab (407-6648) _____

SAMPLE TYPE **(Select ONE box only)**

☐ Private Supply (WP)

☐ Municipal Supply (WM)

Is this for licence purposes? (WR) ____

__ Raw __ Treated

SOURCE (Check one only)

Well (90) ___ River (93) ___

Lake (96) ___ Dugout (91) ___

Creek (94) ___ Canal (97) ___

Cistern (92) ___ Spring (95) ___

Other (98) _____

Well Depth _____ feet

WELL DEPTH MUST BE SPECIFIED

Well ID No. _____

REMARKS OR REQUESTS FOR SPECIAL TESTS

__ Resample (previous confluent growth)

__ Other (specify) _____

4.308.25 Nov 99

10.2 APPENDIX B – STANDARDS AND MANUALS RELEVENT TO GUIDELINES

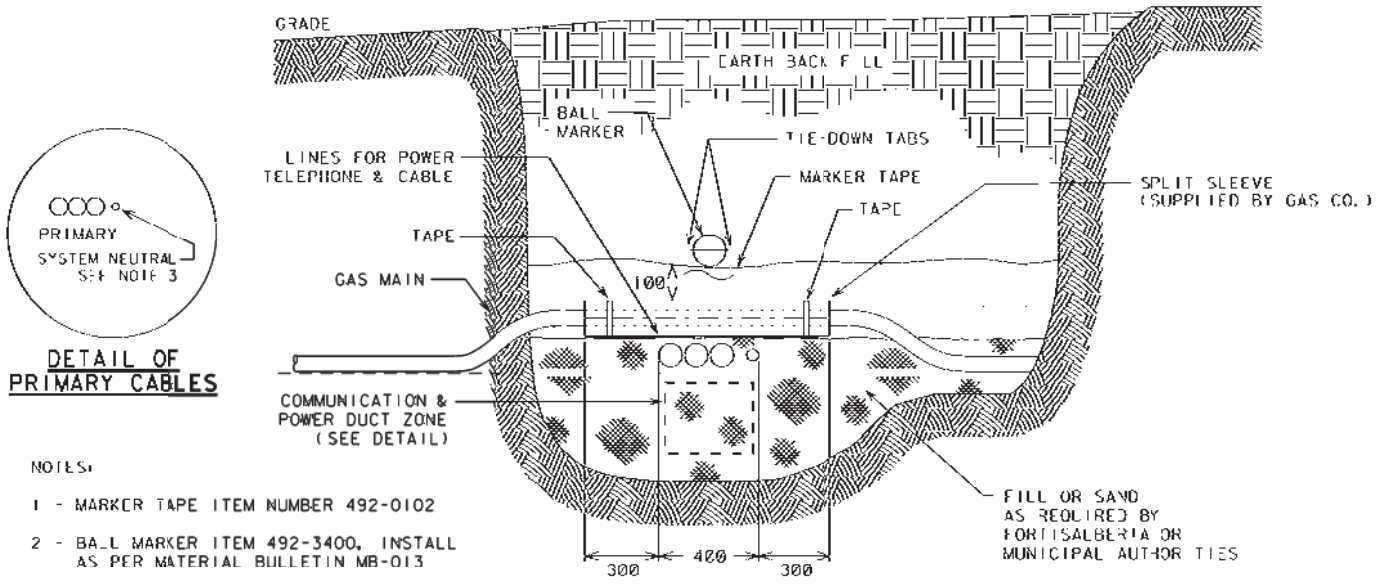
Unless otherwise designated, all specifications and standard references refer to the latest edition.

- AWWA B300 – Hypochlorites
- AWWA C206 – Field Welding of Steel Water Pipe
- AWWA C600 – Installation of Ductile-Iron Mains and Their Appurtenances
- AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
- AWWA C651 – Disinfecting Water Mains
- AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution
- AWWA C901 – Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm), for Water Service
- AWWA C905 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm)
- AWWA C906 – Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission
- AWWA C907 – Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution

END OF SECTION

APPENDIX G

4 PARTY FRANCHISE UTILITY DETAILS



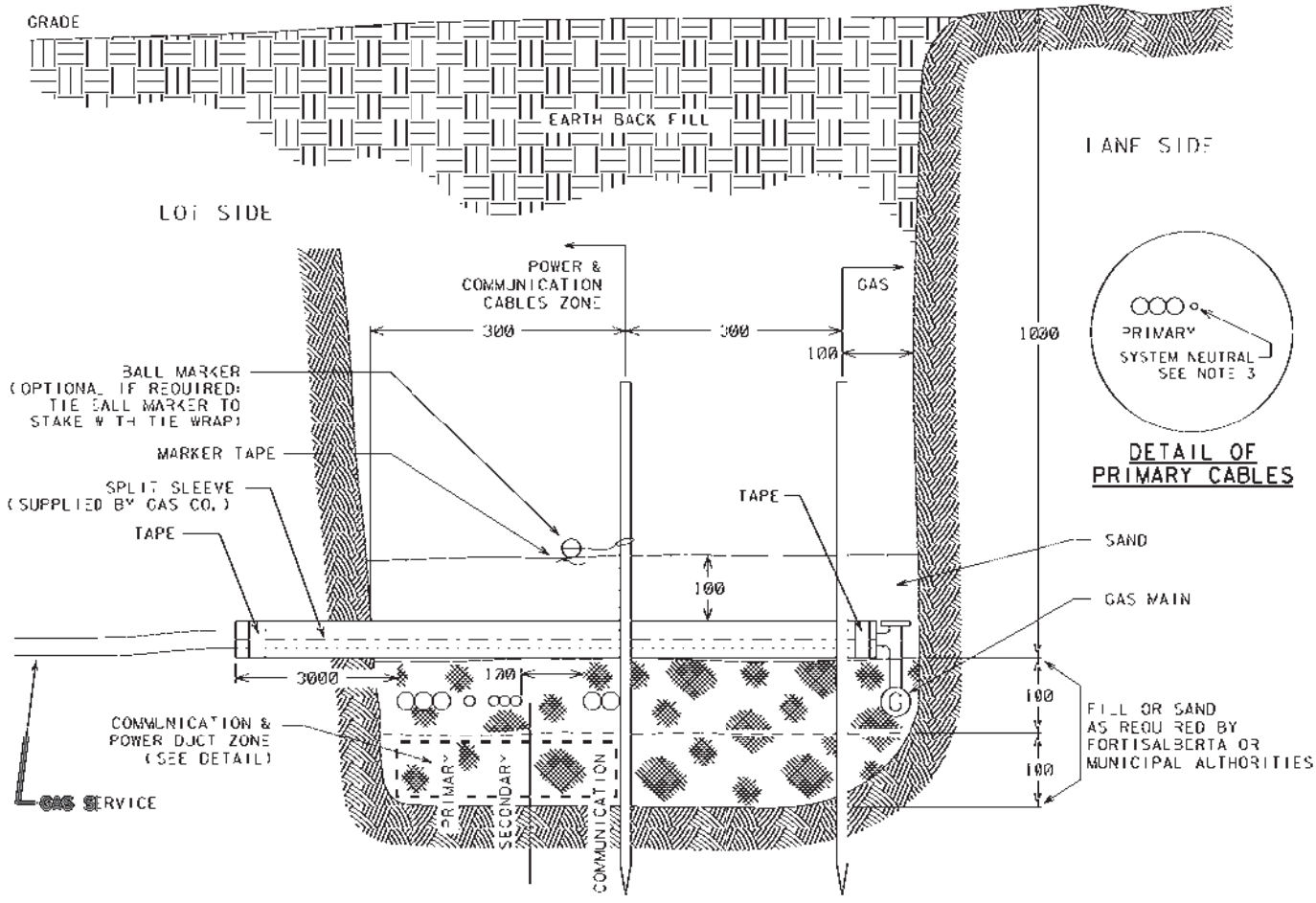
NOTES:

1 - MARKER TAPE ITEM NUMBER 492-0102

2 - BALL MARKER ITEM 492-3400, INSTALL AS PER MATERIAL BULLETIN MB-013

3 - SYSTEM NEUTRAL CAN BE DIRECTLY BURIED OR IN 3 INCH PVC CONDUIT

TRENCH DETAIL - GAS MAIN DUCT CROSSING



FOUR PARTY BACK LANE- TYPICAL SERVICE DUCT CROSSING

Description
- ADDED SYSTEM NEUTRAL
- UPDATED DRAWING

Revision Done (YY/MM/DD)	Date Created (YY/MM/DD)
09-06-10	07-08-13

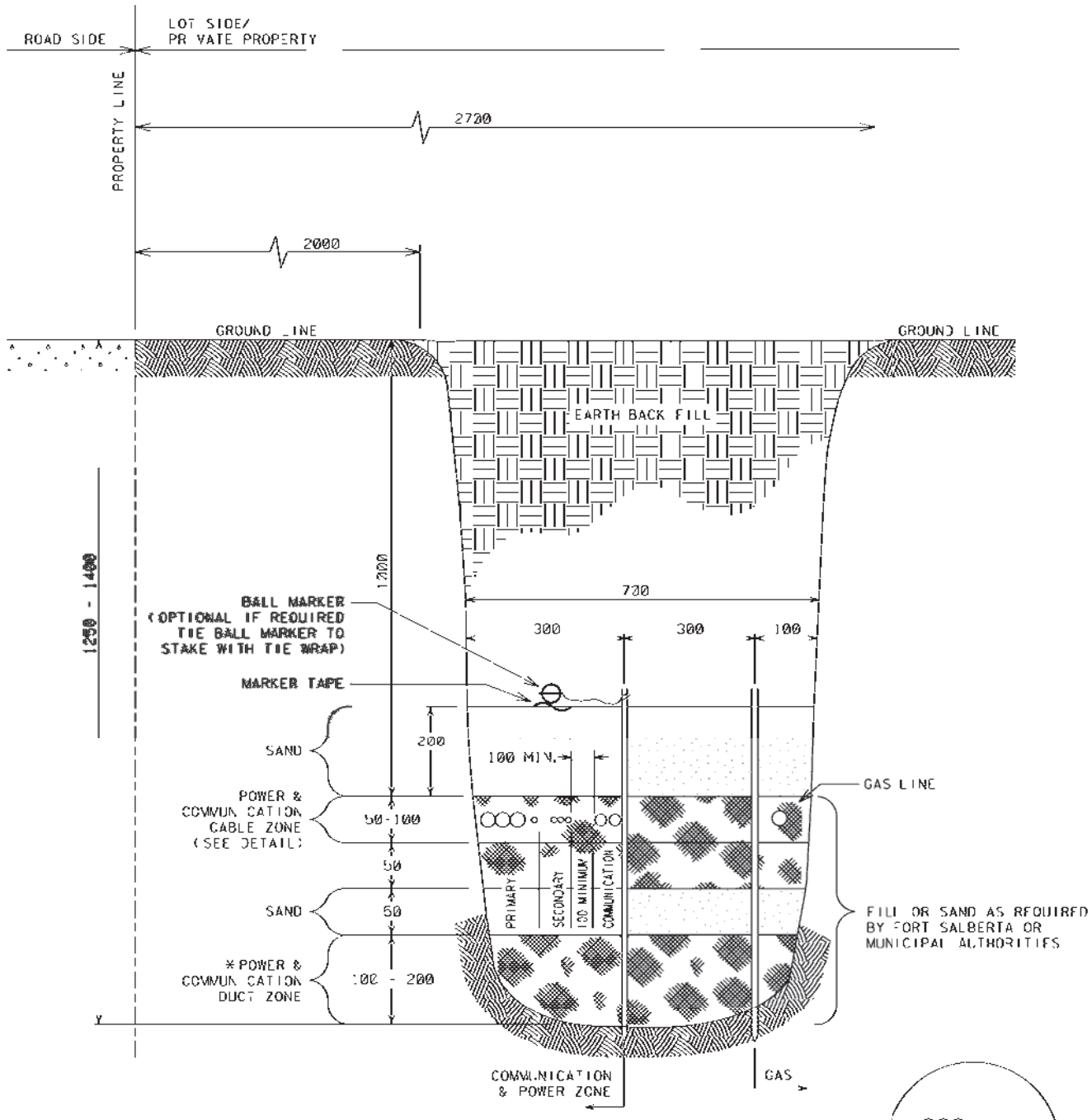
REVISION Checked — ORIGINAL Design / Checked

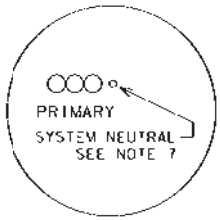
REVISION Approved HN — ORIGINAL Approved

FOUR PARTY TYPICAL SERVICE DUCT CROSSING

FORTIS

Drawing Number 1260 — Sheet 2 / 2





DETAIL OF
PRIMARY CABLES

* IF SPACE IS NOT SUFFICIENT TO AVOID CABLES CROSSING EACH OTHER, THE SAME CABLE LAYOUT AS THE "NARROW TRENCH" IN DRAWING 1216 SHALL BE UTILIZED. ie. PRIMARY & SECONDARY SHALL BE A MINIMUM OF 100mm BELOW COMMUNICATION CABLES.

NOTES:

1 - ENSURE 0.3m MINIMUM SEPARATION BETWEEN GAS LINE AND CLOSEST DUCT/CABLE

2 - STAKES INSTALLED AT 3m INTERVALS

3 ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE INDICATED

4 FACILITIES IN DRAWING ASSUME GAS LINE ON PROPERTY AND MAY BE FLIPPED DEPENDING ON GAS LINE LOCATION. KEEP PRIMARY CABLE THE GREATEST DISTANCE FROM THE GAS LINE

5 - MARKER TAPE ITEM 492-0102

6 - BALL MARKER ITEM 484-3400. INSTALL AS PER MATERIAL BULLETIN MB-013

7 - SYSTEM NEUTRAL CAN BE DIRECTLY BURIED OR IN 3" INCH PVC CONDUIT

Description
- ADDED SYSTEM NEUTRAL
- UPDATED DRAWING

Revision Date (YY/MM/DD)	Date Created (YY/MM/DD)
09-06-10	03-04-23

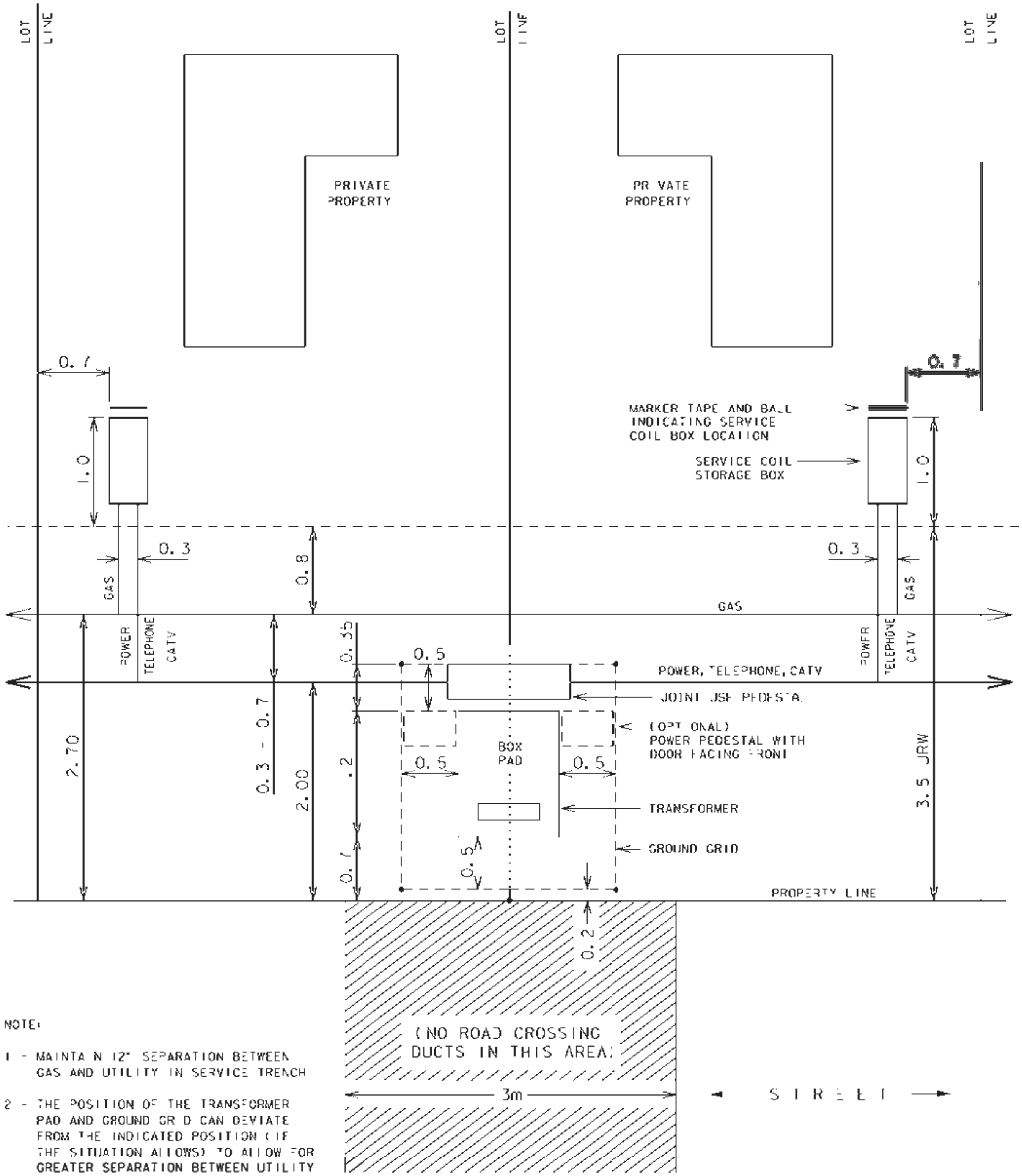
REVISION Checked | ORIGINAL Design / Checked

REVISION Approved HN | ORIGINAL Approved

TYPICAL DETAIL
FOUR PARTY - MAIN TRENCH
FRONT DISTRIBUTION

FORTIS

Drawing Number 1260 | Sheet 1/2



NOTE:

1 - MAINTAIN 12" SEPARATION BETWEEN GAS AND UTILITY IN SERVICE TRENCH

2 - THE POSITION OF THE TRANSFORMER PAD AND GROUND GRID CAN DEVIATE FROM THE INDICATED POSITION (IF THE SITUATION ALLOWS) TO ALLOW FOR GREATER SEPARATION BETWEEN UTILITY AND GAS LINE

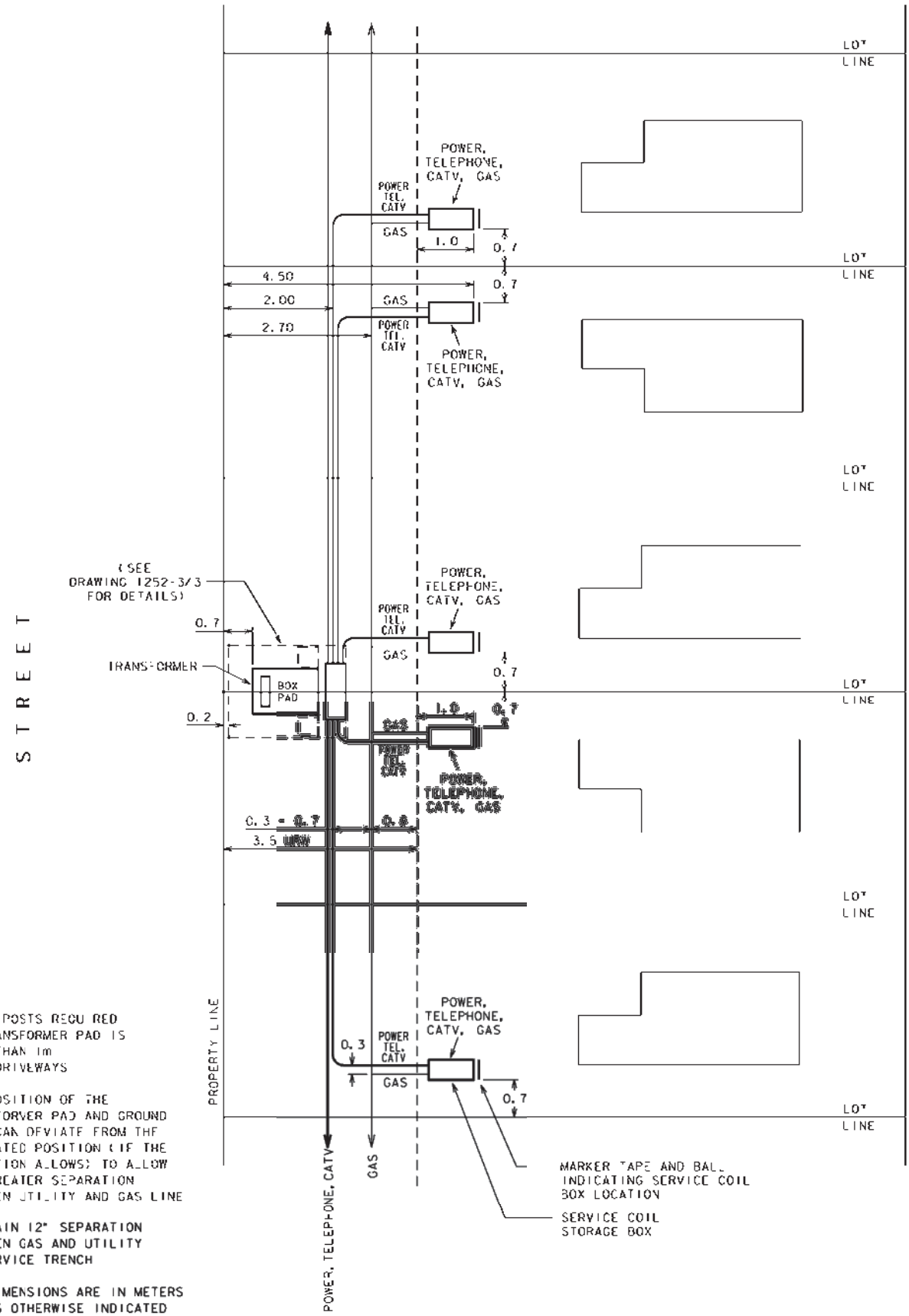
3 - ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE INDICATED

PROFESSIONAL ENGINEER FRANK T. CHAN ALBERTA

Revision Date (YY/MM/DD)	Description
09-01-29	- RENAME DRAWING FROM 1253 TO 1252 3 OF 3 - CORRECTED THE LOCATION OF THE PROPERTY LINE
Checked	
Approved	

Original - Design / Checked	Original - Approved	Date Created (YY/MM/DD)			Drawing Number	Sheet
		02-11-26	NOT TO SCALE	FORTIS	1252	3/3

4 PARTY
TYPICAL TRANSFORMER LOCATION
FRONT DISTRIBUTION



NOTE:

1 - GUARD POSTS REQUIRED IF TRANSFORMER PAD IS LESS THAN 1m FROM DRIVEWAYS

2 - THE POSITION OF THE TRANSFORMER PAD AND GROUND GRID CAN DEVIATE FROM THE INDICATED POSITION (IF THE SITUATION ALLOWS) TO ALLOW FOR GREATER SEPARATION BETWEEN UTILITY AND GAS LINE

3 - MAINTAIN 12" SEPARATION BETWEEN GAS AND UTILITY IN SERVICE TRENCH

4 - ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE INDICATED

PROFESSIONAL ENGINEER — FRANK T. CHU — PRACTISING

Revision Date (YY/MM/DD)	Description
09-01-29	1 - RENUMBERED DRAWINGS 2 - REVISED GAS, POWER AND TEL. ALIGNMENT 3 - CORRECTED THE LOCATION OF THE PROPERTY LINE

Checked: MS

Approved: FC

Original - Design / Checked: RRRR

Original - Approved: FC

Date Created (YY/MM/DD): 02-11-26

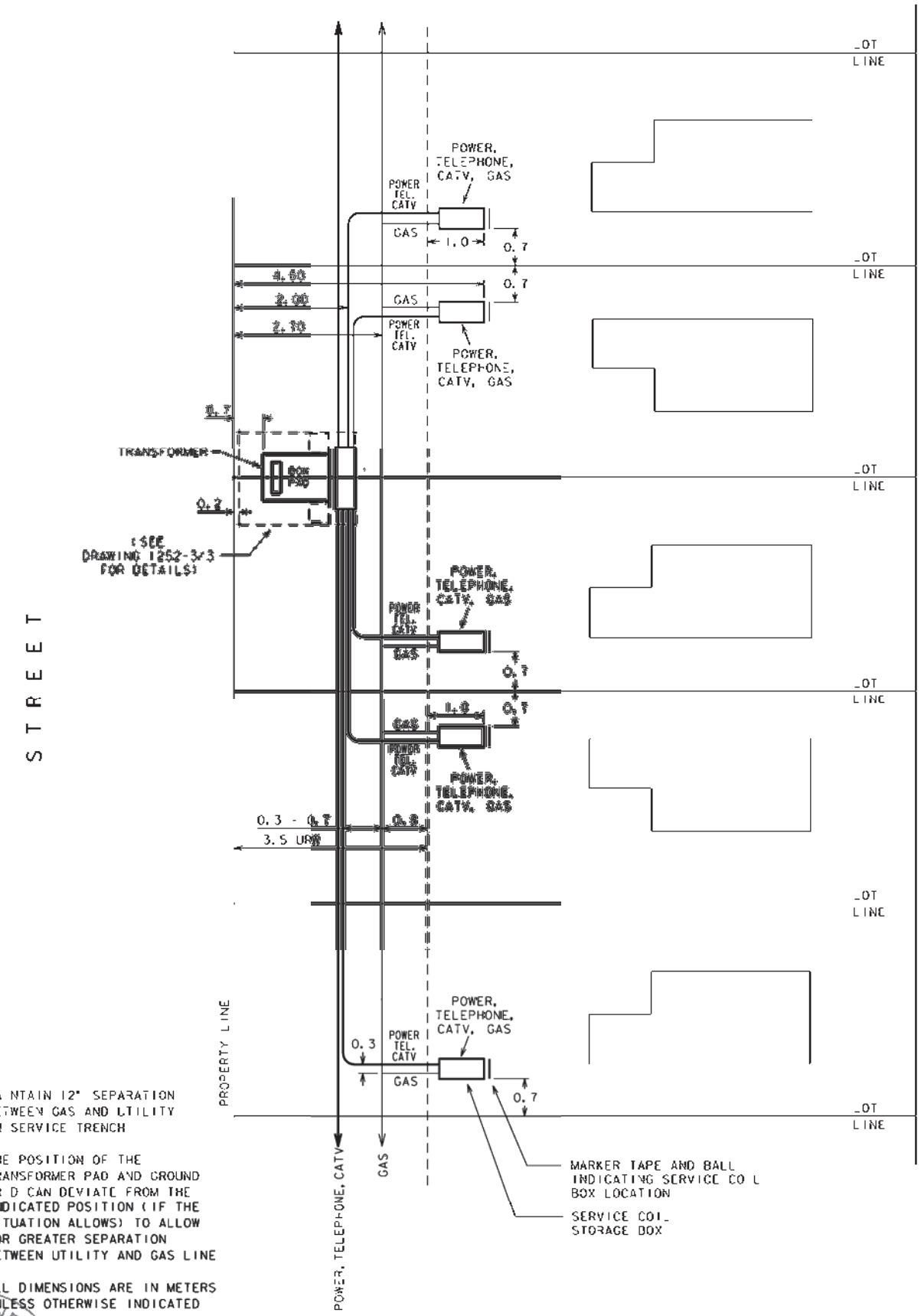
NOT TO SCALE

4 PARTY FRONT DISTRIBUTION GARAGES SIDE BY SIDE

FORTIS

Drawing Number: 1252

Sheet: 2 / 3



NOTE:

- MAINTAIN 12" SEPARATION BETWEEN GAS AND UTILITY IN SERVICE TRENCH

2 - THE POSITION OF THE TRANSFORMER PAD AND GROUND GRID CAN DEVIATE FROM THE INDICATED POSITION (IF THE SITUATION ALLOWS) TO ALLOW FOR GREATER SEPARATION BETWEEN UTILITY AND GAS LINE

3 - ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE INDICATED

PROFESSIONAL ENGINEER FRANK T. CHU

Revision Date (YY/MM/DD)	Description
09-01-29	RENUMBERED DRAWINGS REVISED GAS, POWER, AND TEL. ALIGNMENT CORRECTED THE LOCATION OF THE PROPERTY LINE

Checked: NS

Approved: FC

Original - Design / Checked

Original - Approved: FC

Date Created (YY/MM/DD): 02-11-26

NOT TO SCALE

FORTIS

4 PARTY FRONT DISTRIBUTION GARAGES SIDE BY SIDE

Drawing Number: 1252

Sheet: 1 / 3

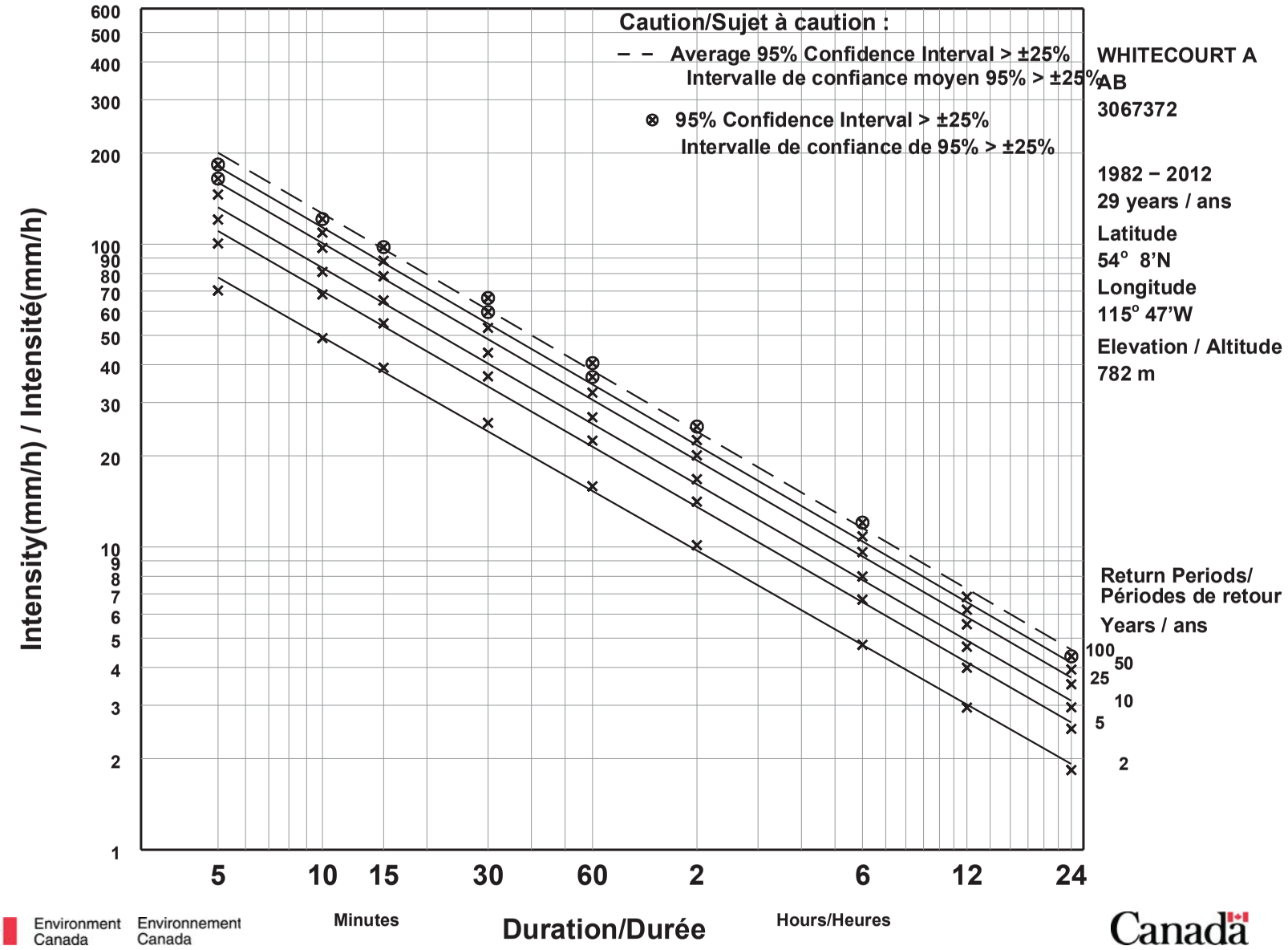
APPENDIX H

ENVIRONMENT CANADA RAINFALL INTENSITY, DURATION, FREQUENCY DATA FOR WHITECOURT

Short Duration Rainfall Intensity−Duration−Frequency Data

2019/02/27

Données sur l'intensité, la durée et la fréquence des chutes de pluie de courte durée



Environment Canada Environnement Canada

Canada

APPENDIX I

GUIDELINES FOR EXTENDED CORNER STREET SIGNS

Guidelines for Extruded Corner Street Signs

Department of Infrastructure Services

TOWN OF WHITECOURT
5004 52 Avenue, Box 509
Whitecourt, AB T7S 1N6

August 29, 2019

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INTRODUCTION

Extruded corner street signs within the Town of Whitecourt are necessary for residents and visitors to distinguish one roadway from another, serve as guidance to traffic and provide an accurate location for the quick response and way finding for emergency vehicles.

Different font types and sheeting colours are available for these corner signs and the inconsistencies can provide difficulty for motorists. Consistency throughout the Town is deemed important in maintaining highly visible signage. These proposed changes will comply with the Manual of Uniform Traffic Control Devices for Canada (MUTCDC) and Traffic Association of Canada (TAC) standards that the Town of Whitecourt follows.

The Infrastructure Department has determined that in order to manage the design of the street identification signs, limitations and standards shall be implemented for decorative street identification signing.

LIMITATIONS

The following limitations will be implemented when determining sign design:

I. Street sign substrate would be aluminum I-plate with a background sheeting colour of green, equal or equivalent to Avery OL-2007 GRN. The sheeting material for the blade must be ASTM Type XI. Text colour will be white, to ensure visibility from the green background.

II. Letter fonts of the signage must conform to MUTCDC standards. For the Town of Whitecourt, Clearview 1B is preferred with a maximum font width of 2”, while maintaining a minimum space of 100 kern per character, and a font height of 4”, with the character touching the top and bottom of the extruded edges.

III. Exact text to be placed on the extruded corner street sign for the roadways are specified in Schedule A – Town of Whitecourt Street Names. All letters shall be in uppercase format. Numbered roadways are not to have any suffixes. Road names and types shall have the same font height throughout the sign except prefixed names that would follow Schedule C.2: Prefixed Names.

IV. Street signs can be 18”, 24”, 30”, or 36” in length, depending on the number of characters on each sign. Spaces between the words of the message would have a minimum of 2” and a maximum of 6”. Fixed spacing per number of characters are further specified in Schedule B – Street Sign Template. Spacing for three-worded messages must be distributed evenly; refer to Schedule C – Specific Signs. Spacing for Veteran Corridors are further specified in Schedule D – Veteran Corridors.

V. If a blade length of 36” will not be able to contain the message, the substrate would be of customized length to fit the message with a space of 2” between the words of the message.

VI. All street sign blades must be 6” in height. The message will occupy 4” to satisfy font height requirements and the remaining 2” will be for the extruded border on top and bottom edges of the sign.

VII. The corner street signs would be extruded. Thickness would be 0.230” for top and bottom edges while the blade would be 0.80” thick in the center.

VIII. All requests for street identification signing shall be approved by the Council of the Town of Whitecourt.

SCHEDULE A – TOWN OF WHITECOURT STREET NAMES

Proposed text containing two words will follow *Schedule B – Street Sign Template* and will depend on the number of characters specified in Column C. Proposed text with more than two words or have other details will follow *Schedule C – Specific Signs*.

Some rows in Table A are highlighted and would require further discussion before placing requests to manufacturers. These include rows that are highlighted in:

- RED, which must follow *Schedule D – Veteran Corridors*;
- BLUE, which are corridors that would fall in industrial areas or arterial roads;
- YELLOW, which are corridors that are already changed or not yet developed; and
- GREEN, which are for manufactured home communities and do not have to follow the designs and standards outlined in this guideline.

TABLE A – TOWN OF WHITECOURT STREET NAMES

A		B	C	D
Street Name		**Proposed Text on Corner Sign**	**# of Characters**	**Blade Length**
30	Street	**30 ST**	4	18"
33	Street	**33 ST**	4	18"
35	Street	**35 ST**	4	18"
36	Street	**36 ST**	4	18"
37	Street	**37 ST**	4	18"
38	Street	**38 ST**	4	18"
39	Street	**39 ST**	4	18"
41	Street	**41 ST**	4	18"
42	Street	**42 ST**	4	18"
45	Street	**45 ST**	4	18"
46	Street	**46 ST**	4	18"
48	Street	**48 ST**	4	18"
49	Street	**49 ST**	4	18"
50	Street	**50 ST**	4	18"
51	Street	**51 ST**	4	18"
52	Street	**52 ST**	4	18"
53	Street	**53 ST**	4	18"

A		B	C	D
Street Name		Proposed Text on Corner Sign	# of Characters	Blade Length
58	Street	**58 ST**	4	18"
59	Street	**59 ST**	4	18"
60	Street	**60 ST**	4	18"
66	Street	**66 ST**	4	18"
34	Avenue	**34 AVE**	5	18"
35	Avenue	**35 AVE**	5	18"
36	Avenue	**36 AVE**	5	18"
37	Avenue	**37 AVE**	5	18"
38	Avenue	**38 AVE**	5	18"
41	Avenue	**41 AVE**	5	18"
42	Avenue	**42 AVE**	5	18"
43	Avenue	**43 AVE**	5	18"
45	Avenue	**45 AVE**	5	18"
46	Avenue	**46 AVE**	5	18"
47	Avenue	**47 AVE**	5	18"
48	Avenue	**48 AVE**	5	18"
49	Avenue	**49 AVE**	5	18"
50	Avenue	**50 AVE**	5	18"
51	Avenue	**51 AVE**	5	18"
52	Avenue	**52 AVE**	5	18"
53	Avenue	**53 AVE**	5	18"
54	Avenue	**54 AVE**	5	18"
55	Avenue	**55 AVE**	5	18"
56	Avenue	**56 AVE**	5	18"
57	Avenue	**57 AVE**	5	18"
32	Highway	**HWY 32**	5	18"
43	Highway	**HWY 43**	5	18"
47a	Street	**47A ST**	5	18"
48A	Street	**48A ST**	5	18"

A		B	C	D
Street Name		Proposed Text on Corner Sign	# of Characters	Blade Length
51A	Street	**51A ST**	5	18"
56A	Avenue	**56A AVE**	6	18"
Baly	Road	**BALY RD**	6	18"
Dahl	Drive	**DAHL DR**	6	24"
Elko	Drive	**ELKO DR**	6	18"
Mill	Road	**MILL RD**	6	18"
Park	Drive	**PARK DR**	6	18"
Park	Lane	**PARK LN**	6	18"
Park	Place	**PARK PL**	6	18"
Park	Point	**PARK PT**	6	18"
Pine	Road	**PINE RD**	6	18"
Reed	Place	**REED PL**	6	18"
West	Street	**WEST ST**	6	18"
Wood	Drive	**WOOD DR**	6	18"
Allan	Place	**ALLAN PL**	7	24"
Birch	Lane	**BIRCH LN**	7	24"
Davio	Place	**DAVIO PL**	7	24"
Davy	Avenue	**DAVY AVE**	7	24"
Feero	Drive	**FEERO DR**	7	24"
Flats	Road	**FLATS RD**	7	24"
Henke	Place	**HENKE PL**	7	24"
King	Court	**KING CRT**	7	24"
Leedy	Drive	**LEEDY DR**	7	24"
Park	Circle	**PARK CIR**	7	24"
Park	Court	**PARK CRT**	7	24"
Park	Heights	**PARK HTS**	7	24"
Park	Key	**PARK KEY**	7	24"
Park	Way	**PARK WAY**	7	24"
Reay	Court	**REAY CRT**	7	24"

A		B	C	D
Street Name		Proposed Text on Corner Sign	# of Characters	Blade Length
Sandy	Drive	**SANDY DR**	7	24"
Soper	Street	**SOPER ST**	7	24"
Tower	Road	**TOWER RD**	7	24"
Wedow	Drive	**WEDOW DR**	7	24"
Beaver	Drive	**BEAVER DR**	8	24"
Caxton	Street	**CAXTON ST**	8	24"
Cedar	Heights	**CEDAR HTS**	8	24"
Flasha	Lane	**FLASHA LN**	8	24"
Graham	Road	**GRAHAM RD**	8	30"
Kepler	Street	**KEPLER ST**	8	24"
Mcleod	Drive	**McLEOD DR**	8	24"
Park	Drive North	**PARK DR N**	8	24"
Poplar	Drive	**POPLAR DR**	8	24"
Ravine	Drive	**RAVINE DR**	8	24"
Reeves	Street	**REEVES ST**	8	24"
Rivers	Place	**RIVERS PL**	8	24"
Rodeo	Way	**RODEO WAY**	8	24"
Spruce	Road	**SPRUCE RD**	8	24"
Abraham	Drive	**ABRAHAM DR**	9	24"
Allan	Crescent	**ALLAN CRES**	9	24"
Caxton	Street West	**CAXTON ST W**	9	30"
Highway	Street	**HIGHWAY ST**	9	24"
Jackson	Place	**JACKSON PL**	9	30"
Kepler	Street West	**KEPLER ST W**	9	30"
Lyons	Crescent	**LYONS CRES**	9	24"
Noyes	Crescent	**NOYES CRES**	9	24"
Nylan	Crescent	**NYLAN CRES**	9	24"
Olson	Crescent	**OLSON CRES**	9	24"
Park	Close	**PARK CLOSE**	9	24"

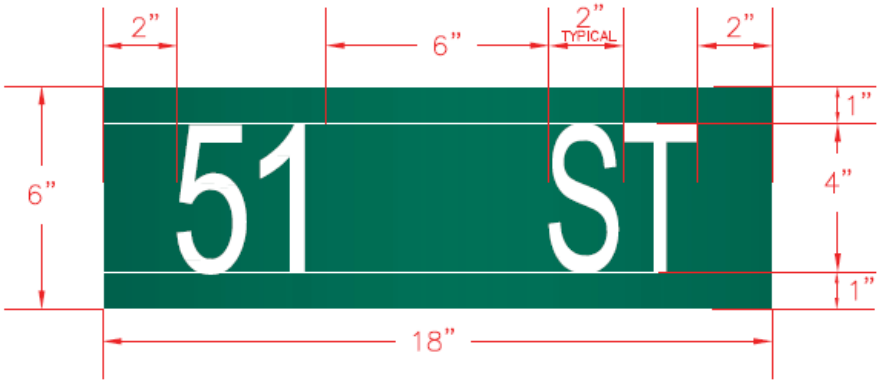
A		B	C	D
Street Name		Proposed Text on Corner Sign	# of Characters	Blade Length
Sonoma	Key	**SONOMA KEY**	9	24"
Steward	Drive	**STEWARD DR**	9	30"
Baxter	Crescent	**BAXTER CRES**	10	36"
Cochrane	Road	**COCHRANE RD**	10	30"
Hospital	Road	**HOSPITAL RD**	10	30"
Karlzen	Court	**KARLZEN CRT**	10	30"
Keystone	Place	**KEYSTONE PL**	10	30"
Lakeview	Place	**LAKEVIEW PL**	10	30"
Nelson	Crescent	**NELSON CRES**	10	30"
Pineview	Road	**PINEVIEW RD**	10	30"
Powers	Cove	**POWERS COVE**	10	36"
Ridgeway	Point	**RIDGEWAY PT**	10	30"
Spring	Cove	**SPRING COVE**	10	30"
Stiles	Cove	**STILES COVE**	10	30"
Sunset	Boulevard	**SUNSET BLVD**	10	30"
Wellwood	Drive	**WELLWOOD DR**	10	36"
Westview	Road	**WESTVIEW RD**	10	30"
Windfall	Drive	**WINDFALL DR**	10	30"
Athabasca	Drive	**ATHABASCA DR**	11	30"
Auttreaux	Drive	**AUTTREAUX DR**	11	30"
Blueberry	Drive	**BLUEBERRY DR**	11	30"
Chickadee	Drive	**CHICKADEE DR**	11	30"
Govenlock	Road	**GOVENLOCK RD**	11	36"
Gunderson	Drive	**GUNDERSON DR**	11	30"
Kallbom	Crescent	**KALLBOM CRES**	11	36"
Kreiner	Crescent	**KREINER CRES**	11	30"
McIlwaine	Drive	**McILWAINE DR**	11	36"
Mink Creek	Road	**MINK CREEK RD**	11	30"
Patterson	Place	**PATTERSON PL**	11	30"

A		B	C	D
Street Name		Proposed Text on Corner Sign	# of Characters	Blade Length
Prestlien	Drive	**PRESTLIEN DR**	11	36"
Pritchard	Drive	**PRITCHARD DR**	11	30"
Riverside	Road	**RIVERSIDE RD**	11	30"
Rockridge	Point	**ROCKRIDGE PT**	11	30"
Sparrow	Crescent	**SPARROW CRES**	11	30"
Stuckey	Crescent	**STUCKEY CRES**	11	30"
Torgerson	Drive	**TORGERSON DR**	11	36"
Virginia	Avenue	**VIRGINIA AVE**	11	30"
Wagoner	Crescent	**WAGONER CRES**	11	30"
Atkinson	Crescent	**ATKINSON CRES**	12	30"
Evergreen	Court	**EVERGREEN CRT**	12	30"
Merrifield	Place	**MERRIFIELD PL**	12	36"
Park	Crossing	**PARK CROSSING**	12	30"
Riverside	Road North	**RIVERSIDE RD N**	12	36"
Riverstone	Road	**RIVERSTONE RD**	12	30"
Rockhaven	Way	**ROCKHAVEN WAY**	12	30"
Sakwatamau	Drive	**SAKWATAMAU DR**	12	30"
Stephens	Crescent	**STEPHENS CRES**	12	36"
Anderson	Close	**ANDERSON CLOSE**	13	36"
Blueberry	Crescent	**BLUEBERRY CRES**	13	36"
Edgewater	Crescent	**EDGEWATER CRES**	13	36"
Richmond	Close	**RICHMOND CLOSE**	13	36"
Riverdale	Bend	**RIVERDALE BEND**	13	36"
Trading Post	Trail	**TRADING POST TR**	13	36"
White	Crossing	**WHITE CROSSING**	13	42"
Whitecourt	Avenue	**WHITECOURT AVE**	13	36"
47	Street	**MILLAR RD (47 ST)**	14	36"
Flats	Connector	**FLATS CONNECTOR**	14	36"
Harolds	Hollow	**HAROLD'S HOLLOW**	14	36"

A		B	C	D
Street Name		Proposed Text on Corner Sign	# of Characters	Blade Length
Kimzey	Crossing	**KIMZEY CROSSING**	14	42"
Skaggs	Crossing	**SKAGGS CROSSING**	14	36"
West Mountain	Road	**WEST MOUNTAIN RD**	14	36"
Riverboat Park	Road	**RIVERBOAT PARK RD**	15	38"
Chaisson	Crossing	**CHAISSON CROSSING**	16	44"
Keystone	Crossing	**KEYSTONE CROSSING**	16	38"
Hillpark Trailer	Court	**HILLPARK TRAILER CRT**	18	44"
River Valley	Estates	**RIVER VALLEY ESTATES**	18	44"
Hillpark Trailer	Park	**HILLPARK TRAILER PARK**	19	46"
Riverside Trailer	Court	**RIVERSIDE TRAILER CRT**	19	46"
Westview Trailer	Park	**WESTVIEW TRAILER PARK**	19	46"

SCHEDULE B – STREET SIGN TEMPLATES
SCHEDULE B.1: 4-6 CHARACTERS

4 CHARACTERS



5 CHARACTERS

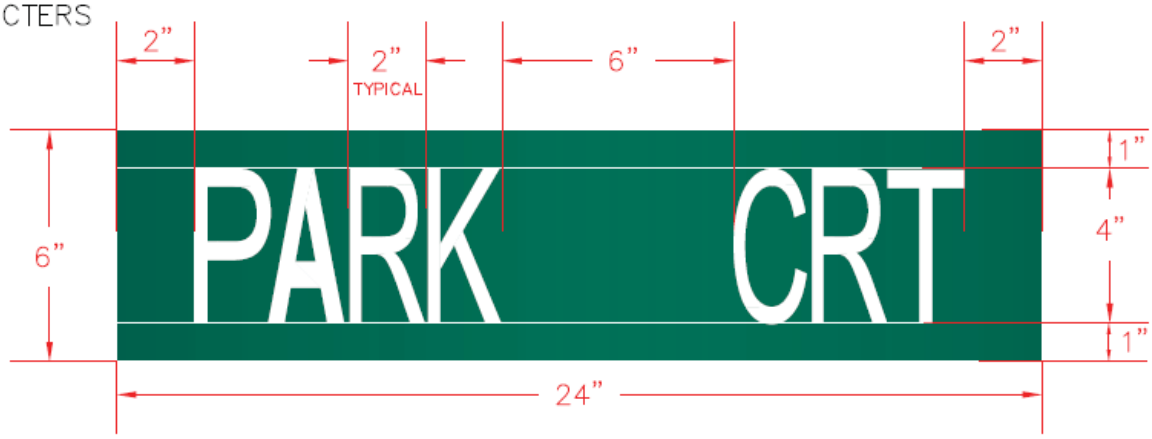
6 CHARACTERS

NOTE:

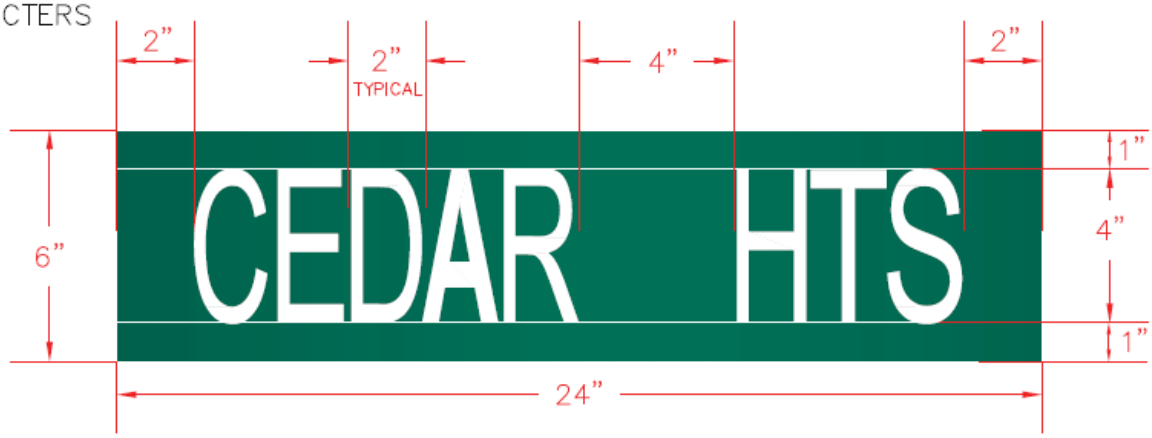
1. Sign substrate material must be extruded aluminum I-plate
2. Thickness shall be 0.230” for top and bottom edges and 0.80” in the center of the blade
3. Blade height must be 6”
4. Blade length must be 18, 24”, 30” or 36” with the fixed space between the two words varying with the number of characters of the message
5. If a blade length of 36” will not accommodate the message, refer to Limitation V of these guidelines. If it contains more than two words, refer to Schedule C.
6. Road name and type must display Clearview 1B font style
7. Named roads will be in uppercase format with a height of 4” and a maximum width of 2” while maintaining a minimum space of 100 kern between characters
8. The blade must be Green, Avery OL-2007 GRN or equivalent, and the message must be White
9. The message must be printed on both sides of the blade

SCHEDULE B.2: 7-9 CHARACTERS

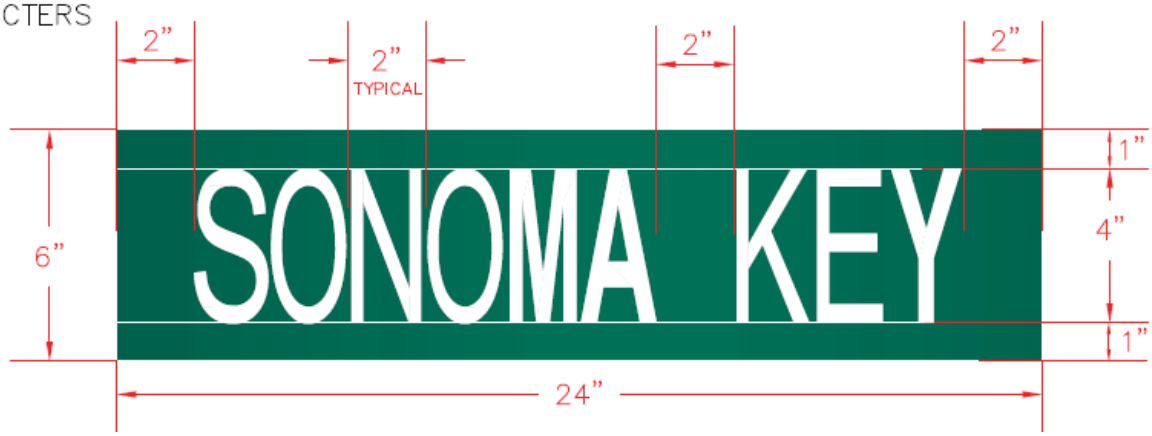
7 CHARACTERS



8 CHARACTERS



9 CHARACTERS



NOTE:

1. Sign substrate material must be extruded aluminum I-plate
2. Thickness shall be 0.230” for top and bottom edges and 0.80” in the center of the blade
3. Blade height must be 6”
4. Blade length must be 18, 24”, 30” or 36” with the fixed space between the two words varying with the number of characters of the message
5. If a blade length of 36” will not accommodate the message, refer to Limitation V of these guidelines. If it contains more than two words, refer to Schedule C.
6. Road name and type must display Clearview 1B font style
7. Named roads will be in uppercase format with a height of 4” and a maximum width of 2” while maintaining a minimum space of 100 kern between characters
8. The blade must be Green, Avery OL-2007 GRN or equivalent, and the message must be White
9. The message must be printed on both sides of the blade

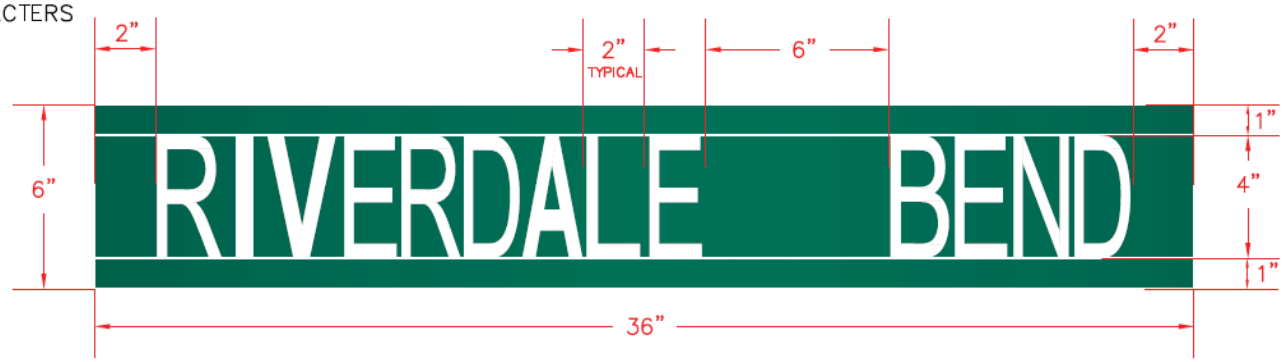
SCHEDULE B.3: 10-12 CHARACTERS

NOTE:

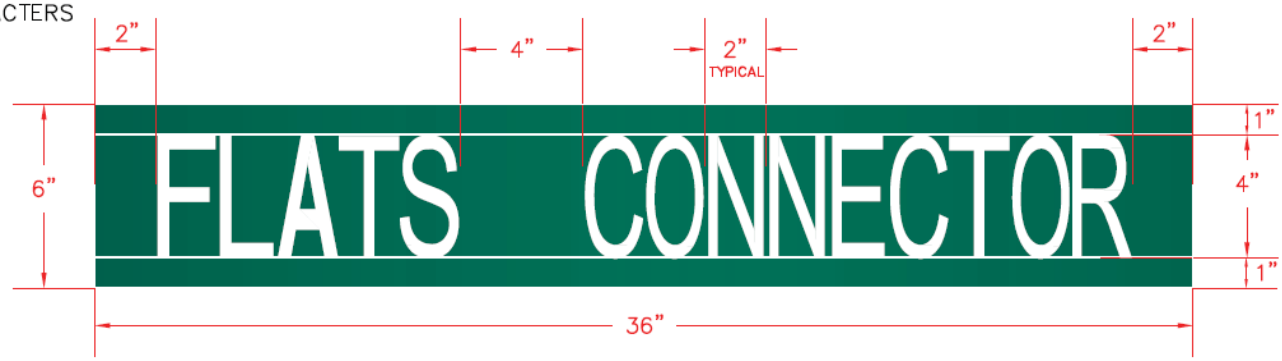
1. Sign substrate material must be extruded aluminum I-plate
2. Thickness shall be 0.230” for top and bottom edges and 0.80” in the center of the blade
3. Blade height must be 6”
4. Blade length must be 18, 24”, 30” or 36” with the fixed space between the two words varying with the number of characters of the message
5. If a blade length of 36” will not accommodate the message, refer to Limitation V of these guidelines. If it contains more than two words, refer to Schedule C.
6. Road name and type must display Clearview 1B font style
7. Named roads will be in uppercase format with a height of 4” and a maximum width of 2” while maintaining a minimum space of 100 kern between characters
8. The blade must be Green, Avery OL-2007 GRN or equivalent, and the message must be White
9. The message must be printed on both sides of the blade

SCHEDULE B.4: 13-15 CHARACTERS

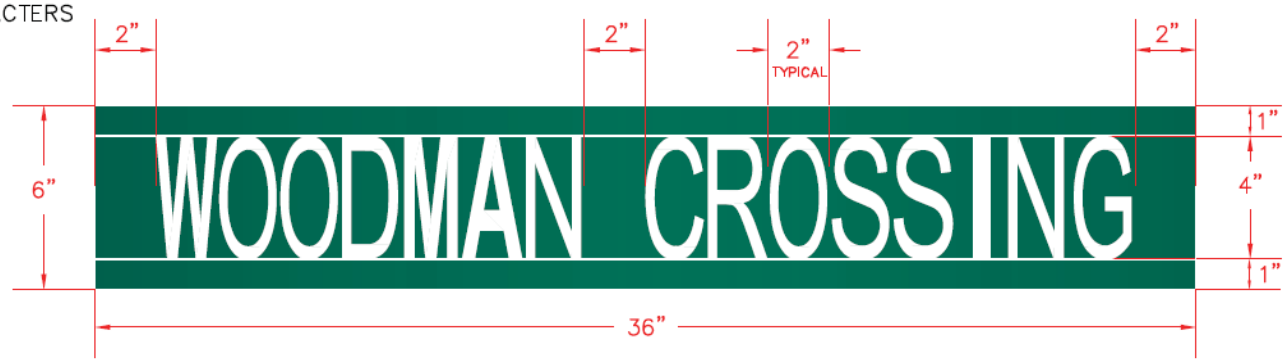
13 CHARACTERS



14 CHARACTERS



15 CHARACTERS



NOTE:

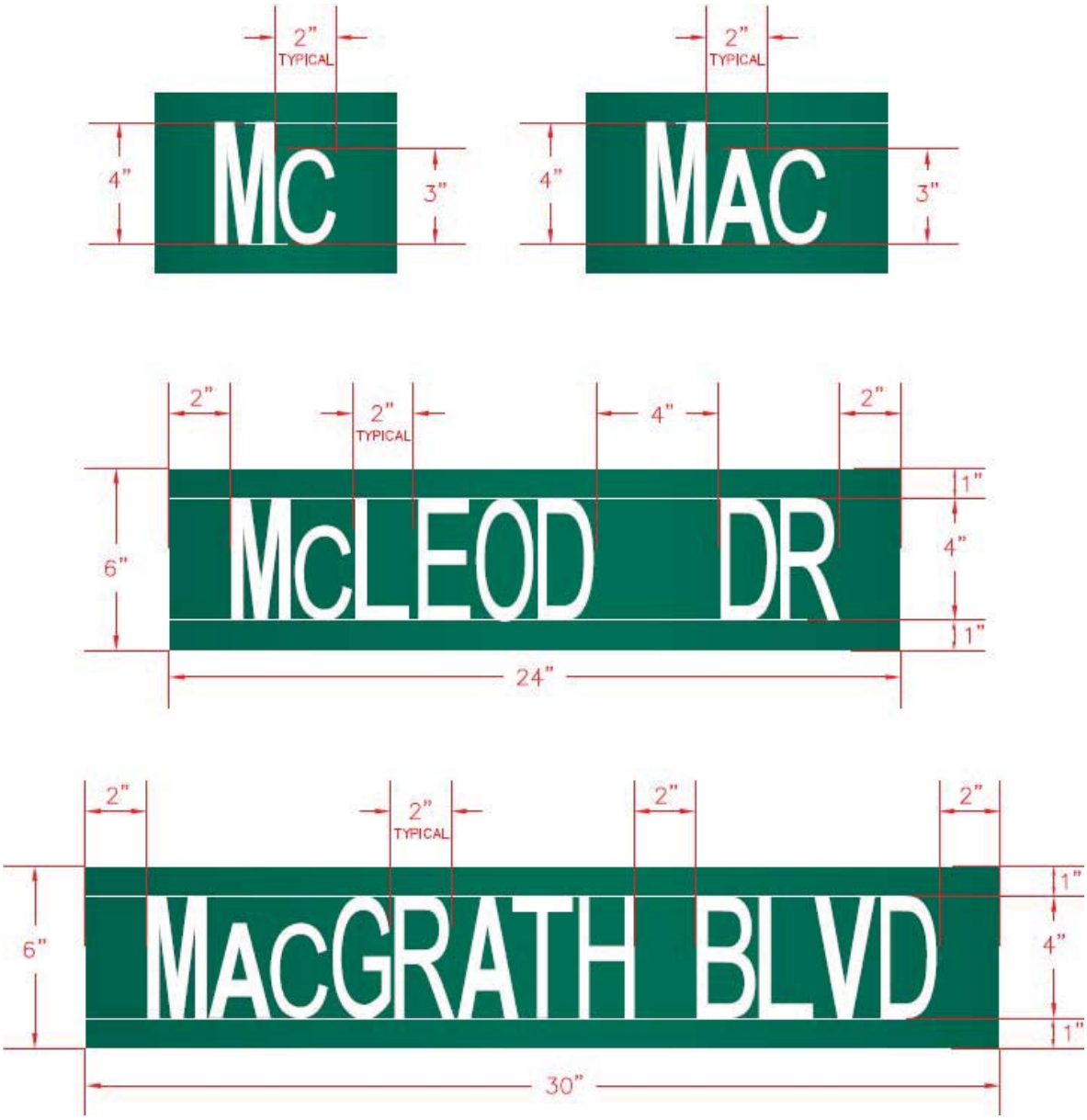
1. Sign substrate material must be extruded aluminum I-plate
2. Thickness shall be 0.230” for top and bottom edges and 0.80” in the center of the blade
3. Blade height must be 6”
4. Blade length must be 18, 24”, 30” or 36” with the fixed space between the two words varying with the number of characters of the message
5. If a blade length of 36” will not accommodate the message, refer to Limitation V of these guidelines. If it contains more than two words, refer to Schedule C.
6. Road name and type must display Clearview 1B font style
7. Named roads will be in uppercase format with a height of 4” and a maximum width of 2” while maintaining a minimum space of 100 kern between characters
8. The blade must be Green, Avery OL-2007 GRN or equivalent, and the message must be White
9. The message must be printed on both sides of the blade

SCHEDULE C – SPECIFIC SIGNS
SCHEDULE C.1: THREE-WORD MESSAGE

NOTE:

1. Sign substrate material must be extruded aluminum I-plate
2. Thickness shall be 0.230” for top and bottom edges and 0.80” in the center of the blade
3. Blade height must be 6”
4. Blade length must be 18, 24”, 30” or 36” with the space amongst the message evenly distributed
5. If a blade length of 36” will not accommodate the message, refer to Limitation V of these guidelines.
6. Road name and type must display Clearview 1B font style
7. Named roads will be in uppercase format with a height of 4” and a maximum width of 2” while maintaining a minimum space of 100 kern between characters
8. Symbols must have a maximum width of 1” with the minimum space of 100 kern per character still satisfied
9. The blade must be Green, Avery OL-2007 GRN or equivalent, and the message must be White
10. The message must be printed on both sides of the blade

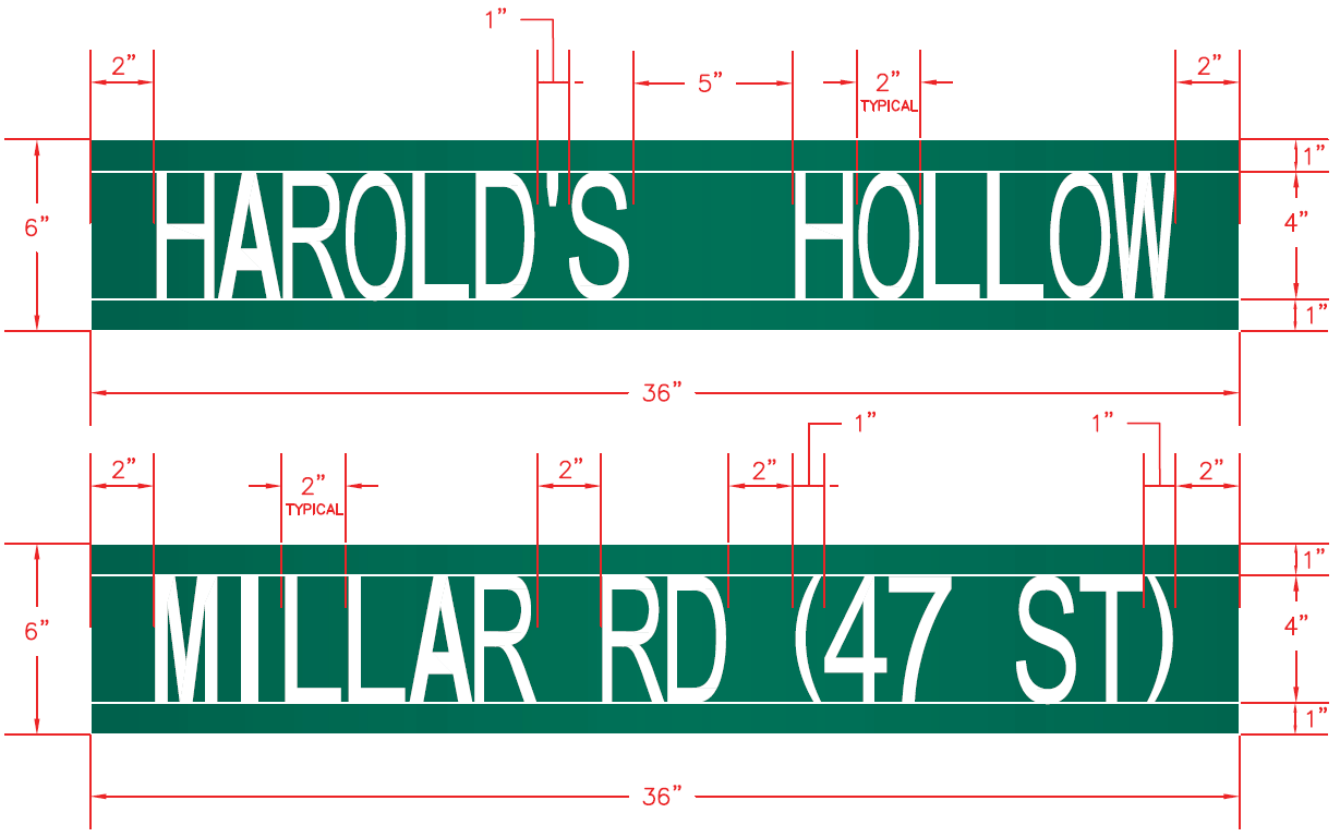
SCHEDULE C.2: PREFIXED NAMES



NOTE:

1. Sign substrate material must be extruded aluminum I-plate
2. Thickness shall be 0.230” for top and bottom edges and 0.80” in the center of the blade
3. Blade height must be 6”
4. Blade length must be 18, 24”, 30” or 36” with the fixed space of 2”, 4” or 6” between the two words varying with the number of characters of the message
5. If a blade length of 36” will not accommodate the message, refer to Limitation V of these guidelines. If it contains more than two words, refer to Schedule C.1.
6. Road name and type must display Clearview 1B font style
7. Named roads will be in uppercase format with a height of 4” and a maximum width of 2” while maintaining a minimum space of 100 kern between characters. Prefixes must display uppercase as well but will have a font height of 3” for the expected lowercase letters.
8. Symbols must have a maximum width of 1” with the minimum space of 100 kern per character still satisfied
9. The blade must be Green, Avery OL-2007 GRN or equivalent, and the message must be White
10. The message must be printed on both sides of the blade

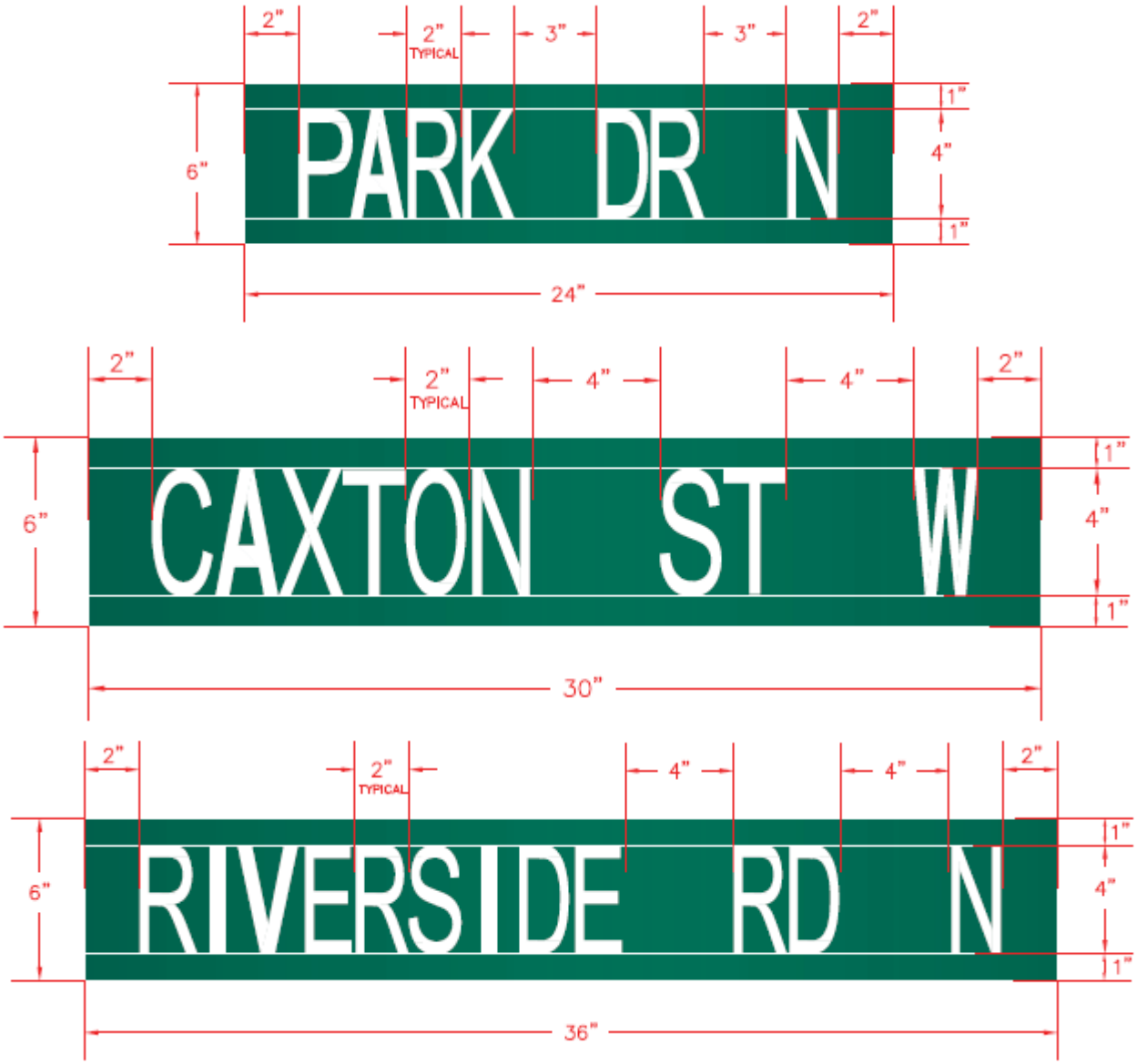
SCHEDULE C.3: SYMBOLS



NOTE:

1. Sign substrate material must be extruded aluminum I-plate
2. Thickness shall be 0.230” for top and bottom edges and 0.80” in the center of the blade
3. Blade height must be 6”
4. Blade length must be 18, 24”, 30” or 36” with the space amongst the message evenly distributed
5. If a blade length of 36” will not accommodate the message, refer to Limitation V of these guidelines. If it contains more than two words, refer to Schedule C.
6. Road name and type must display Clearview 1B font style
7. Named roads will be in uppercase format with a height of 4” and a maximum width of 2” while maintaining a minimum space of 100 kern between characters
8. Symbols must have a maximum width of 1” with the minimum space of 100 kern per character still satisfied
9. The blade must be Green, Avery OL-2007 GRN or equivalent, and the message must be White
10. The message must be printed on both sides of the blade

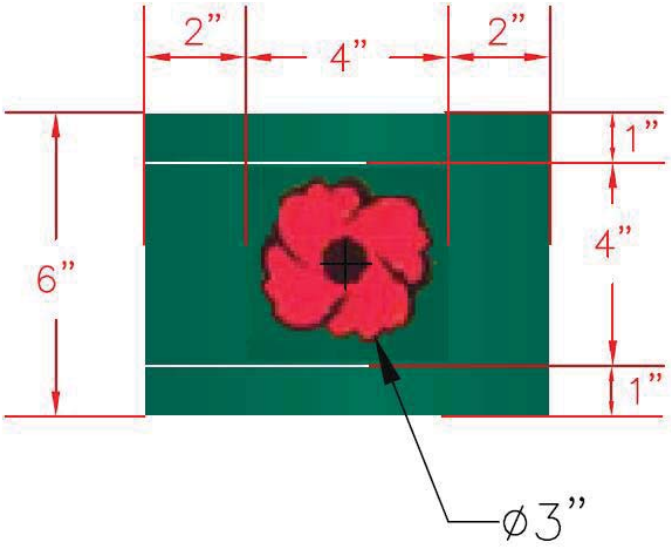
SCHEDULE C.4: N, S, E, W DIRECTION



NOTE:

1. Sign substrate material must be extruded aluminum I-plate
2. Thickness shall be 0.230” for top and bottom edges and 0.80” in the center of the blade
3. Blade height must be 6”
4. Blade length must be 18, 24”, 30” or 36” with the space amongst the message evenly distributed
5. If a blade length of 36” will not accommodate the message, refer to Limitation V of these guidelines.
6. Road name and type must display Clearview 1B font style
7. Named roads will be in uppercase format with a height of 4” and a maximum width of 2” while maintaining a minimum space of 100 kern between characters
8. Symbols must have a maximum width of 1” with the minimum space of 100 kern per character still satisfied
9. The blade must be Green, Avery OL-2007 GRN or equivalent, and the message must be White
10. The message must be printed on both sides of the blade

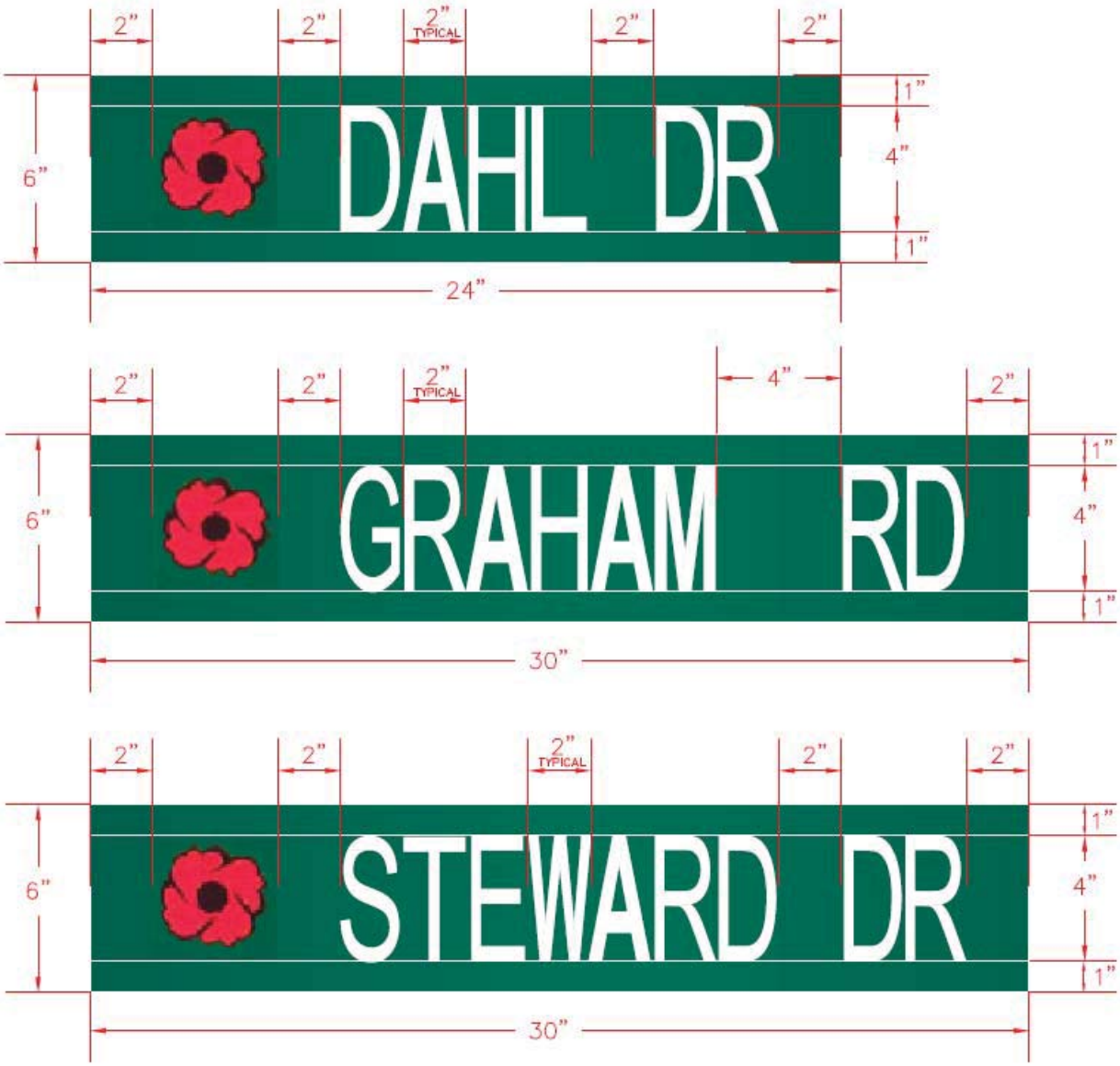
SCHEDULE D – VETERAN CORRIDORS
SCHEDULE D.1: POPPY DESIGN



NOTE:

1. The Poppy Design shall be placed on the left-hand side of the blade
2. The Poppy Design must have a maximum diameter of 3” and should fit in a 4” x 4” square
3. A space of 2” must be placed before the name of the corridor
4. Thickness shall be 0.230” for top and bottom edges and 0.80” in the center of the blade
5. Blade height must be 6”
6. Blade length must be 18, 24”, 30” or 36” with the fixed space of 2”, 4” or 6” between the two words varying with the number of characters of the message.
7. If a blade length of 36” will not accommodate the message, refer to Limitation V of these guidelines.
8. Road name and type must display Clearview 1B font style
9. Named roads will be in uppercase format with a height of 4” and a maximum width of 2” while maintaining a minimum space of 100 kern between characters
10. The blade must be Green, Avery OL-2007 GRN or equivalent, and the message must be White
11. The message must be printed on both sides of the blade

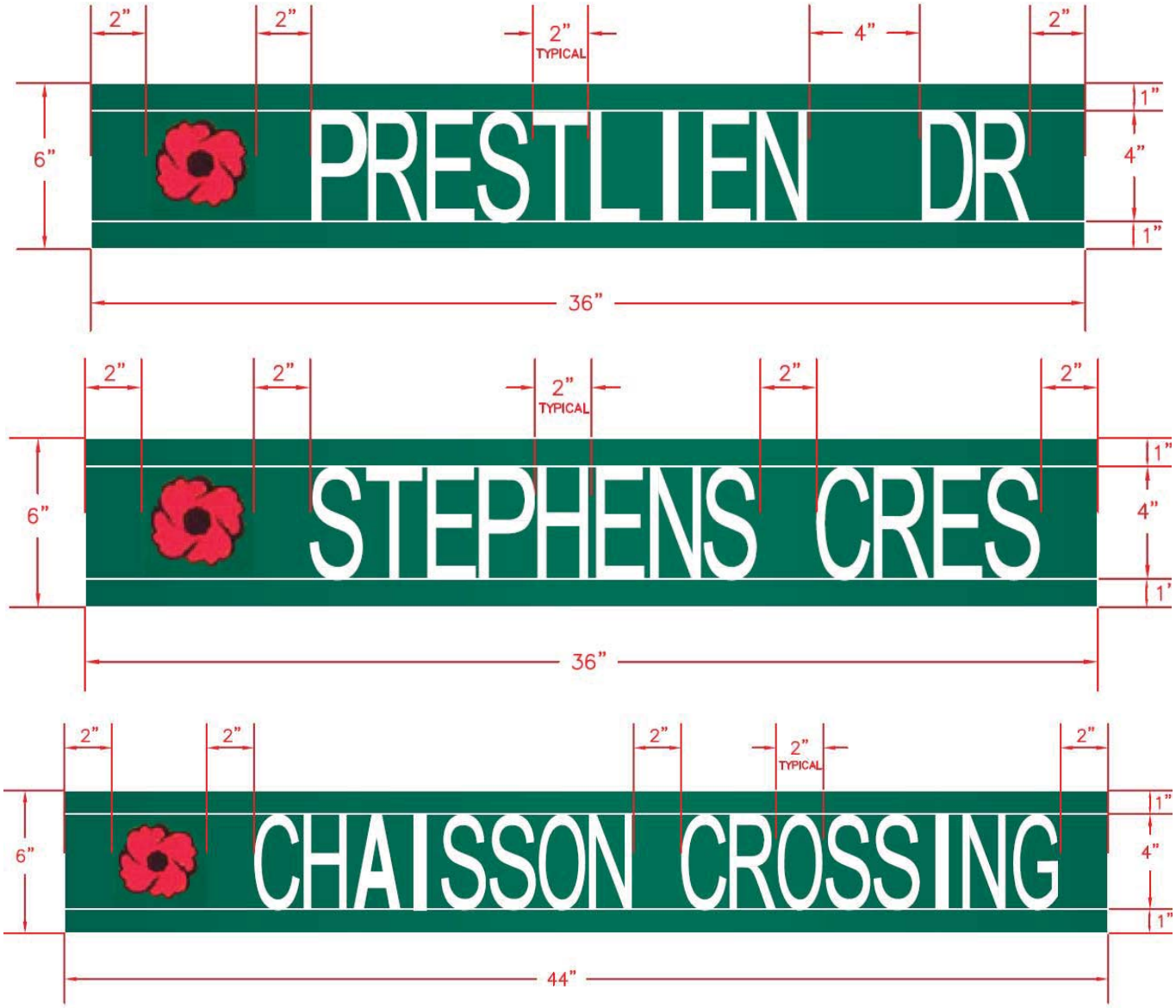
SCHEDULE D.2: POPPY STREET SIGN EXAMPLES 1



NOTE:

1. Sign substrate material must be extruded aluminum I-plate
2. Thickness shall be 0.230” for top and bottom edges and 0.80” in the center of the blade
3. The Poppy Design shall be placed on the left-hand side of the blade
4. A space of 2” must be placed before the name of the corridor
5. Blade height must be 6”
6. Blade length must be 18, 24”, 30” or 36” with the fixed space of 2”, 4” or 6” between the two words varying with the number of characters of the message.
7. If a blade length of 36” will not accommodate the message, refer to Limitation V of these guidelines.
8. Road name and type must display Clearview 1B font style
9. Named roads will be in uppercase format with a height of 4” and a maximum width of 2” while maintaining a minimum space of 100 kern between characters
10. The blade must be Green, Avery OL-2007 GRN or equivalent, and the message must be White
11. The message must be printed on both sides of the blade

SCHEDULE D.3: POPPY STREET SIGN EXAMPLES 2



NOTE:

1. Sign substrate material must be extruded aluminum I-plate
2. Thickness shall be 0.230” for top and bottom edges and 0.80” in the center of the blade
3. The Poppy Design shall be placed on the left-hand side of the blade
4. A space of 2” must be placed before the name of the corridor
5. Blade height must be 6”
6. Blade length must be 18, 24”, 30” or 36” with the fixed space of 2”, 4” or 6” between the two words varying with the number of characters of the message.
7. If a blade length of 36” will not accommodate the message, refer to Limitation V of these guidelines.
8. Road name and type must display Clearview 1B font style
9. Named roads will be in uppercase format with a height of 4” and a maximum width of 2” while maintaining a minimum space of 100 kern between characters
10. The blade must be Green, Avery OL-2007 GRN or equivalent, and the message must be White
11. The message must be printed on both sides of the blade