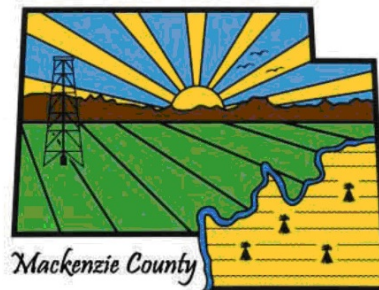


# Mackenzie County

## GENERAL MUNICIPAL IMPROVEMENT STANDARDS



FEBRUARY 2021

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## SECTION A GENERAL CONDITIONS

### A.1 INTENT

- A.1.1** The General Municipal Improvements Standards (GMIS) (hereafter, Standards) are intended to serve as minimum standards that are to be followed by Mackenzie County (hereafter, Municipality), Developers, Engineering Consultants, Contractors and others during all aspects of Municipal Improvements installations, including design, preparation and submission of plans and drawings, and construction operations.
- A.1.2** This document forms an appendix to the Municipality Development Agreement, with clauses in the Development Agreement modifying or providing clarification of design and construction requirements on a site-specific basis.
- A.1.3** Where conditions dictate, and good engineering practices require higher standards than those indicated, the higher standards shall be incorporated into the design of the proposed subdivision. Generally, there will be no departures from the standards put forth in these Standards without prior written approval of the Municipality. In case of deviation from the requirements of these Standards, the Developer shall follow the final design by the Developer's Engineer and approved by the Municipality.
- A.1.4** The standard drawings, as referenced throughout the document, shall form an integral part of these standards.
- A.1.5** These Standards have been developed to:
- i. Ensure that the Municipality is provided with a quality product that will meet an acceptable long-term life expectancy while maintaining cost efficiency and practicality, so as not to prohibit land development;
  - ii. Minimize the maintenance requirements associated with land development.
- A.1.6** These Standards shall only be considered as minimum requirements. The Developer, the Engineer and the Contractor shall remain fully responsible for the design and construction of Municipal Improvements according to accepted engineering practice and standards that address and meet the specific needs and site conditions of the development. Certain site-specific conditions may warrant the use of standards that are more stringent.
- A.1.7** These Standards, as well as the latest editions of any referenced legislation or documents, form part of the requirements for the design and construction of any project within the Municipality.
- A.1.8** These Standards are to be read in conjunction with the Municipality's current Land Use Bylaw. In the event of conflicting statements, the Land Use Bylaw shall generally govern. Where situation dictates, the Developer's Engineer, at his own discretion and based on best engineering practices, will provide the Municipality and the Developer with an expert opinion and professional advice as

to which of the conflicting statements is to be used as guidance in further proceedings.

## A.2 DEFINITIONS

**Adjacent** - shall refer to those lands next to or adjoining the proposed subdivision area and includes those lands severed by a roadway, utility right-of-way, railroad, river, stream, reserve lands or other means of natural barrier.

**Applicant** - shall mean a person or a corporation who has applied for approval of a proposed municipal improvement or subdivision, or to service an existing or proposed parcel of land, whether as the owner or the owner's agent of the land included therein.

**Building Permit** - shall mean a certificate or other document permitting the construction or alteration of a building or structure, which constitutes part or all of the specified subdivision. The permit issuance shall be in accordance with the minimum requirements of the Alberta Building Code.

**Consulting Engineer or Engineer** - shall mean a Professional Engineer(s) and/or firm licensed to practice engineering in the Province of Alberta and retained by the Applicant to be responsible for the design, studies, reports, engineering drawings and documents, layout and supervision of installation, preparing record (as-constructed) drawings and information and performing those duties in connection with the provision of Municipal Improvements as set out in these Standards.

**Contract Drawings** – Detailed drawings, specifications and any other information required to fully describe all aspects of the proposed work. Contract Drawings must be stamped by the Developers Engineer and be “Issued for Construction”.

**Contractor** - shall mean any person, persons or corporation which shall undertake the installation of Municipal Improvements on behalf of either the Applicant or the Municipality.

**Construction Completion Certificate (CCC)** - shall mean a certificate issued after the Construction Completion Inspection pursuant to the Development Agreement indicating the completion of construction on the Development. Generally, indicates the initialization of the Warranty Period.

**Council** - shall mean persons duly elected to the Council of the Municipality.

**Development** - shall mean the carrying out of any construction or excavation or other operations, in, on, over or under land, or the making of any change in the use or the intensity of use of any land, buildings or premises.

**Development Officer** - shall mean person or persons appointed and acting on behalf of the Municipality to regulate the orderly development of subdivisions and properties.

**Developer** - shall mean the person, persons or corporation that has been granted a Subdivision Approval by the Municipality for the development of a subdivision or subdividing land, or an owner or owners of land, or their employee, agent or representative, as defined in the Development Agreement.



**Development Approving Authority(s)** - shall mean the person(s) designated and known to be the Development Authority to exercise the duties and powers and perform the functions prescribed in the Land Use Bylaw pursuant to the Municipality's Development Authority Bylaw.

**Development Agreement** - shall mean documents specifying the general requirements, terms and conditions of the Municipal Improvements. Such an agreement between the Municipality and the Developer shall be in place prior to installation of Municipal Improvements.

**Development Area** - shall mean the lands described in the Development Agreement.

**Developers Engineer** – Shall mean the same as Consulting Engineer.

**Development Permit** - shall mean a certificate or other document permitting a subdivision or development and includes, where applicable a plan or drawing, or a set of plans or drawings, specifications or other documents as authorized by the Development Approving Authority to proceed with the specific development.

**External Road** - shall mean any public road which an internal road or provincial highway is not.

**Final Acceptance Certificate (FAC)** - shall mean a certificate issued pursuant to the Development Agreement indicating the completion of the Developer's responsibilities to the Municipality. The FAC is generally issued after a Final Acceptance Inspection or Warranty Inspection. The FAC transfers full responsibility for a development from the Developer to the Municipality.

**Final Acceptance Inspection** - shall mean an inspection carried out by the Developer and the Municipality at the end of the warranty period of the project to assess any remaining obligations prior to the issuance of the FAC.

**General Design Standards** - shall mean the General Municipal Improvement Standards as approved by the Municipal Engineer for installation of the local improvements.

**Geotechnical Report** - shall mean a document prepared by a Geological or Geophysical Professional Engineer licensed to practice in the Province of Alberta and that bears the seals or stamps signed and dated by the professional in accordance with the enactments that govern their profession.

**Grading** - shall mean an operation or process intended to level or to grade the subdivision area to a desired horizontal gradient.

**Holdback** – shall mean funds which the Municipality will withhold from each payment to the Developer till such time when the FAC is issued and proof is provided that all contractors have been paid and all liens and claims have been released. Amounts and timelines and other conditions of holdback shall be outlined in the Development Agreement.

**Internal Road** - shall mean a public roadway, the primary function of which is to provide access to individual sites within a multi-lot subdivision, with the exception of mobile home communities or bare land condominium subdivisions in which case the internal roads are privately owned.

**Local Improvements, External** - shall mean all of the local improvements or the portions thereof to be constructed by the Developer outside of the proposed subdivision as described in the Development Agreement.

**Local Improvements, Internal** - shall mean all of the local improvements or the portions thereof to be constructed by the Developer within the proposed subdivision as described in the Development Agreement.

**Municipality** - shall mean Mackenzie County.

**Municipal Improvement** - shall mean any addition or modification or proposed addition or modification to a service or facility that the Municipality will ultimately become responsible for. These include, but are not necessarily limited to, watermains, sanitary and storm sewers, roadways, park areas, signs, street lights and fencing.

**Municipal Property** - shall mean:

- any property owned or leased by the Municipality developed for use as public park, sports field, playground or other recreational area, or
- undeveloped reserve land as either: reserve, municipal reserve, school reserve, environment reserve or combination of reserves, or
- municipal right-of-way including all forms of public roadways (roads, lanes, streets, highways), sidewalks, boulevards, road allowances, utility rights-of-way, public utility lots, public spaces, undeveloped rights-of-way and storm water management facilities, bridges, culverts and water bodies, or
- any property developed as a pathway or park trail system, or
- any property owned or titled to the Municipality including buildings, structures and parking facilities.

**Municipal Engineer** - shall mean the professional engineer(s) and/or firm retained by the Municipality to perform the duties as a representative of the Municipality such as; review, inspect and recommend approval or rejection of the work proposed or performed by the Developer under the terms of the Development Agreement.

**Municipal Manager** - shall mean the Chief Administrative Officer, or designate, of the Municipality.

**Off-site Levies** - shall mean the monies collected by the Municipality from the Developer or industry to assist with the payment of the portion of the off-site services that the subdivision may utilize.

**Order** - shall mean an order issued under the Land Use Bylaw in accordance with the Municipal Government Act, or an order issued under provisions of other municipal Bylaws and the governing Provincial Act.

**Person** - shall mean one or more individuals, partnerships, corporate bodies, unincorporated organizations, government body, trustees, executors, administrators or legal representative other than the Municipality or its legal counsel.

**Plans and Specifications** - shall mean plans, specifications, material lists and performance criteria for the subdivision approved by the Municipal Engineer covering design, construction and installation of the Municipal Improvements.

**Private Sewage Disposal System** - shall mean a separate system for treatment and disposal of sewage, including a septic tank and absorption field, which is not connected to a municipal sewage disposal system.

**Property** - shall mean any land, building, structures or premises including any personal property located on, over or in the property that is located within the municipal boundaries of the Municipality.

**Private Property** - shall mean land owned by a person, group, corporation or entity that is not a government body.

**Record Drawings** - shall mean design drawings up-dated to accurately show utility and Municipal Improvements as constructed in the field. Such drawings shall be stamped and signed by the Engineer.

**Rural Roads** – Roadways that generally do not include curb and gutter or sidewalk. Rural roads typically accommodate surface drainage through a ditch system with culverts at crossing locations.

**Subdivision** - shall mean creation of lot(s) within existing boundaries of hamlets.

**Suitable Development Area** - shall mean that each residential lot created by either a single lot or multi-lot subdivision is suitable for the construction and use of a residence, an ancillary building, an access road, a privately owned domestic water well, a sufficient potable water source and a private sewage treatment system.

**Traffic Accommodation Strategy** - shall mean the plans and written procedures detailing the proposed measures to accommodate traffic safely and efficiently for the duration of the project.

**Unauthorized Use** - shall mean the use of the Municipal property either by constructing, storing, landscaping, erecting, placement or removal of any structure, or item on, over or in the Municipal property without written authorization from the Municipality, which include but are not limited to:

- the placement of surface structures such as a driveway, parking area, walkway, patio, deck, stairs or retaining wall, or
- permanent buildings, relocatable structures or accessory structures such as a detached garage, barn, shed, greenhouse or lean-to composter, or
- landscaping including fencing, fire pits or fire wood storage, the addition or removal of vegetation or a use that interferes with the growth of existing vegetation, or
- installation of utilities, antenna, satellite receiving dish or other telecommunication facilities and devices, or
- storage of vehicles or trailers or off-road equipment, building materials, rubble, stockpiles, debris or chattel, or
- site drainage including the use of pipes, culverts, catch basins, ditches, swales, sump

drainage, dry wells, sewage disposal systems, detention ponds or related ancillary structures, or

- excavating, cutting, filling, or undermining.

**Units of Measurement** - shall mean that the standard units of measurement approved by the Municipality are System International (metric) only, and any reference to imperial measurement units may be allowed for convenience purposes only.

**Urban Roads** – Roadways that include curb and gutter are generally urban. Urban roadways frequently include lighting and sidewalk depending on adjacent land use. Urban Roads typically accommodate surface drainage through a minor drainage system comprised of catch-basins and underground storm mains.

**Utilities** - shall mean those utilities together with all necessary appurtenances, which are described in the Development Agreement.

**Utilities, Franchise** - shall mean those utilities provided by a service company such as electrical service, natural gas, telephone or cable television.

**Warranty Period** - shall mean the period commencing on the date of issuance of the Construction Completion Certificate and ending on the date of issuance of the Final Acceptance Certificate.

### A.3 REFERENCE DOCUMENTS

- A.3.1** All references to Acts, Bylaws, Standards, Specifications, or methodologies of technical associations will be made to the current or latest adopted amendment or revision.
- A.3.2** It is the Developer's responsibility to satisfy the requirements established in the Standards unless stated otherwise.
- A.3.3** Should conflicts or inconsistencies with the Standards and referenced documents arise due to compliance with or amendment of statutory requirements, the Developer shall be responsible for satisfying the more stringent requirements.
- A.3.4** All design criteria, methodologies, materials, installation and testing shall be in accordance with the most recent editions of the referenced documents, which include but are not limited to:
- i. Public Lands Act
  - ii. Municipal Government Act
  - iii. Water Act
  - iv. Environmental Protection & Enhancement Act
  - v. Canadian Environmental Assessment Act
  - vi. Canadian Standards & Association
  - vii. Fisheries Act
  - viii. Species at Risk Act

- ix. Navigable Water Protection Act
- x. Occupation Health & Safety
- xi. Safety Codes Act
- xii. Rural Utilities Act
- xiii. Provincial Offences Procedures Act
- xiv. Plumbing Code
- xv. Alberta Private Sewage Standards of Practice
- xvi. Alberta Building Code
- xvii. Provincial Wetlands Policy
- xviii. Alberta Environment, Standards and Guidelines for Municipal Waterworks,
- xix. Wastewater and Storm Drainage Systems
- xx. Alberta Highway Geometric Design Guide
- xxi. Transportation Association of Canada Geometric Design Guidelines
- xxii. Transportation Association of Canada Uniform Traffic Control Devices for Canadian Roads
- xxiii. Transportation Association of Canada Highway Lighting Design Guide
- xxiv. Municipal Bylaws
- xxv. Other Provincial/Federal Government Authorities

**A.3.5** It is the Developer's or the Developer's Engineer's responsibility to obtain, at their own cost, copies of the referenced documents from the applicable authority.

**A.3.6** The above compiled list of referenced documents shall not be considered as all inclusive, as other applicable standards and documents may be listed in specific sections of the Standards for reference. The Developer and the Developer's Engineer shall remain responsible for the design and construction of the proposed subdivision according to accepted best engineering and work practices.

**A.3.7** The following are abbreviations commonly accepted for use with these Standards:

AASHTO	American Association of State Highway and Transportation Officials
AADT	Average Annual Daily Traffic
ABC	Alberta Building Code
ACI	American Concrete Institute
AFBMA	Antifriction Bearing Manufacturers Association
AFPA	Alberta Forest Products Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AISC	American Institute of Steel Construction
AMCA	Air Moving and Conditioning Association
ANSI	American Iron and Steel Institute

AISI	American Iron and Steel Institute
API	American Petroleum Institute
ARI	Air-Conditioning and Refrigeration Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AT	Alberta Transportation
AWMAC	Architectural Woodworkers Manufacturers Association of Canada
AWPA	American Wood Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association
CAN	Canadian National Standard
CBM	Certified Ballast Manufacturers
CBTIC	Clay Brick and Tile Institute of Canada
CCA	Canadian Construction Association
CCDC	Canadian Construction Documents Committee
CEC	Canadian Electrical Code
CEMA	Canadian Electrical Manufacturers Association
CGA	Canadian Gas Association
CGRA	Canadian Good Roads Association
CGSB	Canadian General Standards Board
CISC	Canadian Institute of Steel Construction
CITC	Canadian Institute of Timber Construction
CLA	Canadian Lumbermen Association
CMAA	Crane Manufacturers Association of America
CMHC	Canada Mortgage and Housing Corporation
CPCA	Canadian Painting Contractors Association
CPCI	Canadian Pre-stressed Concrete Institute
CRCA	Canadian Roofing Contractors Association
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Association
CSSBI	Canadian Sheet Steel Building Institute
CUA	Canadian Underwriters Association
CWB	Canadian Welding Bureau
CWC	Canadian Wood Council
CSPI	Corrugated Steel Pipe Institute
DFO	Department of Fish and Oceans
EI	Edison Electrical Institute
EEMAC	Electrical and Electronic Manufacturers of Canada
FFPC	Federal Fire Prevention Committee
FM	Factory Mutual Engineering Corporation
GMSS	General Municipal Servicing Standards
IAO	Insurers' Advisory Organization

IBRM	Institute of Boiler and Radiator Manufacturers
IEC	International Electro Technical Commission
IEE	Institution of Electrical Engineers (UK)
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IGMAC	Insulated Power Cable Engineers Association
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America
ISO	International Standardization Organization
LEMA	Lighting Equipment Manufacturers Association
LTIC	Laminated Timber Institute of Canada
MMA	Millwork Manufacturers Association
MMCD	Master Municipal Construction Documents
NAAMM	National Association of Architectural Metal Manufacturers
NBC	National Building Code of Canada
NEC	National Electric Code
NEMA	National Electrical Manufacturers
NESC	National Electric Safety Code
NFPA	National Fire Protection Association
NLGA	National Lumber Grade Authority
OECI	Overhead Electrical Crane Institute
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
RLM	RLM Standards Institute
RTAC	Road Transportation Association of Canada
SAE	Society of Automotive Engineers
SBI	Steel Boilers Institute
SJI	Steel Joint Institute
SSPC	Steel Structures Painting Council
TAC	Transportation Association of Canada
TTMAC	Terrazzo, Tile and Marble Association of Canada
ULC	Underwriters' Laboratories of Canada
USFG	United States Federal Government
WCB	Workers' Compensation Board
WCLIB	West Coast Lumber Inspection Bureau

#### **A.4 DEVELOPER'S RESPONSIBILITY**

- A.4.1** The Developer shall, at his own expense, provide the following:
- i. Design and construction of the proposed Municipal Improvements including necessary off-site upgrades and utility up-sizing associated with the Development.
  - ii. Quality control and materials testing by an independent third-party qualified engineering firm.

- iii. Acquisition of additional land for roadways widening and municipal utilities and services as required.
- iv. Registration with Alberta Land Titles all easements including plans and documents for the construction of Municipal Improvements outside of the municipal right-of-way.
- v. Register a Plan of the Subdivision, made in accordance with the Plan approved by the Municipality's Subdivision Approving Authority, at the Land Titles Office.
- vi. Supply to the Municipality both digital and hard copies of the Plan of the Subdivision drawings and Record (as-built) drawings, as per Municipality drawing standards.

**A.4.2** It is the Developer's responsibility to satisfy all statutory requirements governing the proposed works and obtaining approvals for compliance with those requirements from the applicable jurisdiction authorities.

**A.4.3** The Developer shall engage a qualified Professional Engineer who is licensed to practice in the Province of Alberta and who is a member of The Association of Professional Engineers, Geologists and Geophysicists of Alberta, who shall undertake all phases of Engineering for the proposed Municipal Improvements including conceptual design, detailed design, general engineering, construction supervision and inspection, and preparation of Shop and Record Drawings. The Developer's Engineer shall design the proposed Municipal Improvements in accordance with accepted engineering practices and principles to meet or exceed the minimum standards as set in this document or established by government authorities. All drawings and documents shall identify the Developer and shall be stamped, signed and sealed by the Developer's Engineer.

**A.4.4** The Developer shall demonstrate conformance to the satisfaction of the Municipal Engineer if there is a question as to whether any product or system is in conformance with applicable Standards and shall pay the costs associated with any testing or certification to demonstrate such conformance. In case of a conflict between the requirements of these Standards and those of the listed Referenced Standards, the requirements of these Standards will prevail.

## **A.5 SUBDIVISION APPLICATION**

**A.5.1** Prior to any subdivision construction taking place, the Developer shall submit a Subdivision Application to the Municipality using the Subdivision Application form provided by the Municipality, for review by the Municipality. The Application must include all pertinent information as to standards of construction, anticipated types of subdivision, requirements for capacity of utility systems and easements, roadways, street patterns and other significant aspects relating to the proposed subdivision.

**A.5.2** The Development Application shall include drawings at a scale of 1:1000 or 1:2000. These drawings shall outline the proposed concept for the layout of all lots, blocks and roadways including the following information:



- i. preliminary subdivision plan;
- ii. proposed lot grading plan;
- iii. contours of existing land surface relative to geodetic elevation datum;
- iv. location and size of utilities, roadways and other facilities;
- v. anticipated impacts on existing facilities because of the proposed subdivision;
- vi. proposed schedule;
- vii. other information that the Developer considers necessary to facilitate the proper assessment of the proposed subdivision.

**A.5.3** No construction shall proceed until a Development Agreement has been approved by the Municipality.

## **A.6 DEVELOPMENT AGREEMENT**

**A.6.1** The Developer will be required to enter into a Development Agreement with the Municipality prior to the construction and installation of the proposed subdivision. No Development Permit will be issued for any construction on any particular area or lot within the proposed subdivision until:

- i. all required Municipal Improvement Plans are in place and accepted by the Municipality;
- ii. Subdivision Plans are endorsed and registered at Alberta Land Titles.

## **A.7 SUBMISSION AND REVIEW OF ENGINEERING DETAIL DESIGN**

**A.7.1** The Developers Engineer shall submit electronically a complete set of plans, drawings and specifications for the proposed subdivision to the Municipality for review, including the following:

- i. prints of the registered plans of the proposed subdivision;
- ii. detailed sanitary and storm sewer capacity and pipe loading calculations;
- iii. water distribution system network analysis;
- iv. Geotechnical investigation if required as a result of the application review;
- v. Any additional requirements as a result of the application review;
- vi. Storm Water Management Plan if identified as being required during the Application review.

**A.7.2** Existing road names shall be shown on the drawings for reference. Proposed road names must be approved by the Municipality prior to submission and also be shown on the drawings.

**A.7.3** The Engineer shall bring to the attention of the Applicant, and the Municipality, the need for any right-of-way outside the area of the proposed subdivision which the Applicant may have to obtain. Where easement or right-of-way documents

and plans are deemed necessary, they shall be prepared by a licensed Alberta Land Surveyor at the Applicant's expense.

- A.7.4** The Engineer shall bring to the attention of the Applicant, and the Municipality, the need for any utility crossing agreements which the Applicant may have to obtain.
- A.7.5** All design drawings, specifications and relevant data will be reviewed by the Municipality and all necessary revisions shall be incorporated by the Engineer in the final design. Such revisions will in no way lessen the responsibility of the Developer and their Engineer for the work.
- A.7.6** Upon completion of all revisions, the Engineer shall submit a complete set of Contract Drawings to the Municipality for review and approval.
- A.7.7** Upon completion of final design review, the Municipality will certify, via their Municipal Engineer signature, the drawings and will return one (1) approved set to the Engineer.
- A.7.8** Review certification does not, in any manner, imply approval of the technical aspects of the reviewed design. No construction activities will be started within any parcel of land or on any of the municipal property until the Contract Drawings are certified by the Municipality, the Subdivision Plans are approved, and the Development Agreement is in place.

## **A.8 APPROVAL TO PROCEED**

- A.8.1** Upon receipt of approved Contract Drawings from the Municipality, the Applicant may proceed with the construction of the proposed Municipal Improvements subject to following:
  - i. satisfactory execution of the required Development Agreement, and
  - ii. all required approvals from the Municipal, Provincial and Federal Regulatory Authorities are obtained by the Applicant.
- A.8.2** A full copy of all approved drawings and specifications shall be maintained at the construction site during the installation of the proposed Municipal Improvements.
- A.8.3** The Developer shall give 48 hours written notice to the Municipality before commencement of work, changes in work schedules, or working hours in order to coordinate adequate Municipality inspection staff.

## **A.9 ENGINEERING AND SUPERVISION**

- A.9.1** Where the Development Agreement requires that the Developer construct local improvements, the Developer shall obtain an accredited Engineer or a firm which will carry out preliminary surveys, prepare and submit design drawings for approval, supply construction survey layout and engineering supervision during construction, certify acceptable completion of the work, and submit record (as-built) drawings of all work performed.

- A.9.2** The Developer shall obtain an accredited Geotechnical Engineer or a firm to carry out all material testing deemed necessary to determine and certify whether workmanship and materials incorporated into the work meet the specified requirements.
- A.9.3** The Developers Engineer(s) or their authorized representative(s) shall have a presence at all times on site during the installation to ensure that all construction activities are carried out in conformance with the standards specified by the Municipality and the requirements of the approved plans and specifications.
- A.9.4** The Developer shall be responsible to have the necessary construction layout carried out to ensure the finished construction conforms to the lines and grades shown on the Contract Drawings.
- A.9.5** In addition to supervision carried out by the Developer's Engineer, the Municipal Engineer appointed by the Municipality may periodically inspect the work. The Municipal Engineer will bring to the attention of the Developer's Engineer and/or the Contractor the use of any unacceptable materials or practices. If remedial action is not taken to the satisfaction of the Municipal Engineer, he may order a stoppage of work. No work will be resumed until required remedial actions are taken by the Contractor to the satisfaction of the Municipal Engineer.
- A.9.6** If the Developer's Engineer, on behalf of the Developer, wishes to make any changes to the Contract Drawings, either before or during the execution of the work, he shall submit drawings and other supporting materials, showing the proposed revisions to the Municipality for review and approval. No revised construction work will be allowed until the proposed changes to the Contract Drawings are approved by the Municipality and new revised Contract Drawings are issued.

## **A.10 SURVEY CONTROL SYSTEM**

- A.10.1** The Developer shall provide, at the discretion of the Municipality, a survey control system within, and adjacent to, the proposed subdivision. The survey control system shall consist of Alberta Survey Control Monuments (ASCM) that are of a design and quality acceptable to Alberta Sustainable Resource Development (ASRD). The Municipality and ASRD shall be provided with the survey measurements for the survey control system.
- A.10.2** The Developer shall ensure that all existing and new ASCM are properly preserved. Should it be necessary to destroy a monument, the Developer shall establish a new one in lieu of the lost monument and provide the Municipality and ASRD with survey measurements for its proper location.
- A.10.3** Any survey monuments disturbed or removed during construction must be replaced prior to Final Acceptance by the Municipality. The Developer shall provide certificates from a registered legal land surveyor, who is practicing member with the Alberta Land Surveyors Association, that all survey monuments are intact or properly replaced at their proper locations.

**A.11 UTILITIES**

- A.11.1** The Developer or the Developer's Contractor shall take all precautionary measures as may be necessary when working over or adjacent to utilities, whether above or below ground, and shall control his equipment and method of construction to prevent any damage to the utility and/or appurtenances.
- A.11.2** The Developer shall be responsible to obtain an appropriate crossing agreement with the utility owner and provide proof of such an agreement to the Municipality prior to commencement of the improvement installation. The Developer shall comply with all terms and conditions of the crossing agreement and make application to transfer the agreement to the Municipality's name prior to the application for the Construction Completion Certificate.
- A.11.3** Under no circumstances shall any construction operations be carried out over or adjacent to any pipeline until the required adjustments and protection required for the proposed construction have been completed. Additionally, he shall provide a minimum forty-eight (48) hours' notice to the pipeline owner, in advance of commencing his construction operations in that area. The Developer shall also maintain appropriate liaison with the pipeline owner.
- A.11.4** Upon completion of the pipeline work, the Contractor shall continue to work in close liaison with the pipeline owner and, if required, ensure that a representative of the affected utility company is present always during active equipment operations. The Contractor shall ensure that no equipment crosses or operates over any pipeline at locations other than where protection has specifically been provided. Where construction is involved over an uncased or otherwise unprotected line, extreme caution shall be exercised to ensure that the line is not damaged as a result of the construction equipment loading.
- A.11.5** The Developer shall be responsible for the installation of power, natural gas and telephone services in the subdivision. Any other utilities that may be required shall be provided at the sole expense of the Developer.
- A.11.6** The Developer of the proposed subdivision is responsible for all arrangements with the utility companies as to the locating and moving of all existing utilities such as power poles, pipelines, telephone poles, buried cables, or any other utility as may be required.
- A.11.7** Gas, power and telephone location plans shall be submitted to the Municipality for approval prior to installation. Approval shall be given in writing once the plans have been approved. The Developer shall be responsible for payment of all costs related to these local improvements.
- A.11.8** If lines cannot be installed in the streets or lanes of the subdivision, the Developer shall provide registered easements or rights-of-way in the name of the Municipality to accommodate the utility services. The required easements or rights-of-way shall be registered on each individual lot prior to the sale of any lot in the subdivision area.

**A.11.9** It is the Developer's responsibility to coordinate the design and installation of works with franchise utilities. The Developer shall be responsible for any deficiencies noted because of installation such as fill settlements and damages occurred to curb and gutter, roadway pavement structure, boulevards or landscaping features.

**A.11.10** All services shall be installed to the property line. In areas where facilities require an easement along the front of the property, the service connections shall be extended to the edge of the easement furthest from the roadway.

## **A.12 SAFETY AND ACCOMMODATION OF TRAFFIC**

**A.12.1** The Developer is responsible, either solely or through his Contractor, for all aspects of site safety, including traffic control and signage. With respect to site safety, the Developer shall be acting as the Prime Consultant, and shall save the Municipality, its employees and agents, from all actions arising from issues of safety.

**A.12.2** The Developer is solely responsible for safety on the site. Nothing contained herein removes, lessens or transfers this responsibility. Signage, accommodation of traffic and other related issues shall conform to industry standards.

**A.12.3** A Traffic Accommodation Strategy may be required to be submitted for review and approval by the Municipality prior to commencement of improvement installation.

**A.12.4** The Developer or the Developer's Contractor shall, at his own expense, make suitable provisions to accommodate all traffic, whether pedestrian or vehicular, over or around any part of the subdivision, and shall supply and maintain such signs, barriers, fences, lights, and flag persons as may be required for this purpose. Where the traffic is required to use a route over or around the work which is of a lower standard than was available before the work commenced, the Contractor shall, at his own cost, continuously provide assistance to traffic as required on a 24 hour per day and 7 day per week basis, particularly during periods of inclement weather. The Contractor shall provide dust control where considered necessary by the Municipality to reduce nuisance or for the safety of the travelling public.

**A.12.5** Flag persons shall be instructed in the proper traffic control procedures for the work and shall be dressed and equipped in a manner consistent with Alberta Transportation requirements.

**A.12.6** When work is not in progress and on days such as Holidays and Sundays, the Contractor shall remove all regulatory signs not essential for the protection of the public, to reduce inconvenience to a minimum.

**A.12.7** All signs and guide posts encountered that must be removed in the prosecution of the work shall be carefully salvaged by the Contractor. Certain signs, such as those marking railroad crossings, intersection warning or stop signs, shall be maintained on the work for the protection of traffic using the roadway.

- A.12.8** Where the subdivision is closed off and traffic is diverted entirely off the subdivision, the Contractor shall, at his own expense, provide and maintain such signs, barriers, lights, and flag persons as may be necessary to direct the travelling public over the detour.
- A.12.9** Traffic must be controlled by flag persons and sufficient warning signs to ensure the safety of the public when any traveled roadway is being entered or crossed by hauling equipment to the satisfaction of the Municipality. Where required for public safety, additional signs will be used. Signage and sign placement shall be consistent with TAC “Manual of Uniform Traffic Control Devices for Canada”.
- A.12.10** Road closures and detours must be approved by the Municipality in writing a minimum of 48 hours prior to scheduled work.
- A.12.11** Haul routes must be kept clear and free from dust by grading and sprinkling. Trucks must be loaded in such a manner that no spillage occurs.
- A.12.12** Where, in the opinion of the Municipality, additional warning signs or other safety devices are required on the work, the Contractor shall supply, erect and maintain the additional facilities as requested.

### **A.13 EASEMENT AND RIGHT OF WAY**

- A.13.1** It is the Developer’s responsibility to obtain all easements and rights-of-way for the installation of Municipal Improvements located outside of the normal right-of-way or utility lot. Prior to application for the Construction Completion Certificate all the permanent easements, including applicable plans and documents, shall be registered at the Land Titles Office naming the Municipality as the Grantor.

### **A.14 PERMITS AND LICENSES**

- A.14.1** It is the Developer’s responsibility to obtain all permits and licenses in compliance with the Provincial and Federal statutory requirements. The Developer will adhere to the Municipality Bylaws and policies relevant to Development.

### **A.15 SUBDIVISION DISPLAY SIGN**

- A.15.1** Where required by the Municipality, the subdivision display sign shall be erected to the following standards:
- i. The subdivision display sign will include the lot layout and subdivision name carved and painted. The sign must be coated with a weatherproof finish. The sign is to be set on a minimum 200mm x 200mm square post or minimum 200 mm diameter round post.
  - ii. The size, design and location of the subdivision sign is to be approved by the Municipality in writing, prior to improvement installation. The Developer shall be responsible for the maintenance of the sign for a period of two (2) years following the Municipality acceptance of the construction completion of the sign.

**A.16 INSPECTIONS, WARRANTY PERIOD AND FINAL ACCEPTANCE**

- A.16.1** Upon completion of all Municipal Improvements associated with the proposed subdivision, the Developer shall request in writing a Construction Completion Inspection. Prior to the Construction Completion Inspection, an inspection conducted by the Developer's Engineer to reveal and mitigate potential deficiencies shall be considered as good practice. Upon the receipt of such request, the Municipal Engineer, on behalf of the Municipality, will inspect the Municipal Improvements, prepare a deficiency list and forward it to the Developer through the Municipality.
- A.16.2** The Developer shall be responsible for, at his own expense, all remedies to correct any defects, faults, or deficiencies in the completed works identified during the Construction Completion Inspection.
- A.16.3** Upon rectification of all deficiencies to the satisfaction of the Municipal Engineer, the Construction Completion Certificate will be issued to the Developer, notifying of the following:
- i. acceptance of work by the Municipality, and
  - ii. commencement date of Maintenance and Warranty Period for all installed Municipal Improvements.
  - iii. Registration of all lots shall be completed before starting construction on lots.
- A.16.4** Municipal utilities and services installed by the Developer shall not be permitted to operate as part of the existing systems until respective utilities and services have been properly inspected, tested and approved in writing by the Municipal Engineer. Formal approval shall be in the form of an approved Construction Completion Certificate.
- A.16.5** Within a two (2) month period after the date of issuance of the Construction Completion Inspection, the Developer's Engineer shall submit Record (As-Built) Drawings to the Municipality. The Developer must also provide the costs of each improvement in a format satisfactory to the municipality; costs must include but are not limited to engineering, materials and installations.
- A.16.6** The Warranty Period for the Municipal Improvements shall commence on the date of issue of the Construction Completion Certificate by the Municipality and shall be governed by the terms outlined in the Development Agreement. Warranty periods generally extend for two (2) years, terminating with the Final Acceptance of work, unless otherwise stated in the Development Agreement. During the Warranty Period, the Developer shall be responsible for, at his own expense, all remedies to correct any defects, faults, or deficiencies in the completed work.
- A.16.7** The Developer shall provide, for the duration of the Warranty Period, an irrevocable Letter of Credit as required by the Municipality to register the property.

- A.16.8** Prior to the expiry of the Warranty Period, the Developer shall notify the Municipality in writing and arrange for an inspection. Upon the correction of all deficiencies to the satisfaction of the Municipal Engineer, the Municipality will issue a Final Acceptance Certificate.
- A.16.9** Where staged construction has been approved by the Municipality in writing, separate Construction Completion and/or Final Acceptance Certificates may be issued for distinct components of the subdivision, with separate Warranty Periods as appropriate. Separation of the project into components shall be at the sole discretion of the Municipality.
- A.16.10** Where the Warranty Inspection indicates expected failures in the work (due to faulty workmanship or materials) shortly after expiration of the Warranty Period, the municipality may request an extension of the Warranty Period on select portions of the work in lieu of requiring immediate corrective action by the Developer prior to issuance of the FAC. Such warranty extension will be limited to an additional two (2) years from issuance of the Final Acceptance Certificate.



**CONSTRUCTION COMPLETION CERTIFICATE**

TO: MACKENZIE COUNTY

DATE: \_\_\_\_\_

RE: \_\_\_\_\_

FILE NO: \_\_\_\_\_

I/We, the Developer(s), hereby request a Construction Completion Certificate for the construction and installation of the following Municipal Improvements in the above-described subdivision:

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Confirm that the total costs of the Municipal Improvement are attached.

Yours truly,

\_\_\_\_\_  
DEVELOPER

We, \_\_\_\_\_, the Developer's consulting engineer, hereby certify that the construction and installation of the above-noted Municipal Improvements have now been completed in accordance with and in compliance with the Development Agreement and respectfully request that a Construction Completion Certificate be issued accordingly.

\_\_\_\_\_  
DEVELOPER'S ENGINEER (SEAL)

**FINAL ACCEPTANCE CERTIFICATE**

TO: MACKENZIE COUNTY

DATE: \_\_\_\_\_

RE: \_\_\_\_\_

FILE NO: \_\_\_\_\_

I/We, the Developer(s), hereby request a Final Acceptance Certificate for the construction and installation of the following Municipal Improvements in the above-described subdivision:

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Confirm that the Construction Completion Certificate was issued on: \_\_\_\_\_

Yours truly,

\_\_\_\_\_  
DEVELOPER

## SECTION B ENGINEERING PLANS AND DRAWINGS

### B.1 GENERAL REQUIREMENTS

- B.1.1** Detailed engineering plans and drawings submitted to the Municipality for review and approval must comply with the requirements stated herein and shall be submitted a minimum eight (8) weeks prior to commencement of construction. Submitted drawings must be legible and contain sufficient information, in the opinion of the Municipality, to allow full review of the proposed work and survey layout on the proposed site.
- B.1.2** The standard drawing size of 841mm by 594mm shall be used for all plan submissions. The index plan may be a reduction of the standard scale to allow the plan to fit the standard size sheet. Original drawings will be prepared in ink on paper and identified appropriately, with the Municipality being provided with a digital AutoCAD copy as specified.
- B.1.3** Drawing scales:
- |                                |                                  |
|--------------------------------|----------------------------------|
| i. Key plans:                  | 1:10000.                         |
| ii. Overall plans:             | 1:5000.                          |
| iii. Index plans:              | 1:1000.                          |
| iv. Plan and profile drawings: | horizontal 1:500, vertical 1:50. |
| v. Cross section drawings:     | horizontal 1:100, vertical 1:50. |
- B.1.4** Elevation data will be relative to the Alberta Survey Control system. The reference Alberta Survey Control Monument (ASCM) and elevation will be shown on the engineering drawings.

### B.2 SUBMISSION REQUIREMENTS FOR DEVELOPMENT AND GRADING PERMIT

- B.2.1** Pursuant to the Municipality's Land Use Bylaw, the Developer is required to submit:
- A General Site Plan illustrating existing elevation contours at 0.5 m intervals preferred, and not to exceed 1 m maximum. Elevations shall be relative to Geodetic Datum. Reference benchmarks shall be indicated on the General Site Plan.
  - A Conceptual Site Plan illustrating proposed site stripping cut and fill requirements and proposed contour elevations. The Developer is responsible for the completion of rough grading for the entire subdivision area including roadway rights-of-way, laneways, drainage, utility easements, municipal reserve and all lots. Rough grades shall ensure that the requirements of the Municipality approved Overall Drainage Plan are met and no standing water or areas where water may pool or pond shall occur. The benchmarks to be used in the control of construction of the project shall be indicated on the plan. Other information to be shown

includes proposed locations for stock piling and windrows, and Engineering requirements for grading of each lot which requires 1 m or more of fill.

- iii. A Geotechnical and Hydrogeological Investigation of the proposed site completed by a qualified Geotechnical Engineer or a firm to a level that will allow the Municipality to assess the site geotechnical and hydrogeological conditions and their effect on the proposed subdivision and the adjacent areas. The report shall include general recommendations and outline any findings of contamination that may exist.
- iv. A Phase I Environmental Site Assessment (ESA) of the proposed subdivision Area completed in accordance with Canada Standards Association requirements. A Phase II ESA shall be required if recommended in the Phase I ESA report.
- v. A Plan of the Floodplain and a letter outlining the recommended measures to ensure that the proposed subdivision and adjacent areas and subdivisions would not be exposed to flooding, where a major watercourse may affect the proposed site.
- vi. Overall conceptual plans and description for the proposed subdivision for review and approval, as well as roadways layout, water and sanitary sewer servicing and storm water management plan. The storm water management plan shall address the capacity of existing systems, and the proposed additional measures to accommodate the new flows shall be required for review along with supporting calculations.

**B.2.2** Additional to the submission requirements listed above, any development or subdivision involving pipeline, power transmission line and/or public utility right-of-way shall be sited to comply with all relevant Federal and Provincial legislation. Setbacks from utility corridors shall be in accordance with appropriate Provincial Regulations of Acts and any regulation or directive established by the Energy and Utilities Board. Letters of crossing agreements shall be provided with the application.

**B.2.3** The Municipality reserves the right to request submission of relevant non-technical information as part of the application, such as a Historical Resource Report to identify any significant historical, archaeological and paleontological resources within or adjacent to the boundaries of the proposed subdivision.

### **B.3 PREREQUISITES TO REVIEW OF ENGINEERING DRAWINGS**

**B.3.1** The Conceptual Subdivision Plan shall be approved by the Municipality prior to the submission of engineering drawings for review and approval.

**B.3.2** The engineering drawings shall be prepared and signed by a qualified Professional Engineer registered in the Province of Alberta and shall be stamped with a Permit to Practice seal.

- B.3.3** The submission of drawings shall be accompanied by all supporting documents, reports, studies, calculations or any other information as required by the Municipality.

#### **B.4 ENGINEERING DRAWING SUBMISSION AND APPROVAL PROCEDURE**

- B.4.1** The Developer shall submit complete engineering drawings a minimum eight (8) weeks prior to the commencement of construction. The Municipality is not responsible for any delay of approval if submissions are incomplete or found to contain excessive errors or omissions.
- B.4.2** Initially, the Developer shall submit three (3) complete sets of drawings and three (3) copies of specifications to the Municipality along with all supporting documents and reports. Additionally, one (1) electronic copy of the drawings and specifications is to be provided.
- B.4.3** The Municipality shall respond to the Developer's initial submissions within four (4) weeks and return one (1) set of drawings and specifications to the Developer with comments for revision.
- B.4.4** The Developer shall promptly revise the engineering drawings to the satisfaction of the Municipal Engineer and re-submit three (3) complete sets of revised drawings and three (3) copies of specifications and one (1) digital copy to the Municipality for approval, along with any additional information as required by the Municipal Engineer.
- B.4.5** Upon receipt of revised drawings satisfactory to the Municipal Engineer, the Municipality shall return one (1) complete set of approved drawings to the Developer with a stamp of "Approved for Construction".
- B.4.6** The Developer shall not proceed with construction until the engineering drawings have been approved for construction.
- B.4.7** The Municipality's approval for construction shall not relieve the Developer or its Engineer from the responsibility for the adequacy of the designs or the liability arising thereof.

#### **B.5 REQUIREMENTS AND STANDARDS FOR ENGINEERING DRAWINGS**

- B.5.1** All drawing shall include a suitable title block, identifying:
- i. The Developer's name,
  - ii. The Developer's Engineer's name,
  - iii. The proposed subdivision title, including staging and/or phasing,
  - iv. Drawing title,
  - v. Drawing number and job number if applicable,
  - vi. Revision number and description,
  - vii. Horizontal and vertical scales,

- viii. Space for signature of the designer, draftsman, checker and approving authority,
  - ix. Space for the number, date, description, designer and approving authority for all revisions and drawings issued including preliminary, approval, tender, construction and Record Drawings,
  - x. Space for professional stamps, permit stamps and preliminary acceptance for construction stamp,
  - xi. Date issued,
  - xii. Legend,
  - xiii. Notes.
- B.5.2** All dimensions shall be given from an iron pin, lot line, chainage station, a center line or any other reference that can be readily established. All dimensions and elevations shall be in the System International (metric).
- B.5.3** All elevations shall be relative to a Geodetic Datum, with all reference benchmarks and elevations clearly identified on the drawing. Benchmark numbers, locations and elevations may be obtained from the Municipality.
- B.5.4** All lettering shall be a minimum of 2 mm high.
- B.5.5** All abbreviations and drawing symbols used in the engineering drawings shall be consistent with drawings standards provided by the Municipality.
- B.5.6** The engineering drawings shall provide a complete description of all existing and proposed Municipal Improvements, including any provisions for future extensions of utilities and systems.
- B.5.7** The engineering drawings shall include:
- i. Index plan of standard size, scale 1:1000 or a reduction thereof, duplicating the legal plan, indicating drawing sheet number and related title.
  - ii. Topography and Land Use Plan, scale 1:1000, indicating the existing contours at 0.5 m intervals and the proposed land uses.
  - iii. Overall Plan, scale 1:1000, indicating:
    - a. Roads, sidewalks and walkways;
    - b. Sanitary sewer, storm sewer and watermains;
    - c. Franchise utilities;
    - d. Overland drainage plan;
    - e. Lot grading plan and Municipal addresses;
    - f. Proposed location of driveways in order to eliminate conflicts with services.
  - iv. Lot Grading Plan, scale 1:1000, indicating:
    - a. Legal base plan including easements;

- b. Original ground contours at 1 m intervals;
  - c. Direction of proposed drainage. Minimum rough site grading requirements to be completed by the Developer's Engineer. Rough grades shall ensure that the overall drainage concept is satisfied. No standing water or areas where water may pool or pond shall be allowed at the rough site grading stage;
  - d. Municipal addresses;
  - e. Proposed lot corners elevations (top of curb) and finished building grades and sewer services invert elevations;
  - f. Any lots built up with fill. Lots with 300mm disturbed soil and areas with known unsuitable soil shall be indicated.
- v. Roadway Plans and Profiles, scale 1:500 horizontal and 1:50 vertical, indicating:
- a. Whole site plan and proposed roadway system and all rights-of-way, walks, lanes, roadway widths and alignments, approaches and horizontal and vertical curves data;
  - b. Original and proposed ground profiles and chainage;
  - c. Access onto existing roadway system;
  - d. Roadway names where required, both existing and proposed;
  - e. Roadway traffic signing;
  - f. Sidewalks, curbs and walkways with proposed top of curb elevations;
  - g. Utilities easements with rights-of-way dimensions, lot configuration and elevations of shallow utilities at road crossings;
  - h. Proposed pavement structure;
  - i. Drainage features including waterways, lakes, ponds, canals, swales, ditches and culverts, noting direction of flows and proposed catch basin locations and inlet elevations;
  - j. Profile chainage must be aligned with the plan view.
- vi. Overland Drainage Plan, scale 1:1000, indicating:
- a. Legal base plan including easements;
  - b. Original contours at 1 m intervals;
  - c. Proposed roadway system;
  - d. Drainage easements;
  - e. Proposed retention ponds with NWL/HWL and cross-sections;
  - f. Culverts;
  - g. Major drainage system;

- h. Proposed site grading contours and elevations;
        - i. Direction of proposed drainage.
  - vii. Sanitary Sewer, Storm Sewer and Watermain Plans and Profiles, scale 1:500 horizontal and 1:50 vertical, indicating:
    - a. Legal base plan;
    - b. Easements and rights-of-way, streets and lanes, alignments, sizes and separation distances between each utility;
    - c. Plans showing pipe sizes, location of manholes, catch basins, hydrants, valves, fittings and other appurtenances;
    - d. Profiles showing pipe sizes and materials, length of pipe, manhole invert elevations, grades between manholes and class of pipe cover and bedding;
    - e. Service to each lot, including inspection chambers and invert elevations at property line;
    - f. Special details, such as inverted siphons, weirs, protection for high velocities, elevations of oil and gas pipeline crossings, pipe crossing cover, etc;
    - g. Off-site connections;
    - h. Profile chainage must be aligned with the plan view.
  - viii. Pavement Marking and Signage Plan, scale 1:1000, indicating pavement marking and proposed signage locations and specifications.
  - ix. Utilities Overall Plan, scale 1:1000, indicating gas, power, telephone, television and other underground utilities locations and easements, including drawings for crossing permits for any oil, power, gas or other transmission lines or railways. Indicate location of surface infrastructure including hydrants, catch basins, manholes, valves, street lights, pedestals, transformers and fencing.
  - x. Landscaping Plan, scale 1:1000, identifying street names and landscape amenities including fencing, signage, screening berms, Canada Post mail boxes and pads, entrance features, entrance signs location and specifications and name and location of all trees and shrubs. Street naming approval will be completed by the Municipality. The Municipality reserves the right to select or reject proposed names.

**B.5.8** Details and typical details shall include:

- i. Standard detail drawings may include typical road cross-sections, trenching details, pipe bedding, valves, hydrants, pavement structure, etc. The details shall be included on a standard A-1 size sheet or may be bound into project specifications on a standard letter size (8<sup>1/2</sup>" x 11") sheets. The scale of individual details will be commensurate with the amount of information to be shown, along with clarity and legibility.



- ii. A minimum of one (1) typical roadway cross-section shall be included within the standard detail drawings. Additional cross-sections shall be provided for roadway sections requiring over 1 m of cut or 2 m of fill. Details on the cross sections shall include:
  - a. Width of right-of-way;
  - b. Finished width of roadway surface;
  - c. Width of sub-grade;
  - d. Slope ratios of side slope and back slope;
  - e. Curb & Gutter and monowalk structures;
  - f. Depth of ditches;
  - g. Surface crown slope;
  - h. Pavement structure details including depth, class, designation and grade of materials.

## **B.6 REPORTS AND STUDIES**

**B.6.1** The Developer shall provide all relevant reports and studies in the submission of engineering drawings including:

- i. Geotechnical and Hydrogeological reports to identify:
  - a. Existing soil and sub-soil conditions, groundwater tables, limits of identified site contamination, top of bank setbacks for adjacent creeks or ravines with stability problems;
  - b. Proposed pavement structure based on in-situ conditions and projected traffic volume. A 20-year structure designed by a Professional Engineer shall be required;
  - c. Construction methodologies and procedures for trenching and backfilling operations for proposed underground infrastructure, storm water drainage facilities and service requirements for proposed private servicing and building foundations.
- ii. Engineering design brief including design calculations and analysis of proposed Municipal Improvements.
- iii. An Environmental Impact Assessment may be required for the proposed subdivision depending on the circumstances.

## **B.7 RECORD (AS-CONSTRUCTED) DRAWINGS**

**B.7.1** Within two (2) months following the issuance of the Construction Completion Certificate, the Developer shall submit two (2) complete sets of record (as-constructed) drawings for review. The plans shall show the “as-constructed” locations, profiles and details of the constructed utilities and surface improvements. All Record Drawings must be received by the Municipality prior

to issuance of a Final Acceptance Certificate. Once the drawings are approved, the Developer shall submit two (2) bound sets of drawings, and the digital files.

- B.7.2** All drawings shall indicate “Record” and shall be stamped, signed, sealed and dated by the Developer’s Engineer.
- B.7.3** The digital files shall be in AutoCAD format and PDF format. Digital files must be geo-referenced to NAD83. This method of data storage is preferred by the Municipality. Acceptable digital files specifications and versions are to be confirmed with the Municipality.
- B.7.4** Record Drawings must contain, at a minimum, the information contained on the project design drawings. Record Drawings shall also include:
- i. Name of the Contractor responsible for construction;
  - ii. Construction completion dates of all work noted on each plan and profile;
  - iii. Dates on which record details were added to the drawing;
  - iv. Any revisions made to construction drawings to create record plans made on all plans that indicate the area of the revision (i.e. revisions shown on detail plans and profiles, will be shown also on overlapping detail drawings where they appear, as well as on the composite plan);
  - v. All pipes, hydrants, valves, plugs, bends, crosses, tees, reducers, manholes and other fittings dimensioned in two directions and detailed description of all fittings. Fittings shall be appropriately numbered and identified according to the Municipality’s numbering system;
  - vi. All roadways shall be identified according to the name or number shown on the registered plan of that particular subdivision. Lanes shown on detail plans where there is no identifying roadway name shown on the detail, shall be identified as the lane east or west of a street, or as the lane north or south of an avenue, (i.e. L.W. 103 Street and/or L.N. 99 Avenue).

## **B.8 ABBREVIATIONS**

The following are the terms and their applicable abbreviations accepted by the Municipality for the engineering drawings:

<b>Term</b>	<b>Abbreviation</b>
Access Manhole	AMH
Abandoned	Ab
Adapter	Ad
Asphaltic Concrete Pavement	ACP
Asphaltic Stabilized Base Course	ASBC
Begin Horizontal Curve	BC
Begin Vertical Curve	BVC
Bench Mark	BM
Block	Blk.
Cast Iron	CI

Catch Basin	CB
Catch Basin Lead	CB Lead
Catch Basin Manhole	CBMH
Center Line	CL
Class	Cl.
Concrete	Conc.
Copper	Cu
Corrugated Steel Pipe	CSP
Curb Cock	CC
Curb Face	CF
Deflection Angle	DA
Degree of Curve	D of C
East Property Line	EPL
Elevation	Elev.
End Horizontal Curve	EC
End Vertical Curve	EVC
Horizontal	Hor.
Hydrant	Hyd.
Invert	Inv.
Iron Pin	I.P.
Length of Curve	LC
Main Stop	MS
Manhole	MH
North Property Line	NPL
Not to Scale	NTS
Point of Intersection	PI
Point of Intersection Vertical Curve	PIVC
Polyvinyl Chloride	PVC
Pressure Reducing Valve	PRV
Property Line	PL
Radius	R
Right-of-way	R.O.W.
Sanitary	San.
South Property Line	SPL
Sprinkler	Spr.
Station	Sta.
Storm	ST.
Street	St.
Survey Monument	SM
Tangent	Tan.
Tapping Valve & Sleeve	TVS
Test Hole	TH
Vertical	Vert.
Vertical Curve	VC
Vitrified Clay Tile	VCT
West Property Line	WPL

## SECTION C LAND USE DISTRICTS AND LEVEL OF SERVICE

### C.1 INTENT

- C.1.1** This section is intended to assist the Municipality and the Developer with general guidelines outlining the level of service for a subdivision based on the land use district. The Developer shall use this section to determine the most appropriate servicing standards presented in the following sections.
- C.1.2** The level of service applicable to any subdivision is subject to review by the Municipality. The Municipality reserves the right to require a higher level of service for any subdivision.
- C.1.3** The guidelines and standards presented in this document shall only be considered as minimum requirements. The Developer shall remain fully responsible for the design and construction of Municipal Improvements according to accepted engineering practice and standards that address and meet the specific needs and site conditions of the subdivision. Certain site-specific conditions may warrant that standards that are more stringent be met.
- C.1.4** It is the Developer's responsibility to satisfy, in addition to requirements of these Standards, all regulations and conditions required by the Provincial and Federal referenced legislation and documents, the Municipality Bylaws and other applicable documents.
- C.1.5** Should the need arise where any of the referenced standards cannot be met, a written request describing the variance complete with supporting documentation shall be forwarded by the Developer to the Municipal Engineer for review. The request shall be reviewed, and a written reply returned to the Developer with the final decision.

### C.2 LAND USE DISTRICTS

- C.2.1** All lands within the Municipality are divided into Zones. The proposed subdivision shall have proper reference to a zone classification according to the Municipality Land Use Bylaw.

### C.3 LEVEL OF SERVICE

- C.3.1** Roadways
- i. The Developer's Engineer shall be responsible for determining an estimated Annual Average Daily Traffic (AADT) generated by the proposed subdivision in order to determine the required roadways cross sectional elements and pavement structure. Section G provides a geometric design table and cross sections for the various roadways and their classifications approved for use within the Municipality.

- ii. The standard roadway cross sections included in Section G are as follows:
  - a. Access Road (7 m wide of gravel surface)
  - b. Rural Road (8 m wide of gravel surface)
  - c. Urban/Rural Hybrid (8 m wide asphalt concrete cement)
  - d. Paved Local Road (8 m wide asphalt concrete cement)
  - e. Urban Local Road (9 m wide of asphalt concrete cement)
  - f. Collector Road (9 m wide of gravel surface)
  - g. Arterial Road (10 m or 11 m wide of asphaltic concrete cement)

**C.3.2** The minimum roadway cross sectional requirements for individual land use classifications have been selected from the above list.

**C.3.3** Water Systems

The proposed subdivisions may require one of the following types of water distribution systems:

- i. Private water systems:
  - a. Private water systems shall consist of individual wells or water cisterns. Systems must be designed and installed according to the Canadian Plumbing Code and applicable Alberta regulations. Water analysis is to be to potable water standards.
  - b. The Municipality will not permit the construction of communal water systems, which are designed to incorporate a water supply from an on-site well.
- ii. Piped water distribution systems:
  - a. Piped water distribution systems shall consist of a piped network at normal operating pressure or a trickle system that delivers water at lower than normal operating pressure. The specific type of system will depend on the type, size and layout of the proposed subdivision as well as the existing infrastructure in the area.
  - b. All piped systems shall be designed and installed according to standards outlined in this document. Additionally, other applicable standards include:
    - American Water Works Association Standards
    - Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems
    - Fire Underwriters Survey
    - Water Supply for Public Fire Protection

**C.3.4** Sanitary

The proposed subdivisions may require one of the following types of sanitary sewer systems:

- i. Private sanitary sewer system (residential):
  - a. Private sanitary sewer systems consist of sewage collection and treatment system located entirely within private property. Private sanitary sewer systems include septic tanks or holding tanks, disposal fields, treatment mounds, sewage lagoons, mechanical treatment units and related piping.
  - b. Private sanitary sewer systems shall be designed and installed in accordance with the most recent version of the Private Sewage Disposal System Regulation, Alberta Private Sewage System Standard of Practice and Canadian Plumbing Code.
  - c. An Information Package for Residential Property Owners is available from the Municipality, which outlines design, material and installation standards and requirements for private sanitary sewer systems.
- ii. Private sanitary sewer systems (non-residential):
  - a. Private non-residential sanitary sewer disposal system that is expected to receive more than 5.68 m<sup>3</sup> of sewage per day shall be designed by a qualified Professional Engineer.
- iii. Communal piped sanitary sewer system:
  - a. Piped sanitary sewer systems consist of either gravity lines or low-pressure lines. The need for this specific type of system shall be determined based on the layout, size and type of subdivision, as well as the existing infrastructure in the area. All communal sanitary sewer systems, including municipal and co-op systems, shall be designed and installed according to the minimum standards outlined in this document. Other applicable standards include the Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems and Rural Utilities Act.

#### **C.3.5 Storm Water Management Systems**

- i. All storm water management systems shall comply with the standards outlined in this document. Other applicable standards include the Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems.
- ii. It is the Developer's responsibility to construct rough grades to ensure that all storm water is properly directed and managed regardless of the stage of subdivision on either public or private property.

### **C.4 UNAUTHORIZED USE**

- C.4.1** Unauthorized use is when a private person or a corporation accesses public or private property with encroachment, construction, storage, landscaping or removal of anything on, over or in public property without written approval of the Municipality.

- C.4.2** Unauthorized use can result in public safety issues, limit public access or use of public or private property, prevent maintenance or operation from occurring and damage natural environment.
- C.4.3** The Municipality as the stewards of all public property shall ensure that the use and enjoyment of public property is a benefit to all residents and is not interfered with by those who deliberately or inadvertently enter onto public lands. The Municipality shall regulate the use of all public or private property to ensure the public safety and to protect natural areas and ecosystems.
- C.4.4** The Municipality shall notify and work with unauthorized users of public or private property on a case by case basis providing an explanation of unauthorized use and detail what corrective measures must be completed.
- C.4.5** Non-compliance with Municipality policies and bylaws may result in legal enforcement.

## SECTION D WATER DISTRIBUTION SYSTEM

### D.1 GENERAL

- D.1.1** The Developer and the Developer's Engineer are responsible to ensure that the water system is designed and constructed according to accepted engineering practice. These guidelines are intended as a guide only and shall not be considered as a substitute for a detailed material and construction specification to be prepared by the Developer's Engineer.
- D.1.2** The current Standards and Specifications issued by the following organizations shall be implemented during design and construction of the water distribution systems:
- i. ASTM - American Society for Testing and Materials
  - ii. AWWA - American Water Works Association
  - iii. CSA - Canadian Standards Association
  - iv. ABC - Alberta Building Code (firewater requirements for new construction)
  - v. AFC - Alberta Fire Code (firewater requirements for new construction)
  - vi. NFPA - National Fire Protection Association
  - vii. FUS - Fire Underwriter's Survey
  - viii. Environmental Protection and Enhancement Act
  - ix. Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems as published by Alberta Environment.
- D.1.3** The specific requirements of the water distribution system will depend on whether the subdivision is defined as a rural or urban. Regardless, the intent of the water distribution system design and installation is to properly distribute potable water throughout the subdivision, including appropriate supply and treatment systems as required. The supply, treatment and distribution systems are to be approved by the Municipality.
- D.1.4** The Developer is responsible to confirm adequate capacity in any existing system to be extended into the subdivision area, if such information is not readily available from the system owner.
- D.1.5** Generally, rural systems will involve individual wells or holding tanks on each lot. Suitability of an aquifer to sustain the subdivision demand with no adverse impact on existing wells is to be evaluated in the Geotechnical / Hydrogeological Report for the proposed subdivision.
- D.1.6** Where the Developer's proposal includes a high-pressure existing pipeline crossing or other such crossings he shall be fully responsible for the preparation and submission of drawings to the pipeline owner(s) and/or proper authorities and for obtaining the necessary permission to enter upon, cross over, or construct near any gas or oil transmission lines or other structures. The Developer shall bear the



full responsibility for any works, extra costs, damage claims or insurance costs related to any of the above-mentioned crossings. The Developer shall also submit documentary evidence that such permits have been obtained at the time of his initial submission of drawings to the Municipality.

**D.1.7** The Developer shall be responsible for obtaining the registration of all features of this water system with Alberta Environment.

**D.1.8** The Developer shall be responsible for obtaining any necessary construction permits, approvals or registrations from Alberta Environment as required by the Environmental Protection and Enhancement Act.

## **D.2 DESIGN REQUIREMENTS FOR URBAN WATER DISTRIBUTION SYSTEMS**

**D.2.1** The following are the minimum flow requirements for the proposed water distribution system:

i.	Population density (residential)-	3.5 persons/residence
ii.	Average daily demand (ADD)	320 L/person/day
iii.	Peak daily demand	2 x average demand
iv.	Peak hourly demand	4 x average demand
v.	Minimum residual water pressure during peak hour flow	280 kPa (40.6 psi)
vi.	Minimum residual water pressure- during maximum day + fire flow	140 kPa (20.3 psi)
vii.	Minimum residual water pressure- during maximum day flow (for operation of residential fire sprinklers)	350 kPa (50.8 psi)

**D.2.2** Polyvinyl chloride (PVC) pipe is the preferred option for all watermains. If required by the Municipality, sizing of watermains shall be determined by hydraulic network analysis. Results shall be submitted to the Municipal Engineer for review and approval. The minimum diameters of distribution mains shall be as follows (in certain situations, different sizes of watermains may be required by the Municipality):

- i. 150 mm diameter for single family residential subdivisions
- ii. 200 mm diameter for multi-family subdivisions
- iii. 250 mm diameter for industrial or commercial subdivisions
- iv. 150 mm diameter for cul-de-sacs

**D.2.3** Lines must be sized to accommodate the anticipated land use. Where watermains run for 200 m or more without ties to other watermains, the minimum pipe diameter shall be 200 mm. For lengths of pipe containing two or more fire

hydrant connections without ties to other watermains the minimum pipe diameter shall be 200 mm. The maximum velocity under normal operating conditions shall not exceed 3.0 m/sec.

**D.2.4** New subdivisions shall be designed and constructed such that all watermains within the proposed subdivision are looped, except where the service into a cul-de-sac is less than 120 m or less than 20 residential lots are being serviced.

**D.2.5** The Hazen-Williams equation shall be used for hydraulic calculations involving pressure pipe systems. The equation is as follows (for System International units):

$$V = 0.85 C R^{0.63} S^{0.54}$$

Where: V = velocity of flow (m/sec)

C = 140 (for PVC pipe)

R = hydraulic radius (m)

S = slope of energy gradient (m/m of length)

**D.2.6** Fire Flow

- i. The Municipality recognizes that, due to the nature and limited extent of existing infrastructure and the high cost associated with developing off-site improvements necessary to support required flows of water for fire protection purposes, the Municipality will not provide infrastructure necessary to deliver water flows required for fire protection in non-hamlet areas. Existing residential or industrial subdivisions outside of the hamlet areas that have fire flow rates are to have fire flow rates maintained.
- ii. The system shall be designed to meet the criteria contained in “Water Supply for Public Fire Protection (latest edition)” as produced by the Fire Underwriters Survey.
- iii. The minimum design fire flow for any watermain providing fire protection shall generally be as follows, plus allowance for peak day demand:
 

a. Commercial/Industrial Zoning	250 L/s
b. Institutional	180 L/s
c. Medium and High Density Residential	180 L/s
d. Single Family and Low Density Residential	100 L/s
- iv. The minimum residual pressure at any location in the distribution system at ground level under fire flow conditions shall be 140 kPa (20.3 psi).
- v. The Developer shall design the proposed piped water distribution system in a manner that the system capacity can meet the fire flow requirements to cover, if required, existing and future developed off-site infrastructure. The minimum pipe size required will be 150 mm. Hydraulic analysis will be required to determine whether there is enough flow and pressure in the system to accommodate fire hydrants.

- vi. Consideration shall be given to maintaining the required fire flow with a supply main cut off for repair. A supply main cut off for repair should not drastically reduce flow to any area. Industries that require greater rates of flow than can be provided by the distribution system may be required to install storage and pumping facilities adequate for their needs.
- vii. Where the municipal system can provide 75 L/sec (1000 igpm) at the boundary of the proposed subdivision, the water system extension shall be designed to produce a minimum of 75 L/sec (1000 igpm) fire flow in residential areas with a minimum residual pressure of 140 kPa at the hydrant from which the water is being taken. A lesser fire flow of 38 L/sec (500 igpm) may be acceptable to the Municipality if, upon their review, it is determined that the higher flow rate is impracticable.
- viii. Automatic sprinkler protection conforming to NFPA 13 Standards is encouraged for all subdivisions if the minimum flow and residual pressure requirements can be met.
- ix. Where required by the current National Building Code and Alberta Building Code, the Developer shall design dedicated self-contained fire water storage and delivery systems in accordance with the Code and NFPA 1231 Standards for the subdivision type and occupancy.

**D.2.7** Various components of waterworks systems should have a design life that is compatible with the function of the component. A water treatment plant should be designed for a minimum period of 10 years with provision for expansion to handle a 25-year design flow. Intakes and outfall structures, which have high base construction costs, should be designed for the entire design horizon of at least 25 years. Storage facilities, on the other hand, should be phased to avoid operational problems (such as increased chlorine demand or oversized pumps) which are associated with excess storage and detention times.

**D.2.8** In addition to the maximum operating pressures, there are transient pressures due to pump starts and stops, power failures, or rapid valve operation. Pumps should be designed to minimize these surges, and watermains should be designed to withstand these surges.

### **D.3 WATERMAIN**

#### **D.3.1 Watermain Alignment and Location**

- i. Watermain shall be located within the roadway right-of-way and outside the carriageway. Minimum depth of cover for the watermain shall be 3.4 m for both urban and rural subdivision.
- ii. Watermain shall be located a minimum of 3.0 m on center (o/c) from any sewer line, 1.5 m o/c from any catch basin and 1.8 m o/c from any gas line or as required by the utility company. Where power cables, telephone cables, television cables, or duct lines cross a watermain, they shall maintain 1.5 meter clearance when possible however a minimum distance of 1.0 m from any valve, hydrant or curb stop will be required.

- iii. Public Utility Lot (PUL) widths shall be at least 4.0 m for a single utility and 6.0 m for two or more utilities.
- iv. In all cases a minimum distance of 1.0 m from the watermain to property line shall be maintained.
- v. The watermain shall have sufficient depth of cover to provide complete frost protection. Watermains shall be installed to provide a minimum depth of cover of 3.4 m from the top of pipe to finished surface grade. In areas susceptible to frost damage, the Municipality may require that a qualified geotechnical firm provide a recommendation on installation methods to mitigate frost damage. All costs are to be borne by the Developer.
- vi. Under normal conditions, efforts shall be made to pass watermain pipes above the sewer pipes providing sufficient clearance between the pipes to allow for proper bedding and structural support of the watermain pipes. Pipe clearance when passing above sewer shall be a minimum of 300 mm separation between the top of the sewer pipe and the bottom of the watermain pipe. Pipe clearance when passing under any sewer shall be a minimum of 500 mm separation between the bottom of the sewer pipe and the top of the watermain pipe.
- vii. The bottom of fire hydrant flanges shall be located 50 mm above finished grade. Invert depths at fire hydrant locations shall be 2.5 m below the top of curb.
- viii. Water distribution and transmission systems in new subdivisions shall be looped wherever possible. Dead ends will be allowed in residential cul-de-sacs provided that a blow-off assembly or hydrant is installed at the end of the water main for maintenance flushing purpose.

#### **D.3.2** Watermain Materials

- i. Approved piping materials include:
  - a. AWWA C900 PVC DR 18 or DR 14 (from 100 mm to 300 mm diameter)
  - b. AWWA C905 PVC DR 25 (from 350 mm to 1200 mm diameter)
- ii. The Developer shall supply and install only new materials. All materials found to be defective or damaged shall be replaced at the cost of the Developer. The pipe shall not be more than two (2) years old at the time of installation.
- iii. Water quality testing, record keeping and reporting standards shall be as required by Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems published by Alberta Environment.
- iv. Joint lubricants must be certified for potable water use in accordance with National Sanitation Foundation Standards.
- v. PVC pipes:

- a. All pipe materials and fabrication shall conform to AWWA C900 or C905, as applicable.
  - b. PVC watermain from 100mm through 300 mm diameter shall be DR18, Class 150 (1035 kPa), PVC watermain from 450 mm through 900 mm diameter shall be DR25, Class 165 (1138 kPa).
  - c. PVC pipe shall be certified under CSA 137.3 and 137.0.
  - d. The pipe shall be supplied with integral wall thickened bell ends and jointless elastomeric gaskets conforming to ASTM F477.
- vi. Polyethylene pipes:
- a. The use of polyethylene pipe requires prior approval in writing by the Municipal Engineer.
  - b. All pipe materials and fabrication shall conform to AWWA C901 or C906, as applicable and meet NSF 61 standards.
  - c. Polyethylene pipe shall conform to CSA B137.1 and ASTM F714, D3035, D3350.
  - d. Watermain shall be minimum HDPE DR11 (Series 100).
  - e. Moulded fittings shall conform to ASTM D2683 or D3261.
  - f. Fabricated fittings shall be manufactured from pipe of the same series as that used in the piping system.
  - g. Pipe shall be joined by thermal butt-fusion, electrofusion coupling, flange assemblies or compression type fittings.
  - h. Compression couplings shall be used with stainless steel inserts.
  - i. Couplers shall be Victaulic Type 995 for use with HDPE piping or approved equal.
  - j. Valves shall be cast iron gates valves with flanged connections.
  - k. Each pipe length shall be marked for use with potable water, the manufacturer's name, nominal pipe size, dimension ratio, material grade, manufacturing standard, and a code indicating the date and place of manufacture.
- vii. Pipe casing:
- a. Steel pipe casings are to conform to AWWA C200, minimum tensile strength of 207 MPa.
  - b. Inside diameter of casing shall be at least 50 mm larger than the outside diameter of the carrier pipe bell and insulator runners.
  - c. Plastic/polyethylene carrier pipe insulators shall be used.

## **D.4 WATER SERVICE CONNECTIONS**

### **D.4.1 Water Services Alignment and Location**

- i. Separate water service connections shall be provided for:
  - a. each separately titled lot, and
  - b. each family dwelling in a multi-family subdivision, such as apartment building.
- ii. Minimum service diameter shall be 25 mm where the service length is 30 m or less. Where service lengths exceed 30 m, the minimum service diameter shall be 38 mm.
- iii. Non-residential service connections shall be sized according to anticipated demand.
- iv. Connections for all water services shall be installed at the time of initial subdivision development.
- v. Curb stops shall be located such that they do not conflict with driveway locations and shall not be placed within concrete sidewalks or driveways.
- vi. For trailer parks or other lots where a split into multiple separate users is present, a separate service line with metering chamber 1.5 m inside the property line is required for each lot/user.
- vii. A minimum 4.0 m utility easement is required to be registered on all lots at the subdivision stage.
- viii. The sewer and water services shall be installed to within 0.3 meters of the property line. In areas where natural gas distribution facilities and other utilities require an easement along the front of the property, the service connections shall be extended to the edge of the easement furthest from the roadway.
- ix. The minimum allowable distance between watermain stops shall be 600 mm and the minimum allowable distance between watermain stops and an adjacent collar or coupling shall be 300 mm.

### **D.4.2 Water Services Materials**

- i. Water service pipe shall be Series 160 Polyethylene tubing conforming to AWWA C901 and CSA B137.1. Type K Copper conforming to AWWA C800 may be used, at the discretion of the Municipal Engineer, in areas with minimum cover and areas of gravel conditions.
- ii. For water services 100 mm in diameter and larger, pipes, fittings and valves shall be matched to main pipe materials.
- iii. Corporation main stops, service saddles, curb cocks, stop cocks, drain cocks, service boxes and couplings shall be according to these standards. Compression connections with stainless steel inserts are required for all materials.

- iv. All fittings shall be designed for an operating pressure of 1035 kPa.
- v. Water service saddles shall be stainless steel type 304, bronze or a combination. Bronze components shall conform to ASTM B62, single or double band design.
- vi. Service saddles for use on polyethylene pipe shall be HYMAX or other Municipality approved coupling. Electrofusion saddles shall be allowed on HDPE pipe.
- vii. Operating rods shall be Type 304 stainless steel with brass cotter pins and brass clevis.

## **D.5 VALVES**

### **D.5.1 Valves Location and Spacing**

- i. The location and spacing of valves shall be such that when the system is in operation the following requirements are met:
  - a. No more than one fire hydrant will be put out of service by a watermain shutdown,
  - b. No more than three valves are required to affect a shutdown,
  - c. No more than twenty residential lots or units are out of service due to a watermain shutdown.
  - d. A valve(s) shall be installed at the end of any waterline which runs through the proposed subdivision to provide a connection points(s) to future subdivisions, in a manner that there will be no interruptions of water supply to the existing subdivision.
- ii. All valves shall be set in a vertical position and valve boxes must be adjustable. The top of valve boxes are to be set 5 mm below grade within both gravel & paved surfaced areas.
- iii. Valves should be no greater than 800 m apart on lines 450 mm in diameter and larger.
- iv. Valves and hydrants shall be located on the projection of the property lines or at the beginning of curb returns at intersections.
- v. Valves shall be located at both ends of a watermain passing through a utility lot or easement and shall be placed 500 mm from the property line.
- vi. Blow off valves (min. 50 mm) must be installed at the end of all dead end lines.
- vii. Valves shall be the same size as the corresponding main.
- viii. Gate valves on the distribution watermains shall be installed:
  - a. At the projection of property lines at mid-block,
  - b. At the projection of property lines at intersections.

**D.5.2 Valve Materials**

- i. All water valves shall be certified to National Sanitation Foundation (NSF) Standard 61 – Drinking Water System Components: Health Effects and Standard 14 – Plastics and Plumbing System Components.
- ii. Mueller gate valves typically utilized in distribution system. Other valve manufacturers to be approved by the Municipality prior to use.
- iii. All valves shall be provided with stainless steel nuts and bolts.
- iv. Operating nuts shall be located at depth 2 - 3 m below ground surface without rock shields on all valves.
- v. Air release valve should be placed at all significant high points in the transmission system. In addition, drain valve should be placed at low points of the mains to permit drainage during repairs to distribution main.
- vi. Gate valves for buried service (100 mm – 300 mm):
  - a. Operating pressure shall be 1035 kPa.
  - b. Gate valves shall conform to AWWA C500 for bronze mounted solid wedge valves or C509 for resilient seated valves.
  - c. Valves shall be an iron body, bronze mounted gate valve with non-rising stem, bell ends, single ring gasket and push-on joints for connecting to pipe with cast iron outside diameter.
  - d. Provide “O” ring seal for valve stem.
  - e. Provide 50 mm square operating nut turning clockwise to close.
  - f. Interior to be factory epoxy coated conforming to AWWA C550. Corrosion protection to be provided by installation of a zinc sacrificial anode.
  - g. PVC valve casing shall be used.
  - h. For blow offs valves to be flanged to AWWA C207, Class D.
- vii. Gate valves in chambers (450 mm – 1500 mm):
  - a. Must conform to same standards as above, in addition, 50 mm square operating nut shall be provided with hand wheel, horizontal setting, bevel gears, and position indicator. By-pass with gate valve to equalize pressure on opening and closing main valve shall be also provided.
- viii. Butterfly valves in chambers (450 mm and larger):
  - a. All butterfly valves shall conform to AWWA C504, Class 150B, short body flanged, and wafer or fully lugged cast iron body, rubber seat, and bronze disk.
  - b. Provide removable “O” ring shaft seals.
  - c. Provide manual geared buried service actuator conforming to AWWA C504.



- d. Screw type versus slide type valve casings shall be determined by the Developer's Engineer and approved by the Municipality.
  - e. Exterior and interior factor applied epoxy coating conforming to AWWA C550. Corrosion protection to be provided by installation of a zinc sacrificial anode.
- ix. Check valves:
- a. Swing check valves shall only be used for sizes 300 mm and smaller conforming to AWWA C508, cast iron body, bronze trimmed cast iron disk, flanged end to ANSI B16.1, bronze seat rings (minimum 1035 kPa working pressure).
  - b. Slanting disc check valves shall be used for sizes 300 mm and greater, cast iron body ASTM A126, Grade B, flanged ends to ANSI B16.1, ductile iron disk to ASTM A536, bronze seat and disc rings, stainless steel pivot pins and bushing to ASTM T303, valve position indicator (minimum 1035 kPa working pressure).
  - c. Double door check valves shall have a cast iron body to ASTM A126, aluminum bronze gates to ASTM B148, Grade B, stainless steel spring 316SS, stainless steel stop pin, ANSI 125# flanges, wafer or threaded lug type, Buna N valve seat (minimum 1035 kPa working pressure).
  - d. Silent check valves shall be wafer style or globe type, cast iron body to ASTM A126, Grade B, bronze trim, stainless steel spring 316 SS, Buna N valve seat, and ANSI 125 flanges (minimum 1035 kPa working pressure).
  - e. Rubber flapper check valves shall have a cast iron body, rubber lined Buna N replaceable flapper, and "O" ring seating (minimum 1035 kPa working pressure).
- x. Pressure reducing valves:
- a. Valves 200 mm and smaller shall be of single diaphragm type. Valves 250 mm and larger shall be double diaphragm type.
  - b. Valves shall be globe style, hydraulically operated, pilot controlled with flanged cast iron body to ANSI B16.1, Class 125. Valves shall have Type 304 stainless steel seat and stem.
- xi. Flow control valves:
- a. Valves shall be diaphragm type, globe or angle style with cast iron body and bronze trim for pipe size less than or equal to 150 mm.
  - b. Provide an "O" ring seat seal on main valve and strainer and needle valve on pilot inlet lines.
  - c. Gate valves shall be used for pipe size over 150 mm with cast iron body and bronze trim.

- xii. Air valves:
  - a. All air valves shall conform to AWWA C512 with minimum working pressure shall be 1035 kPa. Valve body and other materials will be determined by the Developer's Engineer and approved by the Municipality.
- xiii. Valve boxes:
  - a. Valve boxes shall be two sections, bottom is PVC and top shall be bituminous coated, Type A, cast iron adjustable type complete with a cast iron lid.
  - b. Valve boxes shall be of sufficient length to provide for adjustments of up to 300 mm in the up or down directions.
  - c. Valve box extensions shall be cast iron, suitable for use with the valve boxes to be installed.
  - d. All valve boxes located in roads shall be left flush with the base course asphalt or gravel. Immediately prior to the final lift of asphalt or gravel, the valve boxes shall be raised so that they are 5mm below the final grade elevation of the road.

## **D.6 FIRE HYDRANTS**

### **D.6.1 Fire Hydrants Location and Spacing**

- i. The maximum spacing between fire hydrants shall be 160 m for residential areas and 120 m for school, industrial or commercial areas, no greater than 75 m from any building. Additional fire hydrants shall be installed in high value property areas if deemed necessary by the Municipality.
- ii. Fire hydrants shall be located at the projection of the property lines or at the beginning of curb returns at intersections.
- iii. For cul-de-sacs, the fire hydrant shall be located at the end of cul-de-sac.
- iv. Fire hydrants shall conform with curb and sidewalk designs and shall be located as follows:
  - a. Areas with no sidewalk - hydrant to be no more than 2 m from back of curb.
  - b. Areas with monolithic sidewalk - hydrant to be no more than 0.75 m from back of walk.
  - c. Areas with separate sidewalk - hydrant to be no less than 1 m and no more than 1.8 m from back of curb.
- v. Fire hydrants shall be set plumb with the larger pumper nozzle at right angles (90°) to the road alignment. The bottom of ground flanges shall be set to an elevation 50 mm above finished grade. Fire hydrants shall be located to provide complete accessibility and to minimize possibility of damage from vehicles or injury to pedestrians. Unless otherwise approved

in writing by the Municipality, the location of the hydrant shall conform to the Approved Plans.

- vi. Fire hydrants shall be located 1.5 m from the curb face when there is no walkway and 2.7 m from the curb face when walkway exists.
- vii. Fire hydrant shall be connected to the watermain with a 150 mm maximum diameter PVC lead controlled by an independent 150 mm gate valve located at least 1 m apart from the fire hydrant. All underground fittings, bolts and nuts will be Stainless steel and wrapped with Denso wrap.
- viii. Fire hydrants within commercial or industrial subdivisions shall be protected by steel bollards. The Municipality may require bollards to protect hydrants within residential subdivisions that may be placed such that they are at particular risk of damage from vehicles.

#### **D.6.2 Fire Hydrants Materials**

- i. All fire hydrants shall be Canada Valve fire hydrants with the pumper nozzle being a stortz nozzle, unless otherwise approved by the Municipality.
- ii. All fire hydrants shall be certified to NSF Standard 61 – Drinking Water System Components: Health Effects and Standard 14 – Plastics and Plumbing System Components.
- iii. Compression type fire hydrants shall be supplied conforming to AWWA C502 for dry barrel fire hydrants.
- iv. Fire hydrants shall be designed for 1035 kPa working pressure.
- v. Fire hydrants shall be self-draining and a gravel drainage pit shall be provided on each fire hydrant lead. All fire hydrant drain port plugs shall be removed, unless otherwise requested by the Municipality. The Municipality shall be notified of any fire hydrants with plugged drain ports. The Record Drawings shall clearly indicate each plugged fire hydrant.
- vi. Fire hydrants shall have one steamer port, facing the roadway, with a 125 mm stortz connection, and two 65 mm connections with Alberta Mutual Aid thread at least 415 mm above the ground flange. The ground flange shall be located 50 mm above ground level. Nipples shall be provided with caps without chains or cables. The hose and pumper caps and fire hydrant valve shall open counter-clockwise.
- vii. Fire hydrants shall consist of a minimum 2.75 m barrel with 300 mm extension.
- viii. Fire hydrants shall have a 150 mm cast iron inside diameter inlet elbow with bell end and harnessing lugs. Elbow shall be flanged to the barrel.
- ix. Valve stem in fire hydrant head to have “O” ring seals.
- x. Operating nut shall be either three or five sided, or as approved by the Municipality.

- xi. Fire hydrants shall have stainless steel bolt assemblies throughout.
- xii. External paint shall conform to AWWA C550 (Corrosion Resistant) and be the following colours:
  - a. Barrel – yellow as approved by the Municipality.

## **D.7 FITTINGS**

- D.7.1** All fittings shall be coated cast iron conforming to AWWA C110 or PVC injection moulded conforming to CSA 137B with compatible rubber joints and belled ends for the pipe or as otherwise approved by the Municipality.
- D.7.2** PVC fittings:
- i. Injection moulded fittings shall conform to AWWA C907 and CSA B137.2.
  - ii. Extruded fittings shall conform to AWWA C900 and CSA B137.3.
  - iii. Fittings shall be “push-on” type with elastomeric gaskets of pressure actuated seal design and shall be used with PVC or ductile iron pipe.
- D.7.3** Thrust blocks:
- i. Thrust blocks shall be installed at all locations where there is a bend or a joint of pipes or a fitting. Thrust blocks shall be installed between solid ground and the bend, joint or fitting and shall be anchored so that the pipe and fitting joints are accessible for repair. Metal harnesses or corrosive resistant tie rods and pipe clamps shall be used to prevent movement when requested by the Municipality. Refer to the applicable drawings for more details.

## **D.8 COUPLINGS AND ADAPTORS**

- D.8.1** PVC couplings shall conform to AWWA C900, C906, or C907 as applicable.
- D.8.2** Bolted sleeve couplings shall conform to AWWA C219 with carbon steel bodies with epoxy coating conforming to AWWA C213 or AWWA C550 as applicable. Couplings shall have a minimum operating pressure of 1035 kPa. Linings shall be in accordance with AWWA C210, C213 or C550 and be suitable for use with potable water.
- D.8.3** Flange adaptors shall conform to AWWA C219 with carbon steel bodies with epoxy coating conforming to AWWA C210, C213 or C550 as applicable. The minimum operating pressure shall be 1035 kPa. Flanges shall conform to AWWA C207, Class D. Linings shall be in accordance with AWWA C210, C213 or C550 and be suitable for use with potable water.
- D.8.4** Couplings for grooved and shouldered joints shall conform to AWWA C606 and shall have operating pressures, coatings and linings as above.

## **D.9 TAPPING SLEEVES**

- D.9.1** Tapping sleeves shall conform to AWWA C207, Class D with carbon steel body with fusion bonded epoxy coating or Type 304 stainless steel.
- D.9.2** Tapping sleeves for concrete cylinder pipe shall conform to AWWA Manual M-9, body and tapping gland to be fusion epoxy coated to AWWA C213, outlet flange to AWWA C207, Class D.

## **D.10 METERS**

- D.10.1** The Municipality utilizes Sensus or Master meters. All water meters shall conform to AWWA C700, C701 and C710. Meters are provided by the Municipality and the Developer shall be billed.
- D.10.2** Meter chambers are required for trailer parks and other similar types of subdivisions. The meter chambers shall be water tight and frost-free manhole type.
- D.10.3** The meter box shall be Mueller/McCullough Thermal-Coil or approved equal.
- D.10.4** Chamber shall be 380 mm diameter PVC SDR 35 with a 3 m bury.
- D.10.5** Chamber shall be insulated on the sides with 50 mm polyethylene insulation complete with 1.27 mm thick, high density black polyethylene jacket. The jacket shall be factory installed using the “U.I.P.” system furnished by Urecon Ltd. or approved equivalent. The top shall be insulated with 100 mm factory supplied insulation.

## **D.11 CATHODIC PROTECTION**

- D.11.1** All buried metallic fittings and valves shall be cathode protected with 2.3 kg zinc anodes and all fire hydrants shall be cathode protected with a 5.5 kg zinc anode. Zinc anodes shall conform to ASTM B418-73 Type II.
- D.11.2** All old steel, cast iron, or ductile iron being connected to must have at least two 7.7 kg magnesium anodes at point of connection as specified by the Engineer.
- D.11.3** Lead wires shall be No. 10A WG/7 and be 2 m in length. Wire shall be connected to fittings, valves, and hydrants with cadwelds.
- D.11.4** A minimum of 3 litres of water shall be poured on each anode to initiate the galvanic reaction.

## **D.12 GENERAL MATERIAL REQUIREMENTS**

- D.12.1** Unless specified with better material accepted by the Municipal Engineer, all underground water retaining structure and associated structures (valve chambers, pump chambers, etc.) shall be designed against frost and sulphate attack (ASTM Type V) and it shall conform to ACI 350R – 89 “Environmental Engineering of Concrete Structure” and to CSA A23.1. Concrete Grade 30 shall be used and tested in accordance with CSA 23.2.

- D.12.2** Minimum of 100 mm thick bedding of granular material (gravels or sand, with no particles larger than 32 mm) must be placed and compacted to form a leveling bed for the aforesaid structures.

### D.13 CONSTRUCTION

#### D.13.1 Trenching, Bedding and Backfilling

- i. All trenching and backfilling shall be completed in strict accordance with Occupational Health and Safety Guidelines.
- ii. If unsuitable soil conditions are encountered, proper measures for dealing with the conditions shall be identified either on the design drawings or as a brief report to the Municipal Engineer prior to construction.
- iii. Granular materials shall be well graded and approved by the Municipality before use. Class “B” pipe bedding shall be utilized in suitable soil conditions. Washed rock shall be used if water table is above the pipe zone. Bedding sand shall have minimum depth of 100 mm below the pipe and shall extend up both sides to the trench wall and provide a minimum cover of 300 mm above the pipe. Where necessary, the Developer’s Engineer shall determine special pipe foundation measures for areas where unsuitable pipe foundation conditions exist. Bedding sand bedding sand must be clean and meet the following requirements:

Sieve Size Passing	% Passing, By Mass
2,500	100
630	60 or more
315	30 or less
160	20 or less

- iv. The minimum trench width measured at the pipe spring line shall be the pipe outside diameter plus 450 mm. The maximum trench width measured at the pipe spring line shall be the pipe outside diameter plus 600 mm. The Municipal Engineer must be notified and consulted with if the trench must be excavated deeper or wider than specified.
- v. Excavated material shall be stockpiled at a safe distance from the edge of the trench. Backfill material shall be the soil excavated from the trench although approved granular materials may be substituted for poor existing soils. All backfill material will be subject to approval by the Municipality. If possible, the excavated material shall be placed back in the trench in the vertical and horizontal order in which it was excavated. Backfill shall be placed in uniform lifts not exceeding 300 mm loose thickness. Where clay is used as backfill material, its moisture content shall not exceed the Plastic Limit by more than ten percent (10%).
- vi. Within roadways, under no circumstances shall backfill material containing ice, snow, organic or any other deleterious material be used. Trench excavations shall be kept free of water.

- vii. Compaction and densities.
- a. Prior to street construction: all excavations under proposed carriageways, sidewalks, street lights or other similar surface structures shall be backfilled in lifts with maximum compacted thickness of 300 mm or less per lift and compacted to minimum density of not less than 98 % of the Maximum Standard Proctor Density or as otherwise approved by the Municipality. A minimum of two (2) density tests per 100 lineal meters of trench per 600 mm of compacted backfill thickness shall be taken. Additional tests may be called for as deemed necessary. Any free water in a trench shall be removed prior to placing additional lifts.
  - b. Under existing carriageways: all excavations under existing carriageways, sidewalks, lanes or other similar surface structures shall be backfilled to meet the following specifications:
    - 300 mm or more below final grade – backfill materials shall be compacted to minimum density of not less than 98 % of the Maximum Standard Proctor density.
    - 0 - 300 mm below final grade – backfill materials shall be compacted to a minimum of 100 % of the Maximum Standard Proctor Density and based on a minimum of two (2) field tests per 100 lineal meters of trench of compacted backfill. Backfill shall be placed in uniform lifts not exceeding 150 mm of compacted thickness.
  - c. Adjacent to existing carriageways: all material 300 mm below the finished grade shall be compacted to a density not less than 98 % of the Maximum Standard Proctor Density of a five point Standard Proctor Compaction Test and based on a minimum of one (1) field test per 150 lineal meters of trench for each 600 mm of compacted vertical backfill.
  - d. Sand or gravel backfill shall be compacted to meet the following density requirements:
    - 300 mm or more below grade - the minimum acceptable density shall be 98 % of the Maximum Standard Proctor Density.
    - 0 - 300 mm below grade - all sand or gravel in this zone shall compact to 100 % of the Maximum Standard Proctor Density.
  - e. For all density tests indicating insufficient compaction, two (2) more density tests, proportionately representative of the trench length, shall be taken at that depth. If the average of the three (3) tests is below the required density, the area of deficient density shall be re-excavated and re-compacted to meet the specified density. Densities greater than 100 % shall be deemed to be at 100 % for calculating the average of the three tests.
- viii. The Developer's Engineer shall identify areas where the trench excavation requires sheathing, shoring or bracing in order to protect workers, property or adjacent structures.

- ix. If the above standards cannot be achieved due to a large variation in soil types throughout the subdivision, the Municipal Engineer may, at his sole discretion, establish a more appropriate standard on an individual case basis. One-mould Proctor density testing may be permitted if the Developer submits an acceptable proposal prepared by the Developer's Engineer justifying the required changes to the compaction standards.
- x. If the established minimum compaction standards cannot be met due to abnormal weather or wet ground conditions, the Municipal Engineer may establish a more suitable standard on a site-specific basis provided adequate justification is presented by the Developer. One-mould Proctor density testing shall not be permitted as an alternate testing procedure due to wet soil conditions. The Developer's Engineer shall be required to suggest appropriate measures such as drying in-situ material or importing suitable material in order to meet the required minimum densities.
- xi. All landscaping, pavement structures, sidewalks, curb and gutter, and any other existing structures and facilities damaged or removed during trenching shall be restored or replaced at the Developer's expense.
- xii. All debris, surplus fill and unused materials must be removed from the site as directed by the Municipal Engineer.

#### **D.13.2** Watermain Installation

- i. The pipe and gasket installation shall be conducted in compliance with the pipe manufacturer's specifications.
- ii. Installation of PVC pipe and fittings shall conform to AWWA M23.
- iii. Field welding procedures shall be in accordance with CSA Z662. Welders shall be qualified as B pressure welders.
- iv. Pipes shall be carefully aligned when jointing. Joints are to be kept free of mud, gravel and foreign material and shall be completed as outlined in the manufacturer's specifications. Each joint shall be completed before laying the next length of pipe. Deflections shall not exceed those permitted by the pipe manufacturer.
- v. The pipe must be thoroughly flushed of all dirt, stones and pipe lubricant when complete. When pipe installation is not in progress, the open ends of installed pipe shall be closed with an approved plug or cap to prevent entrance of trench water and/or any foreign or other material into the line.
- vi. Adequate backfill shall be placed on the pipe to prevent floating. Any pipe which has floated shall be removed from the trench and be re-installed as directed by the Municipality.
- vii. The alignment of pipes less than 900 mm in diameter shall not be more than 150 mm off the designated alignment. The alignment for pipes larger than 900 mm shall not deviate by more than 50 mm per each 300 mm of diameter.



- viii. The invert of the pipe shall not deviate from the design grade by more than 40 mm.
- ix. Each valve and fitting shall be permanently supported independently of the pipe with 30 MPa concrete.
- x. All bell and spigot joints shall be sealed with rubber rings, unless otherwise approved in writing by the Municipality. All defective joints shall be cut out and entirely replaced with new material.
- xi. The cutting of pipe for closure to fittings, valves and other reasons shall be done in a neat and workmanlike manner, without damage to the pipe and so as to leave a smooth edge at right angles to the axis of the pipe. Pipe cutting for valves and fittings shall be done accurately so as to bring all valves and fittings to their correct positions. Cut standard pipe used with rubber gasket joints shall be field machined and chamfered as required by the manufacturer's instructions.
- xii. Standard plugs shall be inserted into the bells of all dead end fittings and plain ends of pipe. A concrete thrust block shall then be placed behind this plug backing onto undisturbed material. A valve shall be placed within a distance of two full pipe lengths (12 m typical) from the end of the pipe or between the plug and fitting, as required.

#### **D.13.3 Valves Installation**

- i. Valves, valve casings and fittings shall be installed in accordance with the manufacturer's specifications.
- ii. All valves shall be installed with a concrete thrust block.
- iii. Valve casings shall be set at grade for unpaved areas and 5 mm below grade for paved/ gravel surfaces and sidewalks.
- iv. Upon completion, all valve casings must be checked to ensure that they are plumb and that the operating nut can be turned properly.

#### **D.13.4 Fire Hydrants Installation**

- i. Fire hydrants shall be installed in accordance with the manufacturer's specifications and AWWA M17.
- ii. All fire hydrants shall be installed with a concrete thrust block.
- iii. A gravel drain shall be provided at the base of the fire hydrant barrel consisting of a minimum of 1 m<sup>3</sup> of washed rock.
- iv. Fire hydrant drain ports shall be left open except where the water table is above the fire hydrant drain. The Municipality shall be notified of fire hydrants with plugged drain ports.
- v. Upon completion, all hydrants must be checked to ensure that they are plumb and that the operating nut is functioning properly.

**D.13.5** Water service connections installation:

- i. Residential water services shall be installed in common trench with the sanitary and storm sewer services. Double services may be in a common trench to the property line.
- ii. Tapping into the existing watermain for new residential service connections shall be done with full operating pressure in the existing watermain. The tap shall be made within 30° of the pipe crown and adjusted to service trench level. The service line shall be supported by sand bags until it reaches trench level.
- iii. A tapping valve and sleeve must be used for services 100 mm in diameter and larger.
- iv. Curb stops shall be installed 300 mm into right-of-way from the property line.
- v. Services crossing existing roadways and/or sidewalks shall be augured, bored or tunneled unless otherwise approved by the Municipal Engineer.

**D.14 OPERATION OF BOUNDARY VALVES AND EXISTING FIRE HYDRANTS**

**D.14.1** The Developer shall notify the Municipality at least 48 hours (two full business days) in advance of boundary valve operation requirements. The designated Municipality personnel shall operate the boundary valves.

**D.14.2** The Developer shall not use a fire hydrant as a water source for construction without permission from the Municipality. Arrangements for payment for water used may be required. The Municipality may outline conditions of use depending on the circumstances.

**D.14.3** The Developer may be required to tie into an existing water distribution system, or to temporarily shut off the existing water supply, in order to undertake construction activities related to the proposed subdivision. When these situations are required, the Developer shall take the following actions at his own expense:

- i. Notify the Municipality of the proposed work and anticipated schedule.
- ii. Supply all water needed for the work. If the required water supply is withdrawn from the existing water distribution system, an arrangement that details compensatory requirements shall be made between the Developer and the Municipality.
- iii. Obtain written permission from the Municipality prior to operating any of the Municipality's water valves, fire hydrants, or other appurtenances associated with an existing water distribution system. The Developer shall be held responsible for any damage to existing appurtenances or the surrounding area that result from the construction activities. The Municipality may require their own personnel to operate the existing water valves, fire hydrants, or other appurtenances.

- iv. Provide 24 hours written notice to all customers affected by disruptions in the existing water distribution system.
- v. Supply an alternate source of potable water to all customers affected by water distribution system disruptions greater than 4 hours in duration.
- vi. Provide an alternate continuous source of potable water to all customers that require an uninterrupted source for their daily operations.

## **D.15 INSPECTION AND TESTING**

**D.15.1** All water distribution system installations shall be subject to inspections by the Municipal Engineer prior to issuance of the Construction Completion Certificate and Final Acceptance Certificate.

### **D.15.2** Hydrostatic Pressure Testing

- i. The entire system shall be subjected to a hydrostatic pressure test in the presence of the Developer's Engineer. The Developer shall be responsible for the supply of all necessary labour, materials and equipment to complete the testing. The Developer shall notify the Municipality at least 48 hours (two full business days) in advance of the testing.
- ii. Acceptable test sections shall be selected in consultation with the Municipal Engineer. The maximum length of distribution watermain test sections shall be 450 m. The maximum length of transmission watermain sections shall be 800 m.
- iii. The test section shall be filled with water 24 hours prior to the test. All thrust blocks must be cured and backfill partially or completely done.
- iv. Ensure that all watermain valves and fire hydrant isolation valves in the test section are fully opened and that the fire hydrants are closed.
- v. Ensure that all air is expelled from the test section using fire hydrants, service taps, high points, and dead-ends. Raise the watermain pressure to the test pressure. The test pressure shall be 150 % of the working pressure measured at the lowest elevation or 1035 kPa, whichever is greater.
- vi. Note the pressure and water level at the beginning of the test. The test duration shall be 2 hours. The pressure shall be maintained within 20 kPa of the specified test pressure throughout the duration of the test.

- vii. Measure the water level at the end of the test and calculate the observed leakage. Compare against the allowable leakage calculated as follows:

$$L = \frac{NDP^{1/2}}{128,225} \quad \text{for PVC pipe}$$

$$L = \frac{NDP^{1/2}}{32,046} \quad \text{for ductile iron pipe}$$

Where: L = allowable leakage (L/hr)

N = total number of joints

D = nominal pipe diameter (mm)

P = test pressure (kPa)

- viii. The allowable leakage shall be determined by the following table:

**LEAKAGE ALLOWANCE IN LITRES PER 100 JOINTS PER HOUR**

**(PVC pipe, new construction)**

**Test Pressure (kPa)**

**Pipe Ø**

<b>(mm)</b>	<b>345</b>	<b>515</b>	<b>690</b>	<b>860</b>	<b>1035</b>	<b>1380</b>	<b>1550</b>
<b>150</b>	2.17	2.65	3.07	3.42	3.76	4.34	4.60
<b>200</b>	2.89	3.54	4.09	4.57	5.02	5.79	6.14
<b>250</b>	3.62	4.42	5.19	5.71	6.27	7.24	7.67
<b>300</b>	4.34	5.31	6.14	6.86	7.52	8.69	9.21
<b>450</b>	6.51	7.96	9.21	10.29	11.28	13.03	13.81
<b>600</b>	8.69	10.61	12.28	13.71	15.05	17.37	18.41
<b>750</b>	10.86	13.27	15.35	17.14	18.81	21.72	23.01
<b>900</b>	13.03	15.92	18.42	20.57	22.57	26.06	27.62

Leakage allowance for new construction for materials other than PVC shall be in accordance with the applicable AWWA standard.

Each section between valves shall be brought to test pressures with the valves closed, to test the valves under pressure. Test pressure shall be held without loss for 2 minutes before opening the valve and releasing the pressure into the next section.

- ix. No watermains shall be charged and no pressure and leakage tests shall be permitted between October 15<sup>th</sup> and April 15<sup>th</sup> inclusive, unless approved by the Municipality.

**D.15.3 System Disinfection**

- i. Watermains are to be disinfected and flushed in accordance with AWWA C651 using the continuous feed method.
- ii. The Developer shall notify the Municipality at least 24 hours in advance of the testing.
- iii. Chlorine residual tests shall be performed at the beginning and at the end of the disinfection procedure and shall be repeated again after flushing the lines.
- iv. Under Alberta Environment standards and regulations, super chlorinated water used for disinfection of the system cannot be directed into a storm sewer or open water body. Dechlorination will be required prior to flush water being discharged into the environment.
- v. Approximately 16 hours after flushing the chlorine, one (1) bacteriological sample for each section of watermain shall be taken and submitted for analysis unless otherwise directed by the Developer's Engineer. Where dead ends exist, samples shall be taken at the end of the line. For this purpose, a temporary service water line with water valve may be installed. Approved bacteriological sample containers from the Provincial Laboratory of Public Health or the local Health Unit must be used. Testing procedures to adhere to AWWA C651.
- vi. The watermains shall not be commissioned and put into use until the bacteriological sample results are reviewed and approved by the Municipal Engineer. The disinfected watermain shall be flushed prior to being put into full active service. Dechlorination of the test water with neutralizing chemicals may be required prior to discharge to meet the regulatory requirements of Alberta Environment. Dechlorination activities shall be in accordance with the latest edition of AWWA standard C651. The chlorine residual and bacteriological test results must be reviewed and approved by the Municipal Engineer prior to the watermain being put into full active service.
- vii. The Developer shall be responsible for obtaining the necessary supply of test water for the watermain disinfection process as well as all associated costs.

**D.15.4 Fire Hydrants Flow Test**

- i. Prior to issuance of the Construction Completion Certificate, hydrants flow testing shall be conducted by the Developer's Engineer to verify that the flows and pressures identified in the design calculations are being provided in the field. The Developer's Engineer shall coordinate the testing with the Municipality representative to ensure he is present for all testing. Results of the testing shall be compiled by the Developer's Engineer and submitted to the Municipality representative with a comparison of the actual flows and design flows for the same hydrant.

- ii. Where the actual flows do not meet the minimum fire and service requirements all hydrants in the project must be tested and the Developer must advise the corrective action he shall be taking to provide the necessary service level. The location and extent of initial testing shall be as required by the Municipality representative.

## **D.16 WATER STORAGE FACILITIES**

**D.16.1** Municipal potable water reservoirs shall be designed and constructed as an underground concrete reservoir and sized to accommodate 2 times maximum daily demand when no fire storage is required.

**D.16.2** When fire storage is required, potable water reservoirs shall be sized to accommodate the larger of:

$$S = (A + B + C)$$

Where: S = Total storage requirement (m<sup>3</sup>)

A = Fire storage (m<sup>3</sup>)

B = Equalization storage = 25 % of maximum daily demand (m<sup>3</sup>)

C = Emergency storage = Min. 15 % of average daily demand (m<sup>3</sup>)

Disinfection contact time storage required to meet Alberta Environment requirements or 2 times maximum daily demand.

**D.16.3** All municipal water storage facilities shall be designed with security features acceptable to the Municipality. All fences, doorways and hatches shall be lockable. Access shall be restricted to authorized personnel only.

## **D.17 TRICKLE FEED WATER DISTRIBUTION SYSTEM**

**D.17.1** The use of a trickle feed water system must be approved by the County. The Developer's Engineer shall prepare a report that identifies the design parameters and calculations used for sizing the system for the County's review.

**D.17.2** The design must accommodate a minimum residual pressure of 70 kPa (10psi) at the meter lift assembly location and elevation on any of the proposed lots.

**D.17.3** Residential water demand is defined as 3.8 L/unit/min at the meter lift assembly location and elevation. Within Mackenzie County, residential population density is defined as 3.5 persons/unit.

**D.17.4** A curb stop shall be installed between the water main and all permanent air release valves.

**D.17.5** All materials and installation methods for mains and service connections are to adhere to those listed in Section D – Water Distribution System.

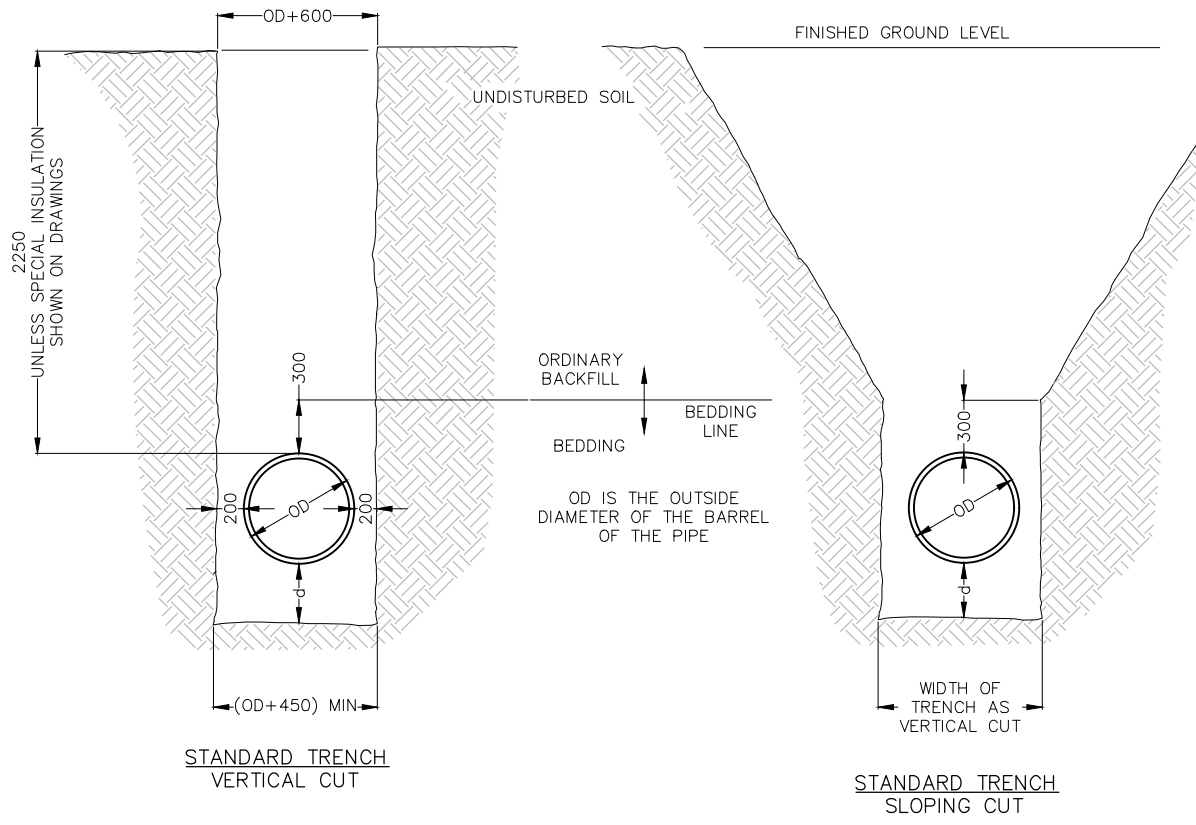
**D.17.6** Main connections shall be fused saddle or fused inline tee. No mechanical connections are permitted.

- D.17.7** The Developer's Engineer must ensure that each lot will be properly designed and serviced with a shut-off valve, flow restrictor, cistern, float valve, power, and water meter.
- D.17.8** The watermain distribution pipe for trickle feed systems shall be a minimum of DR11 HDPE. Sizing to be determined by the Developer's Engineer.
- D.17.9** Water service pipe shall be a minimum diameter of 25mm DR 11 HDPE certified for potable water.
- D.17.10** The watermain shall have sufficient depth of cover to provide complete frost protection. Watermains shall be installed to provide a minimum depth of cover of 3.4 m from the top of pipe to finished surface grade. The service shall be installed with a minimum 2.90m depth of cover from finished grade to the top of the pipe. In areas susceptible to frost damage, the Municipality may require that a qualified geotechnical firm provide a recommendation on installation methods to mitigate frost damage. All costs are to be borne by the Developer.

**D.18 LIST OF DRAWINGS**

- D-01 Standard Trench Dimensions for Circular Pipe
- D-02 Standard Trench Bedding for Circular Pipes
- D-03 Bedding Detail
- D-04 Typical Casing Pipe with Insulator
- D-05 Insulation Requirements for Water Mains / Services
- D-06 Single Low Pressure Sanitary Service
- D-07 Typical Industrial Single Service
- D-08 Typical Industrial Dual Service
- D-09 Thrust Block Details
- D-10 Type 'A' – 30In Top Section c/w PVC Bottom Section
- D-11 Typical Hydrant Connection
- D-12 Flush Point Detail
- D-13 Service Box Detail for 50mm & Smaller Water Service
- D-14 Anode Installation on 50mm & Smaller Copper Water Service
- D-15 Typical Anode Installation at Steel or Iron Fittings used with PVC Watermains
- D-16 Anode Installation for Steel and Iron Water Mains
- D-17 Anode Installation at Hydrant
- D-18 Automatic Air Valve Chamber Detail (Plan)
- D-19 Automatic Air Valve Chamber Detail (Profile)
- D-20 Valve Chamber Detail (Plan)
- D-21 Valve Chamber Detail (Profile)
- D-22 Meter Lift Assembly Installation Details
- D-23 Underground Air Valve System





(EXCAVATION TO BE SHORED AS PER OCCUPATIONAL HEALTH AND SAFETY STANDARDS)

(EXCAVATION TO BE SLOPED AS PER OCCUPATIONAL HEALTH AND SAFETY STANDARDS)

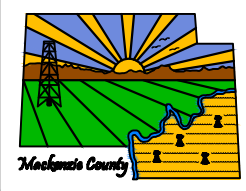
MAXIMUM TRENCH WIDTHS FOR SINGLE PIPES  
 -UP TO AND INCLUDING 400mm $\phi$  - 1000mm  
 -450mm $\phi$  AND ABOVE - OD + 600mm

DEPTH OF BEDDING BELOW PIPE BARREL (d)  
 -100mm MIN.

NOTE:  
 1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

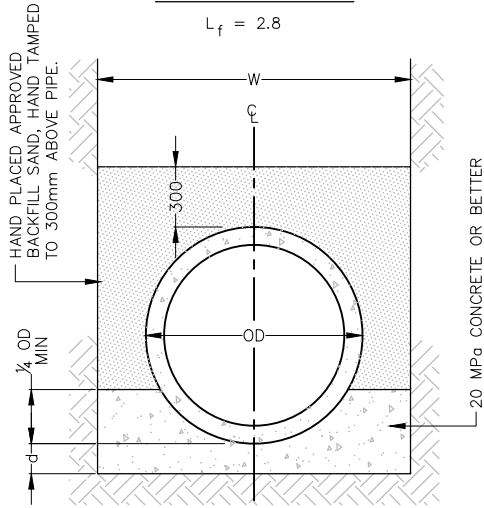
## General Municipal Improvements Standards



Rev.				STANDARD TRENCH DIMENSIONS FOR CIRCULAR PIPE	Approved:	Figure <b>D-01</b>
Rev.						
Rev.						
Rev.	2021-FEB-15	File No.: GP60.33682	Design:			
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			

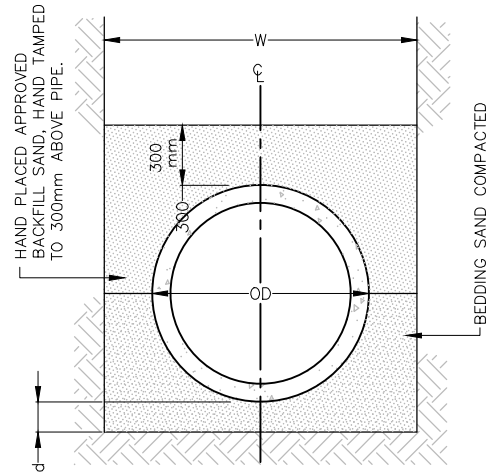
**CLASS A BEDDING**

$L_f = 2.8$



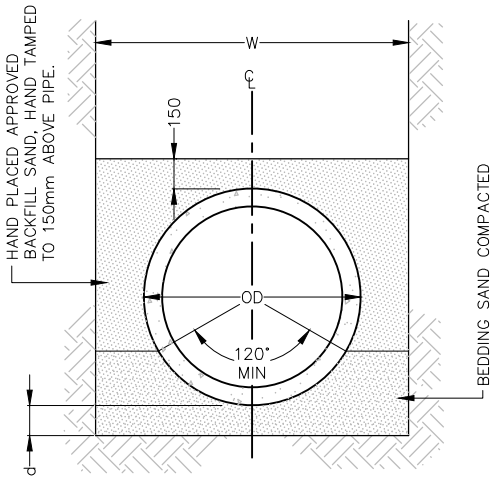
**CLASS B BEDDING**

$L_f = 1.9$



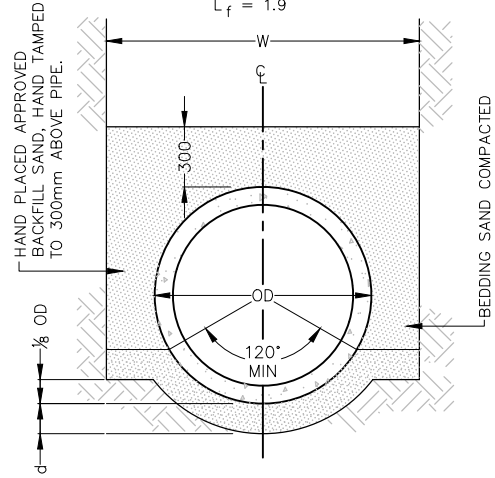
**CLASS C BEDDING**

$L_f = 1.5$



**CLASS B BEDDING**

ALTERNATE - 375mm I.D. & UNDER  
 $L_f = 1.9$

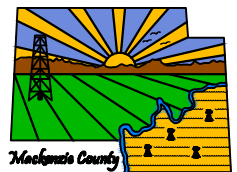


NOTES:

1. W = TRENCH WIDTH - O.D. + 450mm (MINIMUM).  
- 1000mm max. FOR PIPES UP TO AND INCLUDING 400mm DIAMETER.  
- O.D. + 600mm max. FOR PIPE DIAMETERS 450mm AND ABOVE.
2. O.D.= OUTSIDE PIPE DIAMETER.
3. I.D. = INSIDE PIPE DIAMETER.
4.  $L_f$  = LOAD FACTOR.
5. d = DEPTH OF BEDDING BELOW PIPE = 150mm (MIN).
6. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
7. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

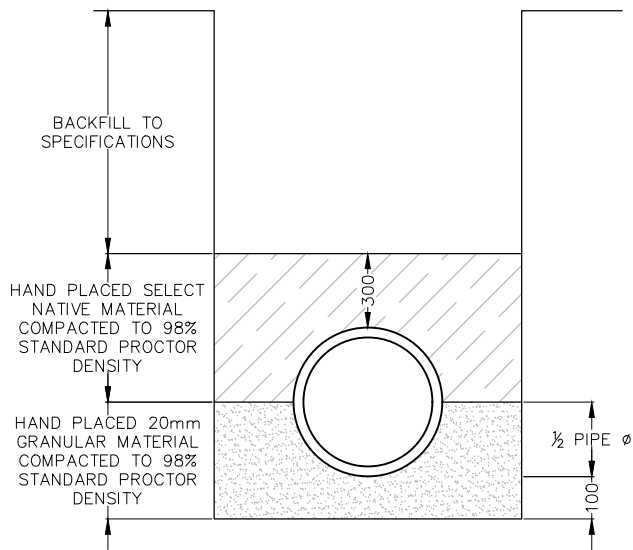


### STANDARD TRENCH BEDDING FOR CIRCULAR PIPES

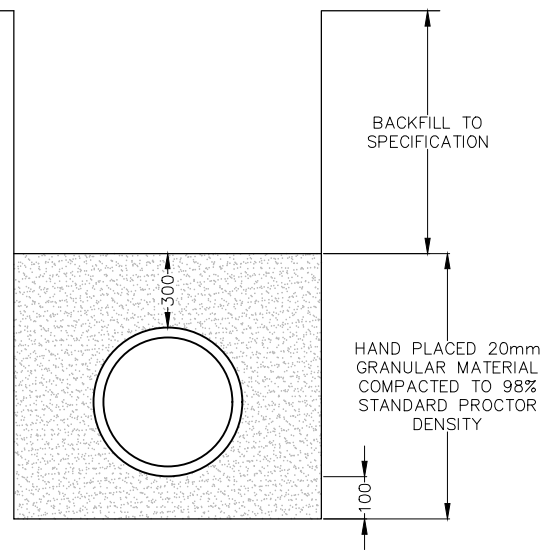
Approved:

Figure **D-02**

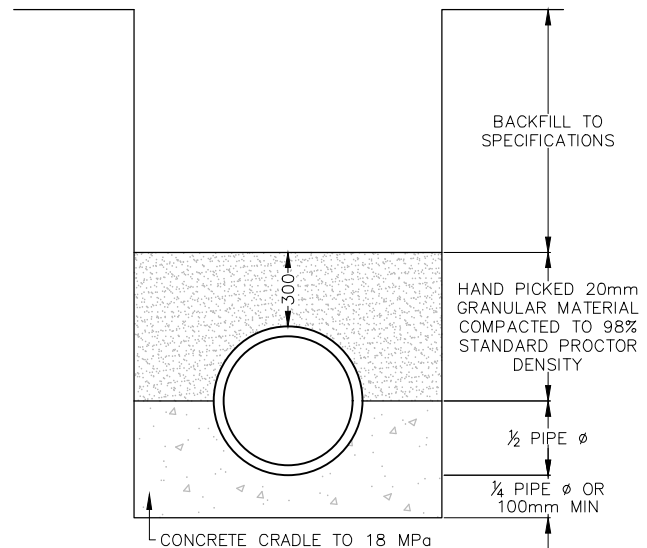
Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S



CLASS B



CLASS B-1



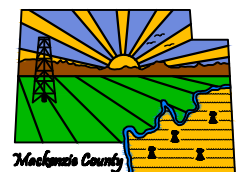
CLASS A-1

NOTES:

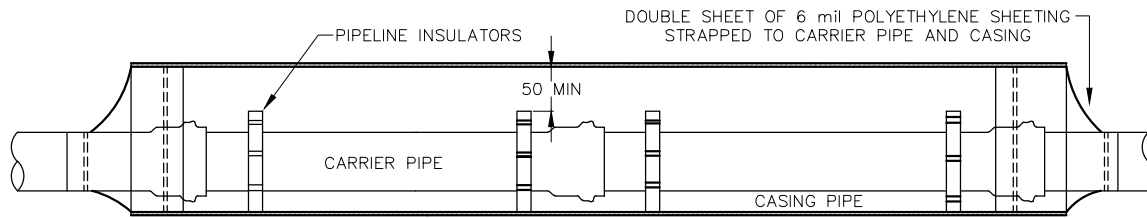
1. SAND MAY BE ALLOWED ON PIPE SIZES LESS OR EQUAL TO 375mm DIAMETER.
2. WITHIN THE PIPE ZONE:  
 MINIMUM TRENCH WIDTH – PIPE DIAMETER + 450mm.  
 MAXIMUM TRENCH WIDTH – PIPE DIAMETER + 600mm.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
4. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4

# MACKENZIE COUNTY

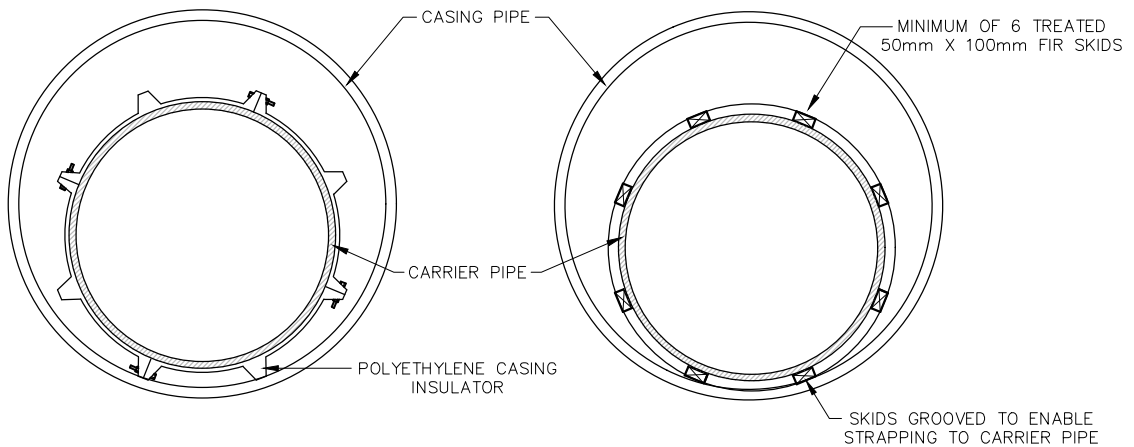
## General Municipal Improvements Standards



Rev.				BEDDING DETAIL	Figure <b>D-03</b>
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:	Approved: 	
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		



ELEVATION



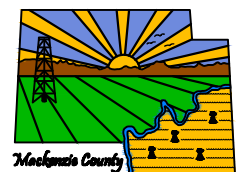
SECTION

NOTES:

1. CASING MATERIAL AND THICKNESS TO BE AS SPECIFIED ON CONSTRUCTION DRAWINGS.
2. INSULATOR SPACING TO BE DETERMINED BY THE MATERIAL AND JOINT TYPE OF CARRIER PIPE BEING USED.
3. CASING COATING AND CATHODIC PROTECTION REQUIREMENTS TO BE AS SPECIFIED ON CONSTRUCTION DRAWINGS.
4. MINIMUM SPACING OF 50mm IS REQUIRED BETWEEN SPACER AND CARRIER PIPE. MAXIMUM SPACE WILL DEPEND ON THE CARRIER PIPE DIAMETER, TYPE OF SPACERS USED CASING PIPE DIAMETER. OVERALL THE MAXIMUM SPACING SHOULD BE NO MORE THAN 200mm.
5. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



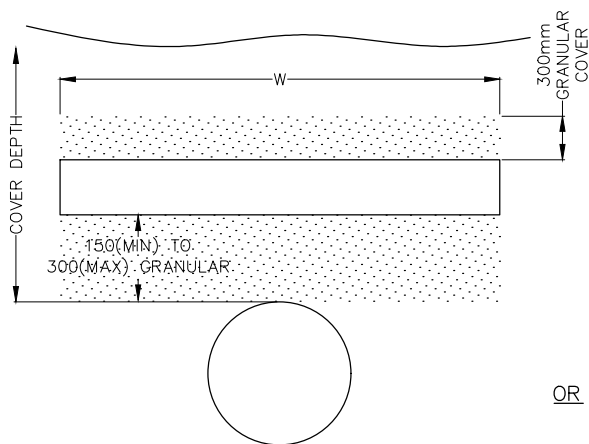
### TYPICAL CASING PIPE WITH INSULATOR

Approved:

Figure **D-04**

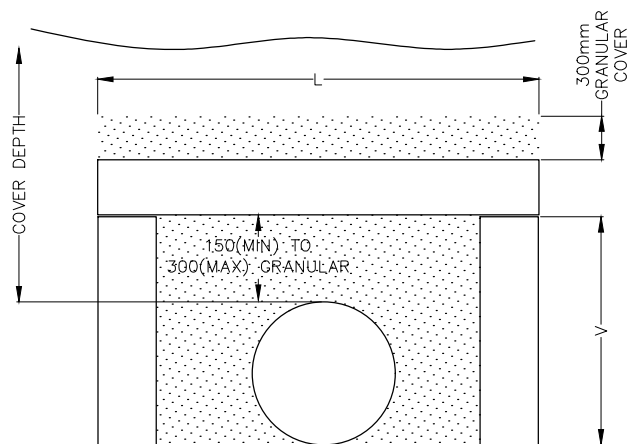
Rev.			
Rev.			
Rev.	2021-FEB-15		
Rev.	2012-JAN-25	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

COVER DEPTH m	THICKNESS mm (IN)	WIDTH (W) m
1.1 – 1.4	90 (3.5)	3.4
1.4 – 1.7	75 (3.0)	2.8
1.7 – 2.0	75 (3.0)	2.2
2.0 – 2.3	50 (2.0)	1.6
2.3 – 2.6	40 (1.5)	1.0
2.6 – 2.9	40 (1.5)	1.0
BELOW 2.9	-	-



HORIZONTAL

OR



INVERTED U

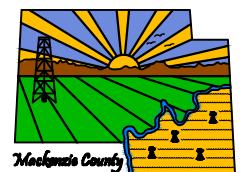
$W = L + 2V$   
 $V$  TO BE LESS THAN OR EQUAL TO  $L$


NOTE:

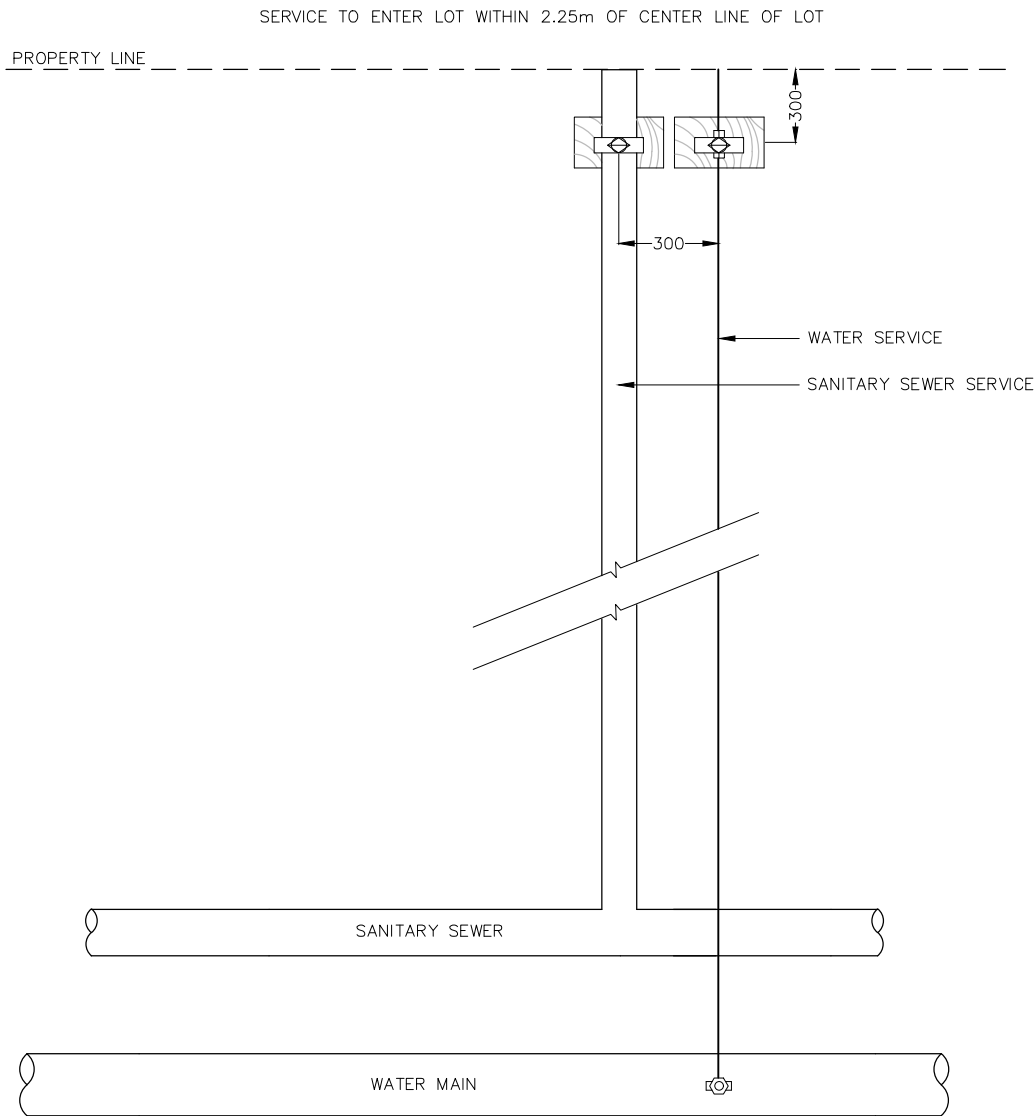
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. APPLICABLE WHEN USING FILCRETE, GRANULAR OR CLAY BACKFILL FOR WATER MAINS WITH DEPTH OF COVER LESS THAN THE MINIMUM DESCRIBED IN THE DESIGN STANDARDS.
3. USE DOW HI-40 STYROFOAM BOARD, OR APPROVED EQUAL.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				INSULATION REQUIREMENTS FOR WATER MAINS/SERVICES	Approved: 	Figure <b>D-05</b>
Rev.						
Rev.						
Rev.	2021-FEB-15	File No.: GP60.33682	Design:			
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			

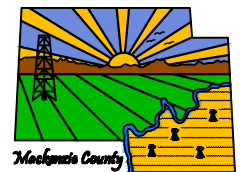


NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. SERVICES MAY BE EXTENDED INTO PRIVATE PROPERTY TO EDGE OF GAS EASEMENT IN LANELESS SUBDIVISIONS.

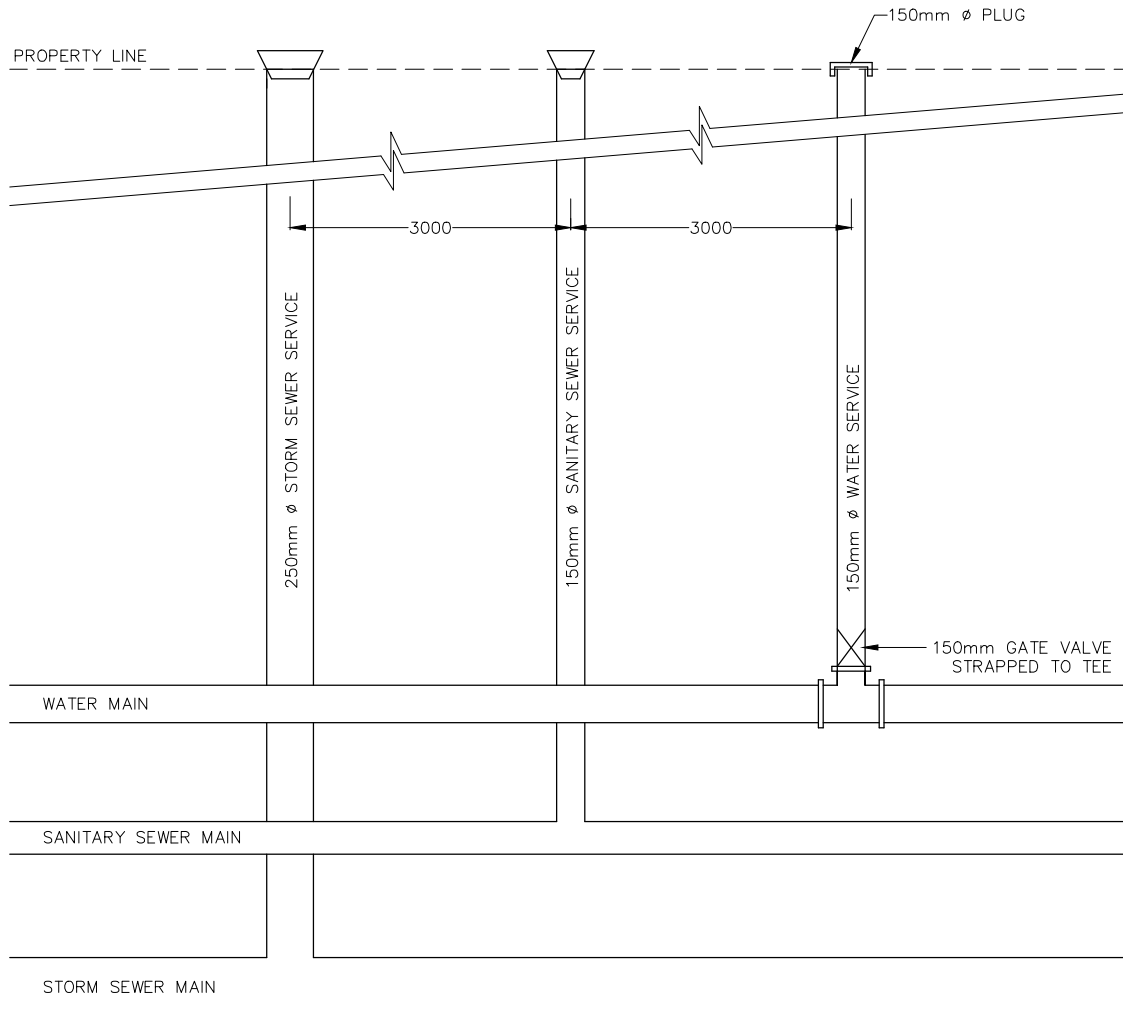
# MACKENZIE COUNTY

## General Municipal Improvements Standards



### SINGLE LOW PRESSURE SANITARY SERVICE

Rev.					
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:	Approved:	Figure
Date:	2014-JUL-08	Drawn: K.P.L	Scale: N.T.S		D-06



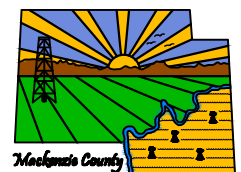
PLAN VIEW

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. SERVICES MAY BE EXTENDED INTO PRIVATE PROPERTY TO THE EDGE OF GAS EASEMENT.
3. STORM SEWER SERVICE NOT PROVIDED AT THIS TIME

# MACKENZIE COUNTY

## General Municipal Improvements Standards

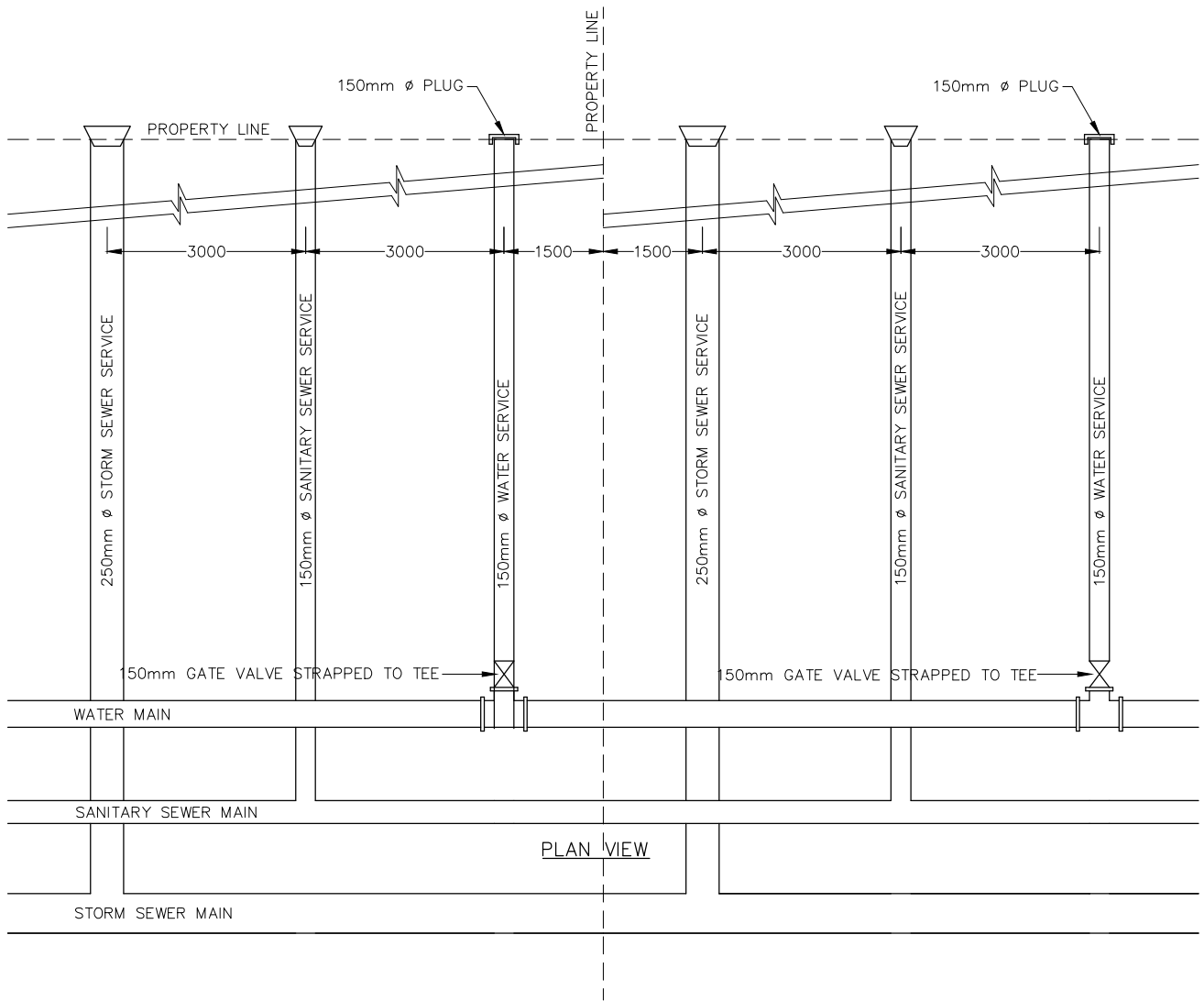


### TYPICAL INDUSTRIAL SINGLE SERVICE

Approved:

Figure **D-07**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2014-JUL-14	Drawn: K.P.L	Scale: N.T.S

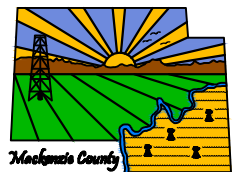


NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. SERVICES MAY BE EXTENDED INTO PRIVATE PROPERTY TO THE EDGE OF GAS EASEMENT.
3. STORM SEWER SERVICE NOT PROVIDED AT THIS TIME

# MACKENZIE COUNTY

## General Municipal Improvements Standards



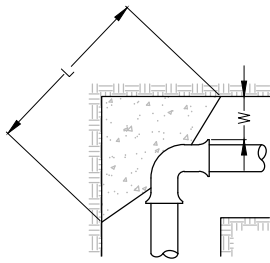
### TYPICAL INDUSTRIAL DUAL SERVICE

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2014-JUL-14	Drawn: K.P.L	Scale: N.T.S

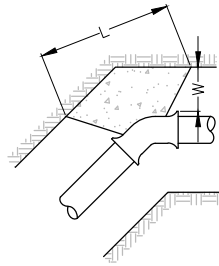
Approved:

Figure **D-08**

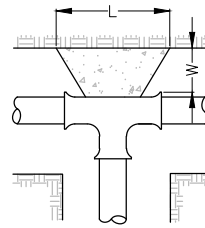




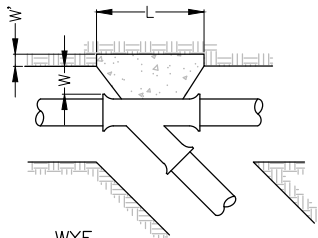
HORIZONTAL 90° BEND



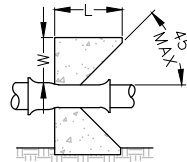
HORIZONTAL 45° BEND



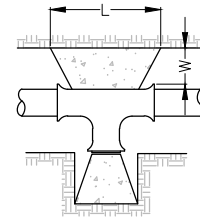
TEE



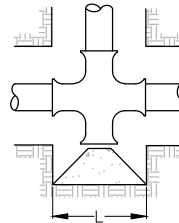
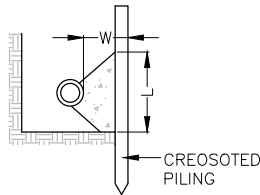
WYE



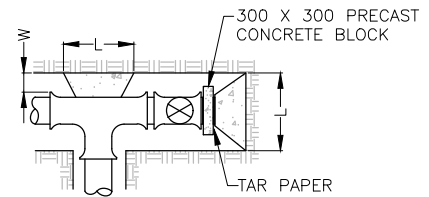
REDUCER



TEE WITH PLUG



CROSS WITH PLUG



TEE WITH VALVE

MINIMUM THRUST AREAS FOR FITTINGS AT 1035 kPa PRESSURE AND FOR SOILS WITH MINIMUM BEARING OF 9765 kg/m (NOT TO BE USED FOR SOFT CLAY, MUCK, PEAT, etc.)

TYPE OF FITTING	FITTING SIZE	OUTSIDE OF FITTING TO BEARING FACE		RECESS IN TRENCH WALL	LENGTH	HEIGHT	TYPE OF FITTING	FITTING SIZE	OUTSIDE OF FITTING TO BEARING FACE		RECESS IN TRENCH WALL	LENGTH	HEIGHT
		D	W						D	W'			
90° BEND	150	300			900	450	CROSS	150	300			600	450
	200	350			1060	600		200	350			825	600
	250	375			1445	750		250	375			975	825
	300	400			1650	900		300	400			1200	900
45° BEND	150	300			450	450	45° WYE	150	300	300		450	450
	200	350			600	600		200	350	400		600	600
	250	375			750	750		250	375	500		825	825
	300	400			900	900		300	400	600		900	900
22.5° BEND	150	300			450	230	REDUCER	150	300	150		450	450
	200	350			600	300		200	350	200		600	600
	250	375			750	450		250	375	250		825	825
	300	400			900	450		300	400	300		900	900
TEE	150	300			450	450	CAPS AND PLUGS (IF NOT BOLTED)	150	300			450	450
	200	350			600	600		200	350			600	600
	250	375			750	825		250	375			825	825
	300	400			900	900		300	400			900	900

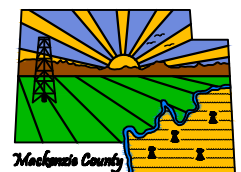
DIMENSIONS APPLY TO THE LARGER DIAMETER END OF FITTINGS

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



### THRUST BLOCK DETAILS

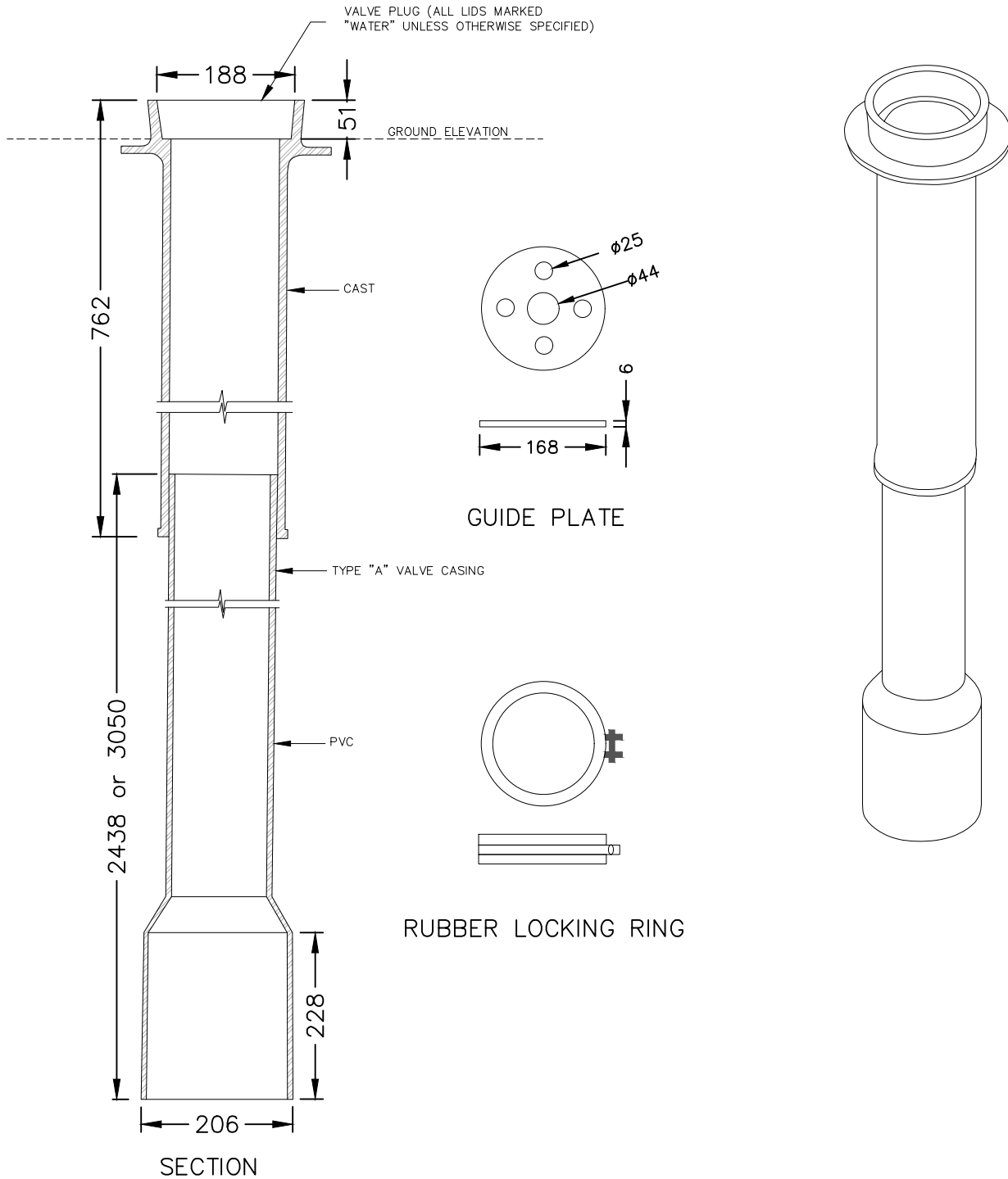
Rev.	
Rev.	
Rev.	
Rev.	2021-FEB-15
Date:	2010-AUG-31

File No.: GP60.33682  
 Drawn: K.P.L

Design:  
 Scale: N.T.S

Approved:

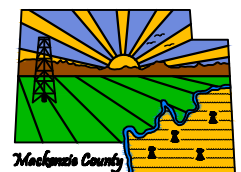
Figure **D-09**



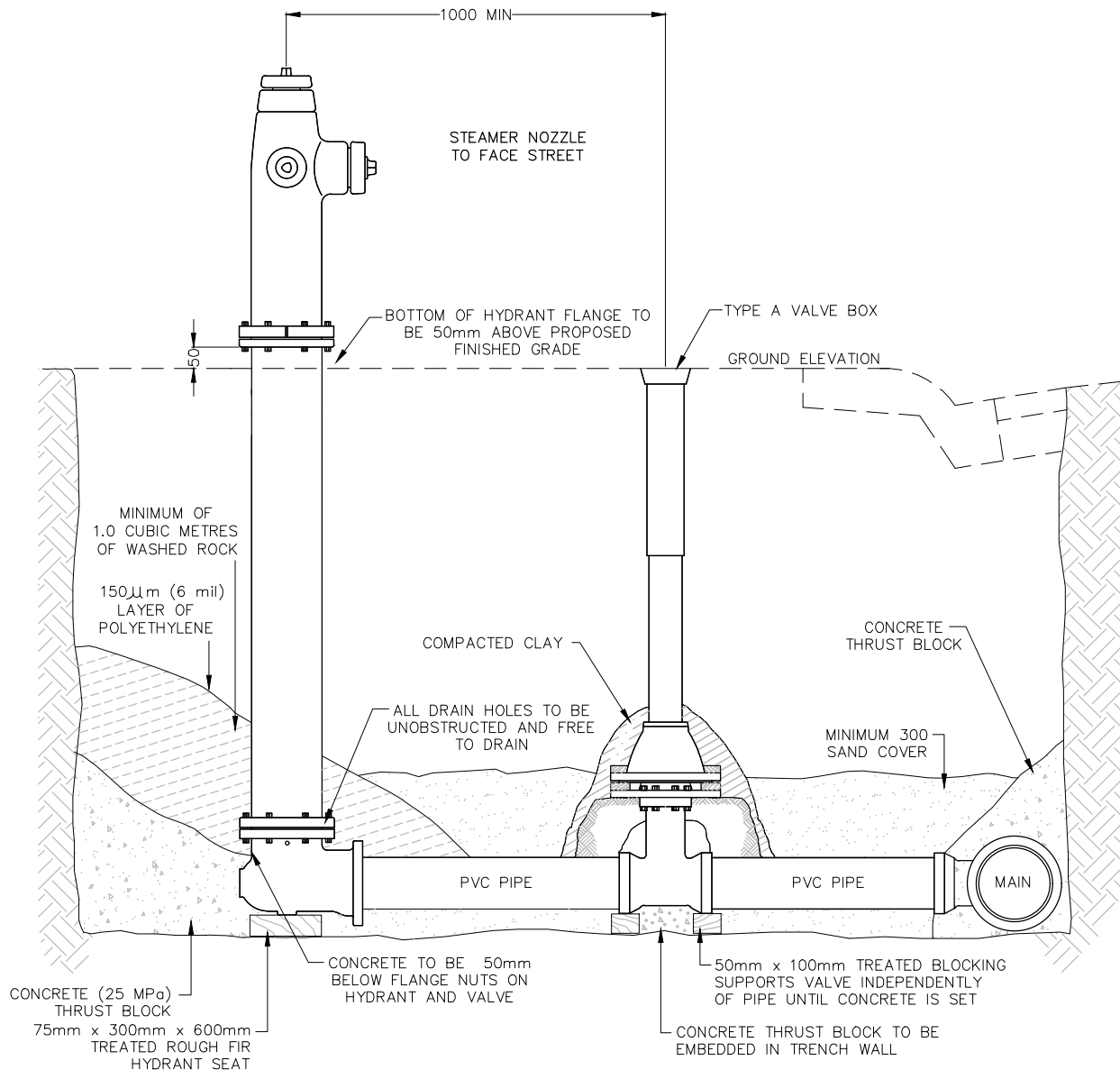
- NOTES:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
  2. BOTTOM SECTION ALSO AVAILABLE IN CAST IRON

# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				TYPE 'A' - 30IN TOP SECTION c/w PVC BOTTOM SECTION	Approved:	Figure D-10
Rev.						
Ref:	GP55.37506					
Rev.	2021-FEB-15	File No.:	GP60.33883	Design:		
Date:	2014-JULY-28	Drawn:	Q.Z	Scale:	N.T.S	

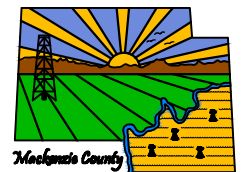


NOTES:


1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.
3. ALL UNDERGROUND FITTINGS, BOLTS, AND NUTS SHALL BE STAINLESS STEEL AND WRAPPED WITH DENSO WRAP.
4. ALL BURIED METALLIC FITTINGS AND VALVES SHALL BE CATHODE PROTECTED WITH 2.3 KG ZINC ANODES AND ALL FIRE HYDRANTS SHALL BE CHATHODE PROTECTED WITH A 5.5 KG ZINC ANODE. ZINC ANODES SHALL CONFORM TO ASTM B418-73 TYPE II.

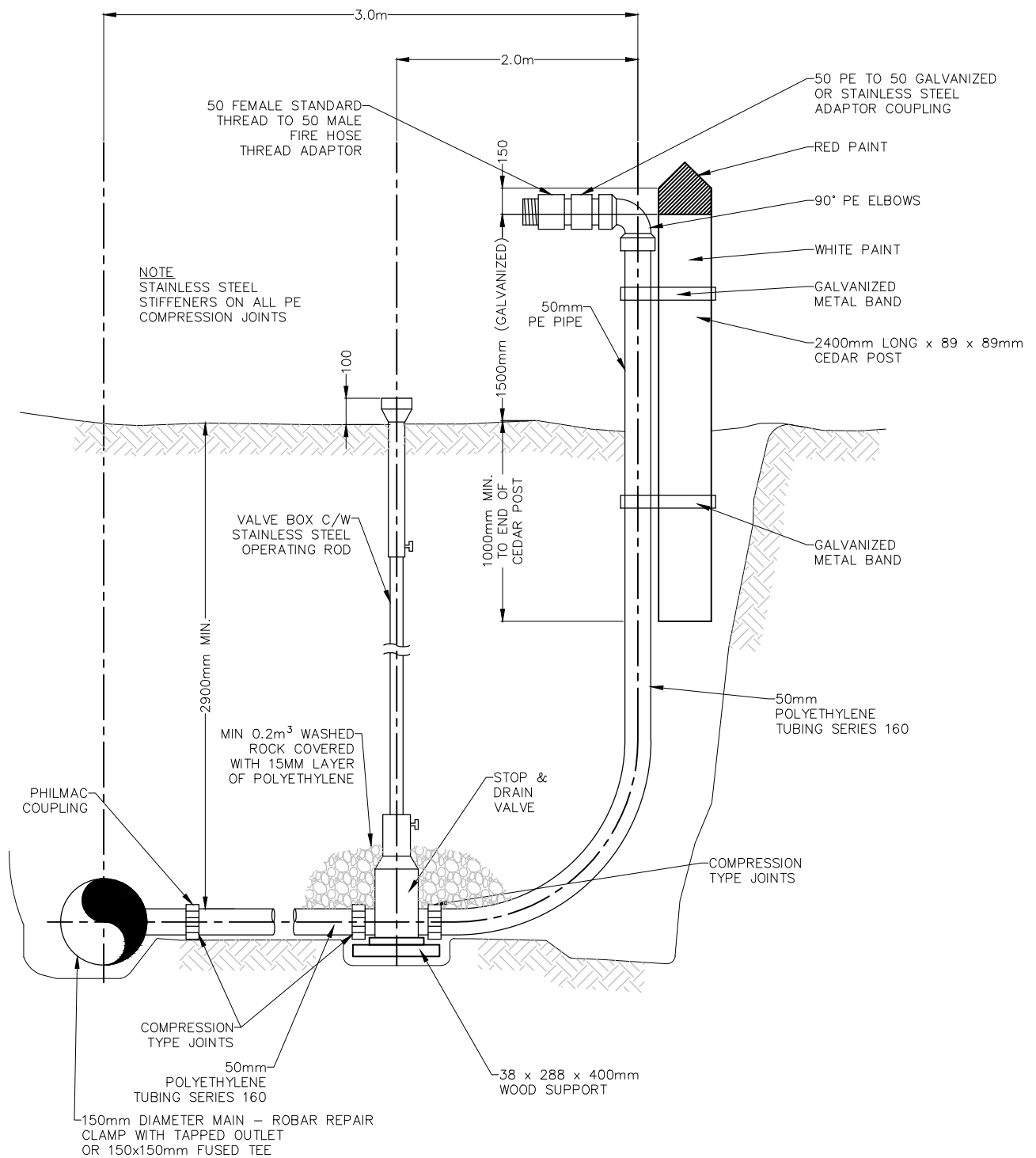
# MACKENZIE COUNTY

## General Municipal Improvements Standards



### TYPICAL HYDRANT CONNECTION

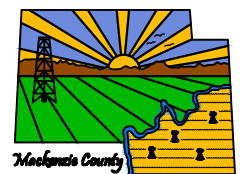
Rev.				Approved: 	Figure D-11
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		



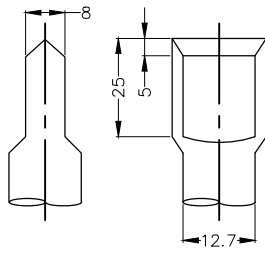
NOTES:  
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

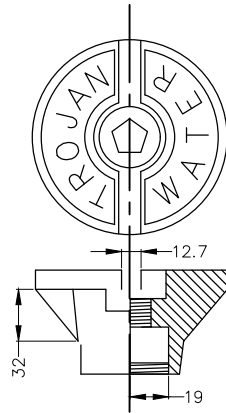
## General Municipal Improvements Standards



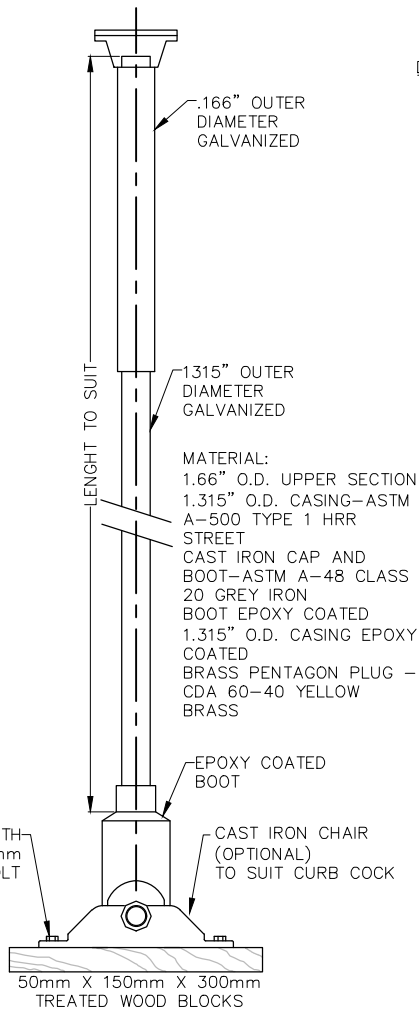
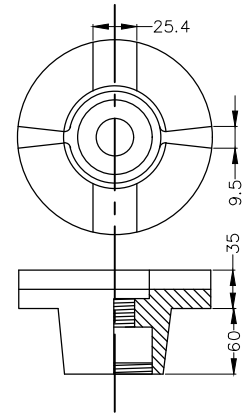
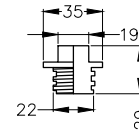
Rev.				FLUSH POINT DETAIL	Figure D-12
Rev.					
Rev.					
Rev.	File No.: GP60.33682	Design:	Approved:		
Date: 2021-FEB-15	Drawn: S.A.M.	Scale: N.T.S			



DETAIL A



CAST IRON OR BRASS CAP



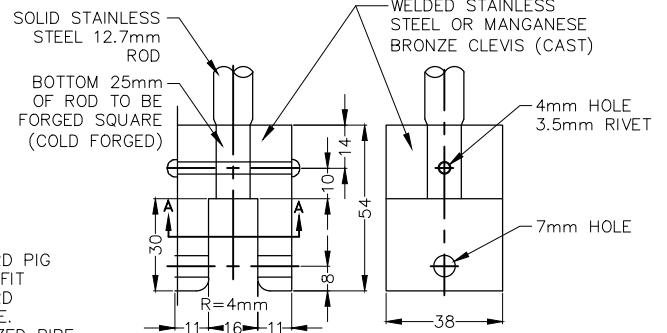
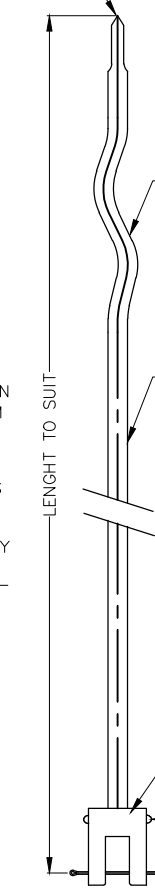
MATERIAL:  
 1.66" O.D. UPPER SECTION  
 1.315" O.D. CASING-ASTM  
 A-500 TYPE 1 HRR  
 STREET  
 CAST IRON CAP AND  
 BOOT-ASTM A-48 CLASS  
 20 GREY IRON  
 BOOT EPOXY COATED  
 1.315" O.D. CASING EPOXY  
 COATED  
 BRASS PENTAGON PLUG -  
 CDA 60-40 YELLOW  
 BRASS

FASTEN WITH  
 10mm x 50mm  
 LONG LAG BOLT

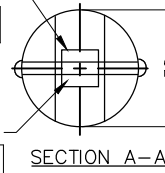
EPOXY COATED  
 BOOT  
 CAST IRON CHAIR  
 (OPTIONAL)  
 TO SUIT CURB COCK

50mm X 150mm X 300mm  
 TREATED WOOD BLOCKS

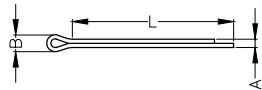
SEE  
 DETAIL A



DETAIL B



SECTION A-A



BRASS COTTER PIN

NOMINAL DIAMETER	DIAMETER A		OUTSIDE EYE DIAMETER B MINIMUM	HOLE SIZE RECOMMENDED	LENGTH L
	MAX.	MIN.			
6.35mm	5.7mm	5.6mm	12.7mm	6.7mm	55mm

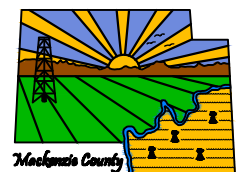
MATERIAL:  
 ROD  
 304 STAINLESS STEEL  
 ASTM A276-94b/A479-94a  
 COLD FINISH TENSILE 90,000 psi MIN.  
 CLEVIS CASTING  
 MANGANESE BRONZE  
 CDA C86500  
 S.A.E. STANDARD #43  
 TENSILE: 65000 psi

NOTES:

1. OPERATING ROD SHALL BE SUPPLIED AS A SINGLE UNIT COMPRISED OF A SOLID STAINLESS STEEL ROD (A.S.T.M. 8554 - 94), ATTACHED TO A WELDED STAINLESS STEEL OR MANGANESE BRONZE CLEVIS WITH A STAINLESS STEEL RIVET.
2. THE MANUFACTURER'S NAME SHALL BE EMBOSSED ONTO THE CLEVIS.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



### SERVICE BOX DETAIL FOR 50mm & SMALLER WATER SERVICE

Approved:

Figure

D-13

Rev.	
Rev.	
Rev.	
Rev.	2021-FEB-15
Date:	2010-AUG-31

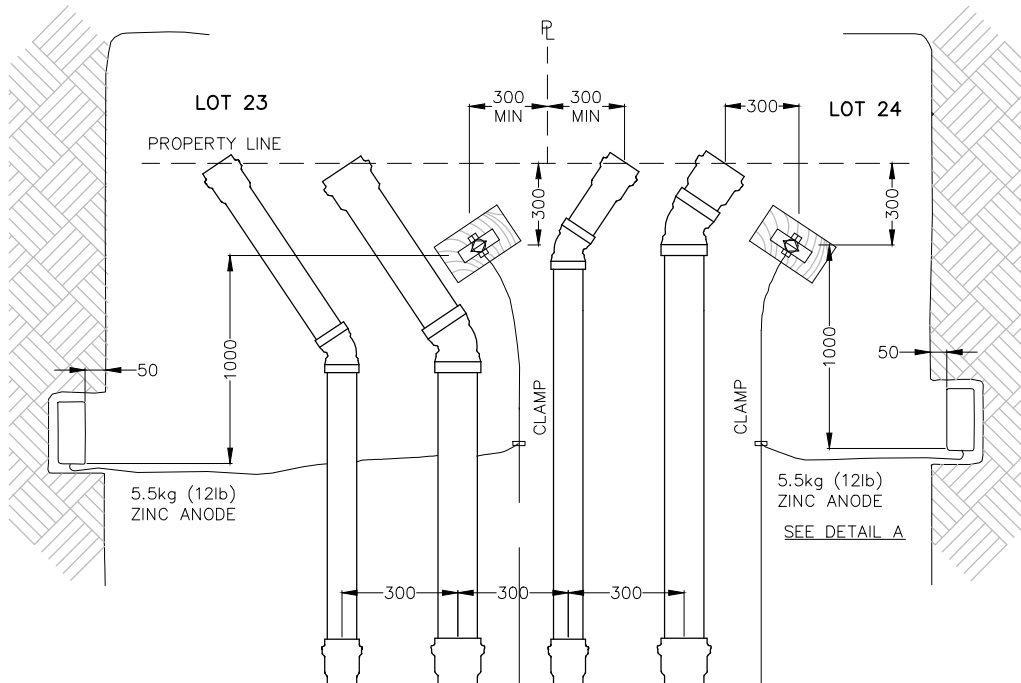
File No.: GP60.33682

Design:  
 Scale: N.T.S.

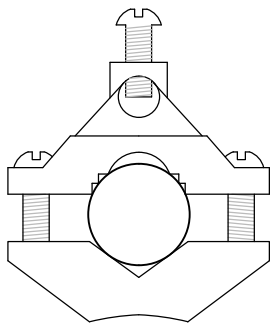
Approved:

Figure

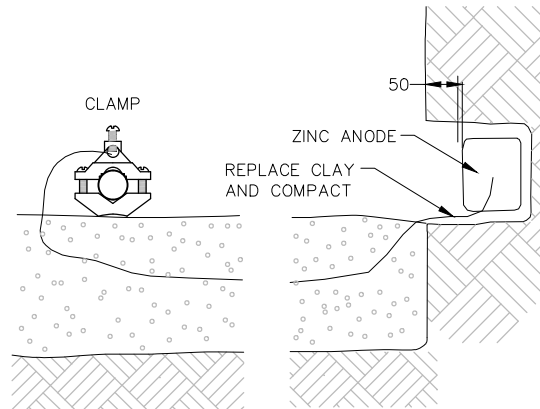
D-13



PLAN VIEW



TYPICAL PIPE CLAMP



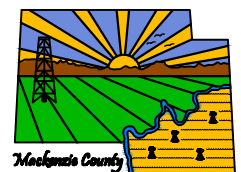
DETAIL A  
TYPICAL

NOTES:

1. PIPE CLAMP TO BE ALL BRASS OR APPROVED EQUIVALENT.
2. ZINC ANODES TO BE EMBEDDED INTO TRENCH WALL TO PROVIDE FOR A MINIMUM OF 50mm OF NATIVE CLAY COMPACTED COMPLETELY SURROUNDING ANODES.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

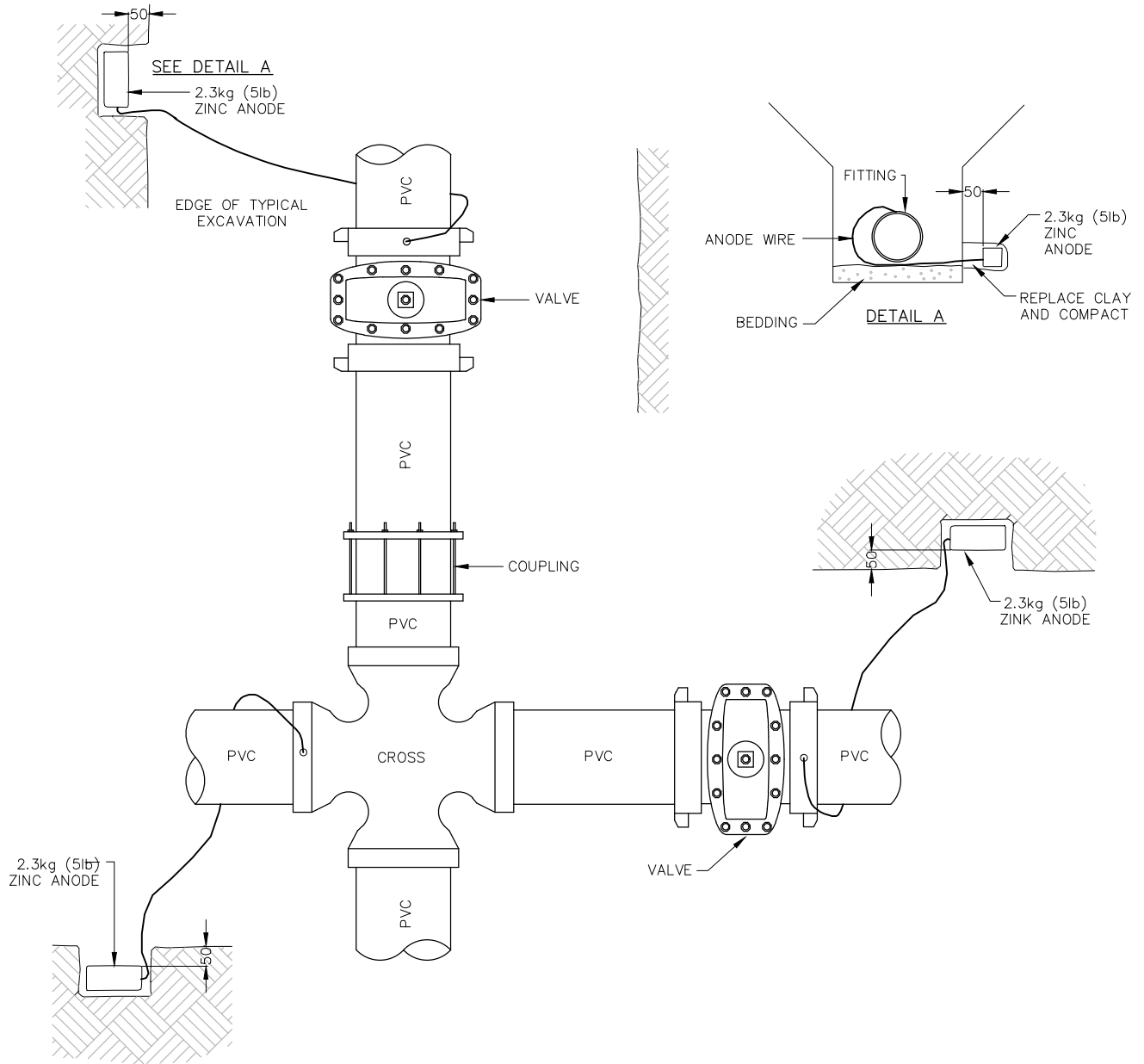


### ANODE INSTALLATION ON 50mm & SMALLER COPPER WATER SERVICE

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

Approved:

Figure **D-14**

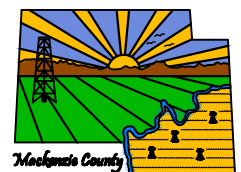


NOTES:

1. MINIMUM DISTANCE FROM ANODE TO PIPE, FITTING, VALVE OR HYDRANT IS 150mm.
2. INSTALL ANODE AT APPROX. PIPE DEPTH IN NATIVE SOIL.
3. ALL ZINC ANODES ON FITTINGS AND VALVES ARE 2.3kg (5lb).
4. ZINC ANODES TO BE EMBEDDED INTO TRENCH WALL TO PROVIDE FOR A MINIMUM OF 50mm OF NATIVE CLAY COMPLETELY SURROUNDING THE ANODE.
5. ANODES TO BE AT LEAST 300mm CLEAR OF THRUST BLOCK.
6. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

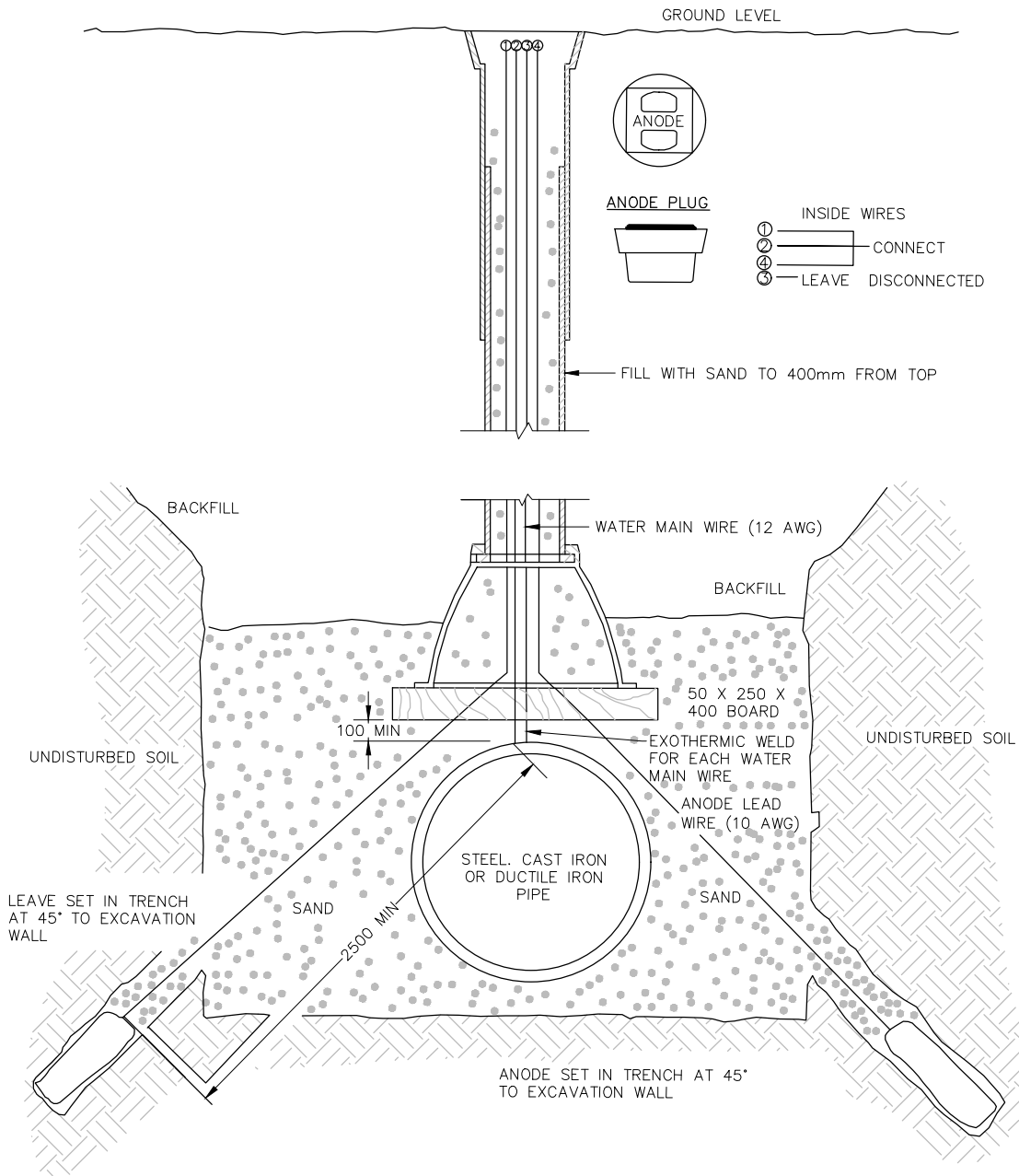


### TYPICAL ANODE INSTALLATION AT STEEL OR IRON FITTINGS USED WITH PVC WATERMAINS

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

Approved:

Figure **D-15**

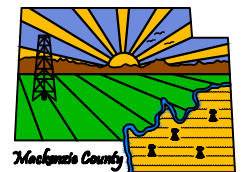


NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. NEW STEEL MAINS—INSTALLATION OF A THIRD ANODE TO BE SET IN TRENCH AT 45° EXCAVATION WALL AND A MINIMUM 3.0m CLEARANCE BETWEEN ANODES.
3. NUMBER, SPACING, TYPE AND WEIGHT OF ANODES TO BE DETERMINED BY ENGINEER.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



### ANODE INSTALLATION FOR STEEL AND IRON WATER MAINS

Approved:

Figure

D-16

Rev.	
Rev.	
Rev.	
Rev.	2021-FEB-15
Date:	2010-AUG-31

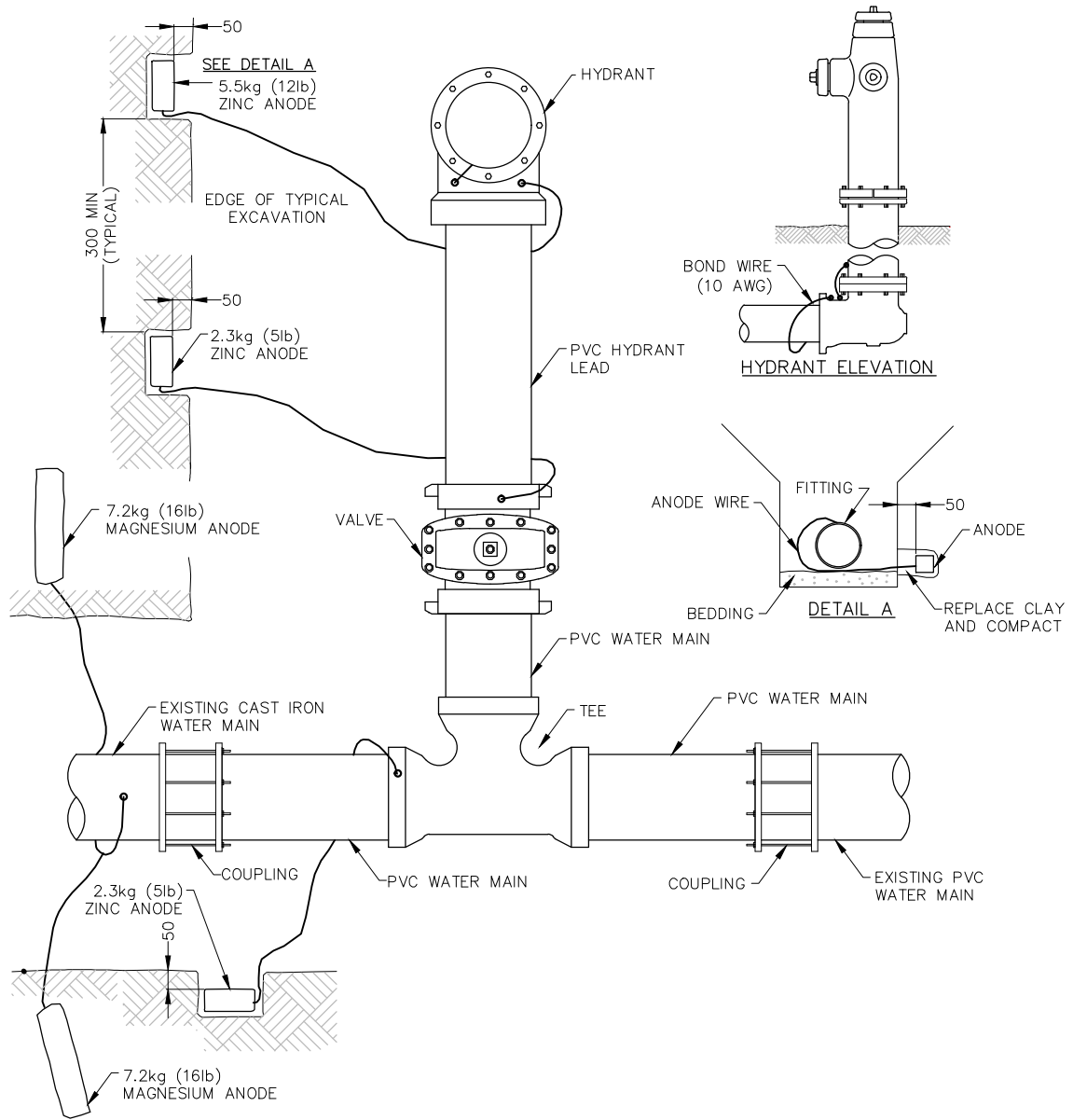
File No.: GP60.33682

Drawn: K.P.L

Design:

Scale: N.T.S



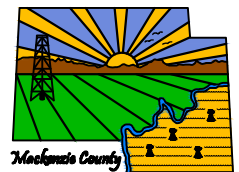


NOTES:

1. MIN. DISTANCE FROM ANODE TO PIPE IS 150mm.
2. INSTALL ANODE AT APPROX. PIPE DEPTH IN NATIVE SOIL.
3. ALL ZINC ANODES ON FITTINGS AND VALVES ARE 2.3kg (5lb).
4. ALL ZINC ANODES ON HYDRANTS ARE 5.5kg (12lb).
5. ZINC ANODES TO BE EMBEDDED INTO TRENCH WALL TO PROVIDE FOR A MINIMUM OF 50mm OF NATIVE CLAY COMPLETELY SURROUNDING THE ANODE.
6. ANODES TO BE AT LEAST 300mm CLEAR OF THRUST BLOCK.
7. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
8. ALL UNDERGROUND FITTINGS, BOLTS, AND NUTS SHALL BE STAINLESS STEEL.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

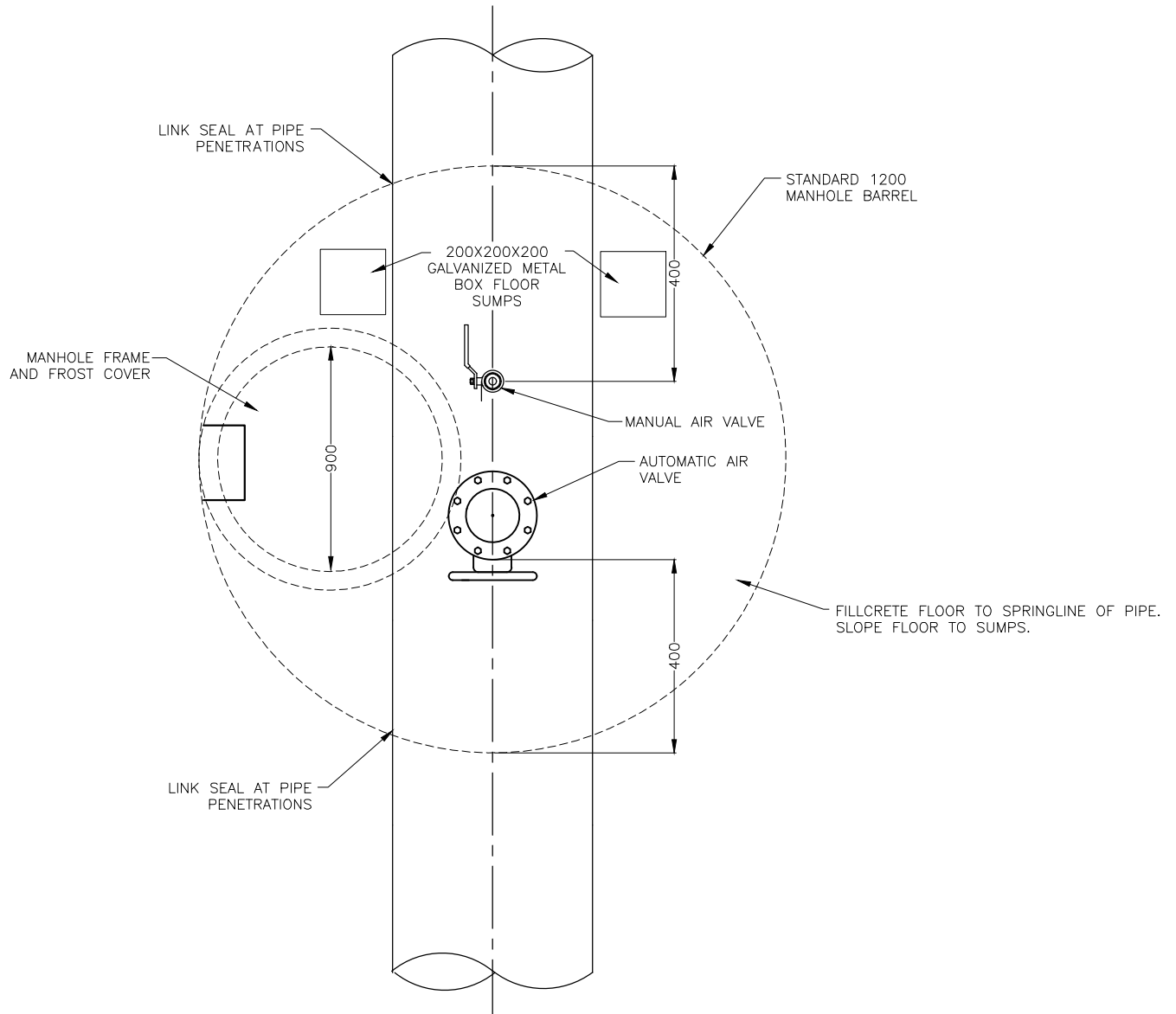


### ANODE INSTALLATION AT HYDRANT

Approved:

Figure **D-17**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

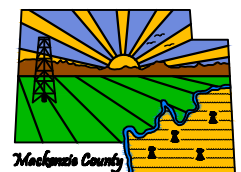


NOTES:

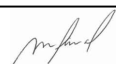
1. INSULATE EXTERIOR OF MANHOLE AND RISER WITH 100mm THICK POLYURETHANE FOAM INSULATION. TREAT WITH APPROVED WATERPROOFING COMPOUND.
2. FOR STEEL AND CONCRETE CYLINDER WATER MAINS, PROVIDE ELECTRICAL ACCESS WIRES WHEN DIRECTED BY THE ENGINEER.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

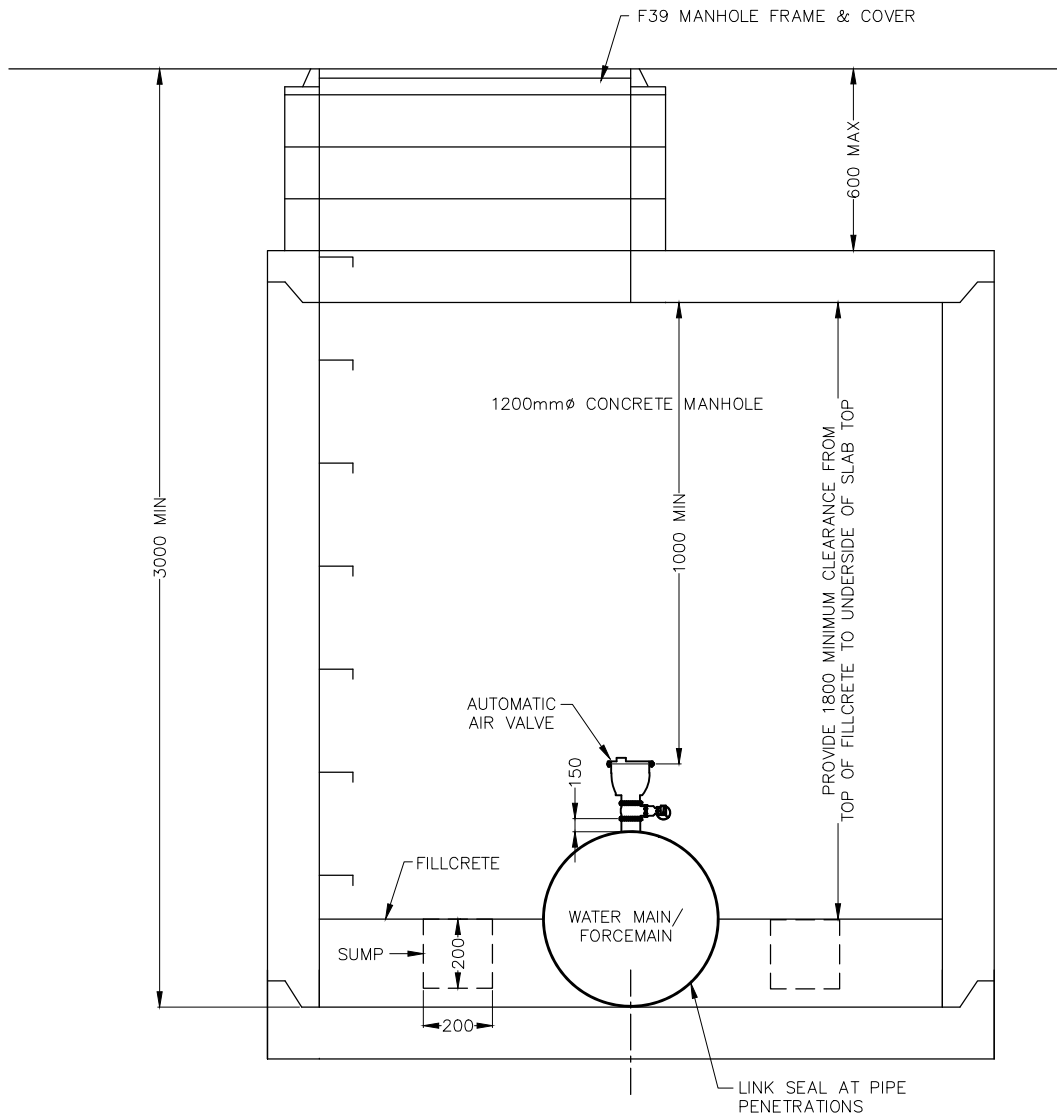
# MACKENZIE COUNTY

## General Municipal Improvements Standards



### AUTOMATIC AIR VALVE CHAMBER DETAIL (PLAN)

Rev.				Approved: 	Figure D-18
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		

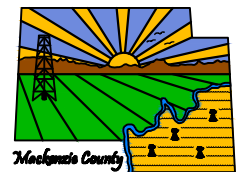


NOTES:


1. ALSO SEE FIGURE D-22.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

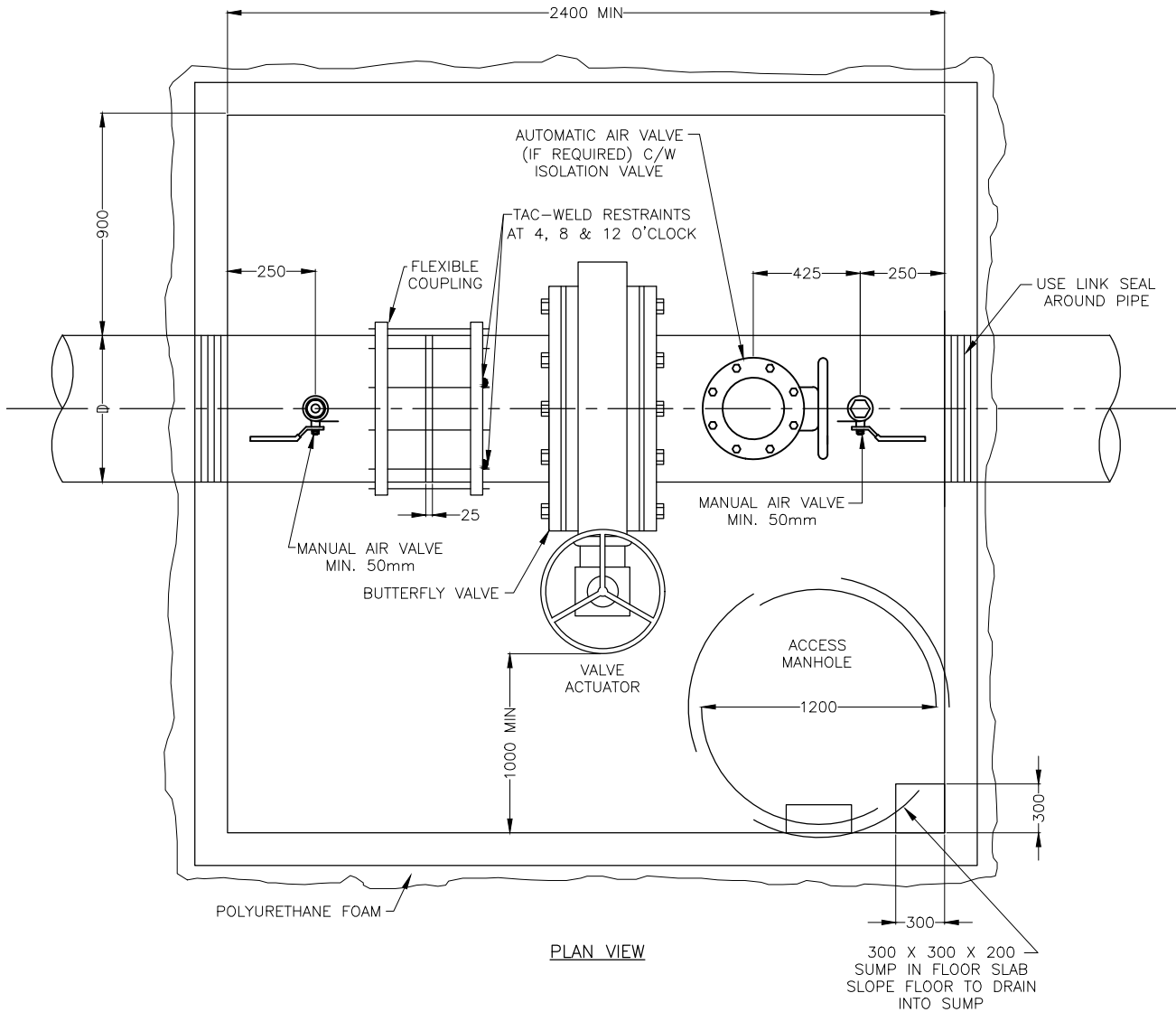
# MACKENZIE COUNTY

## General Municipal Improvements Standards



### AUTOMATIC AIR VALVE CHAMBER DETAIL (PROFILE)

Rev.				Approved: 	Figure D-19
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		



PLAN VIEW

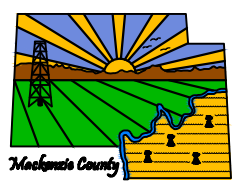
300 X 300 X 200  
SUMP IN FLOOR SLAB  
SLOPE FLOOR TO DRAIN  
INTO SUMP


NOTES:

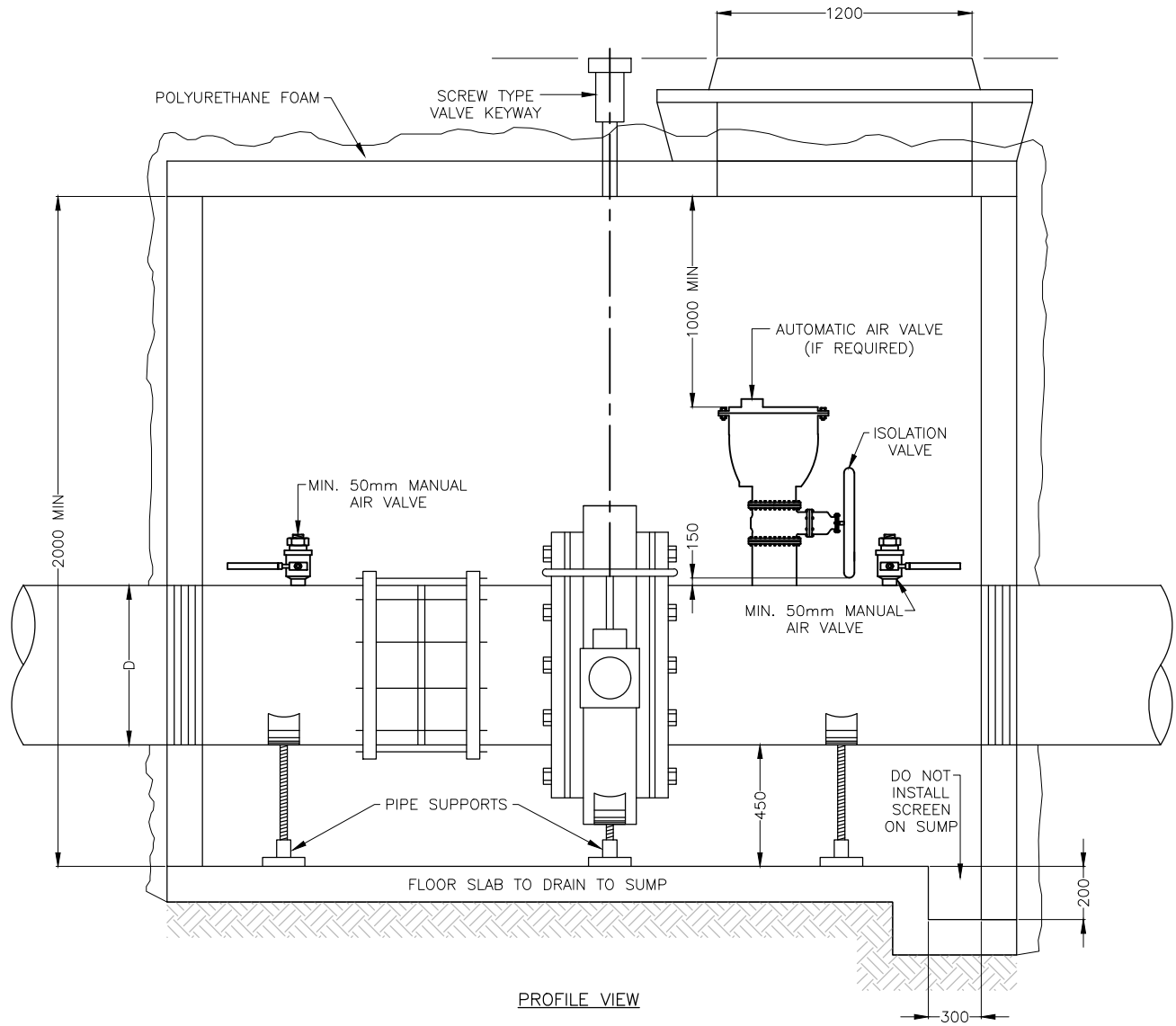
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROVIDE 100mm THICK POLYURETHANE FOAM INSULATION AROUND EXTERIOR OF CHAMBER WALLS, ROOF AND MANHOLE RISER FOR CHAMBERS UTILIZING AUTOMATIC AIR VALVES. PROVIDE A FROST COVER FOR MANHOLE FRAME. COVER ALL INSULATION WITH APPROVED WATERPROOFING COMPOUND.
3. ALSO SEE FIGURE D-25.
4. FOR STEEL AND CONCRETE CYLINDER WATER MAINS, PROVIDE AN ELECTRICAL CONTINUITY BOND ACROSS THE VALVE AND COUPLING WHEN DIRECTED BY THE ENGINEER.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				Approved: 	Figure D-20
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		



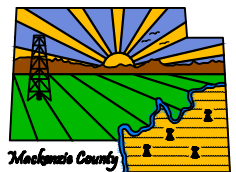
PROFILE VIEW

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. ALSO SEE FIGURE D-24.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

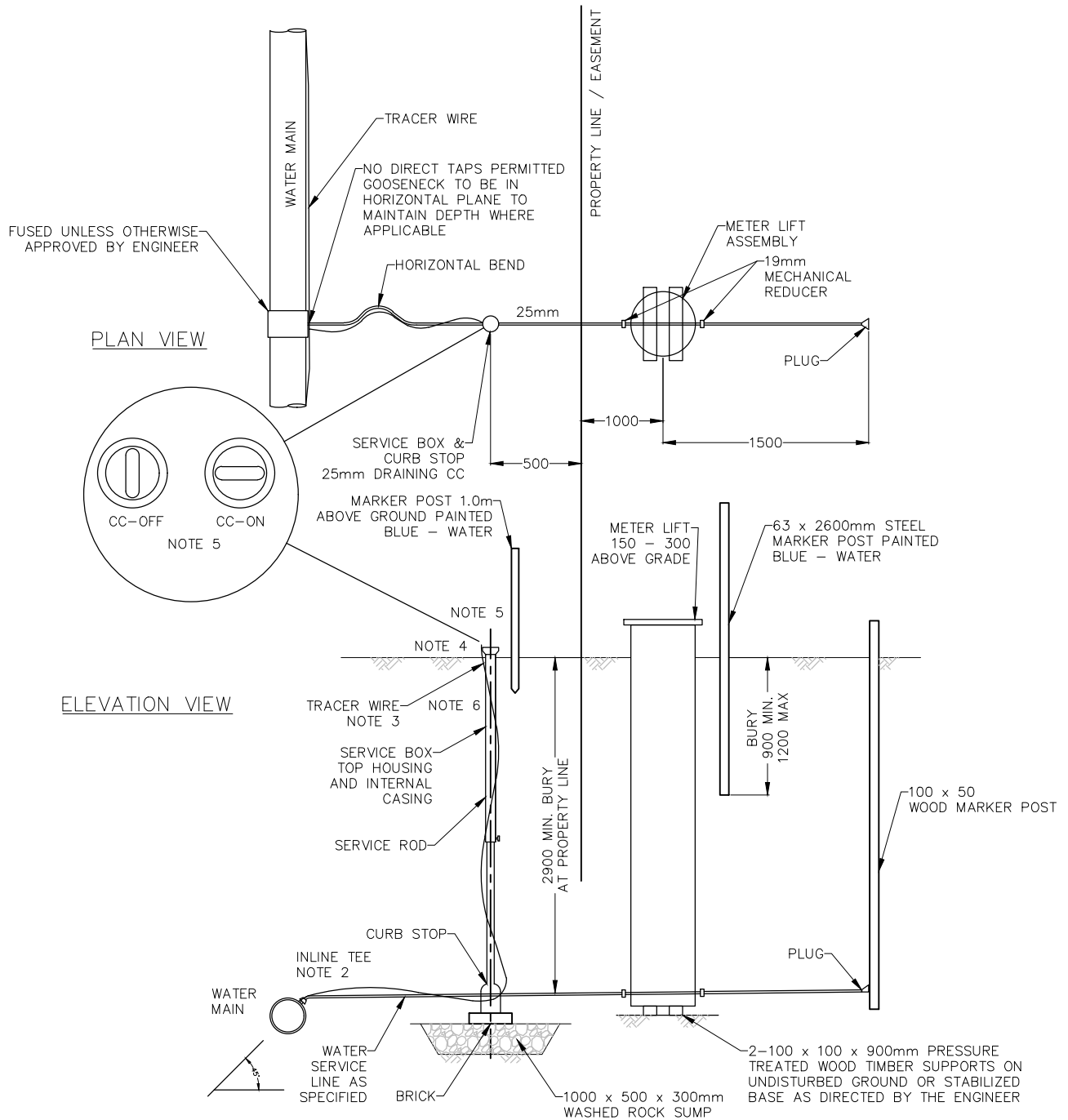


### VALVE CHAMBER DETAIL (PROFILE)

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

Approved:

Figure **D-21**

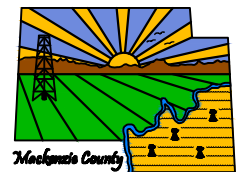


NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. FUSED INLINE TEE OR FUSED SADDLES.
3. TRACER WIRE SHALL BE FASTENED TO THE SERVICE BOX.
4. CC SHALL BE LEFT 6" ABOVE DESIGN ELEVATION AND SHALL BE ADJUSTED AT FAC.
5. CLEVIS SHALL BE INSTALLED SO IT IS PARALLEL THE PROPERTY LINE IN THE OFF POSITION AND IN LINE WITH THE FLOW WHEN IN THE ON POSITION
6. ROD HEIGHT SHALL BE DIFFERENT FROM ANY INTERMEDIATE / INTERIOR CASING HEIGHT AND BE BETWEEN 0 TO 900mm BELOW SURFACE.

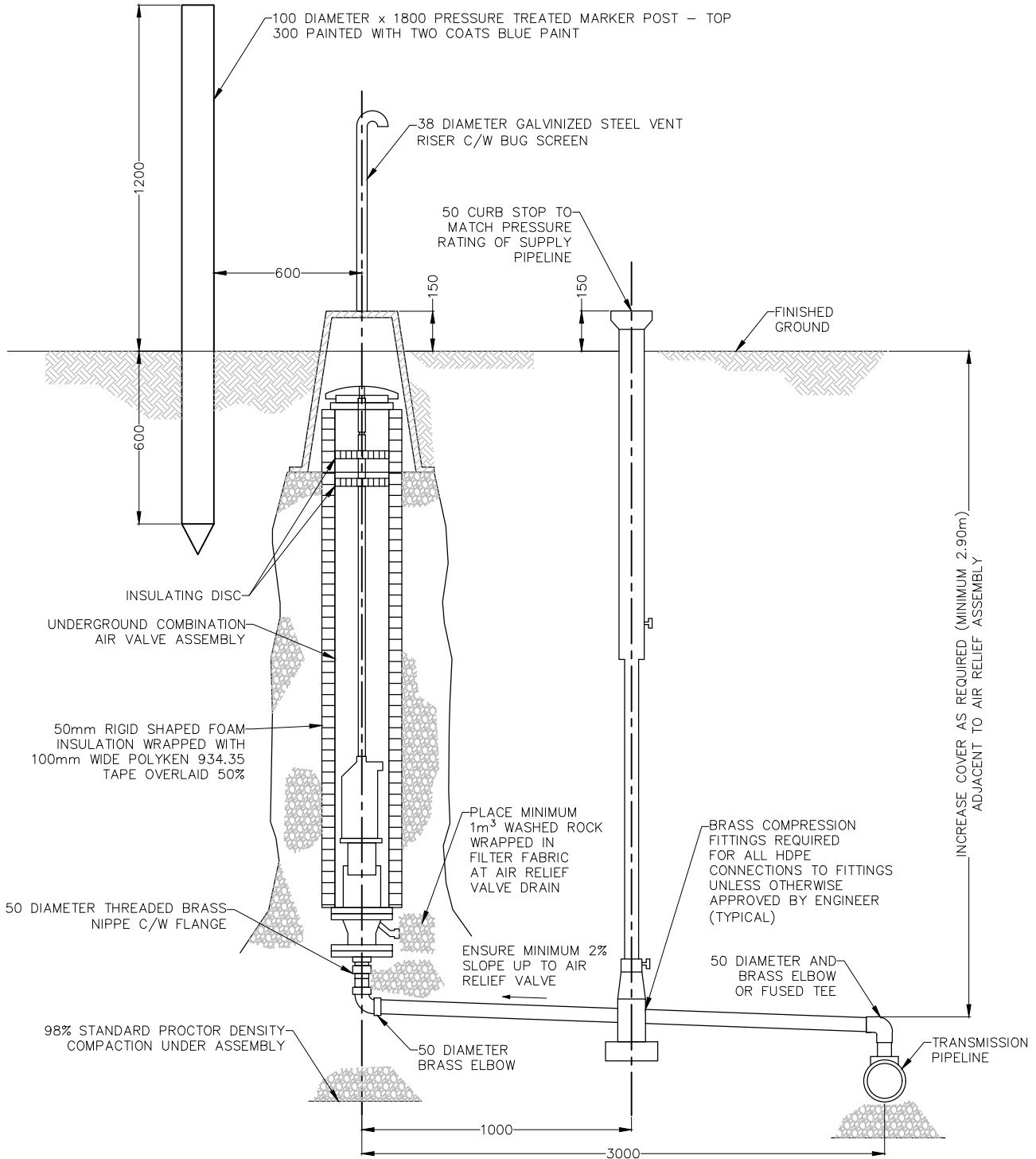
# MACKENZIE COUNTY

## General Municipal Improvements Standards



### METER LIFT ASSEMBLY INSTALLATION DETAILS

Rev.				
Rev.				
Rev.				
Rev.	File No.: GP60.33682	Design:	Approved:	Figure
Date: 2021-FEB-15	Drawn: S.A.M.	Scale: N.T.S		D-22

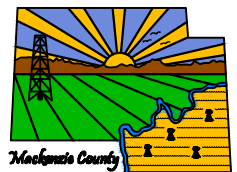


NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



### UNDERGROUND AIR VALVE SYSTEM

Approved:

Figure

D-23

Rev.	
Rev.	
Rev.	
Rev.	
Date:	2021-FEB-15

File No.: GP60.33682  
 Drawn: S.A.M.

Design:  
 Scale: N.T.S





## SECTION E SANITARY SEWER SYSTEM

### E.1 GENERAL

- E.1.1** The Developer and the Developer's Engineer are responsible to ensure that the sanitary sewer system is designed and constructed according to accepted engineering practice. These guidelines are intended as a guide only and shall not be considered as a substitute for a detailed material and construction specifications to be prepared by the Developer's Engineer.
- E.1.2** The current Standard and Specification issued by the following organizations shall be implemented during design and construction of the sanitary sewer systems:
- i. ASTM - American Society for Testing and Materials
  - ii. CSA - Canadian Standards Association
  - iii. Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems
- E.1.3** The specific requirements of the sanitary sewer system will depend on whether the proposed subdivision is defined as a rural or urban subdivision. Regardless, the intent of the sanitary sewer system design is to properly convey sewage generated from the proposed subdivision to an appropriate treatment system. The conveyance and treatment systems are to be approved by the Municipality and must meet current design standards.
- E.1.4** The Developer is responsible to confirm adequate capacity in any existing downstream collection or treatment system, if such information is not readily available from the system owner.
- E.1.5** Generally, a rural sanitary sewer system will involve individual disposal fields on each lot. The system must meet *Municipal Environment & Parks* requirements. Site suitability for disposal fields is to be documented in the Geotechnical/Hydrogeological Report for the site. Private sanitary sewage disposal systems shall conform to the current edition of the Alberta Private Sewage Systems Standard of Practice.
- E.1.6** The requirements for urban sanitary sewer system shall be dependent upon the existing and proposed population numbers, the site suitability, the establishment of contributing sanitary basins or benefiting sanitary areas, existing system capacities and flows, and future growth areas. If these standards do not cover an area of sanitary sewer system concern, the responsibility shall be upon the Developer to make recommendations and present alternative corrective measures based on sound economic, engineering, environmental, operational and maintenance criteria for approval by the Municipality. The system shall meet the recommended standards of Alberta Environment Standards and Guidelines for Municipal Water Supply, Wastewater & Storm Drainage Facilities.

- E.1.7** Connections to the Municipal system from weeping tile or storm run-off connections, or any storm water contribution, including roof drains, will not be permitted.

## **E.2 FLOW GENERATION RATES**

- E.2.1** The proposed sanitary sewer system shall be designed to include all of the total tributary area intended to be serviced by the sewer main at any particular point, as well as the proposed subdivision area, in accordance with the Area Structure Plan engineering recommendation for that area.

- E.2.2** The sanitary system shall be of sufficient capacity to carry peak flows plus an infiltration and inflow allowance. The design flows and factors listed below shall be used as minimum requirements in the design of the sanitary sewer systems:

- i. Residential subdivision.
  - a. Population density 3.5 persons/residence
  - b. Infiltration and inflow 17,000 L/ha/day<sup>1</sup>
  - c. Average sewage flow 350 L/person/day
  - d. Peak sewage flow Average Flow x Peaking Factor
  - e. The Peak Flow for a residential subdivision may be determined by the following formula (if existing data is not available):

$$Q_{PDW} = (G \times P \times Pf) / 86.4$$

Where:  $Q_{PDW}$  = peak dry weather flow rate (L/sec)

$G$  = per capita average daily design flow (L/d)

$P$  = design contributing population in thousands

$Pf$  = peaking factor

<sup>1</sup> The County may consider different infiltration and inflow design criteria if the consultant engineer can justify the proposed change.

- ii. Harmon's Peaking Factor (P.F.):

$$P.F. = (1 + 14) / (4 + P^{1/2})$$

Where:  $P$  = the contributing design population in 1000's.

The population density is to be determined on a subdivision-specific basis using area zoning and subdivision plans.

The Peaking Factor shall be applied against all residential sanitary generations (excluding infiltration) to determine the peak flow. The minimum peak factor shall be 2.5, with a maximum of 5.

- iii. Industrial, commercial and institutional subdivision.
  - a. Infiltration 17,000 L/ha/day
  - b. Average sewage flow 17,280 L/ha/day
  - c. Peaking factor (P.F.):

$$\text{P.F.} = 10Q^{-0.45}$$

Where: Q is in L/sec.

The Peaking Factor shall be applied against all sanitary generations (excluding infiltration) to determine the peak flow. The minimum peak factor shall be 2.5, with a maximum of 5.

- E.2.3** The total design peak flow rates for the sanitary sewer shall be the sum of the peak flow rates plus all extraneous flow allowances.
- E.2.4** Infiltration into the sanitary sewer shall be addressed in design. Sanitary manholes should not be located in areas susceptible to ponding. In areas where there is the risk of surface water intrusion, the frame and cover assembly shall be waterproofed to prevent water infiltration and inflow into the sanitary system.
- E.2.5** These average rates may not be applied to high water consumption land uses, such as heavy industrial. Detailed analysis of the design requirements specific to each subdivision is required.

### **E.3 SEWER MAIN**

#### **E.3.1 Sewer Main Design**

- i. The Manning Equation shall be used to size sanitary sewer mains. The equation is as follows (for System International units):

$$Q = (1/n)AR^{2/3}S^{1/2}$$

Where: Q = quantity of flow (m<sup>3</sup>/sec)

n = roughness coefficient; n=0.013

A = cross sectional area of flow (m<sup>2</sup>)

R = hydraulic radius (m)

S = slope of energy grade line (m/m)

- ii. Gravity sanitary sewers shall be PVC SDR 35. The size shall be based upon Manning's Formula to accommodate the calculated design flow under free flow conditions. The Manning's "n" value shall be 0.013 for all pipes. Minimum diameter of sanitary sewer mains shall be 200 mm for residential areas and 250 mm for commercial and industrial areas.
- iii. All sanitary sewers shall be designed and constructed to achieve a minimum velocity of 0.6 m/sec, a maximum velocity of 3.0 m/sec and mean velocities when flowing full of not less than 0.75 m/sec.

- iv. The minimum slope of the first upstream leg shall not be less than 1.0 %.
- v. Minimum design slopes:

Sewer Diameter (mm)	Minimum Design Slope, %
200	0.40
250	0.28
300	0.22
375	0.15
450	0.12
525	0.10
600	0.08

- vi. Sanitary sewer main inverts shall not deviate from the design grade by an amount equal to 3 mm plus 3 mm for each 300 mm of pipe diameter. It is recommended that all sanitary sewers be designed with a slope of 0.4% or greater, wherever possible. Minimum slopes shall be increased by 50% on all curved sections.
- vii. Sanitary sewer mains shall be designed to convey the design flow when flowing 80 % full by depth, with the hydraulic grade line at the pipe crown. All pipe crown elevations shall match at manhole junctions.
- viii. The Developer is responsible for providing the engineering expertise relating to the structural design of sewers, providing all test results and the quality control of all materials proposed to be used. All sewers shall be designed to prevent damage from superimposed loads.
  - a. For rigid pipes a 0.025 cm crack shall be determined as exceeding the working strength and the pipe will be rejected. For flexible pipe, when deflection greater than seven and one-half percent (7.5 %) of the original diameter is reached, then the pipe shall be considered to have exceeded the limit of serviceability and shall be rejected.
  - b. Proper allowances shall be made with regard to the class of bedding and the trench dimensions when determining the loadings on pipes.
  - c. The "Marston Theory" is to be used in analyzing loadings in the single trench applications for rigid pipe. For flexible pipe, the modified IOWA formula shall be used.
  - d. Concrete pipe specified under ASTM C655 may have combinations of circular and elliptical reinforcement with minimum steel requirements at all outer and inner points as specified under ASTM C76. The Developer shall specify the horizontal and structural strength of all pipes.

### **E.3.2 Sewer Main Location and Installation**

- i. Sanitary sewers shall be installed to provide sufficient thickness of cover to provide complete frost protection. A minimum thickness of ground cover

of 3.0 m from the top of the pipe to the final finished grade shall be provided. If the minimum depth of cover cannot be provided, the sanitary sewer main shall be adequately insulated to the satisfaction of the Municipal Engineer. In areas susceptible to frost damage, the Municipality may require that a qualified geotechnical firm provide a recommendation on installation methods to mitigate frost damage. All costs are to be borne by the Developer.

- ii. Gravity mains shall have sufficient gradients to allow draining from all buildings to the sewer by gravity. Special consideration should be given when building floor elevations are lower than the adjacent roadway. Service lines shall have a minimum cover of 2.60 m from the finished lot surface to the top of pipe at the property line.
- iii. Under normal conditions, sewer mains shall cross below watermains with sufficient clearance to allow for proper bedding and structural support of the pipes. Pipe clearance when passing under watermain shall be a minimum of 300 mm separation between the top of the sewer pipe and the bottom of the watermain. Pipe clearance when passing over watermain shall be a minimum of 500 mm separation between the bottom of the sewer pipe and the top of the watermain. Efforts shall be made to pass under the watermain whenever possible.
- iv. It is recommended that sewers with the inside diameter of 600 mm or less be installed with straight alignment between manholes. Curved sewers will be permitted providing that the following requirements are met:
  - a. Curved sewers shall run parallel to the curb or roadway centerline.
  - b. Sanitary sewer main shall be installed as a simple curve with a radius equal to or greater than 90 m or the manufacturer's minimum recommended radius, whichever is larger.
  - c. Manholes shall be located at intervals not greater than 90 m along the length of the curve.
  - d. Permissible joint deflections shall be in accordance with the manufacture's guidelines.
  - e. Manholes are to be located at the beginning and end of curve.
  - f. The minimum grade for curved sewers shall be fifty percent (50 %) greater than the minimum grade required for straight sewers.
- v. Sewer mains shall be located within the roadway right-of-way and outside the carriageway.
- vi. Sanitary sewers shall be located a minimum of 3 m o/c from any watermain and 1.8 m o/c from any gas line or as required by the utility company.
- vii. Sanitary sewers shall be spaced at a minimum of 0.25 m between pipes (wall-to-wall) from any adjacent storm sewer.

- viii. Public Utility Lot (PUL) widths shall be at least 4 m for a single utility and 6 m for two utilities.

### **E.3.3 Sewer Main Materials**

- i. The Developer shall supply only new materials for the sanitary system installation. All materials found to be defective or damaged shall be replaced at the cost of the Developer.
- ii. Where particular materials and products are specified, it is intended that available equivalents will be acceptable upon approval from the Municipality prior to installation.
- iii. PC pipe and fittings shall conform to the following:
  - a. CSA B182.2, ASTM D3034, ASTM F679, NQ 3624-130 and NQ 3624-135 standards with minimum stiffness of 320 kPa. Service connections pipes shall have a minimum stiffness of 625 kPa.
  - b. Standard Dimension Ratio (SDR) 35 unless otherwise indicated on the drawings.
  - c. Sealing gaskets shall meet requirements of CSA B182.2 and ASTM F477.
  - d. Injection moulded gasketed fittings for service connections shall conform to CSA B182.1 or CSA B182.2 and fabricated fittings shall conform to CSA B182.2 and ASTM F679.
  - e. Pipe shall be tested by the manufacturer and marked in accordance with CSA B182.2. Test results shall be recorded on a certification form signed by a qualified representative of the manufacturer.
  - f. Pipe and fittings shall be installed within two (2) years from the production date indicated on the manufacturer's certification.
- iv. Polyethylene pipe and fittings for low-pressure systems shall conform to the following:
  - a. Polyethylene pipe shall conform to CSA B137.1 and ASTM D3035, D3350.
  - b. Minimum pressure rating of 550 kPa (Series 80).
  - c. Moulded fittings shall conform to ASTM D2683 or D3261.
  - d. Fabricated fittings shall be manufactured from pipe of the same series as that used in the piping system.
  - e. Pipe shall be joined by thermal butt-fusion, electrofusion coupling, flange assemblies or compression type fittings.
  - f. Flanges shall be stainless steel or epoxy coated ductile iron conforming to ASTM A536-80 with stainless steel nuts, bolts and washers.
  - g. Compression couplings shall be used with stainless steel inserts.

- h. Service tapping saddles shall be Robar Type 2706 or approved equal with bronze body, 44 mm wide stainless steel straps with stainless steel nuts and bolts. Electrofusion saddles shall be allowed for services on HDPE pipe.
- i. Valves shall be cast iron gates valves with flanged connections.
- j. Each pipe length shall be marked with the manufacturer's name, nominal pipe size, dimension ratio, material grade, manufacturing standard and a code indicating the date and place of manufacture.
- v. All materials are to be approved by the Municipality in order to ensure consistency and compatibility with materials currently in use. Only approved materials are to be incorporated into the work. The Developer shall be responsible for all materials furnished for the proposed subdivision and shall provide necessary certification by an independent testing authority that the materials delivered conform to the applicable standards. Unapproved materials shall be removed and replaced with acceptable materials, all at the Developer's expense.
- vi. The water tight pipe installation shall be in accordance with manufacturer's instructions and recommendations. When no pipe installation is occurring, the open end of the pipe is to be securely closed. No water shall be allowed to drain through a newly installed pipe. Upon completion, the sewer must be thoroughly cleaned, and video inspected. One (1) copy of the video and report shall be forwarded to the Municipality.
- vii. All jointing shall be made between clean pipe ends, as recommended by the pipe manufacturer. Pipe shall not be deflected either vertically or horizontally in excess of that recommended by the manufacturer or as noted in these standards.

## **E.4 MANHOLES**

### **E.4.1 Manhole Location and Installation**

- i. The maximum spacing of manholes shall be 120 m. Manholes shall be located at the upstream end of each line, at changes in pipe diameter, grade or alignment and at all junctions.
- ii. Inverts in manholes on straight sections of sanitary sewer mains shall have at least 30 mm of fall across the manhole. To maintain a continuous energy gradient through manholes, the obvert elevation of the lowest upstream sewer main shall be equal to or higher than the obvert of the downstream sewer main. The drop across manholes shall be of sufficient magnitude to account for any energy losses in the manhole:
  - a. Pipe deflections of less than 45° require a drop of at least 30 mm;
  - b. Pipe deflections of 45° to 90° require a drop of at least 50 mm.

- iii. For sanitary sewers less than 200mm, interior drop manholes shall be considered whenever the invert elevations of the inlet and outlet differ by more than 750 mm. For sanitary sewers 200mm to 600mm, an external drop manhole shall be considered whenever the invert elevations of the inlet and outlet differ by more than 750mm. Invert drops for pipes larger than 600 mm or for high flow situations shall be assessed on an individual basis.
- iv. Manholes shall be a minimum of 1200 mm in diameter. Precast (Type 50) reinforced concrete manhole barrels conforming to ASTM C478 shall be used. The base shall be constructed of 30 MPa sulphate resistant (Type 50) concrete. Galvanized iron safety steps are required.
- v. Manholes shall be located at the extension of property lines whenever possible in order to avoid conflicts with driveways.
- vi. Manhole frames and covers shall be of cast iron. A Norwood NF-80 or NF-90 frame and cover, or an equivalent approved by the Municipality shall be used for sanitary and storm manholes located in roadways. An appropriate locking manhole frame and cover shall be used on manholes located in parkland areas. Castings shall be marked with series designation, foundry identification and date of casting. Manhole covers with the Municipality identification will be encouraged. Other municipal identification covers are not permitted within the Municipality.
- vii. All industrial, commercial and institutional subdivisions shall have an inspection manhole or chamber installed on their sanitary sewer service connection. Where possible, a service shall be connected to an existing or proposed manhole constructed on the sanitary sewer main alignment. Where a direct connection is made to the sanitary sewer main, an inspection manhole or chamber shall be installed. All inspection manholes or chambers are to be located at the property line or easement line on the sanitary service.

#### **E.4.2 Manholes Materials**

- i. Unless specified with better material accepted by the Municipal Engineer, all underground and water retaining structures shall be designed against frost and sulphate attack, with sulphate resistant cement to ASTM type V, and conform to CSA A23.1 and ACI 350R-89 Environmental Engineering of Concrete Structure. 30 MPa concrete shall be used and tested in accordance with CSA 23.2.
- ii. The design of foundation, footing, excavation, soil, rock and liquid retaining structure shall comply with the current National Building Code and Alberta Building Code. A surface investigation, including ground water condition, shall be carried out by or under the direction of a Professional Engineer having the knowledge and experience in planning and executing such investigations to a degree appropriate for the structure or substructure of its use, the ground and the surrounding condition.



- iii. Concrete manholes, catchbasins shall be manufactured with pre-cast reinforced concrete components conform to ASTM C478. No corrugated steel pipe shall be allowed. Component joint shall be supplied with a pre-formed and sealed O-ring type rubber gasket, comply to ASTM C443 or current requirement.
- iv. Minimum of 100 mm thick bedding of granular material (no particles larger than 32 mm) shall be placed for levelling bed for the aforesaid structures.
- v. Manholes shall be manufactured using sulphate resistant Type V cement as specified or the approved type Chemical Resistance Fibre Glass or HDPE material with proven record of 50 years life time. Material Data sheet and past record shall be submitted to the Municipal Engineer for approval.
- vi. Manhole sections shall be pre-cast reinforced concrete conforming to ASTM C478 and CSA A257.4. The concrete shall achieve compression strength of 30 MPa at 28 days after placing. The maximum allowable slump shall be 75 mm. The precast barrel shall be water proof and supplied with preformed and confined O-ring type gasket, conforming to ASTM C433 or current version thereof.
- vii. All manholes shall have an inside diameter of 1200 mm for pipe 900 mm and less. For pipes exceeding 900 mm in diameter, manhole diameters shall be pipe diameter plus 600 mm or a tee-riser shall be used. For pipe exceeding 900 mm diameter or manhole having multiple inlets, manhole sizing shall be subject to review by the Municipality. The Developer shall submit the specification for the Municipality for review and approval with their design submission.
- viii. The manhole shall be checked against floatation at HWL if the manholes are not using reinforced concrete.
- ix. Manhole steps shall be standard safety type, hot dipped galvanized iron conforming to ASTM A615 and ASTM A123 or aluminum forged from 6061-T6, 6351-T6.
- x. All pipe penetrations shall be sealed with rubber gaskets conforming to ASTM C443, all joints between grade rings, conical top, slab tops and frames will use bituminous type seals (i.e. Ram Neck, Dow Corning 790, Kent Sealant) to create a water proof joint.
- xi. Pre-benched manhole bases shall be used wherever possible with pre-cored connection holes and watertight Duraseal or G-Loc joints or approved equal.
- xii. Tee-riser manholes shall conform to CSA 257.2, ASTM C76 and CSA A257.4, ASTM C76.
- xiii. Safety platforms are not to be used in any manholes. As per ASTM C478-07, Standard Specifications for Reinforced Concrete Manhole Sections, a personal fall protections/rescue harness system will be used.

- xiv. All pre-cast units shall be marked with manufacturer's identification, date of casting, type of cement and CSA standard.

## **E.5 LOW PRESSURE SEWER SYSTEM**

- E.5.1** Low pressure sanitary sewer collection systems are normally installed in situations where there is inadequate grade to economically install gravity collection systems. The requirements listed herein include components to be installed on private property and public rights-of-way. The limits of responsibility must be determined by the Developer at the commencement of the planning and design stage. Due to increased operation costs of low-pressure sewer systems, gravity collection systems are strongly preferred as the sanitary sewer collection system of choice for the Municipality. Applications that include a low-pressure system must be approved by the Municipal Engineer based on site specific conditions.
- E.5.2** Low pressure sanitary sewer collection systems consist of two major components; the onsite pressurization facility and the pressurized sewer main. The pressurization facility may consist of a grinder pump system or a septic tank and effluent pumping system. Grinder pump systems have higher operational and maintenance costs. As a result, septic tank systems are the preferred option. The pressurized sewer mains normally range in size from 30 mm to 100 mm depending upon the number of residences connected to the system.
- E.5.3** It is the responsibility of the Developer's Engineer to determine the maximum number of pumps that will be pumping simultaneously and to size the main accordingly. These are the minimum design requirements:
- |   |           |
|---|-----------|
| i. Minimum main pipe diameter-          | 50 mm     |
| ii. Minimum service pipe diameter-      | 38 mm     |
| iii. Minimum flow velocity-             | 0.6 m/sec |
| iv. Maximum flow velocity-              | 3.0 m/sec |
| v. Hazen Williams flow coefficient (C)- | 150       |
- E.5.4** A two-compartment septic tank is required with a minimum total volume of 3,000 litres for a single-family dwelling. The use of a single chamber tank with a grinder pump is not permitted. Septic tanks shall provide effective solids settling and grease removal capabilities as well as providing adequate storage volumes to ensure reasonable pump cycle times.
- E.5.5** Sanitary sewer pumps shall have an open impeller design suitable for handling septic tank effluent. Pumps may either be submersible pumps installed in the second chamber (liquid chamber) of the septic tank or a centrifugal pump installed in the basement of the building with a suction line to the second chamber. All pump connections shall incorporate double check valves downstream of the pump discharge to prevent backflow into the septic tank.

- E.5.6** The maximum head for economical operation of low pressure sanitary sewer systems is 24 m (35 PSI). Pumps with higher discharge pressures should not be utilized unless detailed engineering design calculations recommend higher operating pressures. All pumps and collection mains within the system shall be designed to accommodate higher pressures if necessary. Small collection systems (40 residences or less) shall have all the discharge pumps designed for the same maximum discharge head.
- E.5.7** All pumps within the system should typically have the same maximum discharge head in order to avoid shutting out smaller pumps. In larger systems or systems with large elevation differences, pumps located further away from the system outlet or at a low elevation may require a higher discharge pressure in order to ensure proper system operation.
- E.5.8** A single pump intended to accommodate multiple services shall not be permitted unless the Developer's Engineer can demonstrate that the design will not be detrimental to the other system users.
- E.5.9** Sewer mains shall be either PVC pressure Class 150 or HDPE Series 100 and shall be capable of operating at a continuous pressure level of 875 kPa at 23°C. The minimum pipe size for sewer mains shall be 50 mm. Sewer mains shall not be oversized to reduce frictional head loss.
- E.5.10** Minimum depth of cover on sewer main shall be 3.0 m, measured from the top of the sewer to the final finished surface.
- E.5.11** Service pipes shall be 38 mm diameter Series 160 polyethylene or polybutylene tubing.
- E.5.12** PVC fittings for use with PVC pipe shall be a rubber gasket joint manufactured for the type of pipe used in the mains. Polyethylene pipe shall be joined by the butt fusion method and connected to fittings as recommended by the pipe manufacturer.
- E.5.13** Fittings shall PVC polyethylene or cast iron conforming to CAN3-B137.3, CAN-B137.1 or CAN3-B131.9 as appropriate. Fittings shall be designed for a working pressure of 900 kPa. Where flanged joints are used the bolts shall be manufactured from stainless steel.
- E.5.14** Service tees for use on 50 mm diameter mains shall be tapped to accept 37 mm or adapters. Only bronze reducing bushings shall be used to decrease the size of threaded opening in PVC tees down to 37 mm. Service tees on pipes 75 mm diameter or larger shall be made using Smith Blair Service Saddles as follows:
- i. Smith Blair Style 342 for 75 mm and 100 mm mains.
  - ii. Smith Blair Style 352 for 150 mm and larger mains.
- Only bronze reducing bushings shall be used to reduce the opening in the service saddle to 37 mm.

- E.5.15** Corporation stops for plastic service tubing shall have a compression joint. Stainless steel stiffeners of the correct size shall be used at all compression joints on polyethylene and polybutylene service tubing.
- E.5.16** Curb stops for plastic pipe shall have a compression type joint. The curb stop shall be of the ball valve type. Curb stops shall be equipped with an extension type valve box suitable for 3 m bury in the extended position. Stainless steel stiffeners of the correct size shall be used at all compression joints on polyethylene or polybutylene pipe.
- E.5.17** Ball valve curb stops shall be used as valves on 50 mm diameter pipe and shall be supplied with an extension type valve box suitable for 3 m bury. Valve boxes shall be protected against damage. Joints shall be of the compression type for both outlets.
- E.5.18** For 75 mm and larger pipe, valves shall be epoxy lined water works gate valves conforming to AWWA Specification C500.
- E.5.19** Valve boxes for 75 mm and larger valves shall be Norwood Foundry Type A or approved equivalent.
- E.5.20** The low pressure sewerage system shall be subjected to, and pass, a leakage test for one hour at 875 kPa pressure. The allowable leakage shall not exceed the pipe manufacturers recommended allowance.
- E.5.21** The use of repair clamps will not be permitted when making repairs to the pipe of the low pressure sewerage system. Regardless of the pipe being used, the bedding shall be placed to provide a minimum of 150 mm of sand cover over the pipe.
- E.5.22** When connecting to low pressure sanitary systems, Vortex equipment is to be installed in order to mitigate hydrogen sulfide gases. Downstream of the Vortex system, or connection to the low pressure sanitary system, two consecutive manholes are to be lined, as approved by the County, in order to mitigate damage from hydrogen sulfide gases.

## **E.6 SANITARY SERVICE CONNECTIONS**

- E.6.1** Separate sanitary sewer connections to the property line shall be provided for each separately titled lot or unit of multi-family dwellings.
- E.6.2** The minimum diameter of a residential gravity sanitary sewer service from the main to the property line shall be 100 mm.
- E.6.3** The minimum diameter of a residential low-pressure sanitary sewer service shall be 38 mm.
- E.6.4** Non-residential service connections shall be sized according to anticipated user requirements.
- E.6.5** Low-pressure service lines shall require a curb stop at the property line. Curb stops for low pressure services shall use caps identifying them as wastewater services. All wastewater caps shall be painted green.

- E.6.6** Connections for all proposed residential lots shall be installed at the time of initial subdivision development.
- E.6.7** The grade(s) of any sewer is governed by the minimum velocity required (0.6 m/sec). If the design flow does not produce a minimum velocity of 0.6 m/sec, the minimum grade must be calculated using d/D of 0.35 and velocity of 0.6 m/sec. Upon this condition the minimum grades for pipes 400 mm and smaller shall be as shown in Table E6.7-1:

**Table E6.7-1 MINIMUM GRADE FOR PIPES 400 mm AND SMALLER**

Pipe Size, (mm)	Grade, (%)	d/D*
200	0.46	0.35
250	0.35	0.35
300	0.27	0.35
350	0.22	0.35
400	0.19	0.8

\*d/D is the depth of flow to diameter of pipe ratio.

- E.6.8** Risers for service lines shall be required when sewer mains exceed 4 m in depth.
- E.6.9** Services shall be located such that they do not conflict with driveway locations.
- E.6.10** The sanitary services shall be installed to the property line. In areas where natural gas distribution facilities require an easement along the front of the property, the sanitary service connections shall be extended to the edge of the easement furthest from the roadway.
- E.6.11** Sanitary services shall always be installed to the right of the water service when facing the property line from the roadway.
- E.6.12** Weeping tiles, roof leaders and other similar appurtenances handling storm or groundwater shall not be permitted to discharge into the sanitary sewer.
- E.6.13** All sanitary services must be connected to the sanitary main. Services are not to be connected into manholes.

## **E.7 CONSTRUCTION**

- E.7.1** Trenching, Bedding and Backfilling
- i. All trenching and backfilling shall be completed in strict accordance with Occupational Health and Safety Guidelines.
  - ii. If unsuitable soil conditions are encountered, proper measures for dealing with the conditions shall be identified either on the design drawings or as a brief report to the Municipal Engineer prior to construction.
  - iii. Granular materials shall be well graded and approved by the Municipality before use. Class "B" pipe bedding shall be utilized in suitable soil conditions. Washed rock shall be used if water table is above the pipe zone. Bedding sand shall have minimum depth of 100 mm below the pipe and

shall extend up both sides to the trench wall and provide a minimum cover of 300 mm above the pipe. Where necessary, the Developer's Engineer shall determine special pipe foundation measures for areas where unsuitable pipe foundation conditions exist. Bedding sand bedding sand must be clean and meet the following requirements:

<b>Sieve Size Passing</b>	<b>% Passing, By Mass</b>
2,500	100
630	60 or more
315	30 or less
160	20 or less

- iv. The minimum trench width measured at the pipe spring line shall be the pipe outside diameter plus 450 mm. The maximum trench width measured at the pipe spring line shall be the pipe outside diameter plus 600 mm. The Developer's Engineer must be consulted if the trench must be excavated deeper or wider than specified.
- v. Excavated material shall be stockpiled at a safe distance from the edge of the trench, as per OH&S guidelines. Backfill material shall be the soil excavated from the trench although approved granular materials may be substituted for poor existing soils. All backfill material will be subject to approval by the Municipality. If possible, the excavated material shall be placed back in the trench in the vertical and horizontal order in which it was excavated. Backfill shall be placed in uniform lifts not exceeding 300 mm loose thickness. Where clay is used as backfill material, its moisture content shall not exceed the Plastic Limit by more than ten percent (10 %).
- vi. Within roadways, under no circumstances shall backfill material containing ice, snow, organic or any other deleterious material be used. Trench excavations shall be kept free of water.
- vii. Compaction and densities:
  - a. Prior to street construction: all excavations under proposed carriageways, sidewalks, street lights or other similar surface structures shall be backfilled in lifts with compacted thickness of 300 mm or less per lift and compacted to minimum density of not less than 98 % of the Maximum Standard Proctor Density or as otherwise approved by the Municipality. A minimum of two (2) density tests per 100 lineal meters of trench per 600 mm of compacted backfill thickness shall be taken. Additional tests may be called for as deemed necessary. Any free water in a trench shall be removed prior to placing additional lifts.
  - b. Under existing carriageways: all excavations under existing carriageways, sidewalks, lanes or other similar surface structures shall be backfilled to meet the following specifications:

- 300 mm or more below final grade – backfill materials shall be compacted to minimum density of not less than 98 % of the Maximum Standard Proctor Density.
  - 0 - 300 mm below final grade – backfill materials shall be compacted to a minimum of 100 % of the Maximum Standard Proctor Density and based on a minimum of two (2) field tests per 100 lineal meters of trench of compacted backfill. Backfill shall be placed in uniform lifts not exceeding 150 mm compacted thickness.
- c. Adjacent to existing carriageways: all material 300 mm below the finished grade shall be compacted to a density not less than 98 % of the maximum density of a five point Standard Proctor Compaction Test and based on a minimum of one (1) field test per 150 lineal meters of trench for each 600 mm of compacted vertical backfill.
- d. Sand or gravel backfill shall be compacted to meet the following density requirements:
- 300 mm or more below grade - the minimum acceptable density shall be 98 % of the Maximum Standard Proctor Density.
  - 0 - 300 mm below grade - all sand or gravel in this zone shall compact to 100 % of the Maximum Standard Proctor Density.
- e. Compaction testing: for all density tests indicating insufficient compaction, two (2) more density tests, proportionately representative of the trench length tested shall be taken at that depth. If the average of the three (3) tests is below the required density, the area of deficient density shall be re-excavated and re-compacted to meet the specified density. Densities greater than 100 % shall be deemed to be at 100 % for calculating the average of the three tests.
- f. Sub-grade and base course compaction for roadway construction shall be as specified in the applicable sections of these standards.
- viii. The Developer's Engineer shall identify areas where the trench excavation requires sheathing, shoring or bracing in order to protect workers, property or adjacent structures.
- ix. If the above standards cannot be achieved due to a large variation in soil types throughout the subdivision, the Developer's Engineer may, at his sole discretion, establish a more appropriate standard on an individual case basis subject to the Municipality's approval. One-mould Proctor density testing may be permitted if the Developer submits an acceptable proposal prepared by the Developer's Engineer justifying the required changes to the compaction standards.
- x. If the established minimum compaction standards cannot be met due to abnormal weather or wet ground conditions, the Municipal Engineer may establish a more suitable standard on a site-specific basis provided adequate justification is presented by the Developer. One-mould Proctor density testing shall not be permitted as an alternate testing procedure due to wet

soil conditions. The Developer's Engineer shall be required to suggest appropriate measures such as drying in-situ material or importing suitable material in order to meet the required minimum densities.

- xi. All landscaping, pavement structures, sidewalks, curb and gutter, and any other existing structures and facilities damaged or removed during trenching shall be restored or replaced at the Developer's expense.
- xii. All debris, surplus fill and unused materials must be removed from the site as directed by the Municipal Engineer.

#### **E.7.2 Sewer Main Installation**

- i. The pipe and gasket installation shall be conducted in compliance with the pipe manufacturer's specifications. Installation of PVC pipe and fittings shall conform to CSA-B182.11.
- ii. Pipe installation shall start at the outlet and work upstream.
- iii. Pipes shall be carefully aligned when jointing. Joints are to be kept free of mud, gravel and foreign material and shall be completed as outlined in the manufacturer's specifications. Each joint shall be completed before laying the next length of pipe. Deflections shall not exceed those permitted by the pipe manufacturer.
- iv. The pipe must be thoroughly flushed of all dirt, stones and pipe lubricant when complete. When pipe installation is not in progress, the open ends of installed pipe shall be closed with an approved plug or cap to prevent entrance of trench water and/or any foreign or other material into the line.
- v. Adequate backfill shall be placed on the pipe to prevent floating. Any pipe which has floated shall be removed from the trench and be re-installed as directed by the Municipality.
- vi. The alignment of pipes less than 900 mm in diameter shall not be more than 150 mm off the designated alignment. The alignment for pipes larger than 900 mm shall not deviate by more than 50 mm per 300 mm of pipe diameter.
- vii. The invert of the pipe shall not deviate from the design grade by more than 6 mm plus 20 mm per metre of pipe diameter.

#### **E.7.3 Manholes Installation**

- i. Manholes shall be installed as depicted on the detail drawings and in accordance with manufacturer's recommendations.
- ii. Backfill around manholes shall be compacted to a minimum of 98% of Standard Maximum Proctor Density.
- iii. Tee riser manholes shall require Class A bedding placed from the bottom of the excavation to the pipe spring line.
- iv. Pre-cast manhole bases shall be installed on a base of 100 mm to 300 mm of washed gravel.



- v. Cast in place manhole bases are not approved by the Municipal Engineer.
- vi. Safety steps shall be aligned on centreline perpendicular to the main flow channel. Wherever possible, the steps shall be aligned so that a person exiting the manhole would face oncoming traffic if not conflicting with the previous requirement. The distance from the top of the rim to the first step shall not be greater than 300 mm. Steps shall be evenly spaced at a maximum of 410 mm to within 600 mm of the base of the manhole.
- vii. The manhole frame and cover shall be installed following manufacturer's recommendations.

## **E.8 INSPECTION AND TESTING**

**E.8.1** All material testing shall be performed by an accredited firm and certified by a Professional Engineer. All test results shall be submitted to the Municipal Engineer with a report indicating any deficiencies and remediation.

### **E.8.2 Closed Circuit Television Inspection of Sewer Lines**

- i. General
  - a. This section of the standards shall form a part of the Contract Documents and should be read in conjunction with them.
  - b. The work shall include video inspection of sewer mains between manholes including a digital or audio commentary on location and distance encoding, written report and still photographs including information within report identifying potential problem areas.
  - c. The equipment, materials and methods used must produce suitable video records and logs for the identification and categorization of deficiencies, as well as the determination of the location, extent and seriousness of each deficiency.
  - d. All sewer lines shall be flushed and cleaned by the Developer prior to video inspection. Lines, including stubs must be inspected with either actual flow or simulated flow pronounced by adding water at an upstream manhole or riser pipe. The simulated flow must produce a visible, laminar flowing stream in the line for the full length of the line being inspected. Inspections will be rejected where the simulated flow exceeds one-third the diameter of the pipe.
- ii. Video Records and Index Plans
  - a. Video records are to be supplied by the Contractor and shall be in a digital format acceptable to the Municipality. The Contractor shall set up the files in a format where each section of pipe or services has a separate chapter number. All video inspections are to be done in color and with sufficient lighting to result in a clear high quality picture.
  - b. The Contractor must also provide an 11" x 17" plan with an Index of video runs to pipe element or manhole numbers. Manhole numbers shall

be as prescribed by the Municipal Engineer and, in the absence of such, the manhole numbers on the Detailed Engineering Drawings shall be used. The manhole numbers from the Detailed Engineering Drawings shall be on a plan showing the location and the number of the manholes, and is to be bound in with the video and index sheet. There shall be separate video files for sanitary mains and services. Separate logs shall be provided for each file.

iii. General Operations

- a. The entire length of each sewer shall be video inspected between manholes. In new subdivisions, terminating videos at the connection point to an existing stub will not be permitted. The camera unit shall, at no time, travel at a rate of speed greater than 6 m per minute. If for any reason, the video camera unit will not pass from one manhole to another then a reverse run shall be done at no extra cost. The video inspection shall take place during low flow conditions. At no time during video inspection shall the depth of flow exceed 1/3 of the pipe diameter. Camera travel shall be in the same direction as the flow, at all times, unless impractical or when a reverse run is necessary. Newly constructed pipes are to be video inspected with simulated flow by running water into an upstream manhole or clean-out.
- b. The camera shall be positioned centrally in the pipe with a tolerance of +/- 10 %. If conditions within the pipe do not allow for this configuration, a greater tolerance may be allowed upon approval by appropriate Utility personnel and/or the Municipal Engineer. Chainages for the video inspection shall begin at the inside face of the starting manhole wall and terminate at the inside face of the end manhole wall.

iv. Video Inspection

- a. The video inspection of each section of sewer line shall begin with a digital or audio commentary describing the following:
  - Time and date
  - Weather conditions at the time of inspection
  - Subdivision description and/or phase
  - Location description in and on-from-to format as described on the list of lines to be inspected
  - Manhole numbers as provided by the Developer
  - Size and use of sewer including pipe material
  - Direction of flow
  - Inspection technician
  - Video identification number
- b. This information shall also be written on the video report sheet.

- v. Work Report
- a. A video work report, in log form, shall be completed during the inspection. This log shall show the exact measured location of faults including, but not limited to:
- Open joints
  - Broken, cracked, collapsed or ovaled pipe
  - Accumulation of debris or obstructions
  - Root penetration and root rating (1 to 9 root rating system)
  - Infiltration and mineral deposits
  - Water depth variation and sags
  - Protruding gaskets
  - Service connections and type (in-line or inserta-tee)
- b. The reference location shall include the distance away from the reference manhole and also the position of the fault as referred to the crown of the pipe using the clock face notation. Significant faults are to warrant audio commentary on the video tape duplicating report information. The camera shall be stopped briefly at these locations. Color photographs shall be taken of all sewer defects. The photographs shall be coordinated with the written report by reference numbers. Photographs of all deficiencies are required. Additional photographs shall be taken as deemed necessary.
- c. One (1) hardcopy of the final written report with corresponding photographs and one (1) electronic copy of the final written report with corresponding photographs and the video inspections shall be furnished to the Municipal Engineer within one (1) week after completion of the inspection.
- d. All video inspection files shall be numbered and cross indexed to the written report. Reports shall be bound and if more than one report is submitted in one binding, then there shall be an index sheet provided with the biding indicating the contents. Separate reports shall be submitted for mains and for services.

**E.8.3** Sections requiring repair will be subject to re-inspection when repairs are complete. At the discretion of the Municipal Engineer, re-inspection by a camera may be required on selected areas prior to issuing of the Final Acceptance Certificate. All video inspection costs shall be borne by the Developer.

**E.8.4** At the Municipal Engineer's discretion, an infiltration and/or exfiltration tests (leakage test) may be required for any section showing deficiencies during the camera test. Tests procedure shall be as follows:

- i. The test section shall be filled with water allowing displacement of air in the line and will be allowed to stand for 24 hours to ensure absorption in the pipe wall. Prior to the test, add enough water to ensure a head of 1 m to 3 m over the pipe crown in the upstream manhole. The test duration shall be 2

hours. The water level should be measured at the beginning and end of the test in order to calculate the infiltration / exfiltration.

- ii. The allowable leakages are as follows:
  - a. Infiltration test shall be performed when the groundwater is above the pipe crown for the entire test length. Allowable infiltration is 5.0 L/day/mm diam/km for PVC pipe and 20.0 L/day/mm diam/km for concrete pipe.
  - b. Exfiltration test shall be performed when the groundwater is below the pipe invert for the entire test length. Allowable exfiltration is 5.0 L/day/mm diam/km and 20.0 L/day/mm diam/km for concrete pipe.

**E.8.5** Each section of sanitary sewer main shall be subjected to a light test. A light shall be shone into the sewer main at the upstream manhole. To pass the test, the light must be fully visible when viewed from the downstream manhole. In the event of an unsuccessful light test, the sewer main section in question shall be subjected to a pill test where a ball, or similar object of a diameter that is 50 mm less than the inside diameter of the sewer main shall be successfully pulled through without encountering any obstructions.

## **E.9 SANITARY WASTEWATER PUMPING SYSTEMS**

**E.9.1** Wastewater pumping systems shall only be installed where site constraints restrict the gravity collection system from tying to an existing sanitary trunk line. The requirement must be justified in an initial proposed subdivision design report taking the subdivision plans for the surrounding area into account.

**E.9.2** The design and construction of the pumping system must meet the current requirements of other governmental authorities and regulations including Alberta Environment, Alberta Occupational Health and Safety and the Alberta Building Code. The Developer is responsible for all submissions and applications required for approval.

**E.9.3** General Requirements for location of the wastewater pumping systems are:

- i. The pumping station shall be located in such a manner as to minimize the impact to adjacent subdivisions in terms of visibility, odour and noise.
- ii. Pumping stations shall not be located in areas subject to flooding during a major rainfall event.
- iii. Pumping stations shall always be accessible by road.

**E.9.4** System configuration shall be as follows:

- i. A wet well configuration with submersible pump or above ground suction head pump is preferred.
- ii. A wet well/dry well configuration may be considered for larger facilities.
- iii. A separate building may be required for the wet well/dry well pumping stations.

- iv. A collection manhole shall intercept flow from all incoming sewers before discharge to the pumping station. The pumping station shall receive flow from one inlet only.
- v. Provisions shall be made to shut off flow from the collection manhole if required.
- vi. Any pumping stations without a separate building shall be fenced with a lockable gate to prevent unauthorized access.
- vii. The Developer shall be responsible for necessary landscaping required to enhance the appearance of the facility when located close to a residential area. Landscaping plans are subject to approval by the Municipality.

**E.9.5** Requirements for force mains:

- i. Force mains shall be constructed of HDPE pipe unless otherwise approved by the Municipality. The minimum force main diameter shall be 100 mm.
- ii. A "system-head" curve shall be provided for each force main. Supplementary information to be provided with the curves will include but not be limited to, population estimates, area served, plan and profile of line, friction coefficients and line head losses.
- iii. The force main design pressure shall allow for the normal static and dynamic operating pressures including water hammer effects. The pressure rating of the pipe shall be twice the operating pressure or 690 kPa, whichever is greater. Surge pressures during starting and stopping of the pumps shall not exceed the safe operating capacity of the force main.
- iv. The velocity shall be within 0.6 m/sec to 3.5 m/sec. The minimum velocity for pipes larger than 300 mm shall be 1.1 m/sec. Special design provisions in order to stabilize the line shall be incorporated when design velocities exceed 3.0 m/sec.
- v. A series of 45° bends shall be used in lieu of 90° bends.
- vi. Air release valves shall be installed in concrete access chambers at all relative high points. Force main grades should be designed in order to avoid the requirement for an air release valve wherever possible.
- vii. Blow-off valves shall be provided at all low points.
- viii. Vacuum relief valves shall be installed wherever necessary in lines designed to drain by gravity between pumping cycles.
- ix. Provide stainless steel bolts on all valves.
- x. Provide operating nuts located between 2 m and 3 m below ground surface without rock shields on all valves.
- xi. The force main invert at the receiving manhole shall be a maximum of 300 mm above the highest invert. The outlet invert of a lagoon inlet manhole shall always be above the high water level.

- xii. When force main length exceeds 1,000 m, cleanouts should be installed in concrete access chambers complete with isolation valves and adaptor coupling for line flushing.
- xiii. A two hour pressure test shall be conducted for all new force mains.
- xiv. Isolation and check valves shall be provided and housed in an accessible valve chamber with removable hatch for facilitating the maintenance work.
- xv. If necessary, the force main shall be oversized to serve areas outside the proposed subdivision area. A gate valve shall be provided at both ends of the sewage force main.

**E.9.5** Requirements for the pumping stations:

- i. The pumps shall be sized to accommodate the maximum expected flow as determined by accepted best engineering practice.
- ii. Pumping stations shall be equipped with two or more pumps sized such that if one pump is out of service, the remaining pump(s) is/are capable of pumping the design capacity flow rate. Pumps shall be identical and interchangeable for a duplex pumping station. Pump starts shall alternate between pumps.
- iii. Pumps shall be provided by an industry recognized manufacturer with a local repair service depot. The design and installation shall meet pump manufacturer's specifications.
- iv. Submersible pumps shall have a non-clog impeller design and flush valves.
- v. Pump motors shall operate on 3-phase power wherever possible. This requirement may be relaxed by the Municipality if 3-phase power cannot be supplied at a feasible cost.
- vi. Dead storage shall be minimized while meeting minimum depth requirements specified by the pump manufacturer.
- vii. Wet wells shall be sized based on accepted engineering practice. Storage shall be provided to minimize the frequency of pump starts but the maximum retention time in the wet well should not exceed 30 minutes.
- viii. Wet wells shall be sized and equipped to accommodate operator access, maintenance and safety requirements.
  - a. Pipes and valves:
  - b. The minimum diameter for all pump suction and discharge piping shall be 100 mm.
  - c. Pipe sizing shall allow for minimum and maximum flow velocities of 0.75 m/sec to 3.5 m/sec respectively within the pumping station.
  - d. The minimum pressure rating of piping within the pumping station shall be determined based on calculated operating pressures but shall not be less than 900 kPa.

- e. Pumps shall be connected in parallel to a common discharge header located within the pumping station. Check valves and isolation valves shall be installed on the discharge line between each pump and the discharge header.
  - f. A forcemain isolation valve shall be installed on the main discharge pipe outside the wet well.
- ix. Water supply:
- a. Water supply must be provided to the facility for washing and cleaning purposes.
  - b. The design shall ensure that the connection between the potable water supply and the wastewater pumping station does not cause contamination of the potable water supply. The design shall comply with the conditions stipulated in the current Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems for Water Supply and Wastewater Facilities published by Alberta Environment.
  - c. Where a potable water supply is to be used for washing and cleaning purposes, a break tank, a pressure pump and a pressure tank shall be provided. In-line backflow preventers are not acceptable. The potable water shall be discharged to the break tank through an air gap at least 150 mm above the maximum flood line or the spill line of the tank.
- x. Alarms and emergency backup:
- a. The Developer shall make provisions to mitigate environmental or property damage caused by facility failure.
  - b. Pumping stations shall be equipped with a feature for future connection of remote sensing and telemetry equipment enabling operators to monitor the system status.
  - c. Power must be supplied from two independent sources. In the event of a power failure, secondary power must automatically engage through a diesel generator or direct-coupled motor. Secondary power system must not be fueled by natural gas unless a supply tank is provided on site.
  - d. Special considerations shall be made to control any possible overflow in a manner acceptable to the Municipality and according to the current requirements of Alberta Environment.
- xi. Access and maintenance:
- a. Permanent hoist equipment and access hatches of sufficient size and capacity shall be provided for removal of the pumping station equipment.
  - b. All access points shall have locking devices.
  - c. Ladders shall be non-skid and shall comply with Occupational Health and Safety requirements.

- d. Pumping stations shall have adequate interior and exterior lighting.
  - e. The Developer is responsible for the supply of an Operating and Maintenance Manual for the facility. The Manual shall include a complete parts list for all mechanical and electrical components and control diagrams, schematics and manufacturer's operation, maintenance, service and repair specifications. The Developer shall submit five (5) copies to the Municipality along with all commissioning and testing results prior to issuance of the Construction Completion Certificate.
- xii. Ventilation and heating:
- a. Forced mechanical ventilation is required for dry wells below ground level and for wet wells containing screens or mechanical equipment requiring maintenance or inspection.
  - b. Equipment shall be able to provide at least six (6) air changes per hour. Provisions shall be made for ventilation of the wells with portable equipment in case of system failure. Ventilation failure alarms shall be required.
  - c. There shall be no interconnection between wet well and dry well ventilation systems.
  - d. Multiple air inlets and outlets are recommended for dry wells over 5 m deep. Air intakes and outlets shall be designed to function year round and screen openings should be sized to avoid frost build-up or clogging.
  - e. Air shall be forced into the dry well at a point 150 mm above the pump floor and into the wet well at a point 150 mm above the high water level.
  - f. Automatic heating and dehumidification equipment shall be provided in all dry wells.
- xiii. Building requirements:
- a. All pumping stations shall be provided with a building to house all electrical and control equipment and to provide a workspace for pump maintenance.
  - b. Buildings shall be of an adequate size to allow for the required access hatches, hoist equipment, ventilation and control equipment.
  - c. Access to the wet well shall not be from within the building.
  - d. Building layout and access shall be designed to facilitate the removal of any equipment that may require off-site maintenance.
  - e. Structural members shall be masonry, concrete or structural steel. Wood frame buildings are not permitted. Buildings shall comply with the current Alberta Building Code.
  - f. The design shall incorporate measures to reduce the noise and odour impact on the surrounding areas.

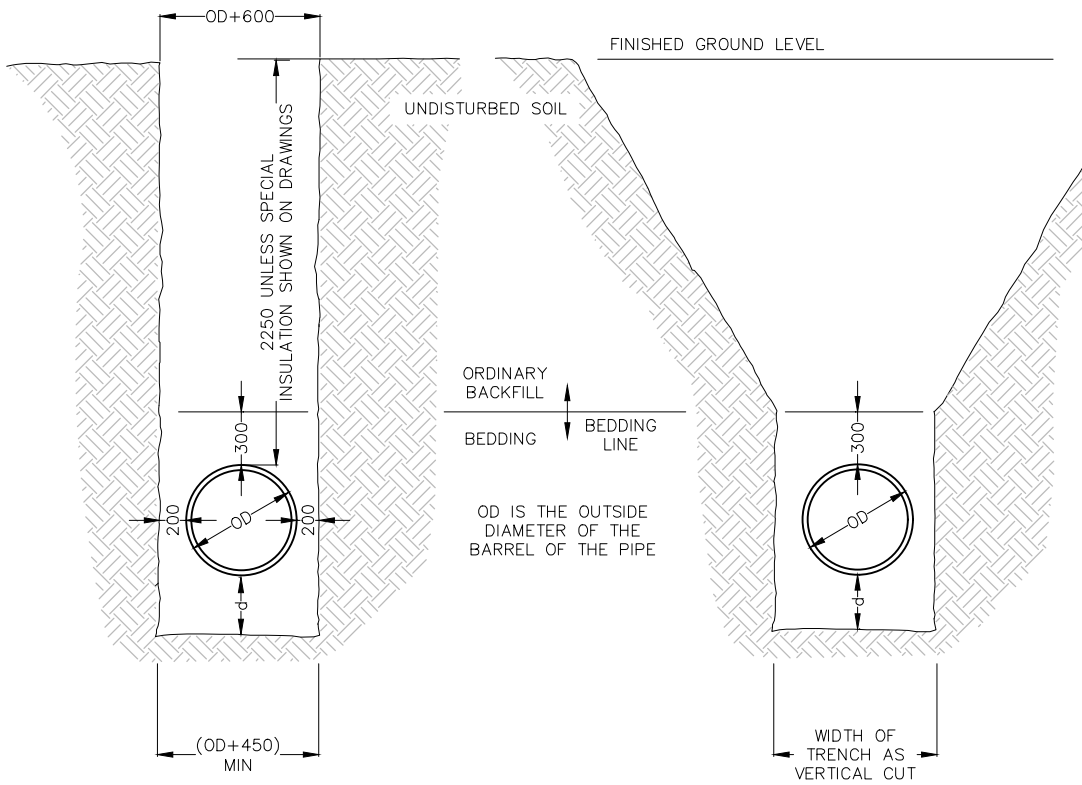


- g. Buildings shall be designed to blend architecturally with the surrounding subdivisions.
- h. Windows shall not be permitted in pumping station buildings.

**E.10 LIST OF DRAWINGS**

- E-01 Standard Trench Dimensions for Circular Pipe
- E-02 Standard Trench Bedding for Circular Pipes
- E-03 Typical Service Connections
- E-04 Single Low Pressure Sanitary Service
- E-05 Typical Services (Single & Dual)
- E-06 Sanitary Cleanout Detail
- E-07 Sanitary Service Connection Manufactured Home
- E-08 Standard 1200mm Manhole
- E-09 Neck Section Details for Standard 1200mm Manhole
- E-10 635 Neck Ring
- E-11 Safety Steps for Manholes
- E-12 Screen
- E-13 Cleanout
- E-14 Low Pressure Septic Tank Installation
- E-15 Floating Manhole Frame and Cover Type NF-80 and NF-90
- E-16 Type NF-39 Cover and Frame
- E-17 Manhole Cover – Sanitary Sewer
- E-18 Concrete Splash Pad Details

**END OF SECTION**



**STANDARD TRENCH  
VERTICAL CUT**

(TO BE SHORED AS PER  
OCCUPATIONAL HEALTH  
AND SAFETY STANDARDS)

**STANDARD TRENCH  
SLOPING CUT**

(TO BE SLOPED AS PER  
OCCUPATIONAL HEALTH  
AND SAFETY STANDARDS)

**MAXIMUM TRENCH WIDTHS FOR SINGLE PIPES**  
 -UP TO AND INCLUDING 400mm DIAMETER - 1000mm  
 -450mm DIAMETER AND ABOVE - OD + 600mm

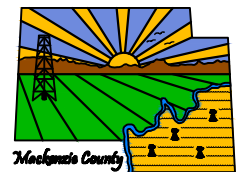
**DEPTH OF BEDDING BELOW PIPE BARREL (d)**  
 -100mm MIN

**NOTES:**


1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

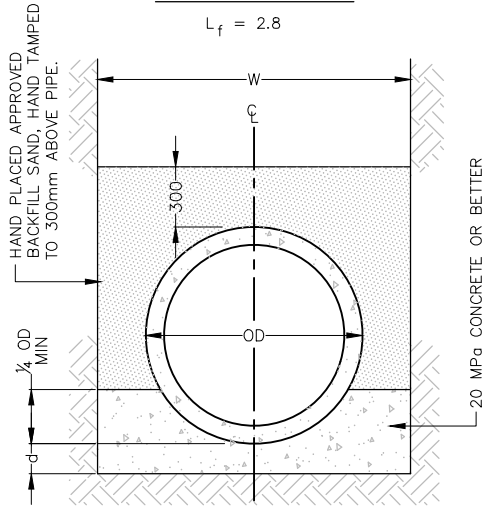


### STANDARD TRENCH DIMENSIONS FOR CIRCULAR PIPE

Rev.				Approved: 	Figure <b>E-01</b>
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		

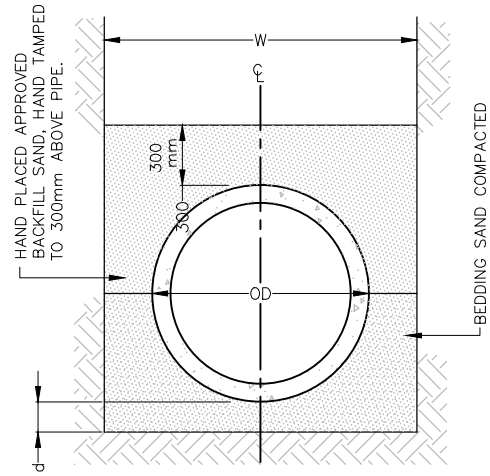
**CLASS A BEDDING**

$L_f = 2.8$



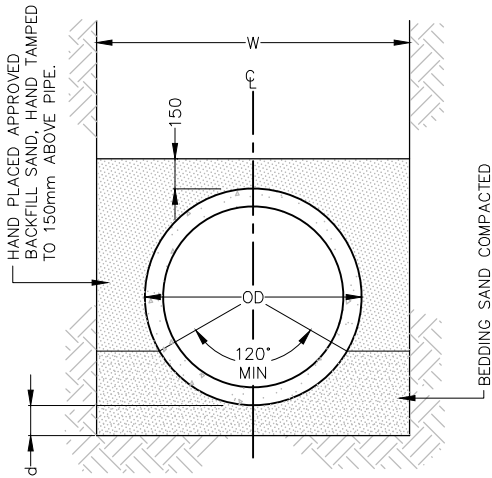
**CLASS B BEDDING**

$L_f = 1.9$



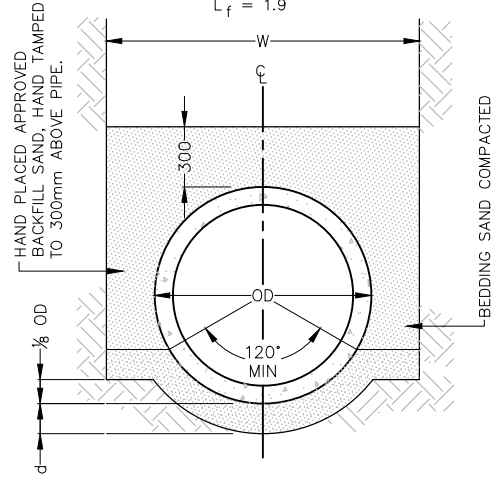
**CLASS C BEDDING**

$L_f = 1.5$



**CLASS B BEDDING**

ALTERNATE - 375mm I.D. & UNDER  
 $L_f = 1.9$

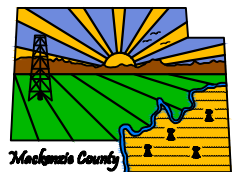


NOTES:

1. W = TRENCH WIDTH - O.D. + 450mm (MINIMUM).  
- 1000mm max. FOR PIPES UP TO AND INCLUDING 400mm DIAMETER.  
- O.D. + 600mm max. FOR PIPE DIAMETERS 450mm AND ABOVE.
2. O.D.= OUTSIDE PIPE DIAMETER.
3. I.D. = INSIDE PIPE DIAMETER.
4.  $L_f$  = LOAD FACTOR.
5. d = DEPTH OF BEDDING BELOW PIPE = 150mm (MIN).
6. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
7. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

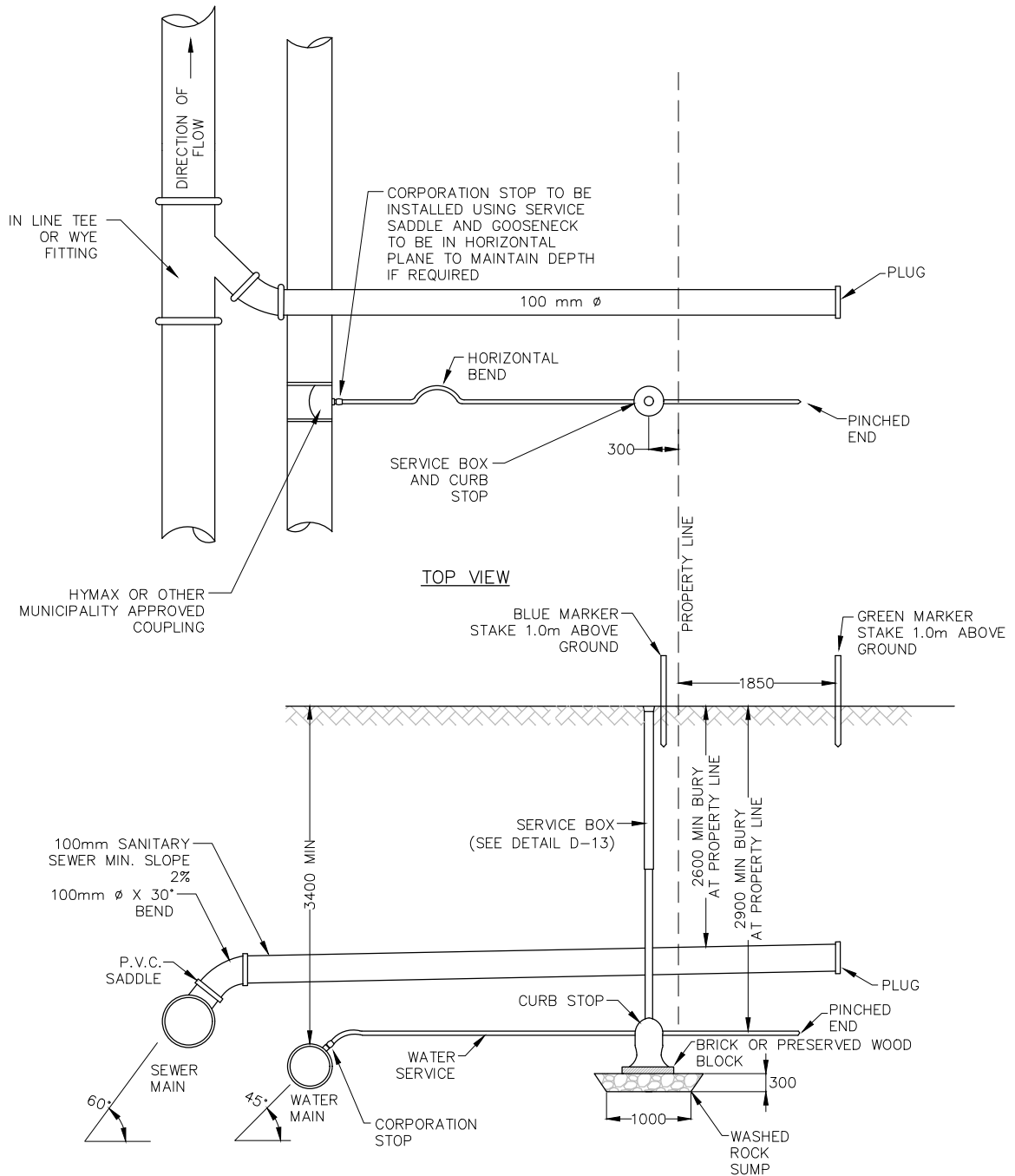


### STANDARD TRENCH BEDDING FOR CIRCULAR PIPES

Approved:

Figure **E-02**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

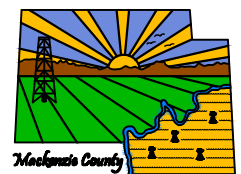


NOTES:


1. AN ADDITIONAL GOOSENECK IS REQUIRED AT EACH SEWER CROSSING.
2. MAINSTOP TAPS SHALL BE A MINIMUM OF 600mm APART, AND NO LESS THAN 300mm FROM A COUPLING OR COLLAR.
3. MINIMUM SERVICE DIAMETER SHALL BE 25mm WHERE THE SERVICE LENGTH IS LESS THAN 30m OR LESS. WHERE SERVICE LENGTHS EXCEED 30m, THE MINIMUM SERVICE DIAMETER SHALL BE 38mm.
4. INVERT ELEV. OF WATER SERVICE PIPES AT P/L SHALL BE 2.90m BELOW ESTABLISHED FINISHED GRADE.
5. WHERE ENGINEER APPROVED COVER OVER WATER SERVICE TO BE LESS THAN 2.90m SERVICE IS TO BE INSULATED.
6. ZINC ANODE SHALL BE ATTACHED TO COPPER PIPE 1.0m FROM CC WITH AN ALL BRONZE (INCLUDING NUTS AND BOLTS) CLAMP OR APPROVED EQUIVALENT.
7. ZINC ANODE TO BE EMBEDDED INTO TRENCH WALL TO PROVIDE FOR MIN. 50mm OF NATIVE CLAY SURROUNDING ANODE.
8. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

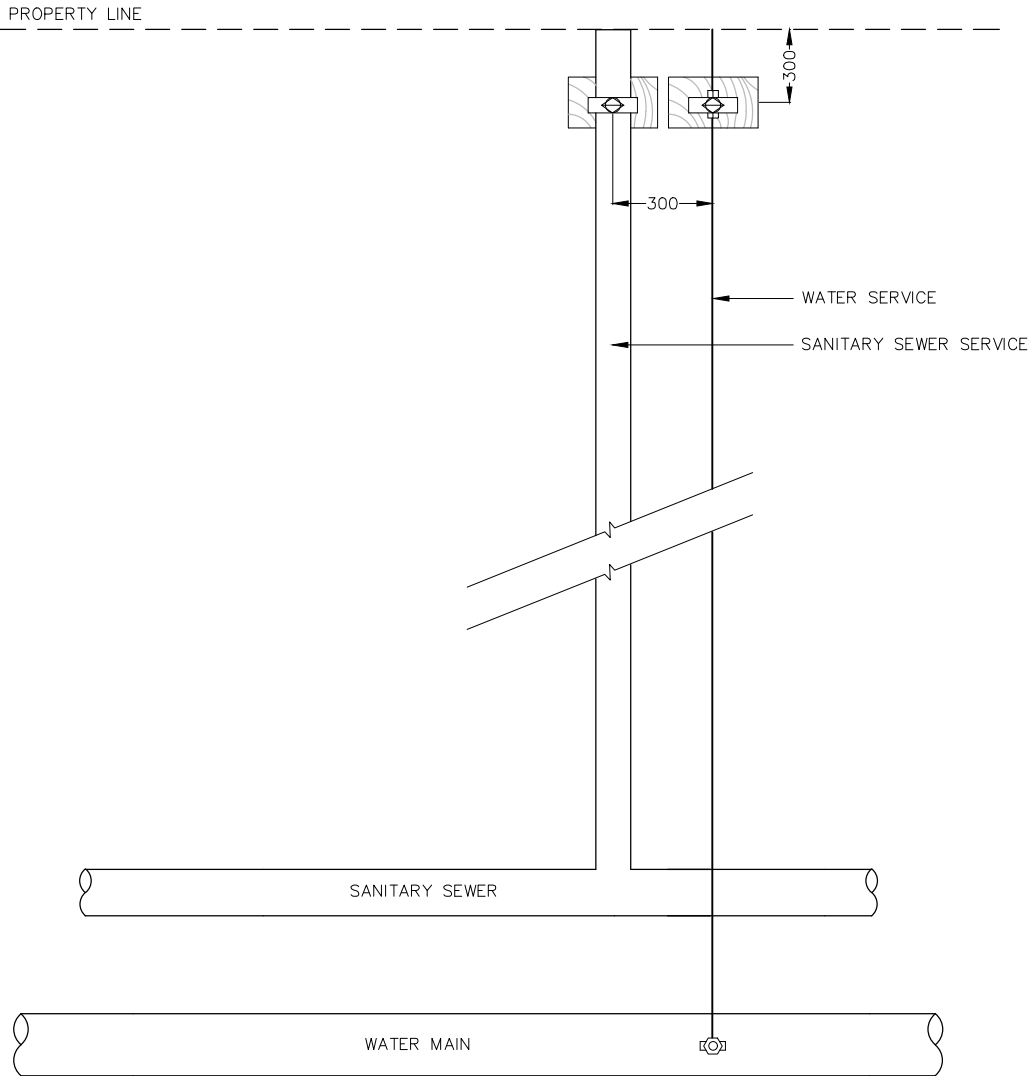
# MACKENZIE COUNTY

## General Municipal Improvements Standards



### TYPICAL SERVICE CONNECTIONS

Rev.				Approved: 	Figure E-03
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2014-JUL-08	Drawn: K.P.L	Scale: N.T.S		

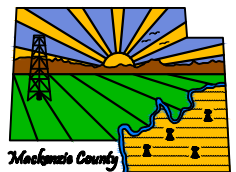


NOTES:


1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. SERVICES MAY BE EXTENDED INTO PRIVATE PROPERTY TO EDGE OF GAS EASEMENT IN LANELESS SUBDIVISIONS.
3. SERVICE LOCATION NOT TO OBSTRUCT PROPOSED DRIVEWAYS.

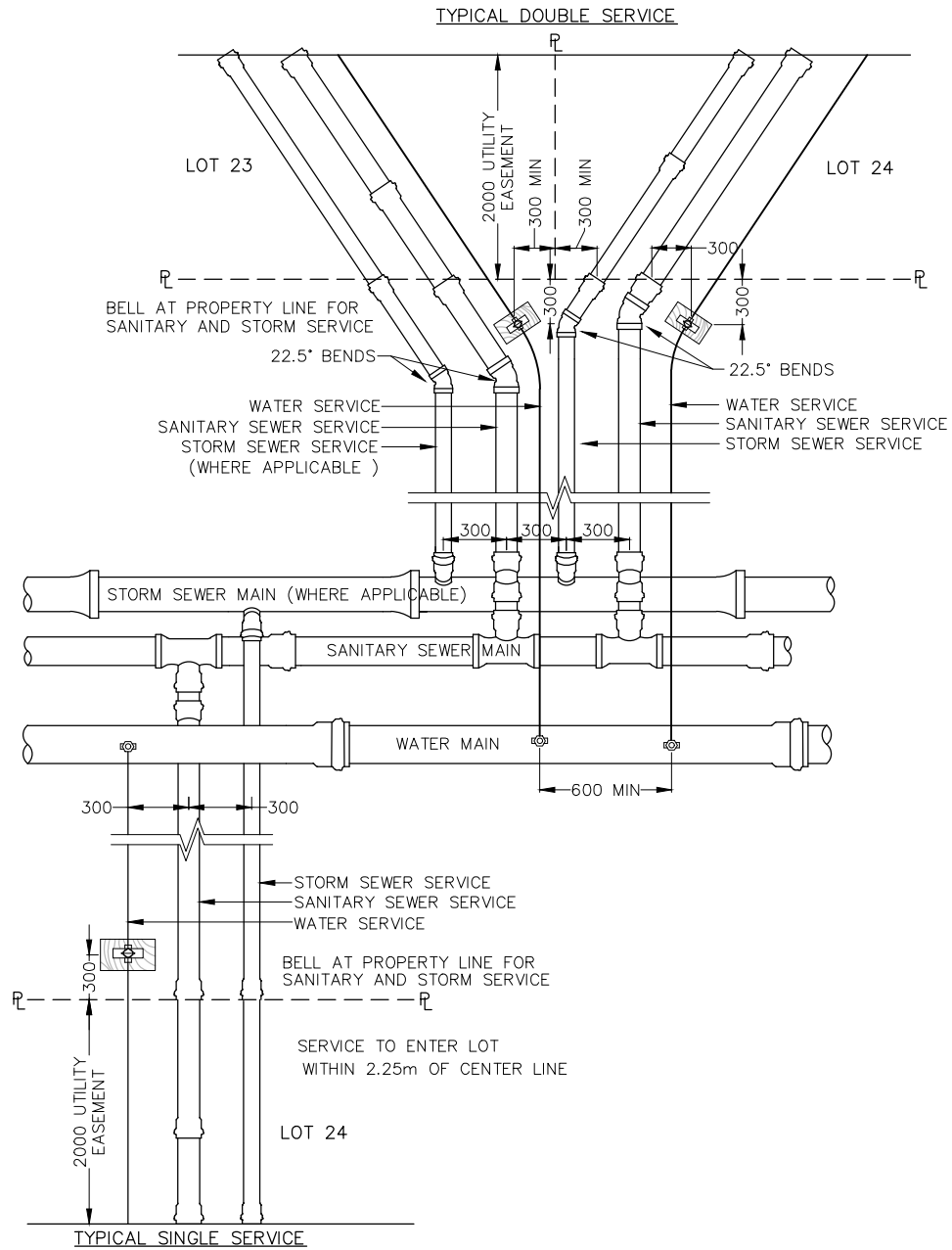
# MACKENZIE COUNTY

## General Municipal Improvements Standards



### SINGLE LOW PRESSURE SANITARY SERVICE

Rev.				Approved: 	Figure E-04
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2014-JUL-08	Drawn: K.P.L	Scale: N.T.S		

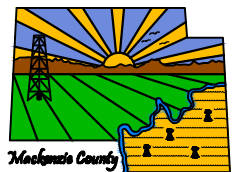


**NOTES:**

1. WATER AND SEWER SERVICES MAY BE EXTENDED TO EDGE OF 2.0m UTILITY EASEMENT.
2. THE MUNICIPAL ACCEPTS NO RESPONSIBILITY FOR THE CONSTRUCTION OR MAINTENANCE OF SERVICES INSTALLED WITHIN THE EASEMENT.
3. MARK ENDS OF SERVICES AT EDGE OF GAS EASEMENT WITH A 50mm X 100mm X 750mm STAKE PROTRUDING 450mm ABOVE GROUND AND PAINTED BLUE. MARK THE CURB CONTROL VALVE WITH A SIMILAR STAKE PAINTED RED.
4. PERMEABLE FILTER CLOTH MAY BE USED ON THE END OF THE WATER SERVICE TO PREVENT INTRUSION OF DEBRIS AND TO ALLOW TESTING FLOW OF CURBSTOP.
5. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

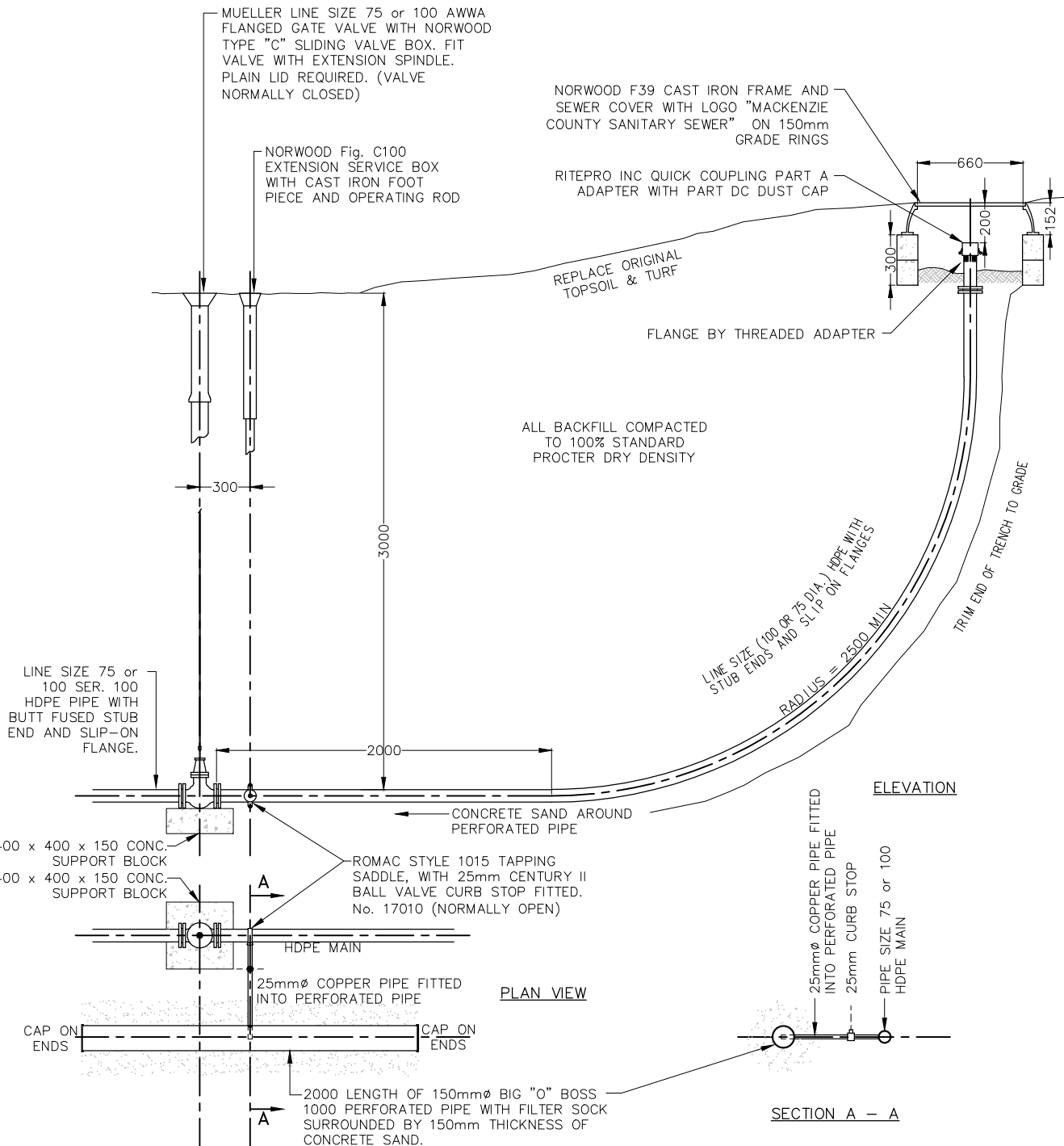
# MACKENZIE COUNTY

## General Municipal Improvements Standards



### TYPICAL SERVICES (SINGLE & DUAL)

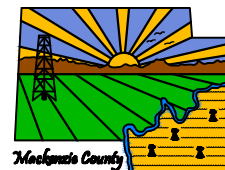
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Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:	Approved:	Figure
Date:	2014-JUL-08	Drawn: K.P.L	Scale: N.T.S	<i>[Signature]</i>	<b>E-05</b>



NOTES:  
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



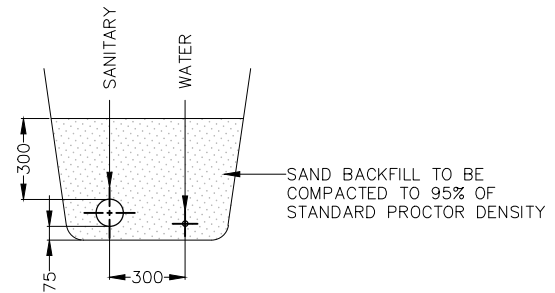
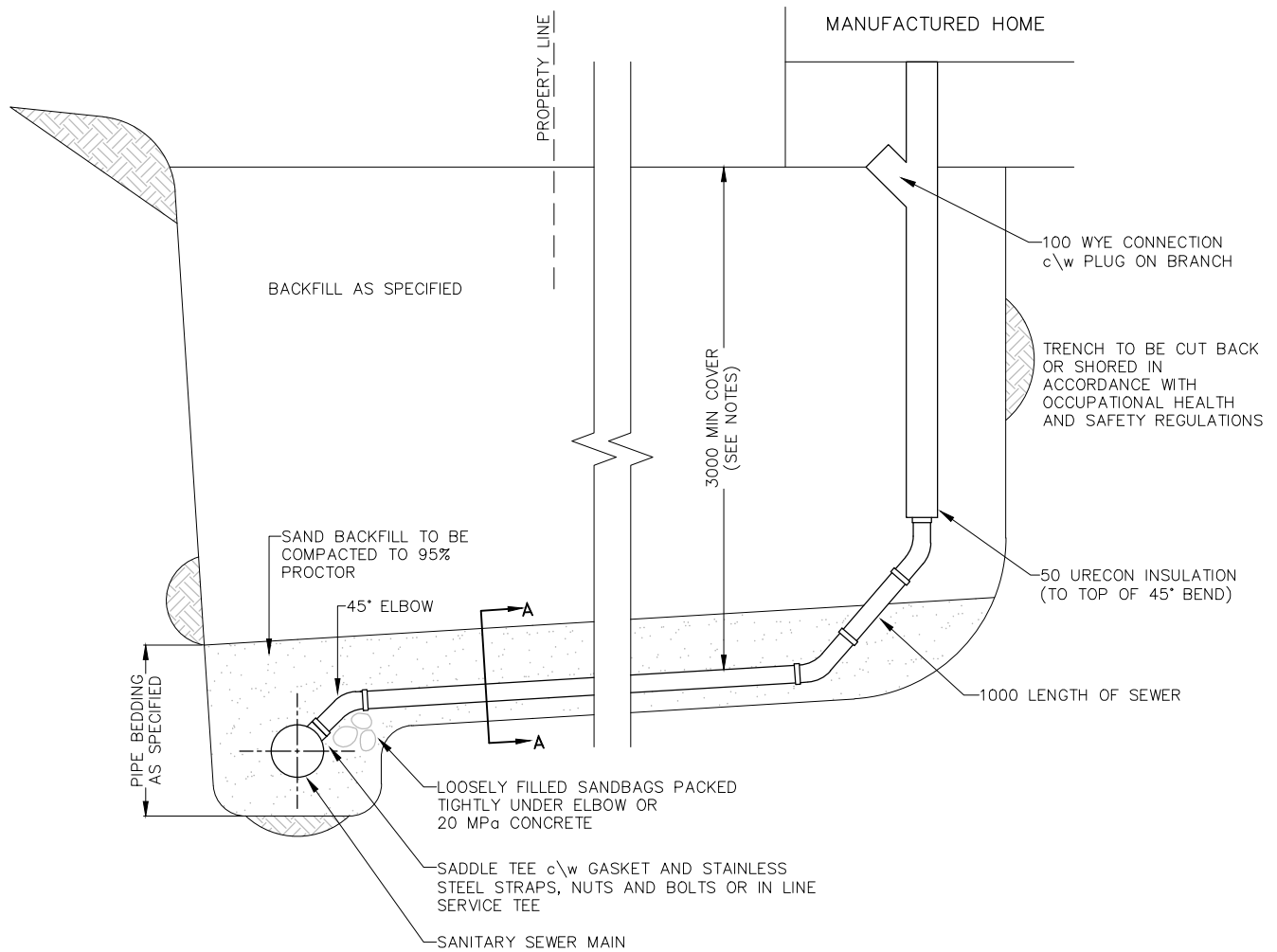
### SANITARY CLEAN OUT DETAIL

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

Approved:

Figure **E-06**





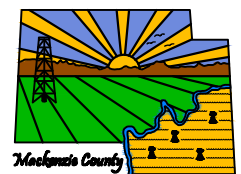
SECTION A-A

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. MIN SLOPE FOR 100 mm DIA. PIPE IS 2%
3. SERVICE CONNECTIONS SHALL BE 100mm UNLESS SPECIFICALLY SHOWN ON THE DRAWINGS.
4. 50mm URECON INSULATION WILL BE REQUIRED.
5. TRENCH TO BE CUT BACK OR SHORED IN ACCORDANCE WITH OCCUPATIONAL HEALTH AND SAFETY REGULATIONS.
6. MUNICIPAL SERVICE TERMINATES AT PROPERTY LINE. BUILDER RESPONSIBLE FOR CONNECTION TO BUILDING.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

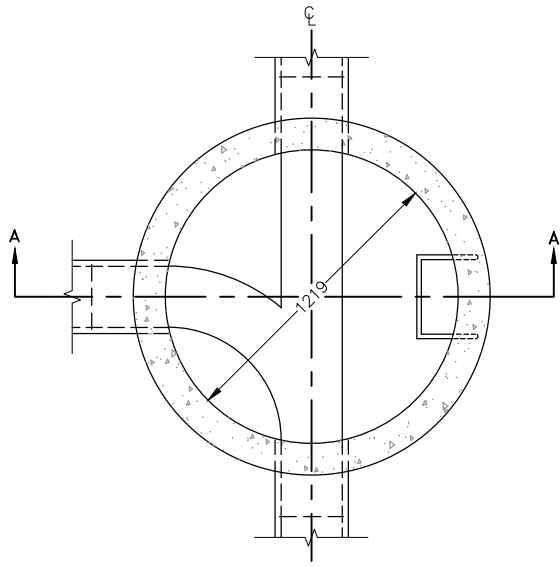


### SANITARY SERVICE CONNECTION MANUFACTURED HOME

Approved:

Figure **E-07**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

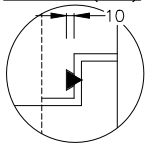


SECTION B-B

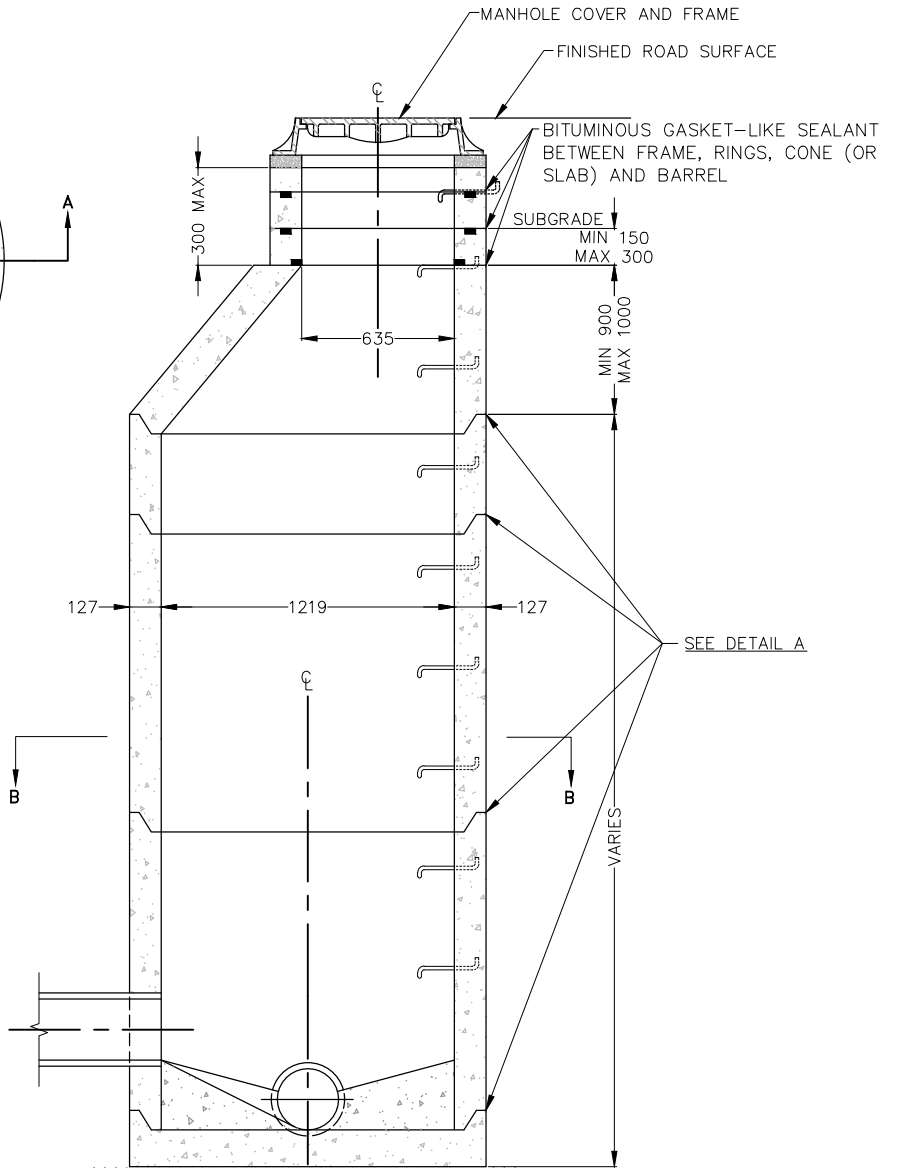
NOTES:

1. THIS STANDARD APPLIES TO MANHOLES ON PIPING OF MAXIMUM DIAMETER 600mm AND MINIMUM DEFLECTION ANGLE OF 120°.
2. 1500mm MANHOLE SHALL BE USED ON PIPING DIAMETER 750mm, 900mm AND 1050mm. FOR PIPE DIAMETER 1200mm AND LARGER, MANHOLE TEE RISERS SHALL BE USED.
3. PREBENCHED MANHOLE BASE UNITS WITH INTEGRAL GASKETS SHALL BE USED.
4. THE SEWER PIPING IS AN EXAMPLE ONLY, REFER TO PROJECT DRAWINGS FOR LAYOUT AND ELEVATIONS.
5. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
6. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

DETAIL A (TYP)



GRADE RINGS (c/w GASKET NOTCH) AS ALTERNATE, RUBBER GRADE RINGS MAY BE ACCEPTED BY MUNICIPAL ENGINEER



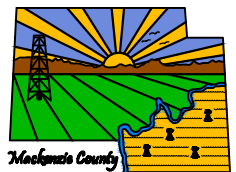
SECTION A-A



100-300 LAYER OF WASHED GRAVEL

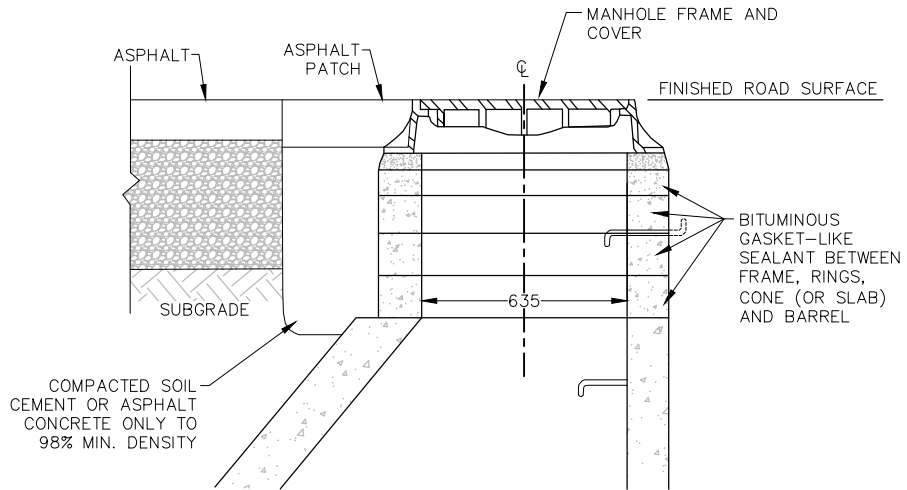
UNDISTURBED SOIL

# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				STANDARD 1200mm MANHOLE	Approved: 	Figure E-08
Rev.						
Rev.						
Rev.	2021-FEB-15	File No.: GP60.33682	Design:	Approved: 	Figure E-08	
Date:	2014-JUN-25	Drawn: K.P.L	Scale: N.T.S			

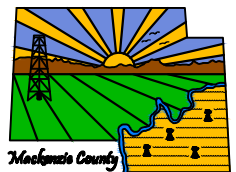


NOTES:


1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

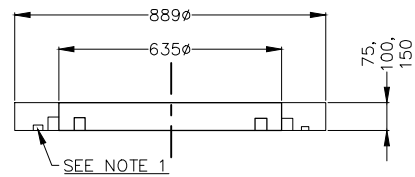
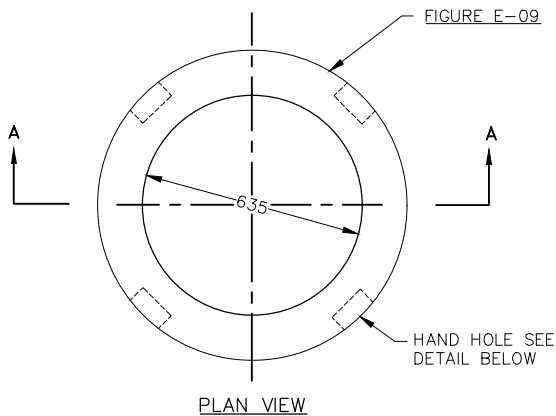
# MACKENZIE COUNTY

## General Municipal Improvements Standards



### NECK SECTION DETAILS FOR STANDARD 1200 MANHOLE

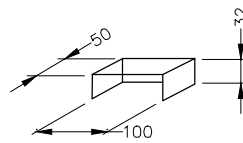
Rev.				Approved: 	Figure E-09
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2014-JUN-25	Drawn: K.P.L	Scale: N.T.S		



SECTION A-A

**635 RING**

(NECK RING FOR USE WITH TYPES 4A, 6, 6A, 8, NF-80, NF-90 FRAMES AND COVERS/GRATINGS)



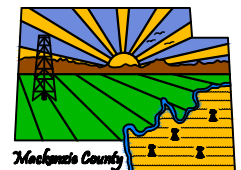
HAND HOLE DETAIL



NOTES:

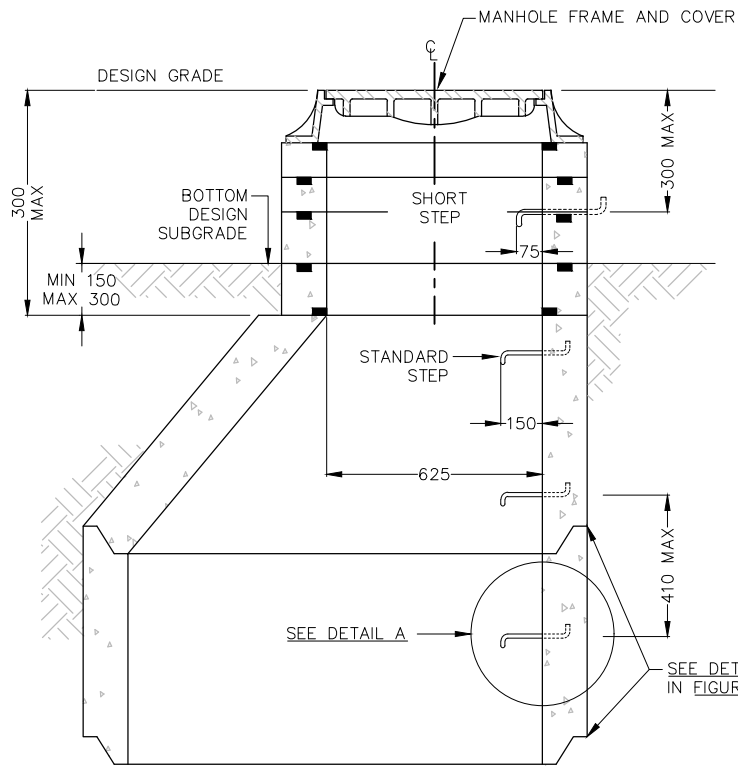
1. A CONCENTRIC GROOVE LOCATED AT MID CROSS SECTION, SUITABLE FOR SEALANT IS REQUIRED FOR NECK RINGS AND EXTENSION RINGS.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

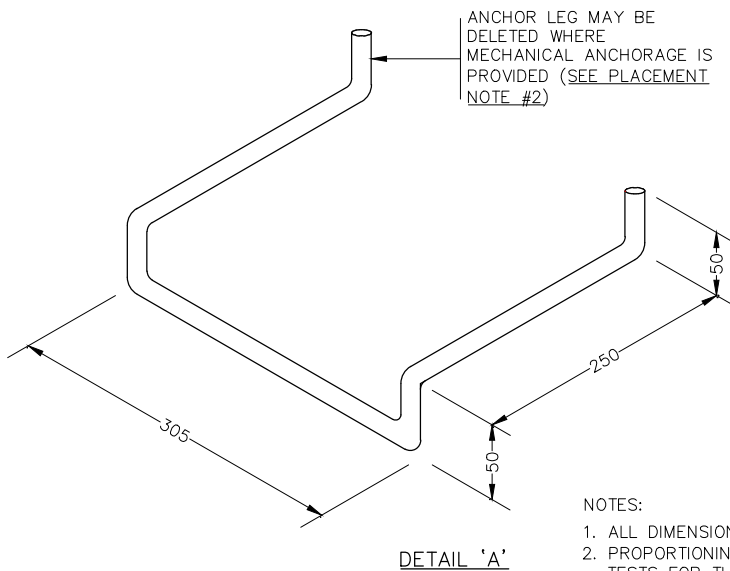
## General Municipal Improvements Standards



Rev.				635 NECK RING	Approved: 	Figure E-10
Rev.						
Rev.						
Rev.	2021-FEB-15	File No.: GP60.33682	Design:	Approved: 	Figure E-10	
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			



TYPICAL MANHOLE SECTION



DETAIL 'A'

NOTES:

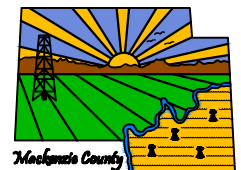
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.



PLACEMENT:

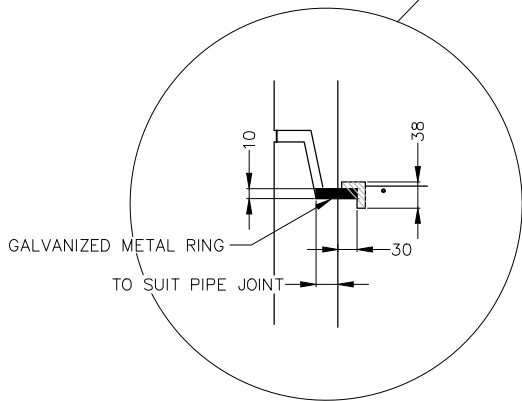
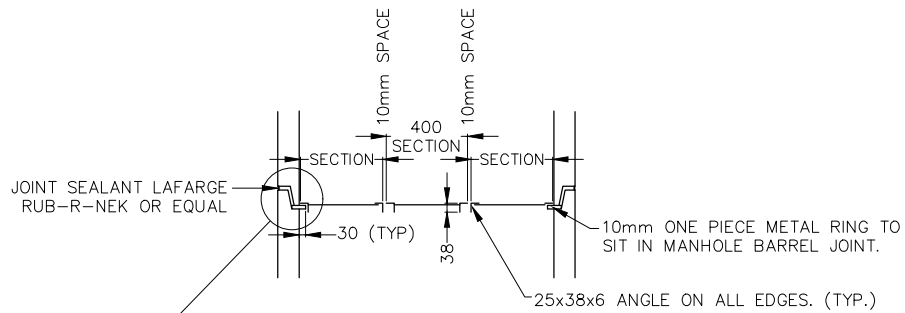
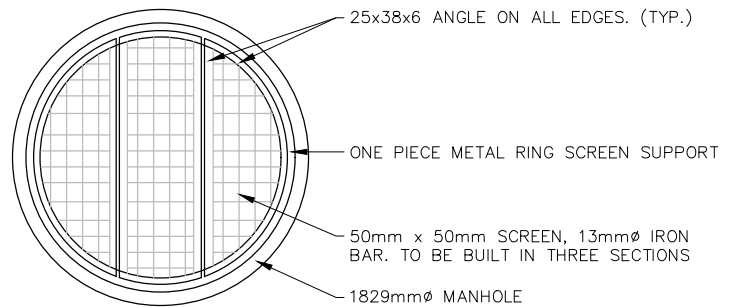
1. EXCEPT WHERE SPECIFIED OTHERWISE, SAFETY STEPS SHALL BE INSTALLED IN ALL PRECAST MANHOLE SECTIONS & CONES, IN THE GRADE ADJUSTMENT SECTIONS AND IN CAST IN PLACE SECTIONS SO THAT WHEN THE VARIOUS SECTIONS ARE ASSEMBLED IN ANY COMBINATION THEY WILL FORM A CONTINUOUS VERTICAL LADDER WITH RUNGS EQUALLY SPACED AT A MAXIMUM OF 410mm TO WITHIN 300mm BELOW THE COVER AND TO WITHIN 600mm OF THE BASE OR BENCHING.
2. STEPS SHALL BE CAST FIRMLY IN PLACE OR SECURED WITH A SUITABLE MECHANICAL ANCHORAGE TO PREVENT PULLOUT, AND MAINTAIN WATER TIGHTNESS.
3. "STANDARD STEPS" SHALL PROJECT A DISTANCE OF 150mm MEASURED AT THE POINT OF EMBEDMENT.
4. A "SHORT STEP" WITH A PROJECTION OF 75mm SHALL BE INSTALLED WITHIN THE GRADE ADJUSTMENT SECTION, CAST INTO THE NECK OR FIRMLY MORTARED IN PLACE BETWEEN THE NECK RINGS, WITH THE ANCHOR LEGS OUTSIDE OF THE NECK RING.
5. EXCEPT AS SPECIFIED ABOVE, DESIGN AND INSTALLATION OF SAFETY STEPS SHALL CONFORM TO A.S.T.M. C478.
6. SAFETY STEPS SHALL BE ALIGNED ON CENTER LINE PERPENDICULAR TO THE MAIN FLOW CHANNEL. WHENEVER POSSIBLE, THE STEPS SHALL BE ALIGNED SO THAT A PERSON EXITING THE MANHOLE WOULD FACE ONCOMING TRAFFIC IF NOT CONFLICTING WITH THE PREVIOUS REQUIREMENT.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				SAFETY STEPS FOR MANHOLES	Approved: 	Figure E-11
Rev.						
Rev.						
Rev.	2021-FEB-15	File No.: GP60.33682	Design:	Approved: 	Figure E-11	
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			

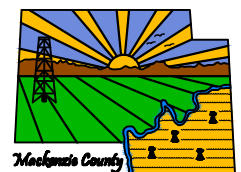




NOTE:

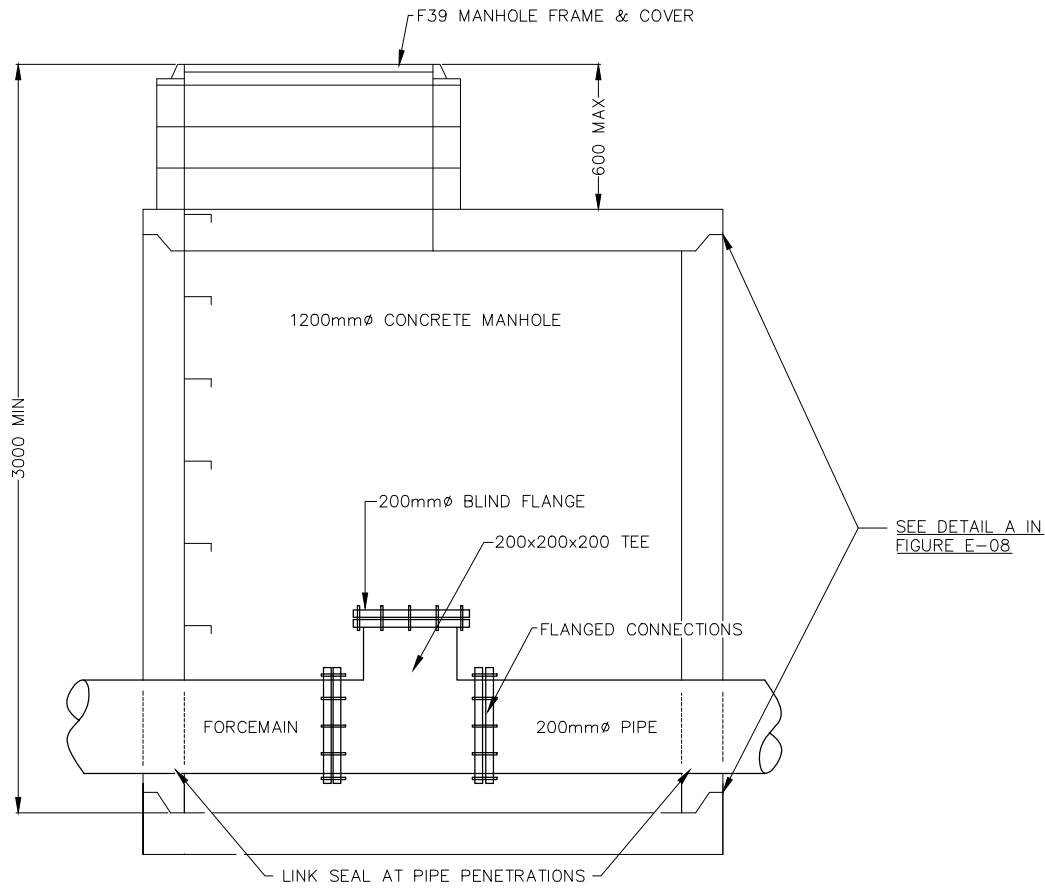
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. ALL STEEL WORK TO BE HOT DIPPED GALVANIZED AFTER FABRICATION.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				SCREEN	Approved: 	Figure E-12
Rev.						
Rev.						
Rev.	2021-FEB-15	File No.: GP60.33682	Design:	Approved: 	Figure E-12	
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			

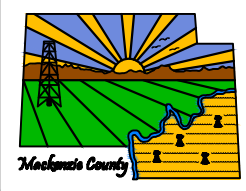


NOTES:

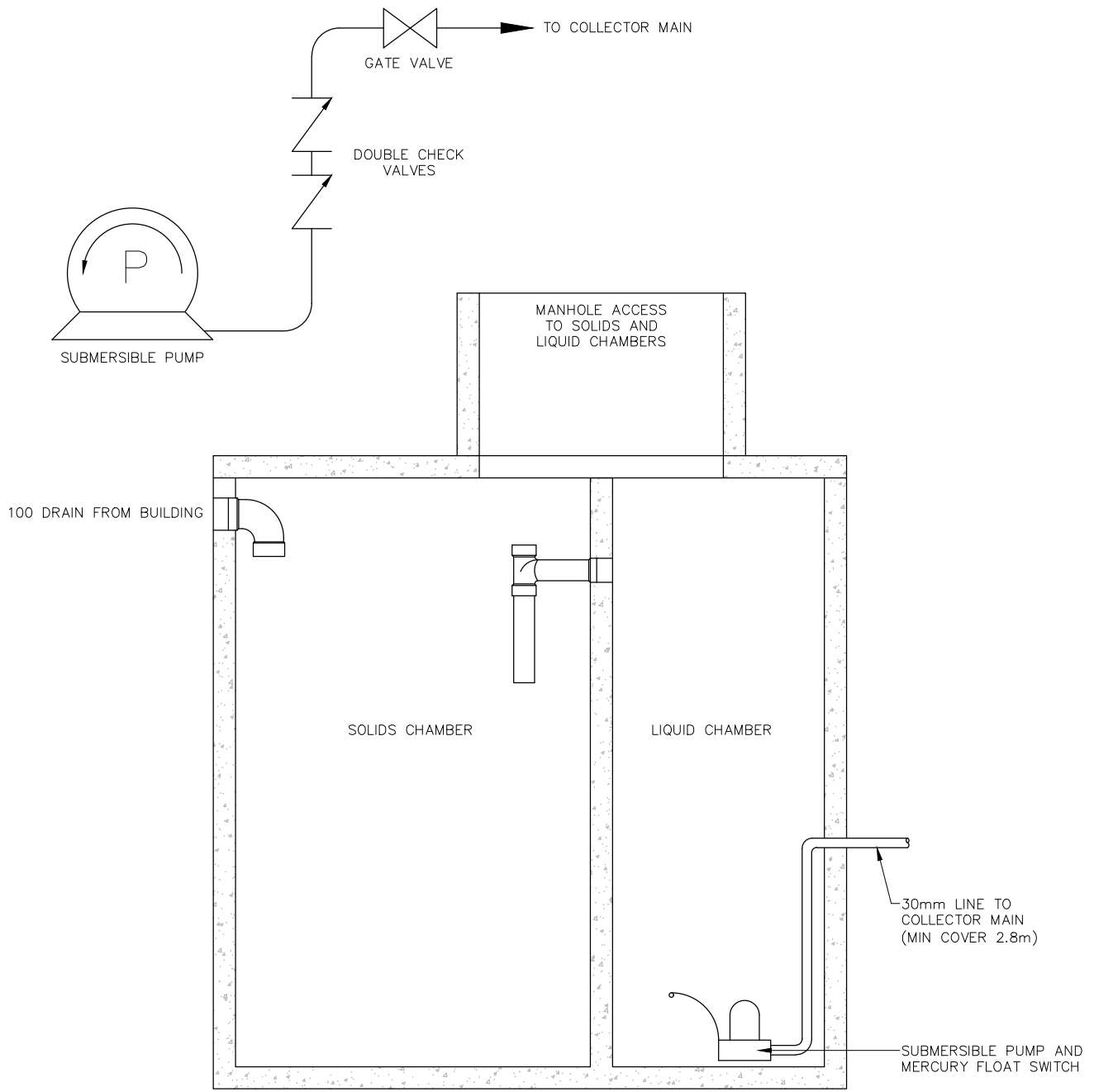
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

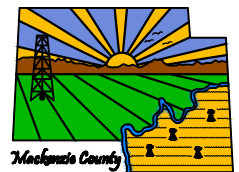


Rev.				<b>CLEANOUT</b>	
Rev.					Figure <b>E-13</b>
Rev.					
Rev. 2021-FEB-15	File No.: GP60.33682	Design:	Approved:		
Date: 2014-JUN-25	Drawn: K.P.L.	Scale: N.T.S.			




# MACKENZIE COUNTY

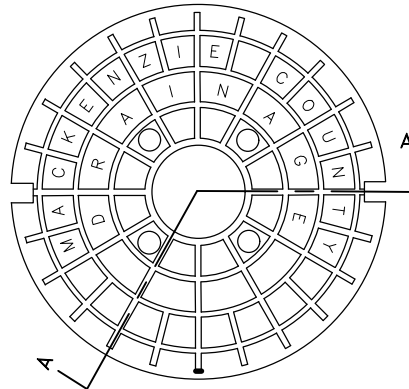
## General Municipal Improvements Standards



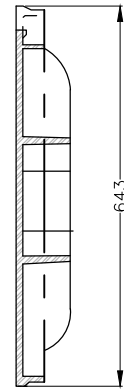
### LOW PRESSURE SEPTIC TANK INSTALLATION

Rev.				Approved: 	Figure E-14
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		

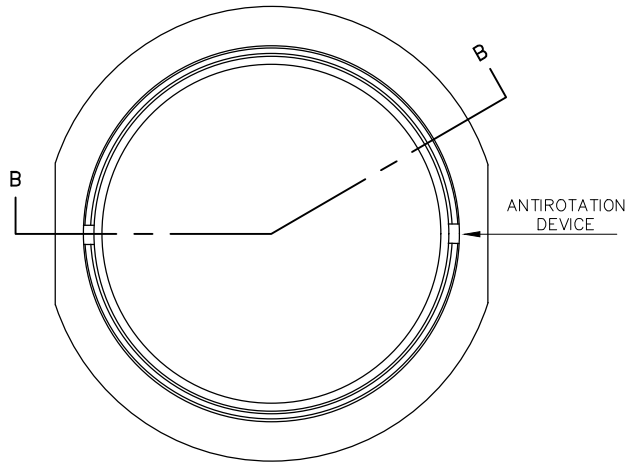




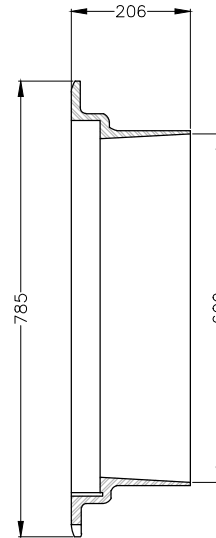
TOP VIEW  
MANHOLE COVER  
WITH 4 VENTHOLES



SECTION A-A



PLAN VIEW



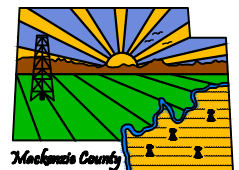
SECTION B-B


NOTES:

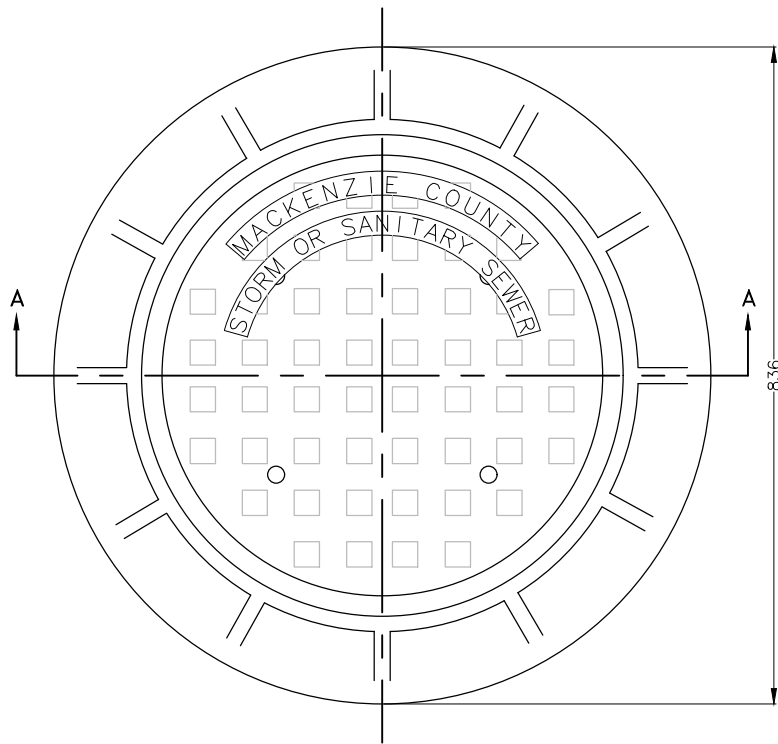
1. MATERIAL SPECIFICATION:  
DUCTILE IRON TO CONFORM TO A.S.T.M. A536 (LATEST EDITION) GRADE 80-60-03.
2. NF-90 FRAME AND COVER IS WATERTIGHT VARIATION OF NF-80.  
THERE ARE NO VENTING HOLES IN NF-90 COVER AND A GASKET IS PLACED BETWEEN THE FRAME AND COVER.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

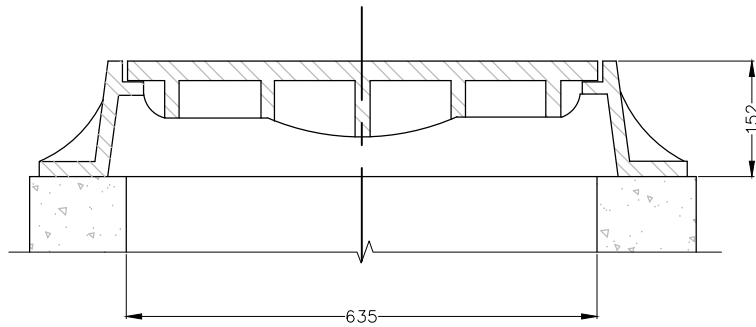
## General Municipal Improvements Standards



Rev.				Approved: 	Figure E-15
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		



PLAN VIEW



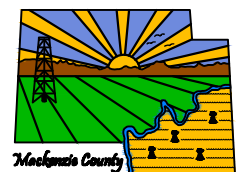
SECTION A-A

NOTES:

1. MATERIALS:  
 FRAME: GRAY IRON CLASS 20B.  
 COVER: GRAY IRON CLASS 20B.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

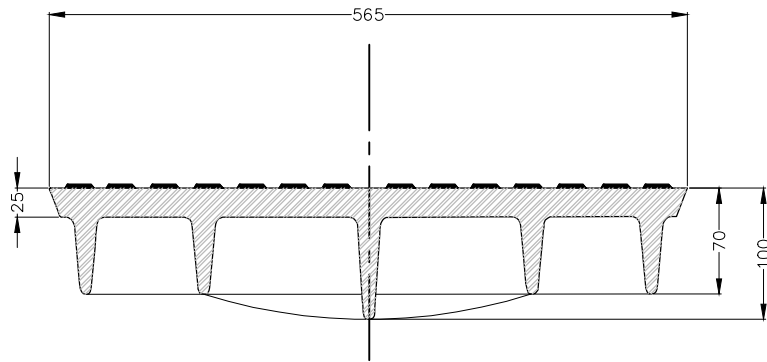
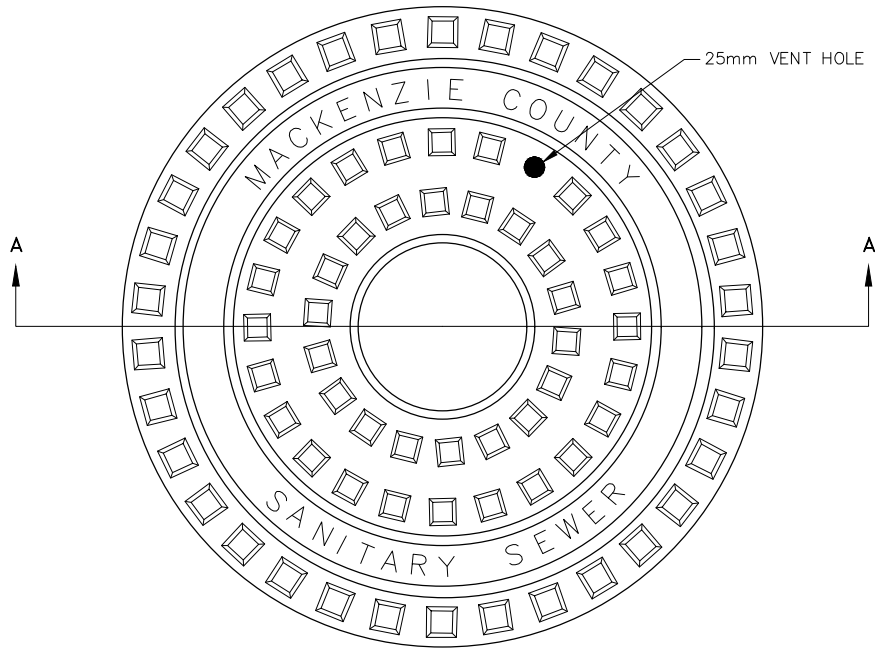


### TYPE NF-39 COVER AND FRAME

Approved:

Figure E-16

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

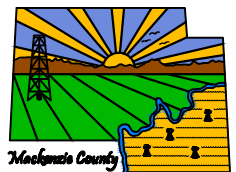


SECTION A-A

NOTES:  
 1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

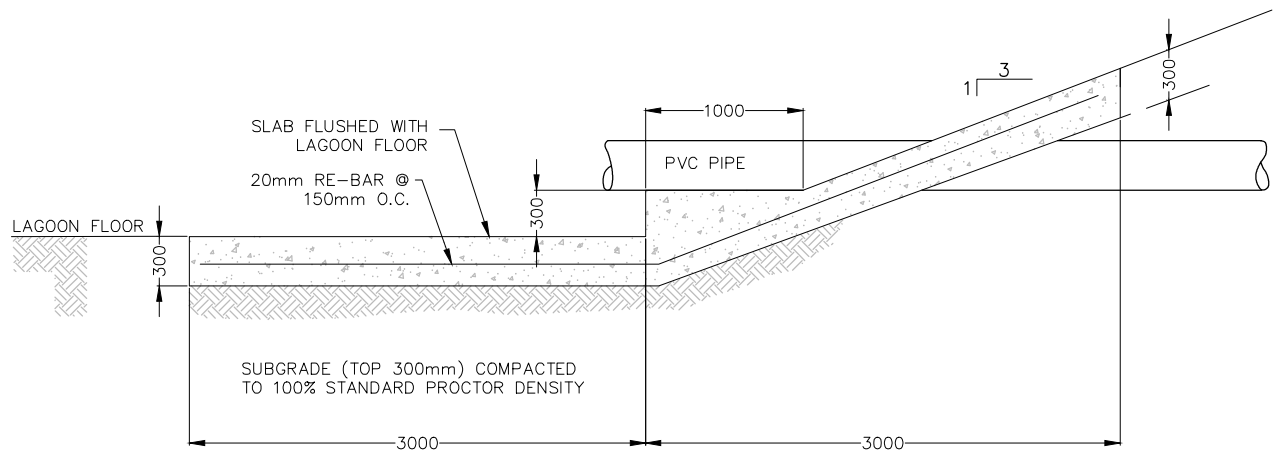


MANHOLE COVER – SANITARY SEWER

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

Approved:

Figure E-17

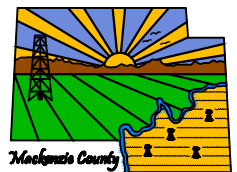


NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.
3. CONCRETE THICKNESS 300mm UNLESS OTHERWISE STATED.
4. CONCRETE COMPRESSIVE STRENGTH MINIMUM 30 MPa @ 28 DAYS.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



### CONCRETE SPLASH PAD DETAILS

Approved:

Figure E-18

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

## **SECTION F      STORM WATER MANAGEMENT SYSTEM**

### **F.1    GENERAL**

- F.1.1**    The Developer and the Developer’s Engineer are responsible to ensure that the storm water management system is designed and constructed according to accepted engineering practice. These standards are intended as a guide only and shall not be considered as a substitute for detailed material and construction specifications to be prepared by the Developer’s Engineer.
- F.1.2**    The current Standards and Specifications issued by the following organizations shall be implemented during design and construction of the storm water management systems:
- i.     ASTM - American Society for Testing and Materials
  - ii.    CSA - Canadian Standards Association
  - iii.    Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems
- F.1.3**    The specific requirements of the storm water management system will depend on whether the proposed subdivision is defined as a rural or urban subdivision. In either case, the intent of the storm water management system is to prevent any negative effects as a result of the subdivision.
- F.1.4**    Detailed design of the storm water management system shall be consistent with the storm water management plan previously submitted by the Developer and approved by the Municipality. Deviation from the intent of the storm water management plan must be approved by the Municipality and supported by engineering analysis.
- F.1.5**    For both rural and urban subdivisions, the storm water management system shall be designed based upon a “net-zero” impact (runoff rates for a 24 hour duration, 1:100 year post subdivision design storm will not exceed rates for the same design storm under pre-subdivision conditions).
- F.1.6**    If these standards do not cover an area of drainage concern, the responsibility shall be upon the Developer to present alternative corrective measures and recommend proposed drainage standards to be used, based on sound economic, engineering, environmental, maintenance and operational criteria for approval by the Municipality. The system shall meet current standards and approvals of Alberta Environment.
- F.1.7**    The Developer shall provide rights-of-way or easements for drainage and have them registered in the name of the Municipality so that future maintenance may be carried out by the Municipality.
- F.1.8**    The Developer shall be responsible not only for the drainage within his subdivision, but also for drainage in the adjoining properties that would be affected by his subdivision.

- F.1.9** Drainage diversions (ditches, berms, ditch checks, installations of culverts, rip-rap) and other means of erosion control shall be approved and licensed by Alberta Environment as applicable.
- F.1.10** Storm sewer pipe shall be manufactured in conformity with the latest standard by the American Society for Testing Materials (ASTM) and the Canadian Standard Association (CSA).
- F.1.11** An urban storm management system shall be designed as a separate system. Pipes and their appurtenances (manholes, catch basins, outfall structures, etc.) shall comprise the minor system. This system shall convey runoff from snow melt and rainfall events without sustaining any surface ponding or excessive surface flows from a 1:5-year event. The road system, detention and retention facilities, parkland and other land shall comprise the major system. The major system shall convey runoff from up to a 1:100-year event and shall be sufficient to prevent any significant property damage (e.g., flooding of buildings).
- F.1.12** For a rural storm management system, both the minor and major systems consist of roadside ditches and swales, culverts and storage facilities. It is expected that the rural system will be comprised primarily of swales, ditches, culverts and similar open flow components. The system shall convey runoff from snowmelt and rainfall events consistent with the storm water management plan. The system will be considered the major system and shall convey runoff for the design storm sufficient to prevent property damage.
- F.1.13** The design of both the major and minor systems must meet the current requirements outlined in the Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems published by Alberta Environment.
- F.1.14** Wastewater from residential, industrial, agricultural or commercial operations shall not discharge into the storm water management system.
- F.1.15** Foundation drain (weeping tile) sump pumps shall discharge collected water onto the ground surface for overland flow.
- F.1.16** Roof drainage downspouts from residential buildings shall not be directly connected to the storm sewer system. Roof drainage downspouts from single and dual family dwellings shall be discharged to grassed or pervious areas. The point of discharge shall be a minimum of 1 m away from the building to ensure positive drainage. Roof drainage downspouts from multi-family buildings, commercial areas, and industrial areas may be allowed to directly discharge to the storm sewer collection system subject to approval in writing by the Municipal Engineer.
- F.1.17** On-site detention strategies that utilize building roofs, parking lots, or landscaped areas to attenuate peak rainfall runoff rates must be approved by the Municipality.
- F.1.18** Properly graded and surfaced roads and lanes, landscaping and sediment control structures at storage facility inlets and outlets shall be used to minimize sediment discharge into the storm water collection system and receiving water body.
- F.1.19** Post-subdivision runoff rates shall not exceed the pre-subdivision runoff rates for a given contributing area in any event. A lower rate of post-subdivision runoff

will be applied when pre-subdivision runoff rates are considered to be excessive. A maximum allowable runoff rate acceptable to both the Municipality and Alberta Environment will be established on an individual case basis.

- F.1.20** The Developer shall provide all detailed design calculations concerning the storm water management system to the Municipality for approval.

## **F.2 MINOR STORM MANAGEMENT SYSTEM**

### **F.2.1 Design Criteria**

- i. The storm sewers shall be designed as a separate sewer system. Effluent from sanitary sewers or any potentially contaminated drainage shall not be discharged in the storm sewers.
- ii. The minor system shall be designed to accommodate the runoff generated from a 1:5 year or more frequent rainfall event without surcharge of sewer pipes or ponding at catch basins. An allowance should be made for sump pump discharge or individual service lines from weeping tiles where required.
- iii. Storm sewer mains shall be designed to flow full when conveying the required design flows. The hydraulic grade line shall be located at the crown of the sewer main. Storm sewer main crown elevations shall match at manhole junctions.
- iv. Roof leaders shall be discharged onto the ground and drain away from the buildings, water supply wells and septic beds. Provisions shall be made to prevent soil erosion. The Municipal Engineer may approve discharge of roof leaders to the storm sewer, when conditions warrant, to prevent erosion and/or property damage.
- v. Dry wells shall be permitted only where the groundwater table is below the bottom of the dry well. Dry wells shall be not less than 5 m from the building foundation and located to ensure that drainage flows away from the building.
- vi. The Rational Method shall be used in estimating flows for the design of storm sewers for areas less than 65 hectares:

$$Q = CIA / 360$$

Where: Q = the design peak flow rate (m<sup>3</sup>/sec)

I = the intensity of rainfall (mm/hour)

A = the contributing area (ha)

C = the runoff coefficient

- a. Rainfall intensity “I” shall be determined using appropriate Intensity Duration Frequency (IDF) or rainfall data. The latest rainfall intensity data to be utilized can be obtained from the latest version of the City of Grand Prairie’s Design Manual.

- b. The runoff coefficient “C” shall be consistent with the following guidelines and based on sound engineering and best management practice:

Land Use / Surface Characteristics	Runoff Coefficient, C	
	1:5 Years Rain	1:100 Years Rain
Undeveloped Farm Land	0.10	0.20
Lawns, Parks, Playgrounds	0.20	0.30
Urban – Residential	0.50	0.60
Urban – Commercial	0.70	0.80
Urban - Apartments	0.70	0.80
Paved Surfaces	0.90	0.95
Gravel Surfaces	0.30	0.70

These values may be further modified based upon the specifics of the proposed subdivision. In rural subdivisions or where a mixture of land uses or surface characteristics are proposed, the weighted average of pervious and impervious area runoff coefficients shall be used.

- c. Due to the large variation in lot sizes for rural residential subdivisions and in impervious areas for commercial and industrial areas, a weighted runoff coefficient for these types of subdivisions can be calculated using the following formula:

$$C = \frac{(0.9 \times \text{Impervious Area}) + (0.15 \times \text{Pervious Area})}{\text{Total Area}}$$

- d. The intensity for the rational formula is to be sought from the Government of Canada’s website.. T<sub>c</sub> is the sum of the inlet time and travel time. The inlet time is the time for the overland flow to reach the curb. The maximum inlet time for residential areas shall be 10 minutes. Inlet times for commercial or industrial areas shall be calculated on a site-specific basis. The travel time, being the time it takes for the runoff to reach the design point from the moment it reaches the curb, is calculated based on gutter and pipe velocity.
- vii. For areas larger than 65 hectares, the Developer must submit an acceptable computer-generated model of the area for review.
- viii. Weeping tile flows must be presented in a detailed Geotechnical Hydrogeological Investigation prepared by a qualified Geotechnical Engineer or Hydrogeologist. The report shall outline expected weeping tile flows and any design and construction procedures required for foundation installation.



- ix. Effluent from sanitary sewers and any drainage from industrial, agricultural or commercial operations that may potentially be contaminated shall not be discharged into the storm sewer system. Weeping tile drainage to the storm sewer shall not be considered for industrial, agricultural, or commercial operations.
- x. Roof drainage downspouts from residential buildings shall not be directly connected to the storm sewer system. Roof drainage downspouts from single and dual family dwellings shall be discharged to grassed or pervious areas. The point of discharge shall be a minimum of 1 m away from the building to ensure positive drainage. Roof drainage downspouts from multi-family buildings, commercial areas, and industrial areas may be allowed to directly discharge to the storm sewer collection system subject to approval in writing by the Municipal Engineer.
- xi. Best management practices shall be provided to minimize sediment discharge to the storm sewers. This shall be in the form of properly graded and surfaced streets and lanes, landscaping, catch basin sumps, sediment control structures at pond and lake inlets, or other means where appropriate.

**F.2.2 Pipe Sizing**

Storm sewer pipe shall be designed to convey the design flow when flowing full with the hydraulic grade line at the pipe crown. All pipe crown elevations shall match at manhole junctions. The following design factors shall be used in determining the storm sewer pipe sizes:

- i. Minimum pipe diameter for storm sewer main 300 mm
- ii. Minimum pipe diameter for foundation drains 100 mm  
(accommodating flow from weeping tiles only)
- iii. Minimum pipe size for catch basin leads 250 mm
- iv. Manning’s Formula “n” 0.013
- v. Minimum flow velocity when flowing full 0.6 m/sec
- vi. Maximum flow velocity 3.0 m/sec
- vii. Minimum design slopes:

Sewer Diameter (mm)	Minimum Design Slope (%)
300	0.194
375	0.145
450	0.114
525	0.092
600	0.077
675	0.065
750	0.057
900	0.045
1050	0.036

<b>Sewer Diameter (mm)</b>	<b>Minimum Design Slope (%)</b>
1200	0.031
1350	0.027
1500	0.023
1650	0.020
1800	0.018
1950	0.016
2100	0.015
2250	0.013
2400	0.012
2550	0.011
2820	0.010

viii. Minimum slope on curved sections:

<b>Sewer Diameter (mm)</b>	<b>Minimum Design Slope (%)</b>
300	0.25
375	0.18
450	0.15
525	0.13
600 and greater	0.10

- a. The minimum grade for catch basin leads shall not be less than 1%.
- b. The minimum grade of the first upstream leg shall not be less than 0.5%.

### **F.2.3** General Material Requirements

- i. Unless specified with better material accepted by the Municipality, all underground and water retaining structure shall be designed against frost and sulphate attack (with sulphate resistant cement to ASTM type V) and conform to CSA A23.1 and ACI 350R-89 Environmental Engineering of Concrete Structure. Concrete Grade 25 shall be used and tested in accordance with CSA 23.2.
- ii. Storm sewers 900 mm diameter and smaller shall be PVC SDR 35 or Ultra Rib PVC storm sewer pipe, provided that manufacturer's recommended pipe loadings are not exceeded. Storm sewers greater than 900 mm diameter shall be of concrete pipe unless approved otherwise by the Municipality.
- iii. Concrete manholes and catchbasins shall be manufactured with pre-cast reinforced concrete components conform to ASTM C478. Concrete pipe shall be of sulphate resistant concrete with a gasketed jointing system. No corrugated steel pipe shall be used. On steep slopes, welded steel pipe or another rigid piping system shall be constructed as approved by the Municipality. Component joint shall be supplied with a pre-formed and

sealed O-ring type rubber gasket, comply to ASTM C443 or current requirement.

- iv. Minimum of 100 mm thick pipe granular bedding with no particles larger than 32 mm shall be required.
- v. The Developer is responsible for providing the engineering expertise relating to the structural design of storm sewers, providing all test results and the quality control of all materials proposed to be used. All storm sewers shall be designed to prevent damage from superimposed loads. Notwithstanding information contained herein, all materials and loading calculation shall be consistent with current ASTM and CSA standards.
  - a. For rigid pipes a 0.025 cm crack shall be determined as exceeding the working strength and the pipe rejected. For flexible pipe, when deflection greater than seven and one-half percent (7.5 %) of the original diameter is reached, then the pipe shall be considered to have exceeded the limit of serviceability and shall be rejected.
  - b. Proper allowances shall be made with regard to the class of bedding and the trench dimensions (width, depth) when determining the loadings on pipes.
  - c. The minimum depth of cover to pipe crown shall be 1.8 m, or 2.6 m to invert, whichever is greater.
  - d. "Marston Theory" is to be used in analyzing loadings in the single trench applications for rigid pipe. For flexible pipe, the modified IOWA formula shall be used.
  - e. Concrete pipe specified under ASTM C655 may have combinations of circular and elliptical reinforcement with minimum steel requirements at all outer and inner points as specified under ASTM C76. The Developer shall specify the horizontal and structural strength of all pipes.

#### **F.2.4 Storm Sewer Alignment and Location**

- i. Storm sewer mains shall be located within the road right-of-way and outside the carriageway.
- ii. Storm sewers shall be located a minimum of 3.0 m o/c from any watermain and 1.8 m o/c from any gas line or as required by the utility company.
- iii. Storm sewers shall be spaced at a minimum of 0.25 m between pipe walls from any adjacent sanitary sewer.
- iv. Public Utility Lot (PUL) widths shall be at least 4 m for a single utility and 6 m for two utilities.
- v. For storm sewer pipes greater than 600 mm in diameter, change in flow direction at manholes should not exceed 45°. This limit may be exceeded if care is taken to design a proper transition manhole.

- vi. It is recommended that storm sewers 600 mm inside diameter or less be installed with straight alignment between manholes. Curved sewers will be permitted providing that the following requirements are met:
  - a. Permissible joint deflections shall be in accordance with the manufacturer's guidelines.
  - b. Manholes are to be located at the beginning and end of curve.
  - c. The curve shall run parallel to the roadway centerline.
  - d. The minimum grade for curved sewers shall be fifty percent (50 %) greater than the minimum grade required for straight runs.
  - e. Storm sewer main shall be laid as a simple curve with a radius equal to or greater than 90 m or the manufacturer's minimum recommended radius, whichever is larger.
  - f. Manholes shall be located at intervals not greater than 90 m along the length of the curve.
- vii. Storm sewers and catch basin leads shall be installed at a sufficient depth to meet the following requirements:
  - a. The storm sewer shall have sufficient depth of cover to provide complete frost protection. The storm sewer main shall have a minimum depth of cover of 1.8 m measured from finished grade to the top of the pipe. In areas susceptible to frost damage, the Municipality may require that a qualified geotechnical firm provide a recommendation on installation methods to mitigate frost damage. All costs are to be borne by the Developer.
  - b. The storm sewer main shall have sufficient depth to allow all required building foundations to drain by gravity to the sewer. Special consideration shall be given when building floor elevations are lower than the roadway. Service lines shall have a minimum cover of 2 m from the finished lot surface to the top of pipe at the property line.
  - c. The catch basin leads shall have a minimum of 1.5 m of cover measured from the finished surface to the top of pipe.
  - d. Pipe clearance when passing under any watermain shall be a minimum of 300 mm separation between the top of the storm sewer pipe and the bottom of the watermain. Pipe clearance when passing over any watermain shall be a minimum of 300 mm separation between the bottom of the storm sewer pipe and the top of the watermain.

#### **F.2.5 Storm Sewer Materials**

- i. The Developer shall supply only new materials. All materials found to be defective or damaged shall be replaced at the cost of the Developer.

- ii. Where particular materials and products are specified, it is intended that approved equals are also acceptable. Approval must be obtained from the Municipality prior to installation.
- iii. Polyvinyl chloride (PVC) pipe shall conform to the ASTM D3034 Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings, CAN 3–B182.1 and CAN 3–B182.2 - minimum Class SDR 35, separate gasket and intergraded bell system. Joints shall meet the ASTM D3212 Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals. Pipe may be any colour except blue. Minimum stiffness of the pipe shall be 320 kPa. Service lines shall have minimum stiffness of 625 kPa. Injection moulded gasketed fittings for service connections shall conform to CSA B182.1 or CSA B182.2 and fabricated fittings shall conform to CSA B182.2 and ASTM F679.
- iv. PVC pipe shall be tested by the manufacturer and marked in accordance with CSA B182.2. Test results shall be recorded on a certification form signed by a qualified representative of the manufacturer. Pipe and fittings shall be installed within two (2) years from the production date indicated on the certification.
- v. Ultra-rib PVC pipe shall conform to ASTM F794 and Uni-bell B-9, and fittings shall conform to CSA B182.4 with a minimum stiffness of 320 kPa. Pipe may be any colour except blue.
- vi. The non-reinforced concrete pipe shall conform to the ASTM C14 Non-Reinforced Concrete Sewer, designed for flexible rubber gasket joints to ASTM C443. Sulfate resistant cement shall be used. Reinforced concrete pipe shall conform to the ASTM C76 Reinforced Concrete Sewer-Storm Drain and Culvert Pipe, designed for flexible rubber gasket joints to ASTM C443. Sulfate resistant cement shall be used. Flexible rubber gasket joints shall conform to CSA 257.3 and ASTM C443.
- vii. The manufacturer of the concrete pipe shall perform quality testing and control in accordance with CSA 257.0, 257.1, 257.2 and 257.3. Each concrete pipe shall be marked with the manufacturer's name, date of casting and quality testing passing stamp.

#### **F.2.6 Manhole Design and Location**

- i. Manholes shall be located at the end of each line, at all changes in pipe diameter, grade or alignment, and at all junctions. Manholes shall be located at the extension of property lines whenever possible in order to avoid conflicts with driveways.
- ii. The maximum spacing between manholes shall not exceed:
  - a. 120 m for storm sewers less than 1200 mm in diameter.
  - b. 500 m for storm sewers 1200 mm to 1650 mm in diameter.
  - c. 800 m for storm sewers larger than 1650 mm in diameter.

- iii. Manholes shall be 1200 mm minimum inside diameter. Precast (Type 50) reinforced concrete manhole barrels conforming to ASTM C478 shall be used. The base shall be constructed of 30 MPa sulphate resistant (Type 50) concrete.
- iv. The drop across manholes should be of sufficient magnitude to account for any energy losses in the manhole:
  - a. Pipe deflections of less than 45° require a drop of at least 30 mm.
  - b. Pipe deflections of 45° to 90° require a drop of at least 60 mm.
- v. Pipe deflections in manholes shall not be greater than 90°.
- vi. For storm sewers less than 200mm, interior drop manholes shall be considered whenever the invert elevations of the inlet and outlet differ by more than 750 mm. For storm sewers 200mm to 600mm, an external drop manhole shall be considered whenever the invert elevations of the inlet and outlet differ by more than 750mm. Invert drops for pipes larger than 600 mm or for high flow situations shall be assessed on an individual basis.
- vii. The obvert elevation of a sewer entering a manhole shall not be lower than the obvert elevation of the outlet pipe.

#### **F.2.7** Manhole Materials

- i. Manhole sections shall be pre-cast reinforced concrete conforming to ASTM C478 and CSA A257.4. Manholes shall be manufactured using sulphate resistant Type 50 cement or the approved type Chemical Resistance Fibre Glass or HDPE material with proven record of 50 years life time. Material Data Sheet and past record (at least 5 references in Canada) shall be submitted to the Municipality for acceptance.
- ii. CSP manholes will not be allowed.
- iii. All manholes shall have an inside diameter of 1200 mm for pipe 900 mm and less. For pipe exceeding 900 mm or manhole having multiple inlets, manhole sizing shall be subject to review by the Municipal Engineer. All cones shall be eccentric. Reducing rings or slabs may be used.
- iv. Manhole frames and covers shall be of cast iron conforming to Class 20, ASTM C48 and have at least 4 lift holes. Grated or standard manhole covers shall be used as required. A Norwood NF-80 or approved equal frame and cover shall be used on manholes located in carriageways and an appropriate locking manhole frame and cover shall be used on manholes located in parkland areas. Manhole covers with the Municipality identification will be encouraged. The use of manhole covers marked with names of other municipalities shall not be permitted.
- v. Manhole steps shall be standard safety type, hot dipped galvanized iron conforming to ASTM A615 and ASTM A123 or aluminum forged from 6061-T6, 6351-T6.

- vi. All joints shall be sealed with rubber gaskets conforming to ASTM C443, all joints between grade rings, conical top, slab tops and frames will use bituminous type seals (i.e. Rubber Neck) to create a water proof joint.
- vii. Manhole bases shall be reinforced precast slabs, vault or precast tees (reinforced). The concrete base is to be of a minimum of 150 mm in thickness constructed on compacted granular material or undisturbed native material. Perched manhole bases shall be a minimum of 200 mm in thickness. Pre-benched manhole bases shall be used wherever possible with pre-cored connection holes and watertight Duraseal or G-Loc joints or approved equal.
- viii. Tee-riser manholes shall conform to CSA 257.2, ASTM C76 and CSA A257.4, ASTM C76.
- ix. All pre-cast units shall be marked with manufacturer's identification, date of casting, type of cement and applicable standards.

#### **F.2.8 Storm Services and Foundation Drains**

- i. Foundation drain service connections will be required for weeping tile flow in areas where the water table is higher than the basement foundations. Sizing of foundation drain service lines shall be based on expected flows as determined by the geotechnical investigation. Sump pump discharge directly into collection systems shall not be permitted in areas with urban road cross sections.
- ii. Storm sewer connections for the connection of roof drains will only be required where geotechnical conditions dictate such as areas where slope stability is an issue.
- iii. When required, separate storm sewer or foundations drain service connections shall be provided for each separately titled lot.
- iv. The minimum diameter of a residential storm sewer or foundation drain service shall be 100 mm. Non-residential service connections shall be sized according to anticipated flow.
- v. Connections for all proposed residential lots requiring storm sewer or foundation drain services shall be installed at the time of initial subdivision development.
- vi. The minimum grade for a storm sewer or foundation drain service line shall be 2%.
- vii. Services shall be located such that they do not conflict with driveway locations.
- viii. The storm sewer or foundation drain services shall be installed to the property line. In areas where natural gas distribution facilities require an easement along the front of the property, the service connections shall be extended to the edge of the easement furthest from the roadway.

**F.2.9 Catch Basins and Leads**

- i. For urban design, surface water shall not be permitted to run a distance greater than 300 m along roadways without provision for interception by a catch basin, except in lanes or walkways where 200 m in either direction may be permitted. Overland flows on collector and arterial roadways shall not travel a distance greater than 120 m without interception by catch basins.
- ii. Surface water shall be intercepted with a number of catch basins such that the combined inlet capacity is sufficient to receive the design storm water flow. At sag locations, the determination of the required capacity must account for flow that may bypass inlets at upstream gutter locations.
- iii. Gutter flow shall be intercepted by a catch basin prior to crossing a walkway wherever possible. The depth of flow in gutters shall not exceed the top of curb at any point. Minimum gutter grade shall be 0.5 % except in cul-de-sacs and around curb returns where minimum gutter grade shall be 0.8 %.
- iv. Catch basins shall be located at the beginning of the curve or at the end of the curve of any curb return. Catch basins and leads shall not be placed beyond the public right-of-way. Lots must be graded to ensure that all runoff drains to an existing approved drainage system.
- v. All catch basin bodies shall be 900 mm pre-cast sulphate resistant concrete sections. The body will be constructed to provide a minimum 600 mm sump unless otherwise approved. The minimum inside diameter for a pre-cast catch basin shall be 610 mm. The minimum sump depth in catch basins shall be 500 mm.
- vi. The minimum catch basin lead diameter shall be 250 mm with a minimum slope of 1 % and a maximum length of 30 m. If the length must exceed 30 m, a catch basin manhole (CBMH) must be installed on the upstream end. For leads of greater length or for those from a CBMH to a manhole the minimum lead size shall be 300 mm. All leads shall be connected to a manhole or catch basin manhole at the downstream end.

**F.2.10 Catch Basins Materials**

- i. Catch basins shall conform to the ASTM C478. Catch basin barrels shall be manufactured using sulphate resistant Type 50 cement.
- ii. The catch basin grates, leads and spacing shall be designed such that there will be no ponding during a 1:5 year rainfall event. Catch basin frames and covers shall be combination precast iron inlet type. Norwood F41 & F51, Trojan K2 or approved equal shall be used with 900 mm concrete sections. Catch basin frames and grates shall be cast iron conforming to Class 20 ASTM A48 and ASTM A536. Any other types must be approved by the Municipal Engineer. Castings shall be marked with series designation, foundry identification and date of casting.



- iii. Catch basin leads shall be Poly Vinyl Chloride (PVC) pipe conforming to CSA B182.2 – M1983 and ASTM D 3034, SDR 35. Jointing shall be bell and spigot type with rubber gaskets conforming to ASTM D 3212. As an alternative, Profile Wall (ribbed) PVC pipe may be used. The pipe and fittings shall adhere to CSA B182.4, jointing shall bell and spigot type with rubber gaskets as above.
- iv. If required, catch basin steps shall be standard safety type, hot dipped galvanized iron conforming to ASTM A615 and ASTM A123 or aluminum forged from 6061-T6, 6351-T6.
- v. All pre-cast units shall be marked with manufacturer’s identification, date of casting, type of cement and applicable standards.
- vi. Corrugated steel pipe (CSP) material will not be allowed.

**F.3 CONSTRUCTION**

**F.3.1 Trenching, Bedding and Backfill**

- i. All trenching and backfilling shall be completed in strict accordance with Occupational Health and Safety Guidelines.
- ii. If unsuitable soil conditions are encountered, proper measures for dealing with the conditions shall be identified either on the design drawings or as a brief report to the Municipal Engineer prior to construction.
- iii. Granular materials shall be well graded and approved by the Municipality before use. Class “B” pipe bedding shall be utilized in suitable soil conditions. Washed rock shall be used if water table is above the pipe zone. Bedding sand shall have minimum depth of 100 mm below the pipe and shall extend up both sides to the trench wall and provide a minimum cover of 300 mm above the pipe. Where necessary, the Developer’s Engineer shall determine special pipe foundation measures for areas where unsuitable pipe foundation conditions exist. Bedding sand must be clean and meet the following requirements:

Sieve Size Passing	% Passing, By Mass
2500	100
630	60 or more
315	30 or more
160	20 or less

- iv. Mortar sand shall be clean and shall contain no deleterious material and conform to CAN 3-AS-M, sulphate resistant (type 50).

- v. Washed rock shall contain no deleterious materials or other impurities and shall meet the following grading requirements:

Sieve Size Passing	% Passing, By Mass
25,000	100
5,000	60 or more
80	30 or less

- vi. The minimum trench width measured at the pipe spring line shall be the pipe outside diameter plus 450 mm. The maximum trench width measured at the pipe spring line shall be the pipe outside diameter plus 600 mm. The Municipal Engineer must be consulted if the trench must be excavated deeper or wider than specified.
- vii. Excavated material shall be stockpiled at a safe distance from the edge of the trench, as per OH&S guidelines. Backfill material shall be the soil excavated from the trench although approved granular materials may be substituted for poor existing soils. All backfill material will be subject to approval by the Municipality. If possible, the excavated material shall be placed back in the trench in the vertical and horizontal order in which it was excavated. Backfill shall be placed in uniform lifts not exceeding 300 mm loose thickness. Where clay is used as backfill material, its moisture content shall not exceed the Plastic Limit by more than ten percent (10 %).
- viii. Within roadways, under no circumstances shall backfill material containing ice, snow, organic or any other deleterious material be used. Trench excavations shall be kept free of water.
- ix. Compaction and densities:
  - a. Prior to street construction: all excavations under proposed carriageways, sidewalks, street lights or other similar surface structures shall be backfilled in lifts with compacted thickness of 300 mm of loose material or less per lift and compacted to minimum density of not less than 98 % of the Maximum Standard Proctor Density or as otherwise approved by the Municipality. A minimum of two (2) density tests per 100 lineal meters of trench per 600 mm of compacted backfill thickness shall be taken. Additional tests may be called for as deemed necessary. Any free water in a trench shall be removed prior to placing additional lifts.
  - b. Under existing carriageways: all excavations under existing carriageways, sidewalks, lanes or other similar surface structures shall be backfilled to meet the following specifications:
    - 300 mm or more below final grade – backfill materials shall be compacted to minimum density of not less than 98 % of the Maximum Standard Proctor Density.
    - 0 - 300 mm below final grade – backfill materials shall be compacted to a minimum of 100 % of the Maximum Standard Proctor Density and based on a minimum of two (2) field tests per 100 lineal meters of

trench per 600 mm of compacted backfill. Backfill shall be placed in uniform lifts not exceeding 150 mm compacted thickness.

- c. Adjacent to existing carriageways: all material 300 mm below the finished grade shall be compacted to a density not less than 98 % of the maximum density of a five point Standard Proctor Compaction Test and based on a minimum of one (1) field test per 150 lineal meters of trench for each 600 mm of compacted vertical backfill.
- d. Sand or gravel backfill shall be compacted to meet the following density requirements:
  - 300 mm or more below grade - the minimum acceptable density shall be 98 % of the Maximum Standard Proctor Density.
  - 0 - 300 mm below grade - all sand or gravel in this zone shall compact to 100 % of the Maximum Standard Proctor Density.
- e. Compaction testing: for all density tests indicating insufficient compaction, two (2) more density tests, proportionately representative of the trench tested length shall be taken at that depth. If the average of the three (3) tests is below the required density, the area of deficient density shall be re-excavated and re-compacted to meet the specified density. Densities greater than 100 % shall be deemed to be at 100 % for calculating the average of the three tests.
- f. Sub grade and base course compaction for roadway construction shall be as specified in the appropriate section of these standards.
- x. The Developer's Engineer shall identify areas where the trench excavation requires sheathing, shoring or bracing in order to protect workers, property or adjacent structures.
- xi. All debris, surplus fill and unused materials must be removed from the site as directed by the Municipal Engineer.

### F.3.2 Bedding

The pipe shall be installed in the class of bedding shown on the plans as specified herein:

- i. Class A: method of bedding on which the lower part of the pipe exterior is set in concrete of suitable thickness to encase at least one-quarter of the pipe diameter for the full trench width. Compacted sand shall be placed to a minimum depth of 300 mm above the top of the pipe.
- ii. Class B: method of bedding in which the pipe is set in compacted sand or gravel, as specified, on a trench bottom shaped to fit the pipe. The pipe is entirely encased with sand to a minimum of 300 mm above its top in layers not exceeding 150 mm in thickness. Depth of bedding below the pipe to be a minimum of 75 mm for 675 mm diameter pipe or smaller at 100 mm for pipe 750 mm diameter or greater.

- iii. Class C: method of bedding in which the pipe is placed on an earth foundation shaped to fit the lower part of the pipe. The remainder of the pipe is encased in sand compacted to a height of at least 150 mm above the top of pipe.
- iv. Class D: method of bedding in which the foundation is not shaped to fit the lower part of the pipe, but the pipe must be evenly supported throughout its length (except for the pipe bells).

### **F.3.3 Storm Sewer Installation**

- i. Pipe shall not be deflected either vertically or horizontally in excess of that recommended by the manufacturer.
- ii. Pipe installation shall start at the outlet and work upstream.
- iii. The pipe and gasket installation shall be conducted in compliance with the pipe manufacturer's specifications.
- iv. Installation of PVC pipe and fittings shall conform to AWWA M23.
- v. Installation of concrete steel cylinder pipe shall conform to AWWA M9.
- vi. Field welding procedures shall be in accordance with CSA Z662. Welders shall be qualified as B pressure welders.
- vii. The trench shall be kept dry during pipe installation and no water shall be allowed to drain through the newly installed pipe for at least two hours where mortar joints have been used. No pipe shall be installed in wet trench conditions that preclude proper bedding or on frozen trench bottom or when, in the opinion of the Developer's Engineer, the trench conditions or the weather are unsuitable for proper installation.
- viii. Pipes shall be carefully aligned when jointing. Joints are to be kept free of mud, gravel and foreign material and shall be completed as outlined in the manufacturer's specifications. Each joint shall be completed before laying the next length of pipe. Deflections shall not exceed those permitted by the pipe manufacturer.
- ix. The pipe must be thoroughly flushed of all dirt, stones and pipe lubricant when complete. When pipe installation is not in progress, the open ends of installed pipe shall be closed with an approved plug or cap to prevent entrance of trench water and/or any foreign or other material into the line.
- x. Adequate backfill shall be placed on the pipe to prevent floating. Any pipe which has floated shall be removed from the trench and be re-installed as directed by the Developer's Engineer
- xi. The horizontal alignment of pipes less than 900 mm in diameter shall not be more than 150 mm off the designated alignment. The alignment for pipes larger than 900 mm shall not deviate by more than 50 mm per each 300 mm of diameter.

- xii. The invert of the pipe shall not deviate from the design grade by more than 6 mm plus 20 mm per metre of diameter of sewer pipe.
- xiii. Each valve and fitting shall be permanently supported independently of the pipe with 30 MPa concrete.
- xiv. The cutting of pipe for closure to fittings, valves and other reasons shall be done in a neat and workmanlike manner, without damage to the pipe and so as to leave a smooth edge at right angles to the axis of the pipe. Pipe cutting for valves and fittings shall be done accurately so as to bring all valves and fittings to their correct positions. Cut standard pipe used with rubber gasket joints shall be field machined and chamfered as required by the manufacturer's instructions.
- xv. Standard plugs shall be inserted at all dead end pipe for connection to future infrastructure.

#### **F.3.4 Manhole Installation**

- i. Manholes shall be installed as depicted on the detail drawings and in accordance with manufacturer's recommendations.
- ii. Backfill around manholes shall be compacted to a minimum of 98 % of Standard Proctor Density.
- iii. Tee-riser manholes shall require Class A bedding to the elevation of the spring line.
- iv. Pre-cast manhole bases shall be installed on a base of 100 mm to 300 mm of washed gravel.
- v. Cast in place manhole bases approved by the Municipal Engineer shall be placed directly on undisturbed ground.
- vi. Safety steps shall be aligned on centreline perpendicular to the main flow channel. Wherever possible the steps shall be aligned so that a person exiting the manhole would face oncoming traffic if not conflicting with the previous requirement. The distance from the top of the rim to the first step shall not be greater than 300 mm. Steps shall be evenly spaced at a maximum of 410 mm to within 600 mm of the base of the manhole. Refer to Drawing F-14 for details.
- vii. The frame and cover shall be installed following manufacturer's recommendations.

#### **F.3.5 Riprap**

- i. When required by the plans, or as ordered by the Developer's Engineer, embankments, the ends of culverts and ditch bottoms shall be protected by riprap as directed. This item consists of supplying materials and constructing a protective covering of approved stone or sacked concrete on an earth bed, granular filter blanket or filter fabric in accordance with these standards. Riprap shall be constructed at the locations and in conformity

with the lines and grades shown on the plans or as designated by the Developer’s Engineer subject to the Municipality’s approval.

- ii. The Developer shall supply all riprap materials for the proposed subdivision. The materials supplied will be subject to the approval of the Municipality.
- iii. The Municipality reserves the right to select an independent testing firm to conduct inspections and testing of riprap and compile its own data during or after the construction period. Any costs associated with inspections and testing conducted by the Municipality for areas that fail initial testing shall be borne by the Developer and may be taken from the security held by the Municipality. These results will be made available to the Developer’s Engineer. This quality assurance testing program does not relieve the Developer of their responsibility to conduct their own quality control testing program.
- iv. Stone riprap: materials shall consist of sound, hard and dense stones, boulders or quarry rocks resistant to the action of air and water and free from seams, cracks or other structural defects. The particles shall be generally of equal dimensions in all directions, with a minimum of flat and/or elongated particles. Types of stone riprap:
  - a. Normal stone riprap - used for corrugated steel pipe culverts, ditch checks and ditch blocks. Shall consist of particles having dimensions of not less than 150 mm in any one direction.
  - b. Heavy stone riprap - used for corrugated structural plate pipe culverts, bridges, and major stream bank protection.

<b>Weight of stones (kg)</b>	<b>Percentage</b>
400 – 600	40 - 60
200 – 400	20 - 40
25 – 200	10 - 30
Under 25	0

- c. Armour stone riprap:

<b>Weight of stones (kg)</b>	<b>Percentage</b>
600 – 900	60 - 70
300 - 600	20 - 30
100 - 200	10 - 20
Under 100	0

- d. Hand laid riprap - hand laid riprap shall be sound, durable stones and in no case measure less than 150 mm. The stones shall be placed with their beds at right angles to the slope, with larger stones used in the bottom courses, and the smaller stones at the top. They shall be laid in close contact so as to break joints, and in such manner that the weight of the

stone is carried by the earth and not by the adjacent stones. The spaces between the larger stones shall be filled with spalls, securely rammed into place. The finished work shall present an even, tight, and reasonably plain surface, varying not more than 75 mm from the required contour.

- e. Random riprap - random riprap, graded so that the smaller stone is uniformly distributed throughout the mass, shall be dumped randomly over the areas until the required depth is attained. The occasional manual handling of rocks or stones shall in no manner be construed to transform the classification of random riprap into that of hand laid riprap.
  - f. Sacked concrete riprap - granular material used for the concrete and consists of well graded gravel with a maximum particle size of 75 mm. Sacks shall be manufactured from burlap and shall have a capacity of approximately 0.03 m<sup>3</sup>. The cement shall be Portland cement conforming to the latest CSA Specifications A5, Type 1.
- v. Construction:
- a. Preparation of foundation: aprons and slopes to be rip rapped shall be excavated as shown on the plans or as specified by the Developer's Engineer. The foundation bed shall be fine graded to form a uniform and even surface. Granular filter blankets or filter fabrics when required shall be placed as specified by the Developer's Engineer. A thin layer of fine-grained material shall be placed over filter fabric to prevent damage to the fabric by the stones.
  - b. Hand placed riprap: the stones, boulders or quarry rocks shall be placed by hand to conform to the lines and grades as shown on the plans or as specified by the Developer's Engineer. The stones shall be firmly bedded into the bed and against adjoining stones and smaller stones used to fill in the voids. Hand placing will generally be designated for normal stone riprap.
  - c. Machine placed riprap: the stones, boulders or quarry rocks shall be sorted and placed by machine to produce a uniform blanket or riprap conforming to the lines and grades shown on the plans or as specified by the Developer's Engineer. The equipment used shall be capable of handling and positioning individual riprap particles. Machine placing will generally be designated for heavy stone riprap and armour stone riprap.
  - d. Random riprap: the stones, boulders or quarry rock shall be placed onto the surface to be rip rapped and enough hand and/or machine work shall be done to produce a uniform mat conforming to the lines and grades shown on the plans or as specified by the Developer's Engineer. Random placing may be designated for all types of stone riprap.
  - e. Sacked concrete rip-rap: The Developer's Engineer will establish the mix design for the concrete to be used and it will be based on a minimum

compressive strength of 14 MPa after 28 days. Each burlap sack shall be filled with at least 40 kg of concrete and securely stapled or tied with wire ties. Within one half hour after mixing of the concrete, the filled sacks shall be placed in their final position on the prepared base and packed into conformance with the base and the adjacent sacks already in place. The pattern to which the sacks are laid shall be as required by the plans or as specified by the Developer's Engineer. Following placing, the sacked concrete riprap shall be kept moist for 24 hours by sprinkling water or by covering with at least 100 mm thick of moistened earth.

#### **F.4 INSPECTION AND TESTING**

- F.4.1** During construction, all excavating, installation, joining of pipes, backfilling and completion of all works shall be subject to inspection by the Municipality's authorized representatives. Unsatisfactory conditions shall be remedied at the Developer's expense. All equipment, tools and labor for testing shall also be provided by the Developer at his expense.
- F.4.2** Prior to issuance of the Construction Completion Certificate(CCC) and Final Acceptance Certificate (FAC), all sewer installations shall be subject to inspections and testing.
- F.4.3** All material testing shall be performed by an accredited agency. All test results shall be submitted to the Municipal Engineer with a report indicating any deficiencies and remediation.
- F.4.4** Where deemed necessary by the Municipal Engineer, an infiltration and/or exfiltration test (leakage test) shall be conducted for each section of the storm sewer:
- i. The test section shall be filled with water allowing displacement of air in the line and will be allowed to stand for 24 hours to ensure absorption in the pipe wall. Prior to the test, add enough water to ensure a head of 1m to 3m over the pipe crown in the upstream manhole. The test duration shall be 2 hours. The water level should be measured at the beginning and end of the test in order to calculate the infiltration/exfiltration.
  - ii. The allowable leakages are as follows:
    - a. Infiltration test shall be performed, if deemed necessary, when the groundwater is above the pipe crown for the entire test length. Allowable infiltration is 5.0 L/day/mm diam/km for PVC pipe and 20.0 L/day/mm diam/km for concrete pipe.
    - b. Exfiltration test shall be performed when the groundwater is below the pipe invert for the entire test length. Allowable exfiltration is 5.0 L/day/mm diam/km and 20.0 L/day/mm diam/km for concrete pipe.
  - iii. Light and pill tests:
    - a. Each section of storm sewer main shall be subjected to a light test. A light shall be shone into the sewer main at the upstream manhole. To



pass the test, the light must be fully visible when viewed from the downstream manhole. In the event of an unsuccessful light test, the sewer main section in question shall be subjected to a pill test where a ball, or similar object of a diameter that is 50 mm less than the inside diameter of the sewer main shall be successfully pulled through without encountering any obstructions.

#### **F.4.5** Closed Circuit Television Inspection of Sewer Lines

##### **i.** General

- a. This section of the standards shall form a part of the Contract Documents and should be read in conjunction with them.
- b. The work shall include television inspection of sewer mains between manholes including a digital or audio commentary on location and distance encoding, written report and still photographs of problem areas.
- c. The equipment, materials and methods used must produce suitable video records and logs for the identification and categorization of deficiencies, as well as the determination of the location, extent and seriousness of each deficiency.
- d. All sewer lines shall be flushed and cleaned prior to video inspection. Lines, including stubs must be inspected with either actual flow or simulated flow pronounced by adding water at an upstream manhole or riser pipe. The simulated flow must produce a visible, laminar flowing stream in the line for the full length of the line being inspected. Inspections will be rejected where the simulated flow exceeds one-third the diameter of the pipe.

##### **ii.** Video Records and Index Plans

- a. Video records are to be supplied by the Contractor and shall be in a digital format acceptable to the Municipality. The Contractor shall set up the files in a format where each section of pipe or services has a separate chapter number. All video inspections are to be done in colour and with sufficient lighting to result in a clear high quality picture.
- b. The Contractor must also provide an 11" x 17" (279 mm x 432 mm) plan with an Index of video runs to pipe element or manhole numbers. Manhole numbers shall be as prescribed by the Municipal Engineer and, in the absence of such, the manhole numbers on the Detailed Engineering Drawings shall be used. The manhole numbers from the Detailed Engineering Drawings shall be on a plan showing the location and the number of the manholes, and is to be bound in with the video and index sheet.
- c. There shall be separate video files for storm mains and services. Separate logs shall be provided for each file.

## iii. General Operations

- a. The entire length of each sewer shall be video inspected between manholes. In new subdivisions, terminating videos at the connection point to an existing stub shall not be permitted. The camera unit shall, at no time, travel at a rate of speed greater than 6 m per minute. If for any reason, the video camera unit will not pass from one manhole to another then a reverse run shall be done at no extra cost to the Municipality.
- b. The video inspection shall take place during low flow conditions. At no time during video inspection shall the depth of flow exceed 1/3 of the pipe diameter, except at sag locations. At all times camera travel shall be in the same direction as the flow unless impractical or when a reverse run is necessary. Newly constructed pipes are to be video inspected with simulated flow by running water into an upstream manhole or clean-out.
- c. The camera shall be positioned centrally in the pipe with a tolerance of +/- 10 %. If conditions within the pipe do not allow for this configuration, a greater tolerance may be allowed upon approval by the Municipal Engineer. Chainages for the video inspection shall begin at the inside face of the starting manhole wall and terminate at the inside face of the end manhole wall.

## iv. Video Inspection

- a. The video inspection of each section of sewer line shall begin with a digital or audio commentary describing the following:
  - Time and date
  - Weather
  - Subdivision description and/or phase
  - Location description in and on-from-to format as described on the list of lines to be inspected
  - Manhole numbers as provided by the Developer
  - Size and use of sewer including pipe material
  - Direction of flow
  - Inspection technician
  - Video identification number
- b. This information shall also be written on the video report sheet.

## v. Work Report

- a. A video work report, in log form, shall be completed during the inspection. This log shall show the exact measured location of faults including, but not limited to:
  - Open joints
  - Broken, cracked, collapsed or ovaled pipe
  - Accumulation of debris or obstructions
  - Root penetration and root rating (1 to 9 root rating system)

- Infiltration and mineral deposits
  - Water depth variation and sags
  - Protruding gaskets
  - Service connections and type (in-line or inserta-tee)
- b. The reference location shall include the distance away from the reference manhole and also the position of the fault as referred to the crown of the pipe using the clock face notation. Significant faults are to warrant audio commentary on the video tape duplicating report information. The camera shall be stopped briefly at these locations. Color photographs shall be taken of all sewer defects. The photographs shall be coordinated with the written report by reference numbers. Photographs of all deficiencies are required. Additional photographs shall be taken as deemed necessary.
- c. One (1) hardcopy of the final written report with corresponding photographs and one (1) electronic copy of the final written report with corresponding photographs and the video inspections shall be furnished to the Municipal Engineer within one (1) week after completion of the inspection.
- d. All video inspection files shall be numbered and cross indexed to the written report. Reports shall be bound and if more than one report is submitted in one binding, then there shall be an index sheet provided with the binding indicating the contents. Separate reports shall be submitted for mains and for services.

**F.4.6** Sections requiring repair will be subject to re-inspection when repairs are complete. At the discretion of the Municipal Engineer, re-inspection by a camera may be required on selected areas prior to issuing of the Final Acceptance Certificate. All video inspection costs shall be borne by the Developer.

**F.4.7** At the Municipal Engineer's discretion, an infiltration and/or exfiltration tests (leakage test) may be required for any section showing deficiencies during the camera test.

## **F.5 MAJOR SYSTEM**

### **F.5.1 General**

- i. The major conveyance system accommodates flows not intercepted by or beyond the capacity of the minor drainage system through planned surface flow routes and storage facilities. The intent of the major system is to provide surface flow management in order to minimize flooding and property damage from a 1:100 year rainfall event. The design of the major drainage system shall not be limited to the immediate subdivision area but must consider overland flows that may enter the area from adjacent land as well as downstream effects on adjacent subdivision and receiving water bodies.

- ii. The Rational Method shall not be used to design the storm water management system for areas greater than 65 ha. Computer models shall be used to determine design flows and to properly size storm water management facilities. The selection of an appropriate computer model shall be based on a solid understanding of the principles, assumptions, and limitations of each model and methodology in relation to the system being designed. SWMM models are preferred for the design of drainage systems. Wherever possible, the computer model shall be calibrated. In all analyses, the parameters used, the drainage boundaries and the storm sewer collection network shall be clearly identified on an overall drawing. Computer printouts and a design summary report shall be provided to the Municipal Engineer for review.
- iii. For storm water management systems that consist of sewers only, the design storm duration to be used shall be 1 hour. For storm water management systems requiring storage facilities, the design storm duration to be used shall be at minimum of 12 hours. Longer design storm duration shall be used, if necessary, to properly assess the post-event drainage/discharge of the storage facility.
- iv. Overland flows shall not be permitted to travel a distance greater than 300 m along local roadways without provision for interception by catch basins. Overland flows on collector and arterial roadways shall not travel a distance greater than 120 m without interception by catch basins. Overland flows shall be intercepted with a sufficient number of catch basins such that the total inlet capacity provided is sufficient enough to receive the design storm water flow rates.
- v. The minimum slope of roadway gutters shall be 0.5 % in the longitudinal direction. For cul-de-sacs and curb returns, the minimum slope of the gutter shall be 0.8 % in the longitudinal direction.

#### **F.5.2** Lot Grading

- i. The intent of the lot grading shall be to ensure that water flows away from the buildings, water supply wells, and septic beds, and in no case shall ponding levels come within 150 mm from the finished ground elevations around the buildings during a 1:100 year rainfall event. Site grading shall be done to ensure proper drainage of private property and to establish an adequate drainage system for the entire subdivision.
- ii. Flow from lots shall always have an escape route to a public right-of-way. The lot-grading plan shall develop a proper balance between the road and gutter elevations, proposed building elevations, surrounding subdivisions and existing topography.
- iii. Generally, the lots shall be designed to drain from back to front. Drainage towards the back of lot will be permitted where laneways or public rights-of-way are in place to accommodate drainage directly from the lot without crossing adjacent lots. Split drainage or front-to-back drainage may be

allowed when a road, lane or public right-of-way exists at both the front and back of the lot, or as approved otherwise by the Municipality.

- iv. Back-to-front drainage shall be the standard practice. They shall be graded to achieve a minimum slope of 2 % or greater away from buildings and along the lot boundaries. Provisions shall be made to keep the runoff at least 3 m away from buildings where practical. An initial grade of 10 % sloping away from the building for a distance of 2 m shall be required on all sides. The slope shall continue at a minimum grade of 2 % or greater to the property boundary. Larger slopes are desirable if topography allows to a maximum of 10 %.
- v. Reverse (back sloped) driveways shall not be permitted.
- vi. Reserves and public lands shall be graded to drain towards developed roadway, lanes and/or the storm drainage system according to a specific landscape or site plan submitted by the Developer and approved by the Municipality.
- vii. The construction of all overland drainage control shall be completed to the satisfaction of the Municipality, in accordance with approved plans, prior to the issuance of the Construction Completion Certificate for storm sewer mains.

### **F.5.3 Roadways**

- i. Grading of streets comprising the major drainage system shall follow the guidelines listed below:
  - a. Continuity of overland flow routes between adjacent subdivisions shall be maintained.
  - b. Collector roadways shall have at least one lane that is not inundated.
  - c. Local roads should not have a depth of water more than 50 mm above the crown of the road.
  - d. The depth of water at the curb shall be less than 500 mm for all roadways.

## **F.6 STORM WATER MANAGEMENT FACILITIES**

### **F.6.1 General**

- i. Storm water management facilities shall be designed as an integral part of both the minor and major storm water management systems. These facilities shall attenuate the peak post-subdivision runoff flow hydrograph for the 1:100 year return period storm event to the peak flow calculated under pre-subdivision conditions for the same contributing area.
- ii. In assessing the need for a storm water management facility to be included as part of a proposed subdivision, the Developer shall consider the impacts of uncontrolled storm water drainage on the subdivision itself and the surrounding environment, as well as any potential impacts on receiving

water bodies. The type of facility to be used shall be based on the principles of Best Management Practices for end of pipe treatment of storm water runoff and shall be subject to approval by the Municipality.

- iii. Soils investigations, specific to the type of storm water management facility being considered, shall be undertaken to determine the appropriate design factors and field conditions. If a storm water management facility is to be located above a shallow aquifer, the potential for groundwater contamination must be considered and the necessary measures shall be taken to minimize the potential impacts.
- iv. The design of any storm water management facility shall consider the aesthetic implications of shape, size, grading, and required landscape features.
- v. High water level elevations in the storm water management facilities shall be considered in the design of both the minor storm water management system and lot grading. Hydraulic grade line elevations for the minor storm water management system shall be based on the maximum water level elevation calculated for the 1:5 year storm event. Whenever feasible, obvert elevations of the minor system pipes located in the first manhole upstream of a storm water management facility shall be at, or above, the maximum water level elevation achieved in the storage facility during the 1:5 year storm event.
- vi. Outlet capacity shall be of sufficient size so that 90 % of the active storage volume is recovered after 96 hours. This time requirement is based on the flood waters reaching the high water levels during the 1:100 year design storm event. Private property lines and building openings shall be at an elevation equal to, or above, the elevation achieved at the top of the freeboard depth.
- vii. Emergency overflow provisions (overflow channels and overland drainage route) shall be provided, where feasible, for storm water management facilities. If emergency overflow means cannot be provided, the freeboard depth shall be increased (subject to approval by the Municipality).

#### **F.6.2 Swales**

- i. Drainage swales on municipal or private property shall be constructed prior to any development of subdivision lots. Drainage swales located between adjacent lots shall be concrete. Completion of the swales construction shall be a prerequisite prior to the issuance of the Construction Completion Certificate.
- ii. All surface runoff drainage swales shall be contained within Public Utility Lots and shall become the property of the Municipality. Detailed drainage swale calculations and designs shall be submitted to the Municipality for approval.
- iii. Drainage swales located on private property shall be covered by an easement in favour of the Municipality. A minimum clearance of 200 mm

shall be provided between the edge of the swale and the property line. Major rainfall event flows shall be contained within the easement.

- iv. Drainage swales crossing several properties for the collection of runoff shall not be permitted unless special circumstances warrant.
- v. Bottom and side slopes of the earthen swales shall be protected from erosion by grass cover, appropriate ground cover or geotextile fabric, as specified by the Municipality and shown on the approved drawings.
- vi. The minimum design slope for concrete swales on private property is 0.75%, on public property is 0.5% or as required to provide adequate hydraulic capacity, and for swales without a concrete gutter is 1.5%.

### **F.6.3** Channels and Ditches

- i. Side slopes and back slopes of channels or ditches shall be at 3:1 minimum.
- ii. For a flat bottom ditch, the minimum width shall be 1 m for local and collector roads and a minimum of 3 m for arterials, unless otherwise approved by the Municipality.
- iii. Minimum depth of ditch shall be 1 m.
- iv. Bottom and side slopes of channels and ditches shall be protected from erosion by grass cover, appropriate ground cover or geotextile fabric, as specified by the Municipality and shown on the approved drawings.
- v. Ditch checks:
  - a. Ditch checks shall be required for any ditch that has 4 % or greater grade. The ditch check shall be considered as part of the design of the proposed subdivision and addressed in the storm water management plan.
  - b. Ditch checks shall be of a permanent nature and shall be maintained by the Developer until final acceptance of the completed subdivision by the Municipality. The distance between ditch checks shall be a minimum of 5 m from any culvert invert; and have a maximum spacing of 20 m, or as specified by the Municipality.
  - c. Ditches with grades exceeding 3 % shall include permanent erosion control measures.

### **F.6.4** Outfalls

- i. Proper outfall structures shall be placed at the end of all storm water outfall pipes that discharge to open channels or receiving water bodies. The outfall structures shall provide a means for reducing the velocity of the discharge flow and dissipating the associated energy. As well, these structures shall incorporate the necessary design features to prevent erosion of the surrounding environment.

- ii. Outfall structures must receive written approval from the following federal and provincial regulatory authorities (the Developer shall obtain all necessary regulatory approvals and permits at their own expense):
  - a. Federal
    - Transport Canada (Coast Guard) - Navigable Waters Protection Act
    - Department of Fisheries and Oceans – Fisheries Act
  - b. Provincial
    - Alberta Environment – Water Act
    - Sustainable Resource Development – Public Lands Act
- iii. Outfall structures may be a chute, spillway, stilling basin, or plunge pool with headwall. Cut off walls are required at the end of the outfall apron to prevent undermining support structure.
- iv. Outfall structure aprons shall be 150 mm to 225 mm above the invert of the receiving water body to prevent the collection of debris on the apron. Weeping tile shall be placed under the structure to reduce the effects of water pressure on the headwall of the outfall structure. Safety railings and trash screens shall be installed in the outfall structure.
- v. Obverts of outfall pipes shall be at least 150 mm above the 1:5 year flood level in the receiving watercourse. Inverts of outfall pipes shall be above the winter ice level to prevent the pipes submerging below the bottom of ice level. Outfalls shall be protected against damage from moving ice during spring break-up.
- vi. Drop structures, slope protection material (riprap, filter fabric, etc.) and energy dissipaters shall be used where necessary to prevent erosion. Outfall structures shall be properly landscaped and finished so that they may blend in with the existing topography as much as possible. Facilities shall be provided with removable gates to discourage unauthorized access.

#### **F.6.5** Receiving Water Bodies

- i. Necessary engineering measures shall be incorporated in the design of the proposed subdivisions to prevent any increase in the amount of downstream erosion experienced by receiving water bodies as a result of the subdivision.
- ii. If a development causes downstream erosion despite the use of on-site peak runoff rate controls, appropriate mitigating measures shall be taken in the downstream areas.
- iii. Preservation of watercourse aesthetics and wildlife habitat shall be considered a high priority for all erosion protection and bank stability work.

#### **F.6.6** Culverts

- i. Culverts shall be placed so that the minimum distance from the top of the finished grade of the roadway to the top of the culvert pipe shall be not less



than one-half the diameter of the pipe or a minimum of 300 mm, whichever is greater, unless approved otherwise by the Municipality.

- ii. If proposed culverts cross existing water bodies, the design shall incorporate allowances for backwater effects over a range of flows. The design of culverts shall require an assessment of both the nominal design capacity and the performance of the structure during 1:100 year flood events. Design calculations shall be performed by qualified Structural and Hydrological Engineers and submitted to the Municipality for approval.
- iii. A trench shall be excavated to the specified depth and grade with the bottom shaped to conform to the bottom of the pipe to afford a firm and uniform bearing over the entire length of the culvert. If the material in the bottom of the excavation is unsuitable, the trench shall be sub-excavated 100 mm below the grade as ordered and backfilled with approved granular material and thoroughly compacted to ensure an unyielding foundation for the culvert.
- iv. Where the trench is in solid rock or other hard material, it shall be excavated to a depth of at least 100 mm below the design grade of the bottom of the pipe, and backfilled with suitable material in such manner as to ensure a uniform bearing for the length of the culvert.
- v. Selected backfilling material, free from stones, frozen lumps, and other deleterious material, shall be placed under and around the pipe and thoroughly compacted in place. The trench shall be completely filled and the pipe cover at least 300 mm thick with hand placed and properly compacted material before the construction of the embankment over the culvert proceeds.
- vi. If a trench is not required, the culvert pipe shall be installed true to line and grade on a bed that is uniformly firm throughout its entire length, and the backfilling shall be completed to form a minimum 100 mm thick granular cover over the top of the pipe.
- vii. When using corrugated pipe, the pipe shall be installed in the trench with the separate sections firmly joined together and with outside laps of circumferential joints pointing upstream and with longitudinal laps on the side. Corrugated pipe shall be so handled as to prevent bruising and scaling. In no case shall culvert pipe be dragged on the ground.
- viii. Where necessary, the Developer shall carefully remove existing culverts and other structures and dispose of or place the materials as directed by the Developer's Engineer.
- ix. All drainage culverts shall have riprap placed as specified at both inlet and outlet. The size and type of riprap shall conform to these standards requirements.
- x. Minimum diameter of roadway culvert shall be 600 mm. Minimum diameter of entrance culvert shall be 500 mm. Minimum wall thickness shall be 1.6 mm or as required by the design criteria.

**F.6.7 Storm Water Storage Facilities**

- i. This section identifies the general design parameters for the planning and design of storm water storage facilities.
- ii. A drainage master plan must be prepared by the Developer providing a detailed description of the subdivision area including overland flow, catchment areas, natural storage and planned storage.
- iii. Several different storage methods may be employed for a storm water storage facility such as:
  - a. Retention storage (wet pond) – collects and stores runoff for a period of time and releases it after the inflow has ceased. Retention storage also includes constructed wetland.
  - b. Detention storage (dry pond) – provides a control outlet to the area restricting flow. When the inflow exceeds the allowed outflow, water is detained in the designated storage area until flows diminish. Low flows are not usually detained.
  - c. Channel storage – channel constructed with wide bottoms and small grades will provide a type of storage as the channel fills with water.
- iv. The design of the storage facility shall be based on a 1:100 year rainfall event. The Developer's Engineer shall include detailed calculations for a range of storm durations to determine the critical volume as well as an analysis of the capacity and characteristics of the downstream receiving drainage course. Measures shall be taken in order to avoid flooding, erosion or sedimentation in the downstream receiving drainage course.
- v. These standards are not intended to restrict developers from formulating innovative storm water management processes intended to protect the environment and improve the storm water quality prior to release. All storm water management plans must be submitted to Alberta Environment & Parks and the County for review and approval.

**F.6.8 Storm Water Ponds**

- i. Storm water ponds are considered as detention or retention facilities which shall be designed as part of both the minor and the major drainage systems. They must control the peak runoff conditions for events up to the 1:100 year return period. Storm water ponds become municipal property.
- ii. The need for a specific storm water detention facility shall require the approval of the Municipality. In assessing the need for specific detention facilities, the Developer's Engineer shall consider the impacts of uncontrolled drainage.
- iii. The ratio of land area for open space use around the pond shall be twice the area of the water surface for the 1:100-year runoff event, unless approved otherwise.

- iv. Soils investigations specific to the detention facility shall be undertaken to determine appropriate design factors. Where the facility is situated above a shallow aquifer or high-water table, the potential for groundwater contamination must be minimized.
- v. Wet pond detention facilities should be constructed in impervious soils to minimize water losses during dry weather periods. Intruding silt, sand or gravel seams shall be sealed off.
- vi. Where a detention facility is to have multiple functions, its design shall consider the aesthetic implications of shape, grading, landscape features and use.
- vii. An emergency overflow system shall drain to a receiving watercourse, or outlet acceptable to the Municipality, for storms greater than the 1:100-year event.
- viii. The effects of the maximum pond water levels shall be considered in the design of the minor system and lot grading. The crown elevations of the pipes in the first manhole upstream of a facility shall be at or above the maximum detention pond level during the 1:5-year storm event.
- ix. The maximum water level fluctuations for detention ponds in residential areas during the 1:100-year storm event shall be 2 m. All inhabited building space, including basements, shall be constructed 150mm above the 100-year flood level.
- x. Design standards for wet ponds:
  - a. Lands covered by the facility including areas covered by water at the normal water level (NWL), inlets, outlets, control structures and access routes shall be designated as Public Utility Lot (PUL). Private property subject to potential flooding shall be covered by an easement in the favour of the Municipality.
  - b. The pond shall be located at local low points or adjacent to an existing water course. A restrictive covenant shall be placed on the lots abutting the facility as required to control development that will restrict the capacity of the pond.
  - c. The design shall incorporate a semi-annual turnover at average annual precipitation. Minimum detention time shall be 24 hours.
  - d. The pond shall have a minimum depth of 2.5 m at NWL. The high water level (HWL) shall be at least 300 mm below the lowest building opening on adjacent lots.
  - e. The minimum surface area at normal water level shall be 2 ha in order to discourage a large number of small facilities.
  - f. The pond shall have side slopes no steeper than 3:1 from the bottom of the pond to 1 m below NWL. From there to 5 m (horizontal) beyond the 100 year flood level the side slopes shall be no steeper than 7:1. A 4:1

slope shall be considered if appropriate slope protection is proposed as part of the design. These slopes may be revised in confined spaces or areas with extreme topography at the discretion of the Developer's Engineer and acceptance by the Municipality.

- g. Where the ground water level is below the NWL, the pond bottom shall be of impervious material as recommended by geotechnical investigation. Where the ground water level is near or above the NWL, the pond bottom may be made of a pervious material based on geotechnical investigation.
- h. Inlets and outlets are to be placed in order to maximize detention time and water circulation thereby avoiding dead bay areas.
- i. Inlet and outlet pipes are to be fully submerged and at least 200 mm above the pond bottom and 1 m below the NWL. Inlets and outlets shall be submerged below ice level and above the level of anticipated sediment accumulation.
- j. Invert of the upstream minor system pipe in the inlet manhole of the wet pond and the invert of the downstream pipe in the outlet manhole of the wet pond shall be at, or above, the NWL elevation to ensure that the NWL elevation can be maintained.
- k. Provision shall be made in order to drain the pond completely by gravity or portable pump system, and for sediment accumulation at the points of inflow, and for the later removal of the sediment. Sediment traps, pre-treatment sumps, or fore-bays shall be provided at each inlet.
- l. An overflow channel and overland drainage route must be provided at the high water level.
- m. Edge treatment is required for erosion protection due to wave action from 0.3 m below the NWL to 0.3 m above the NWL. The edge treatment shall be compatible with adjacent land use and consider safety, maintenance, access and erosion reduction.
- n. All weather vehicle access must be provided to all control works. Access to the lake for launching boats shall also be made available. Fencing, signage and lighting approved by the Municipality shall be installed where necessary for safety purposes.
- o. An inspection manhole shall be located no greater than 18 m from shore on both the inlet and outlet lines.
- xi. Design standards for dry ponds:
  - a. Lands covered by the facility including areas covered by water at the 1:5 year level, inlets, outlets, control structures and access routes shall be designated as Public Utility Lot (PUL). Private property subject to potential flooding shall be covered by an easement in the favour of the Municipality.

- b. Dry ponds shall be designated as off-line storage areas designed to temporarily detain excess flow and control downstream flow to acceptable limits. Low flow conditions shall not be diverted to the dry pond. Storm water flow bypass provisions shall be provided for minor storm events that are less than the 1:5 year storm event. Minimum detention time shall be 24 hours.
- c. A restrictive covenant shall be placed on the lots abutting the facility as required to control development that will restrict the capacity of the pond.
- d. Maximum storage depth shall be 1.5 m measured from the invert of the outlet pipe. A freeboard depth shall be 0.3 m.
- e. The pond shall be designed to drain completely after excess flow has dissipated. The pond bottom shall have a minimum slope of 2 % towards the outlet. French drains (pond under drain system) shall be provided in the pond bottom where longitudinal slopes are less than 2 %.
- f. Sediment traps, or hard bottom pre-treatment sumps, shall be provided at each inlet.
- g. Side slopes shall not be sloped steeper than 7:1 within private property and 5:1 within public property.
- h. Grass cover shall be established after completion of construction. Slope erosion protection measures shall be used when required by the Municipal Engineer.
- i. All inlets and outlets shall have grates with a maximum bar spacing of 150 mm over their openings in order to prevent unauthorized access.
- j. The possibility of plugging shall be considered when determining the diameter of the outlet pipe. Maximum flow through the grating shall be 1 m<sup>3</sup>/sec.
- k. Inlets and outlets shall utilize trash racks and proper security measures to limit human access into the structures.

#### **F.6.9** Alternative Storm Water Management Facilities

- i. Underground storm water storage tanks may be used when designs that involve the use of wet ponds or dry ponds as storage facilities are not feasible.
- ii. Parking lot and rooftop storage of storm water may be permitted as part of the overall storm water management design but must be approved by the Municipality.
- iii. Infiltration and evaporation detention facilities may be used in subdivisions where a suitable receiving water body cannot be found or the location of the water body makes construction of a proper outfall improbable. These types of facilities require detailed field investigations that involve site specific measurements of infiltration rates and a solid understanding of the local

groundwater hydrology and what effects the detention facility would have on existing condition.

## **F.7 STORM WATER QUALITY AND BEST MANAGEMENT PRACTICES**

- F.7.1** The design of all storm water management systems shall adequately address the issue of storm water quality. Specifically, Best Management Practices for storm water management shall be followed as described in the Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems as published by Alberta Environment and Parks (latest revision).
- F.7.2** The use of constructed wetlands for further water quality enhancement is encouraged prior to discharge to a receiving water body.
- F.7.3** Dry ponds are utilized as a means of attenuating the peak storm water runoff rates that are experienced in the collection system immediately after a rainfall event. Dry ponds do not address the quality of the storm water runoff. Best Management Practices shall be used downstream of all dry ponds to properly address the quality of the storm water being produced by the storm water management system.

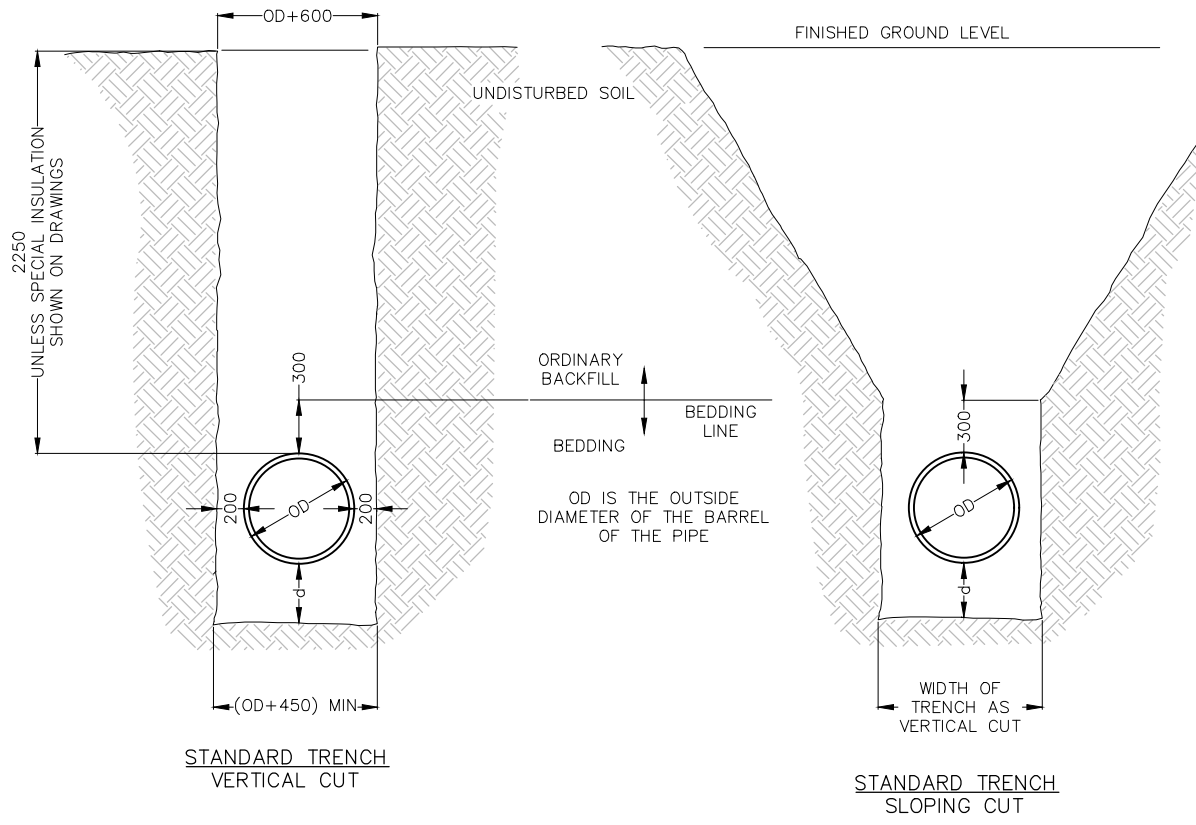
**F.8 LIST OF DRAWINGS**

- F-01 Standard Trench Dimensions for Circular Pipe
- F-02 Standard Trench Bedding for Circular Pipes
- F-03 Typical Services (Single & Dual)
- F-04 Precast Drop Manhole
- F-05 Neck Rings
- F-06 K-7 DF&G Shoulder Ring
- F-07 Trash Guard for Manhole Assembly
- F-08 Steel Plate Top System
- F-09 Standard 1200mm CB Manhole
- F-10 Safety Steps for Manholes
- F-11 Precast 610mm Catchbasin
- F-12 Standard 900mm Catchbasin with Type DK-7 Grating & Frame
- F-13 Standard 900mm Precast CB c/w K7 Double Frame & Grate
- F-14 Steel Plate Top System
- F-15 Slabtops for Standard 900mm Catch Basin
- F-16 Two Piece Type 4A Grating & Frame
- F-17 Frame & Grating Type 6 and 8
- F-18 Round Top Catch Basin and Manhole
- F-19 Frame & Grating Type K-7
- F-20 K-7 DF&G Catch Basin
- F-21 K-7 DF&G Shoulder Ring
- F-22 K-7 SF&G Shoulder
- F-23 K-7 DF&G Neck Ring
- F-24 K-7 SF&G Neck Ring
- F-25 Typical Catch Basin Installation 150 Curb & 250 Gutter
- F-26 Storm Pond Outlet Structure
- F-27 Storm Pond Outlet Control
- F-28 Swale Inlet Structure
- F-29 Grate C/W Trash Basket
- F-30 Concrete Culvert Flared End Detail
- F-31 Gabion Basket Detail Storm Sewer Outlet
- F-32 Pipe Grate Detail Storm Sewer Outlet
- F-33 1000mm Concrete Swale
- F-34 Guard Posts
- F-35 Typical Dry Pond Section
- F-36 Typical Wet Pond Section

**END OF SECTION**







(EXCAVATION TO BE SHORED AS PER OCCUPATIONAL HEALTH AND SAFETY STANDARDS)

(EXCAVATION TO BE SLOPED AS PER OCCUPATIONAL HEALTH AND SAFETY STANDARDS)

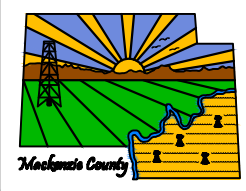
MAXIMUM TRENCH WIDTHS FOR SINGLE PIPES  
 - UP TO AND INCLUDING 400mm $\phi$  - 1000mm  
 - 450mm $\phi$  AND ABOVE - OD + 600mm

DEPTH OF BEDDING BELOW PIPE BARREL (d)  
 - 100mm MIN.

NOTE:  
 ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

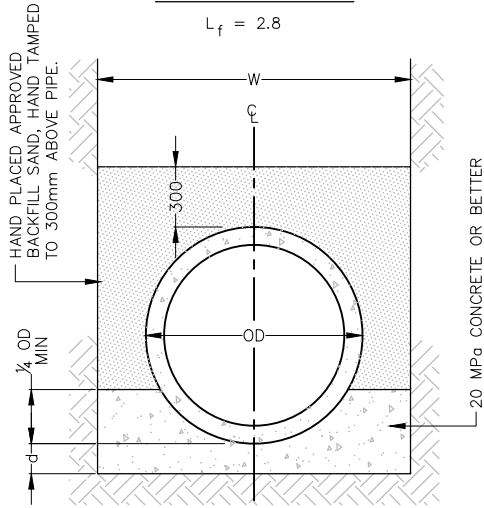
## General Municipal Improvements Standards



Rev.				STANDARD TRENCH DIMENSIONS FOR CIRCULAR PIPE	Approved:	Figure <b>F-01</b>
Rev.						
Rev.						
Rev.	2021-FEB-15	File No.: GP60.33682	Design:			
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			

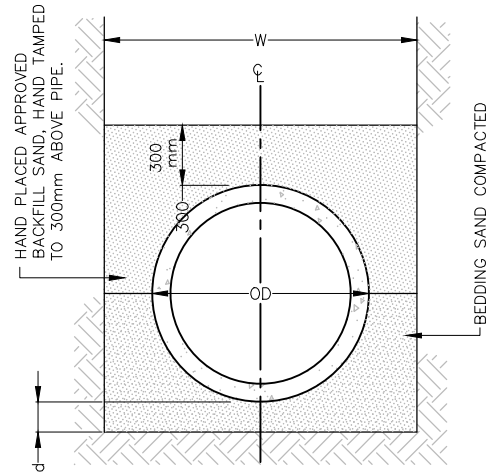
**CLASS A BEDDING**

$L_f = 2.8$



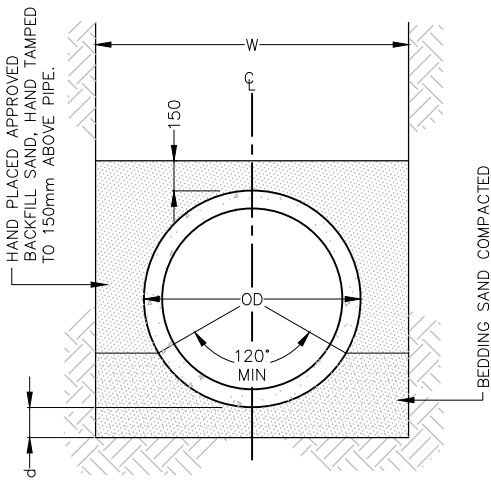
**CLASS B BEDDING**

$L_f = 1.9$



**CLASS C BEDDING**

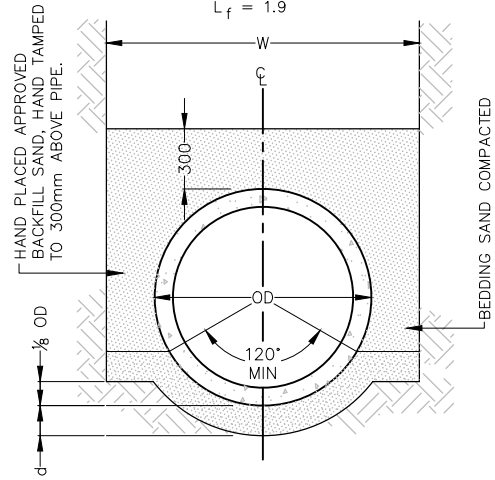
$L_f = 1.5$



**CLASS B BEDDING**

ALTERNATE - 375mm I.D. & UNDER

$L_f = 1.9$

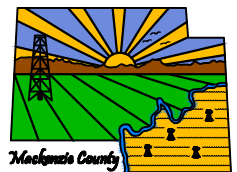


NOTES:

1. W = TRENCH WIDTH - O.D. + 450mm (MINIMUM).  
 - 1000mm max. FOR PIPES UP TO AND INCLUDING 400mm DIAMETER.  
 - O.D. + 600mm max. FOR PIPE DIAMETERS 450mm AND ABOVE.
2. O.D.= OUTSIDE PIPE DIAMETER.
3. I.D. = INSIDE PIPE DIAMETER.
4.  $L_f$  = LOAD FACTOR.
5. d = DEPTH OF BEDDING BELOW PIPE = 150mm (MIN).
6. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
7. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

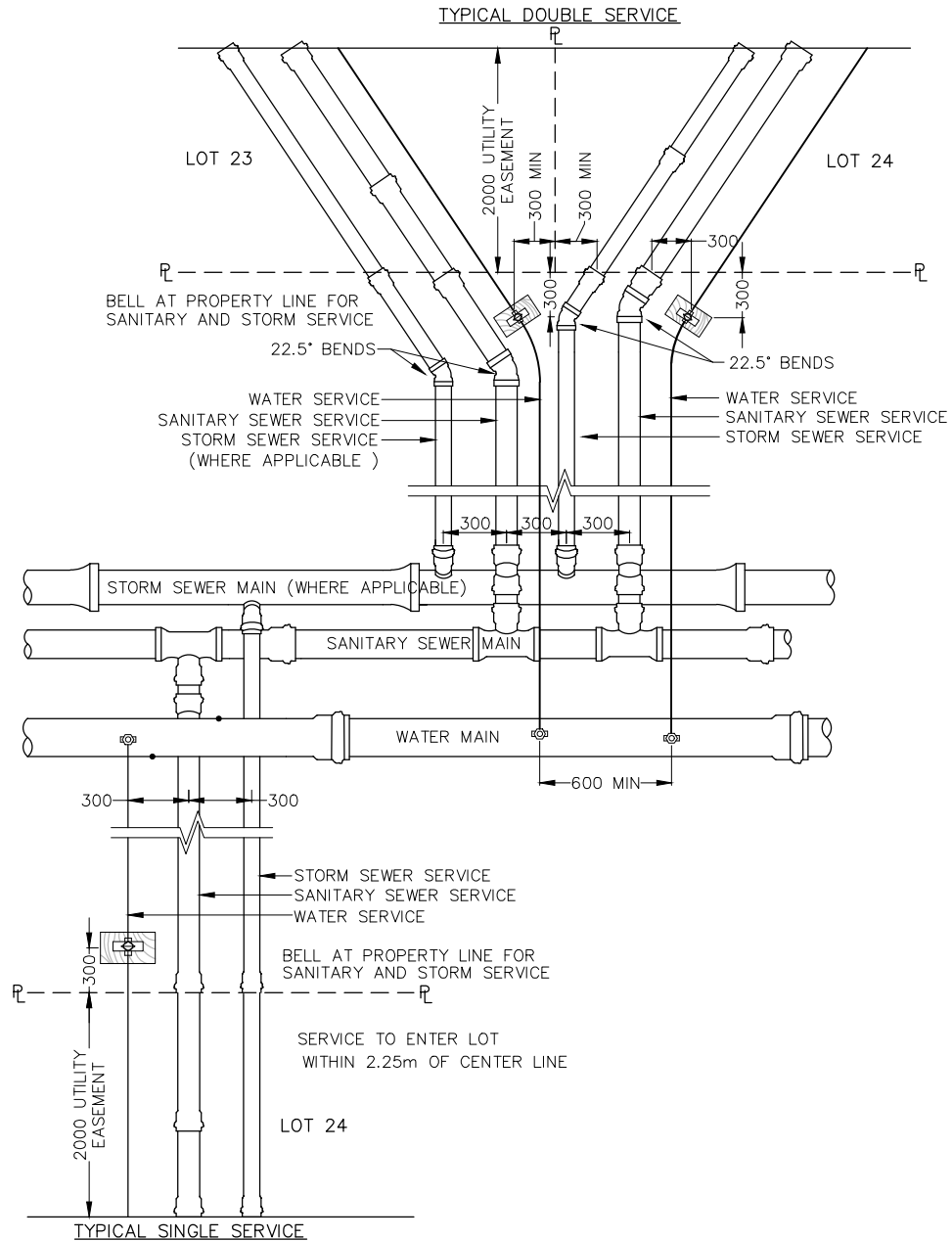


### STANDARD TRENCH BEDDING FOR CIRCULAR PIPES

Approved:

Figure **F-02**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

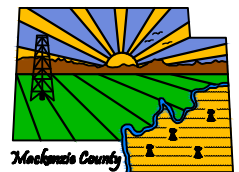


NOTES:

1. WATER AND SEWER SERVICES MAY BE EXTENDED TO EDGE OF 2.0m UTILITY EASEMENT.
2. THE COUNTY ACCEPTS NO RESPONSIBILITY FOR THE CONSTRUCTION OR MAINTENANCE OF SERVICES INSTALLED WITHIN THE EASEMENT.
3. MARK ENDS OF SERVICES AT EDGE OF GAS EASEMENT WITH A 50mm X 100mm X 750mm STAKE PROTRUDING 450mm ABOVE GROUND AND PAINTED BLUE. MARK THE CURB CONTROL VALVE WITH A SIMILAR STAKE PAINTED RED.
4. PERMEABLE FILTER CLOTH MAY BE USED ON THE END OF THE WATER SERVICE TO PREVENT INTRUSION OF DEBRIS AND TO ALLOW TESTING FLOW OF CURBSTOP.
5. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

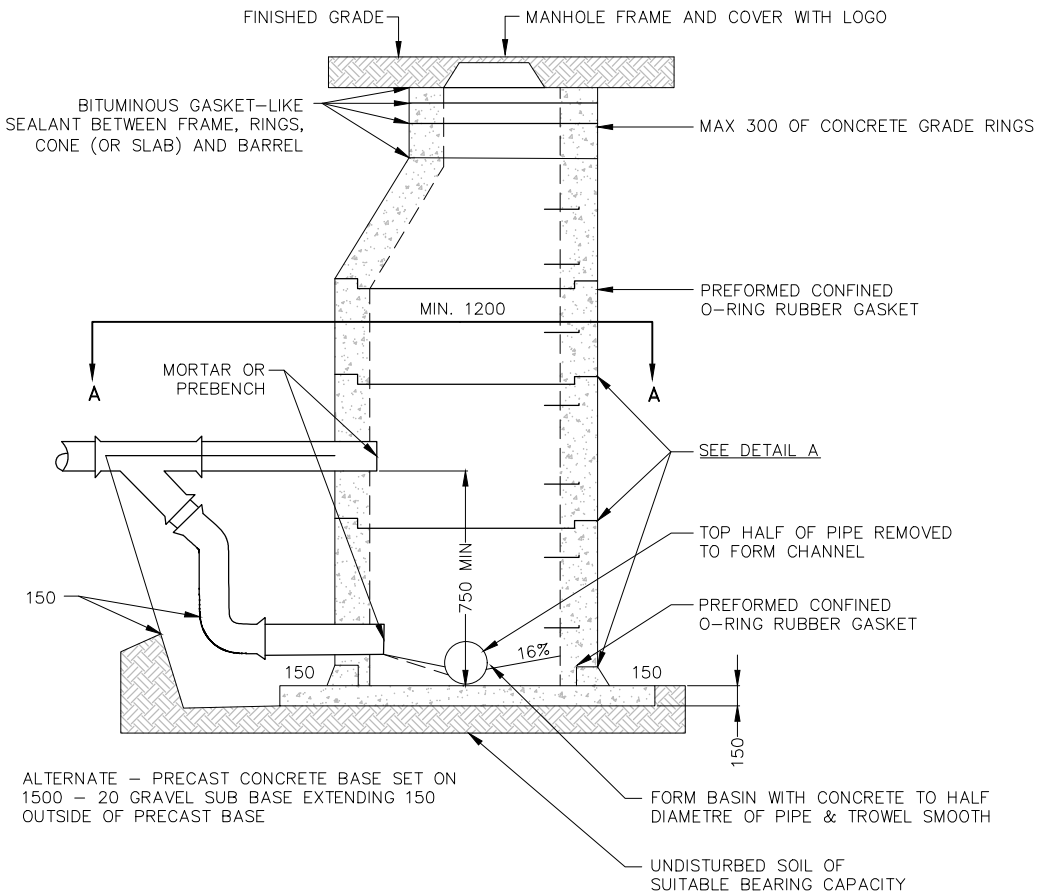


### TYPICAL SERVICES (SINGLE & DUAL)

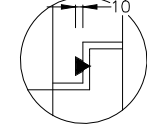
Approved: *[Signature]*

Figure **F-03**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2014-JUL-08	Drawn: K.P.L	Scale: N.T.S



DETAIL A (TYP)



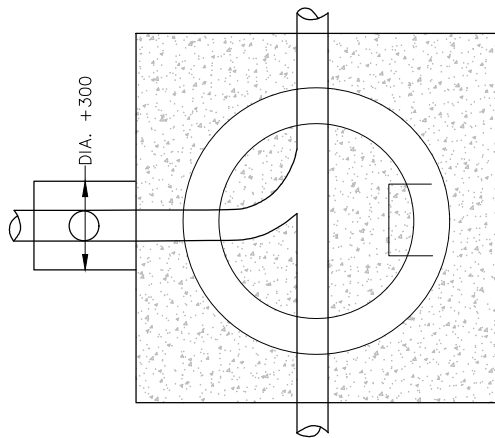
GRADE RINGS (c/w GASKET NOTCH) AS ALTERNATE, RUBBER GRADE RINGS MAY BE ACCEPTED BY MUNICIPAL ENGINEER

ALTERNATE - PRECAST CONCRETE BASE SET ON 1500 - 20 GRAVEL SUB BASE EXTENDING 150 OUTSIDE OF PRECAST BASE

FORM BASIN WITH CONCRETE TO HALF DIAMETRE OF PIPE & TROWEL SMOOTH  
UNDISTURBED SOIL OF SUITABLE BEARING CAPACITY

NOTES:

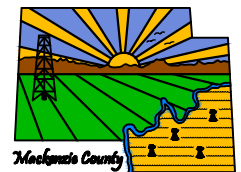
1. FOR MAINS WITH DIAMETERS BETWEEN 200mm AND 600mm, EXTERNAL DROP STRUCTURE REQUIRED WHEN DIFFERENCE BETWEEN INLET AND OUTLET IS GREATER THAN 750mm.
2. ALL PRECAST MANHOLES MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.
3. POURED IN PLACE CONCRETE SHALL HAVE 28 DAYS COMPRESSIVE STRENGTH OF 30 MPa.
4. FORM FLOW THROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.
5. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
6. MAX DIST. FROM RIM TO TOP RUNG IS 300mm.
7. BACKFILL MANHOLE WITH SELECT NATIVE MATERIAL.
8. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.




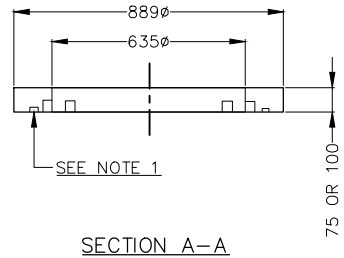
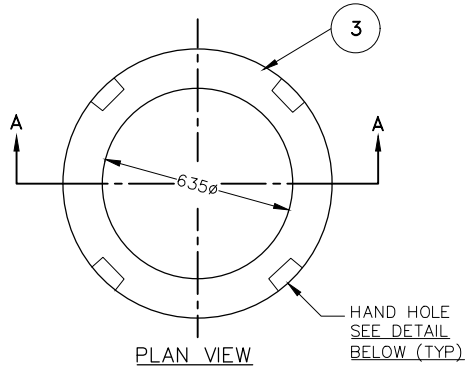
SECTION A-A  
N.T.S.

# MACKENZIE COUNTY

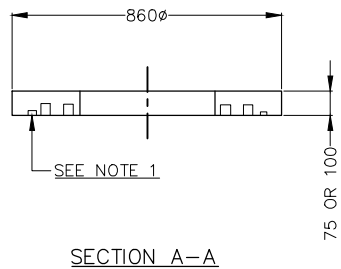
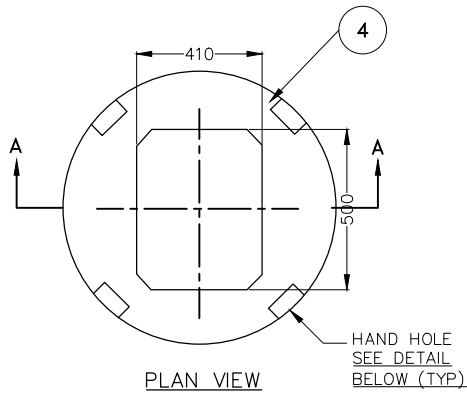
## General Municipal Improvements Standards



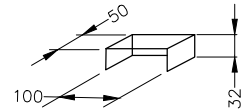
Rev.				APPROVED: 	Figure F-04
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:	Approved:	Figure F-04
Date:	2014-JUN-25	Drawn: K.P.L	Scale: N.T.S		



**635 RING**  
(NECK RING FOR USE WITH TYPES 4A,6,6A,8,NF-80,NF-90 FRAMES AND COVERS/GRATINGS)



**K-7 RING**  
(NECK RING FOR USE WITH TYPE K-7 OR F-5I WITHOUT SIDE INLET FRAMES AND GRATINGS)



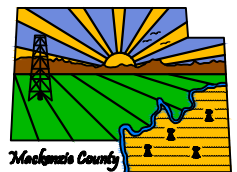
**HAND HOLE DETAIL**

NOTES:


1. A CONCENTRIC GROOVE LOCATED AT MID CROSS SECTION, SUITABLE FOR SEALANT IS REQUIRED FOR NECK RINGS AND EXTENSION RINGS.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

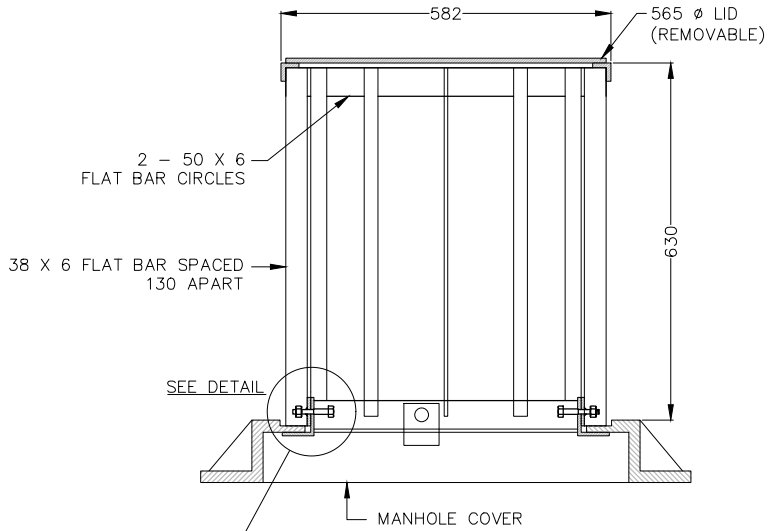
## General Municipal Improvements Standards



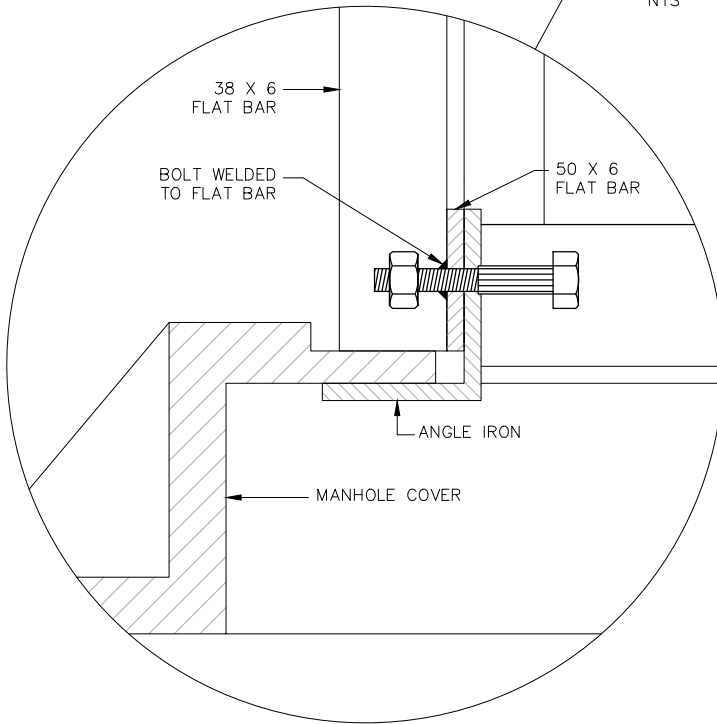
### NECK RINGS

Rev.				Approved: 	Figure F-05
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		





SECTION/ELEVATION VIEW  
NTS

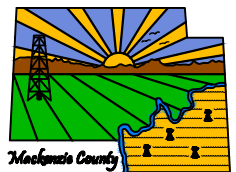


CLAMP ASSEMBLY DETAIL  
NTS

NOTE:  
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

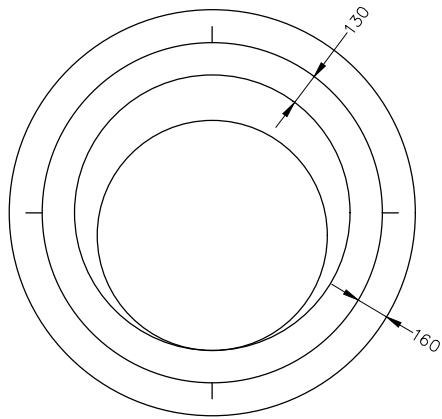


### TRASH GUARD FOR MANHOLE ASSEMBLY

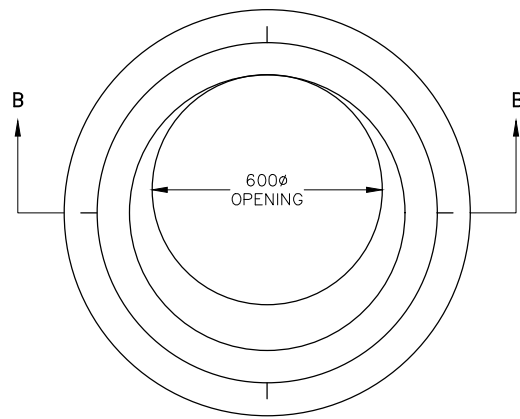
Approved: *[Signature]*

Figure **F-07**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S



BOTTOM VIEW



TOP VIEW

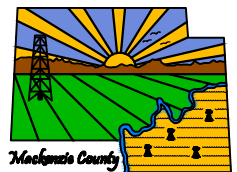


SECTION B-B


NOTE:  
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

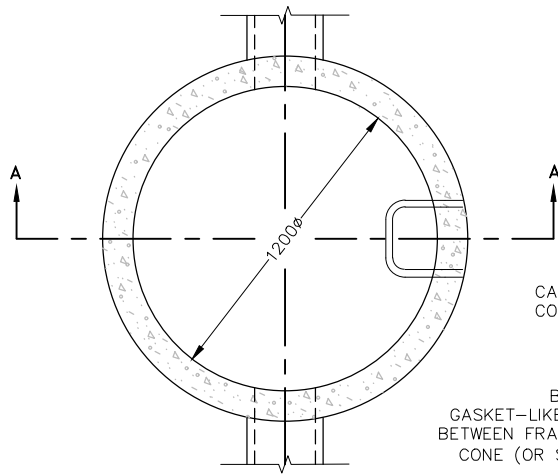
## General Municipal Improvements Standards



### STEEL PLATE TOP SYSTEM

Rev.				Approved: 	Figure F-08
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		

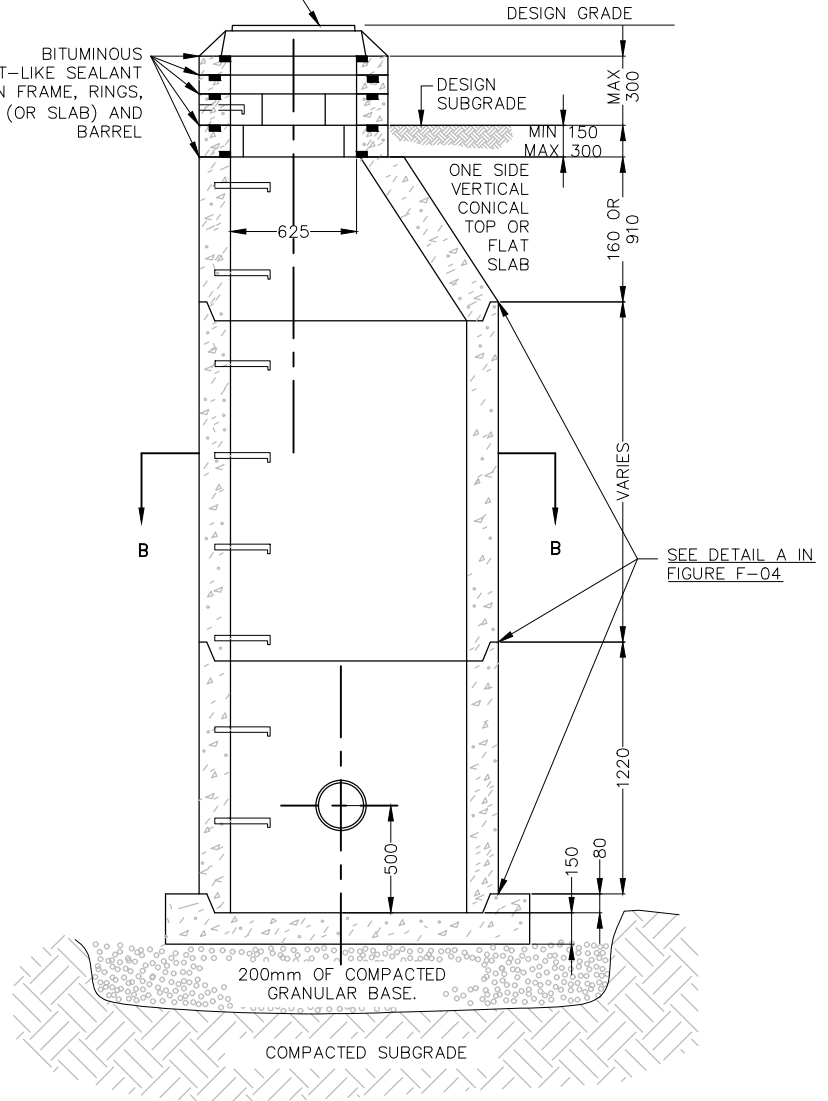




SECTION B-B

CATCH BASIN FRAME AND COVER AS SPECIFIED

BITUMINOUS GASKET-LIKE SEALANT BETWEEN FRAME, RINGS, CONE (OR SLAB) AND BARREL



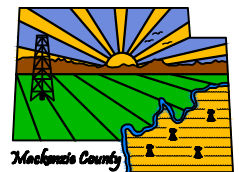
SECTION A-A

NOTES:

1. MANHOLE BARRELS TO MEET ASTM C478.
2. POURED IN PLACE CONCRETE BASES MAY BE USED.
3. FOR CBMH. OVER 5.0m IN DEPTH, PRECAST OR POURED IN PLACE BASES SHALL BE REINFORCED WITH BARS.
4. POURED IN PLACE CONCRETE TO BE 30MPa AT 28 DAYS.
5. INLET & OUTLET PIPE TO BE GROUTED FLUSH WITH WALL.
6. GALVANIZED STEEL SAFETY STEPS AT 0.41m MAXIMUM TO FULL HEIGHT OF M.H.
7. RUBBER GASKET JOINTS.
8. SAFETY STEPS SHALL BE ALIGNED ON CENTERLINE PERPENDICULAR TO THE MAIN FLOW CHANNEL. WHENEVER POSSIBLE, THE STEPS SHALL BE ALIGNED SO THAT A PERSON EXITING THE MANHOLE WOULD FACE ONCOMING TRAFFIC IF NOT CONFLICTING WITH THE PREVIOUS REQUIREMENT.
9. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
10. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

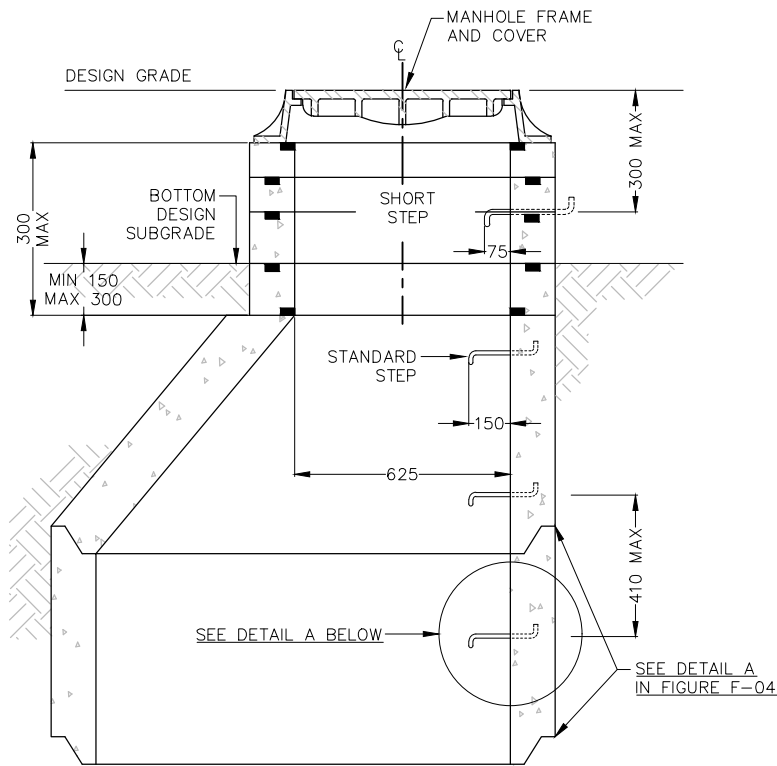


### STANDARD 1200mm C.B. MANHOLE

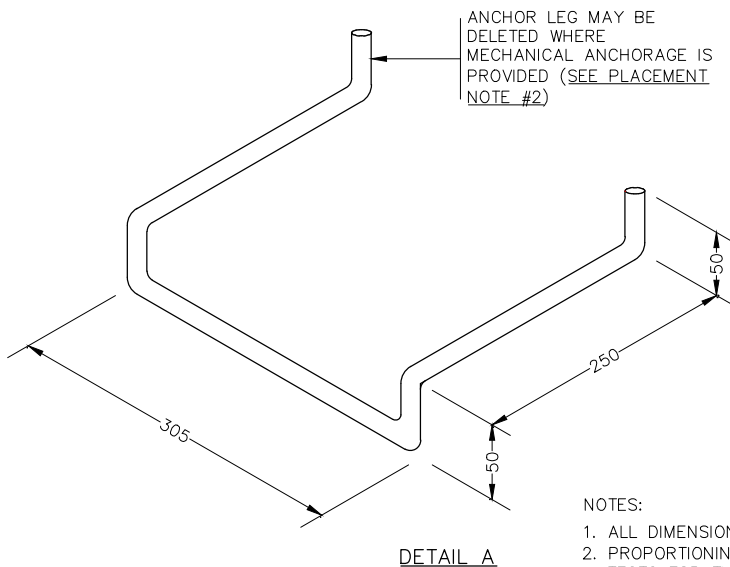
Approved:

Figure **F-09**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2014-JUN-25	Drawn: K.P.L	Scale: N.T.S



TYPICAL MANHOLE SECTION



NOTES:

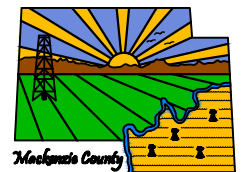
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

PLACEMENT:

1. EXCEPT WHERE SPECIFIED OTHERWISE, SAFETY STEPS SHALL BE INSTALLED IN ALL PRECAST MANHOLE SECTIONS & CONES, IN THE GRADE ADJUSTMENT SECTIONS AND IN CAST IN PLACE SECTIONS SO THAT WHEN THE VARIOUS SECTIONS ARE ASSEMBLED IN ANY COMBINATION THEY WILL FORM A CONTINUOUS VERTICAL LADDER WITH RUNGS EQUALLY SPACED AT A MAXIMUM OF 410mm TO WITHIN 300mm BELOW THE COVER AND TO WITHIN 600mm OF THE BASE OR BENCHING.
2. STEPS SHALL BE CAST FIRMLY IN PLACE OR SECURED WITH A SUITABLE MECHANICAL ANCHORAGE TO PREVENT PULLOUT, AND MAINTAIN WATER TIGHTNESS.
3. "STANDARD STEPS" SHALL PROJECT A DISTANCE OF 150mm MEASURED AT THE POINT OF EMBEDMENT.
4. A "SHORT STEP" WITH A PROJECTION OF 75mm SHALL BE INSTALLED WITHIN THE GRADE ADJUSTMENT SECTION, CAST INTO THE NECK OR FIRMLY MORTARED IN PLACE BETWEEN THE NECK RINGS, WITH THE ANCHOR LEGS OUTSIDE OF THE NECK RING.
5. EXCEPT AS SPECIFIED ABOVE, DESIGN AND INSTALLATION OF SAFETY STEPS SHALL CONFORM TO A.S.T.M. C478.
6. SAFETY STEPS SHALL BE ALIGNED ON CENTER LINE PERPENDICULAR TO THE MAIN FLOW CHANNEL. WHENEVER POSSIBLE, THE STEPS SHALL BE ALIGNED SO THAT A PERSON EXITING THE MANHOLE WOULD FACE ONCOMING TRAFFIC IF NOT CONFLICTING WITH THE PREVIOUS REQUIREMENT.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

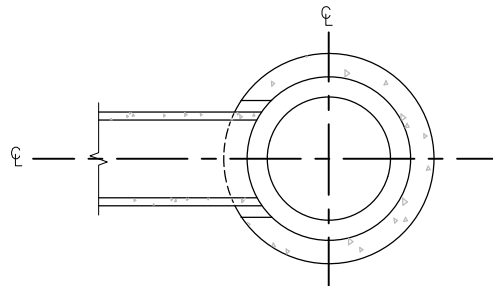


### SAFETY STEPS FOR MANHOLES

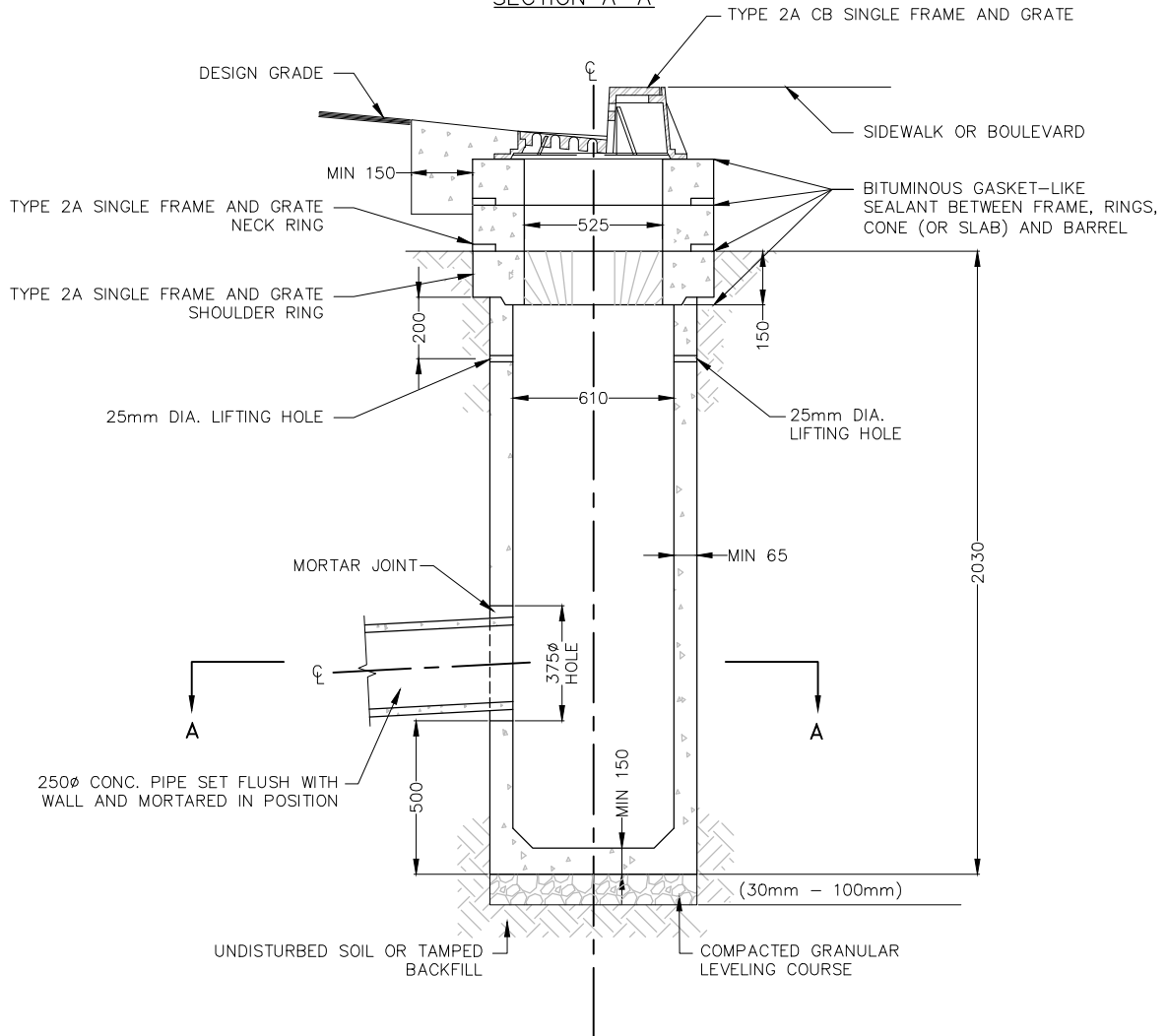
Approved:

Figure F-10

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2014-JUN-25	Drawn: K.P.L	Scale: N.T.S



SECTION A-A

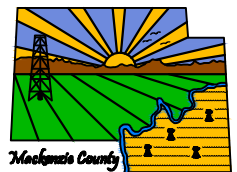


NOTES:

1. BITUMINOUS GASKET-LIKE SEALANT BETWEEN FRAME, RINGS, CONE (OR SLAB) AND BARREL.
2. ALL ROUGH JOINTS SHALL BE POINTED WITH MORTAR TO ENSURE SMOOTHNESS.
3. ALL CATCH BASIN COMPONENTS TO BE IN ACCORDANCE WITH ASTM C478.
4. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
5. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

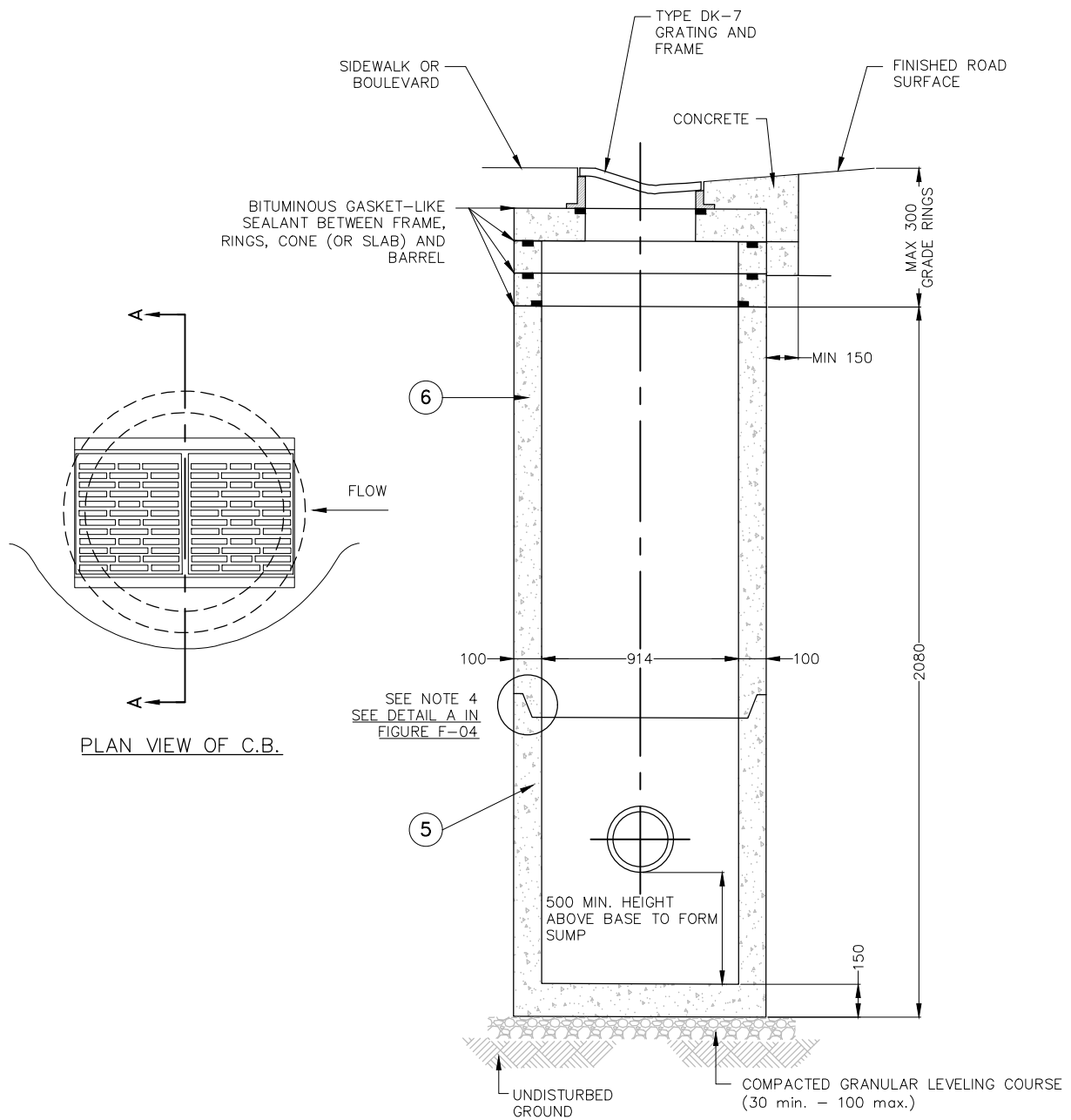


### PRECAST 610mmØ CATCH BASIN

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

Approved:

Figure **F-11**



SEE NOTE 4  
SEE DETAIL A IN  
FIGURE F-04

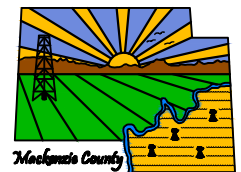
SECTION A-A

NOTES:

1. ITEM 5 COULD BE MADE UP FROM TWO ITEMS (BASE AND BARREL).
2. ITEM 6 COULD BE MADE UP FROM TWO ITEMS (SHOULDER RING SLAB TOP AND BARREL).
3. ITEMS 5 AND 6 COULD BE MADE AS ONE UNIT.
4. OPPOSITE ORIENTATION OF JOINTS IS ACCEPTABLE.
5. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
6. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

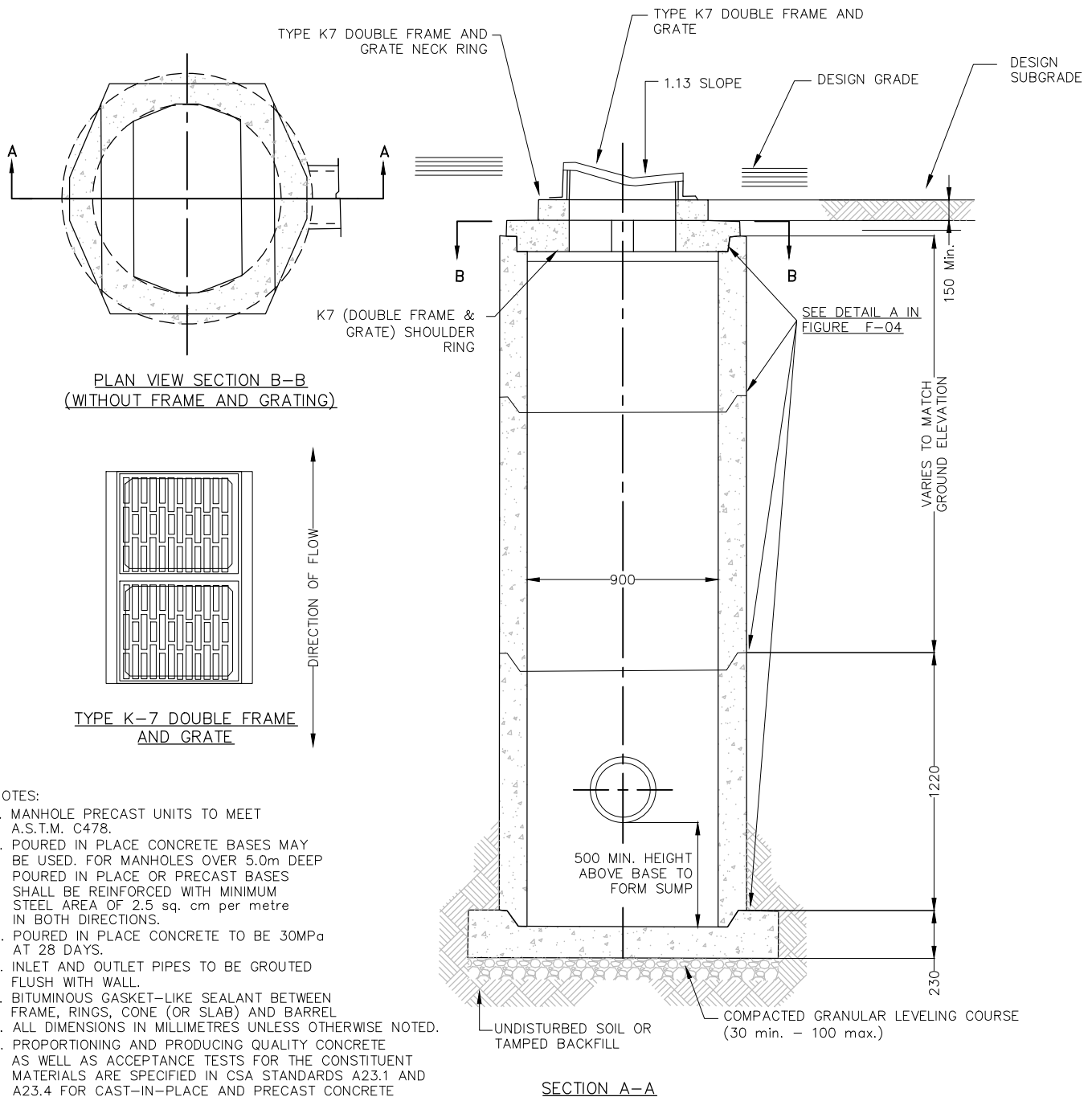


### STANDARD 900mm CATCH BASIN WITH TYPE DK-7 GRATING & FRAME

Approved: *[Signature]*

Figure **F-12**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2014-JUN-25	Drawn: K.P.L	Scale: N.T.S

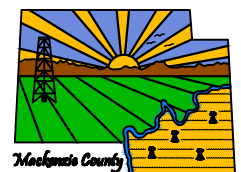



NOTES:

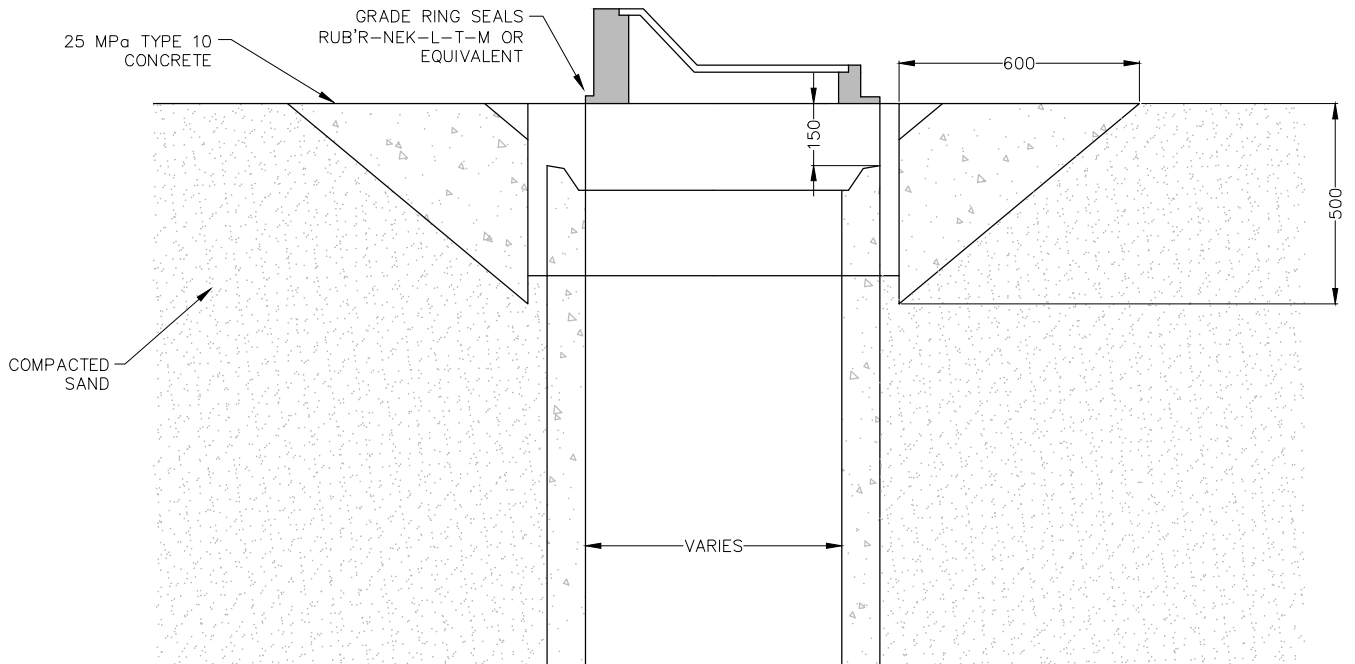
1. MANHOLE PRECAST UNITS TO MEET A.S.T.M. C478.
2. POURED IN PLACE CONCRETE BASES MAY BE USED. FOR MANHOLES OVER 5.0m DEEP POURED IN PLACE OR PRECAST BASES SHALL BE REINFORCED WITH MINIMUM STEEL AREA OF 2.5 sq. cm per metre IN BOTH DIRECTIONS.
3. POURED IN PLACE CONCRETE TO BE 30MPa AT 28 DAYS.
4. INLET AND OUTLET PIPES TO BE GROUTED FLUSH WITH WALL.
5. BITUMINOUS GASKET-LIKE SEALANT BETWEEN FRAME, RINGS, CONE (OR SLAB) AND BARREL
6. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
7. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				STANDARD 900mm PRECAST C.B. c/w K7 DOUBLE FRAME & GRATE	Approved: 	Figure <b>F-13</b>
Rev.						
Rev.						
Rev.	2021-FEB-15	File No.: GP60.33682	Design:			
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			

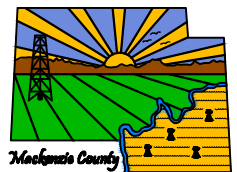


NOTES:

1. ALL MATERIAL IS 7.5mm (1/4) MILD STEEL PLATES.
2. ALL METAL JOINTS TO BE WELDED.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
4. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

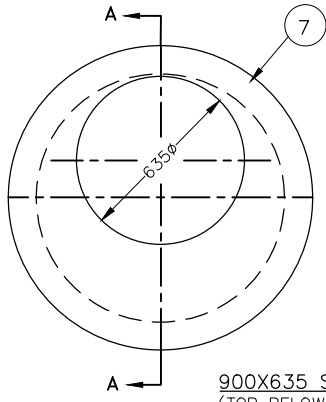


### STEEL PLATE TOP SYSTEM

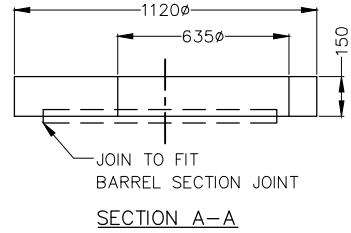
Approved:

Figure **F-14**

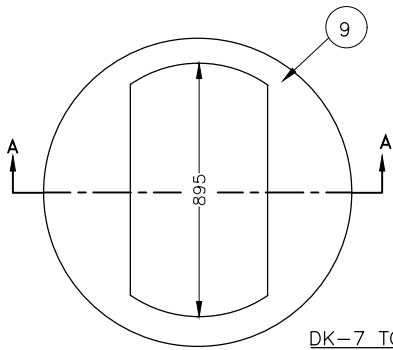
Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S



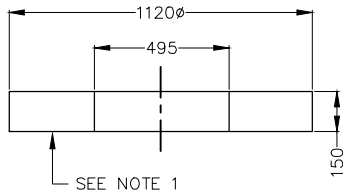
**900X635 SLAB TOP**  
 (TOP BELOW NECK FOR USE WITH  
 4A, 6, 8 FRAME AND GRATING)



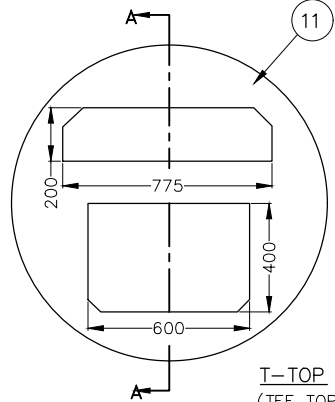
**SECTION A-A**



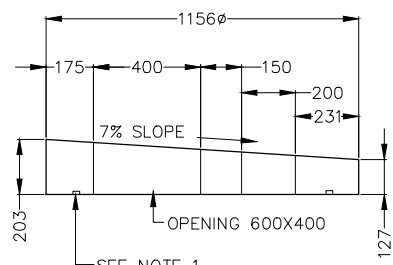
**DK-7 TOP**  
 (SLAB TOP FOR USE WITH  
 DK-7 FRAME AND GRATING)



**SECTION A-A**



**T-TOP**  
 (TEE TOP FOR USE WITH  
 F-5I WITH SIDE INLET)



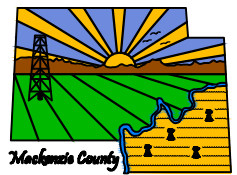
**SECTION A-A**

**NOTES:**

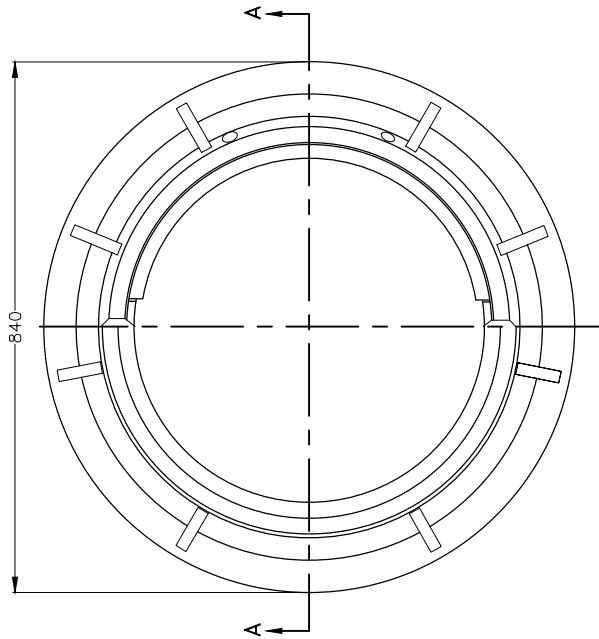
1. A CONCENTRIC GROOVE LOCATED AT MID CROSS SECTION, SUITABLE FOR SEALANT IS REQUIRED FOR NECK RINGS AND EXTENSION RINGS.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

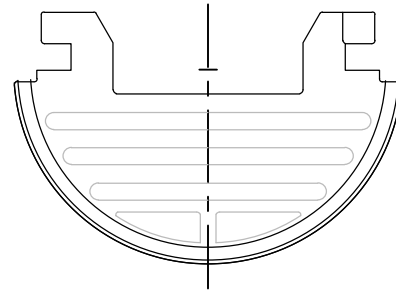
## General Municipal Improvements Standards



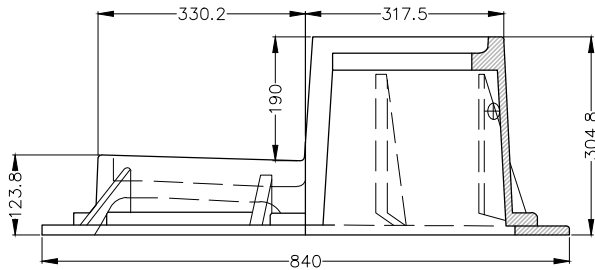
Rev.				<b>SLABTOPS FOR STANDARD          900mm CATCH BASIN</b>	Approved:	Figure <b>F-15</b>
Rev.						
Rev.						
Rev.	2021-FEB-15	File No.: GP60.33682	Design:			
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			



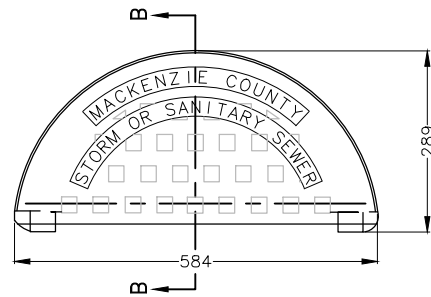
TOP VIEW (FRAME)



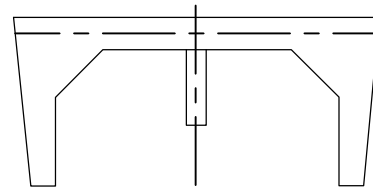
TOP VIEW - COVER (PART A)



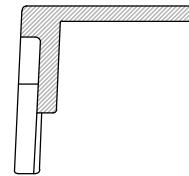
SECTION A-A



TOP VIEW - COVER (PART B)



FRONT VIEW - COVER (PART B)

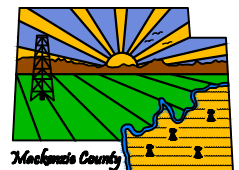


NOTES:

1. MATERIALS:  
 FRAME: GRAY IRON CLASS 20B.  
 COVER: PART A IRON CLASS 20B,  
 PART B DUCTILE IRON GRADE 65-45-12.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



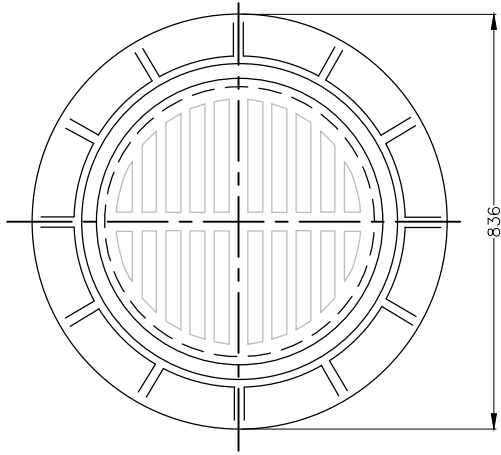
### TWO PIECE TYPE 4A GRATING & FRAME

Approved:

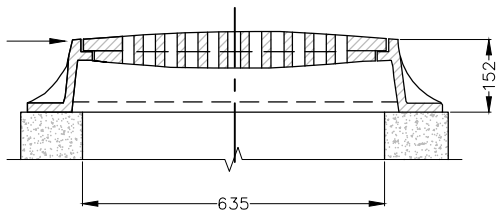
Figure **F-16**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

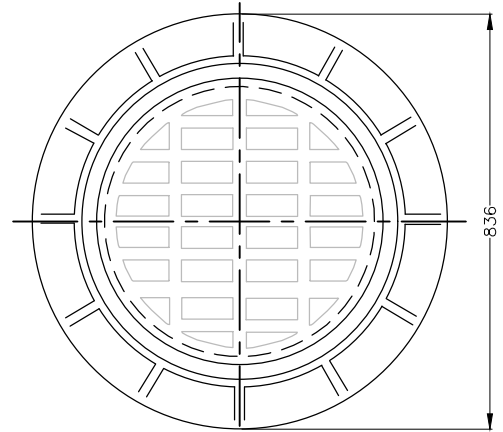




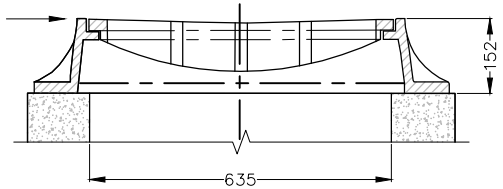
MATERIAL: GRAY IRON  
 FRAME: CLASS 20B  
 COVER: CLASS 20B



**NO.6**  
 ROUND TOP CATCHBASIN  
 OR MH FRAME & COVER



MATERIAL: GRAY IRON  
 FRAME: CLASS 20B  
 COVER: CLASS 20B

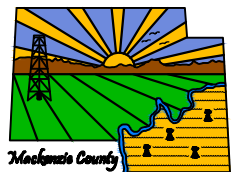


**NO.8**  
 LARGE PAVING AND CURB RAMP  
 CATCHBASIN OR MH FRAME & COVER

NOTES:  
 1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



### FRAME & GRATING TYPE 6 AND 8

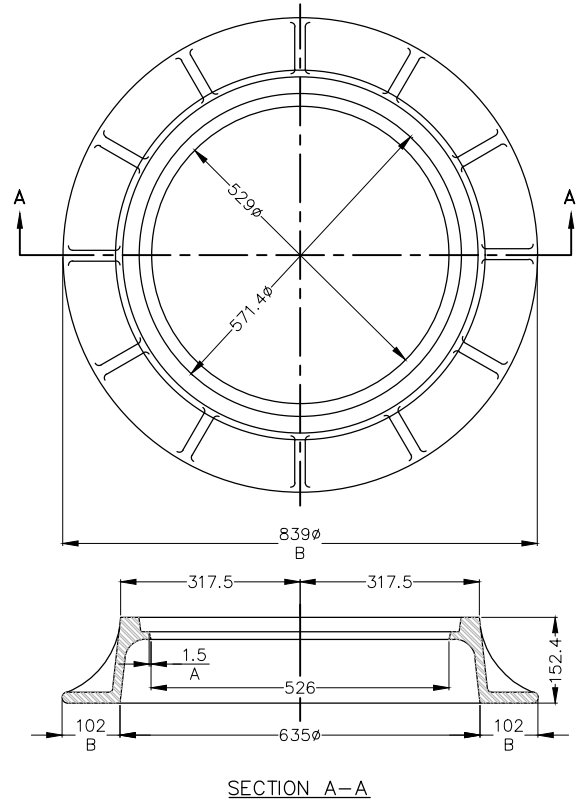
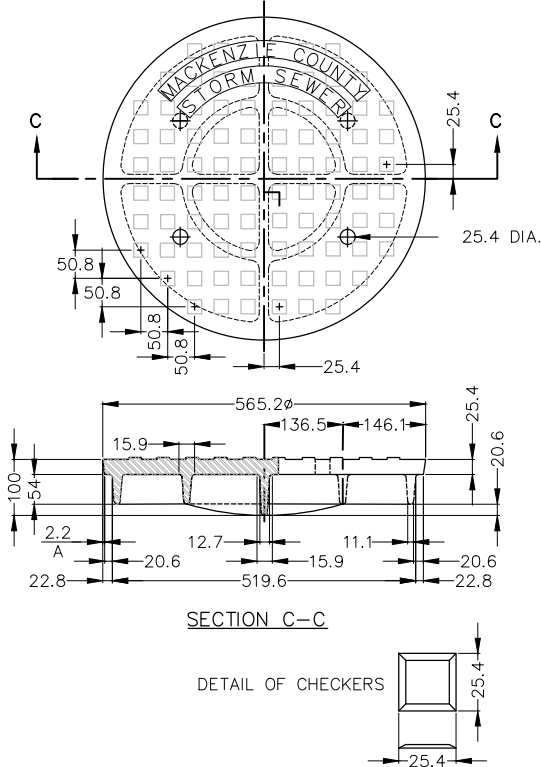
Approved:

Figure **F-17**

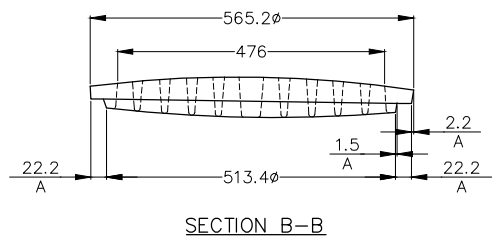
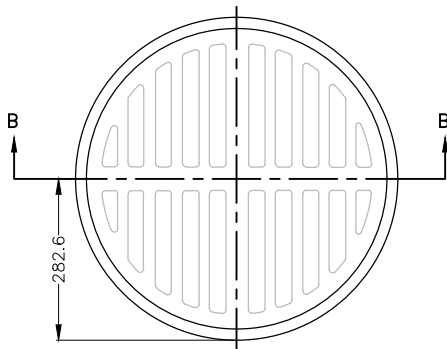
Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

No.6 STANDARD FRAME FOR MANHOLE AND ROUND CATCH BASIN TOP

No. 6A STANDARD MANHOLE COVER



No. 6B STANDARD ROUND CATCH BASIN TOP

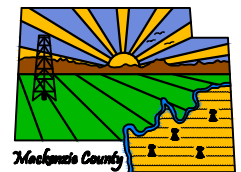


NOTES:

1. MATERIAL SPECIFICATION:  
DUCTILE IRON TO CONFORM TO A.S.T.M. A536 (LATEST EDITION) GRADE 80-60-03.
2. NF-90 FRAME AND COVER IS WATERTIGHT VARIATION OF NF-80.  
THERE ARE NO VENTING HOLES IN NF-90 COVER AND A GASKET IS PLACED BETWEEN THE FRAME AND COVER.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

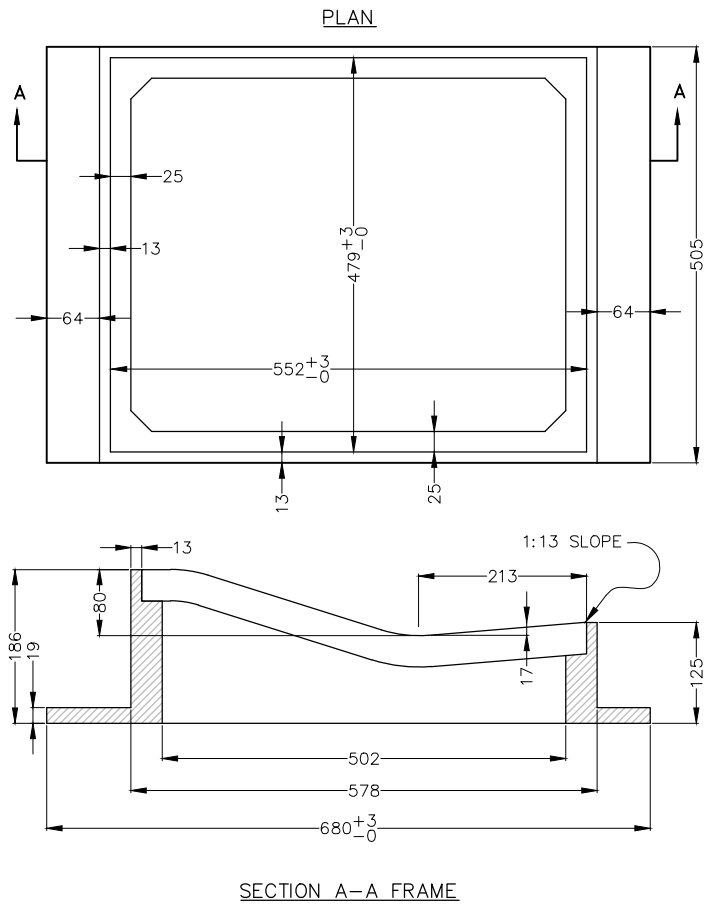
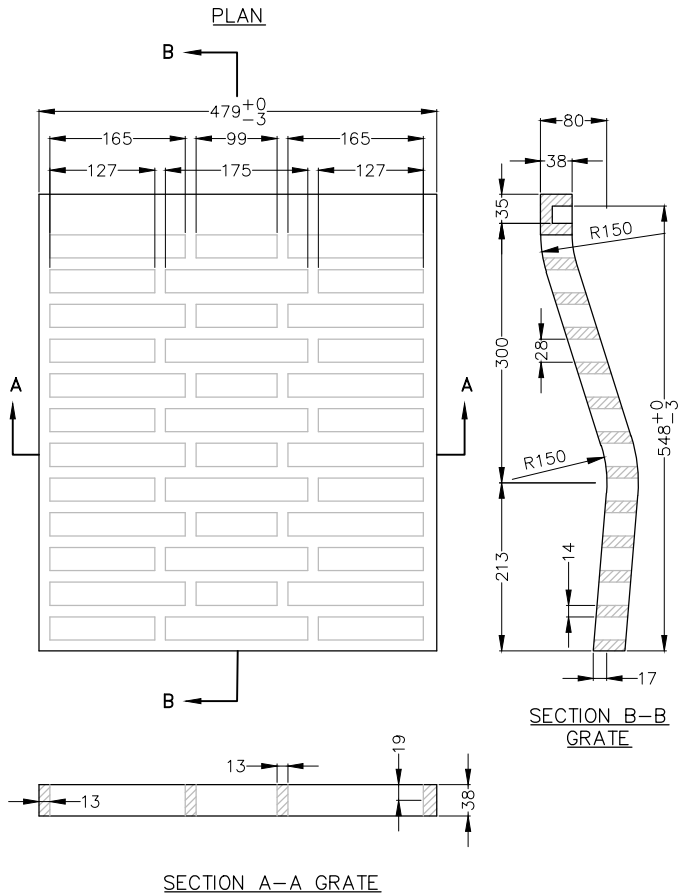


### ROUND TOP CATCH BASIN AND MANHOLE

Approved: *[Signature]*

Figure F-18

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

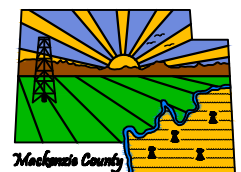


NOTES:

1. MATERIALS:
  - FRAME  
GREY CAST IRON TO CONFORM TO CLASS  
25B A.S.T.M. A48 (LATEST EDITION).
  - GRATE  
DUCTILE IRON TO CONFORM TO A.S.T.M.  
A536 (LATEST EDITION) GRADE 80-55-06.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

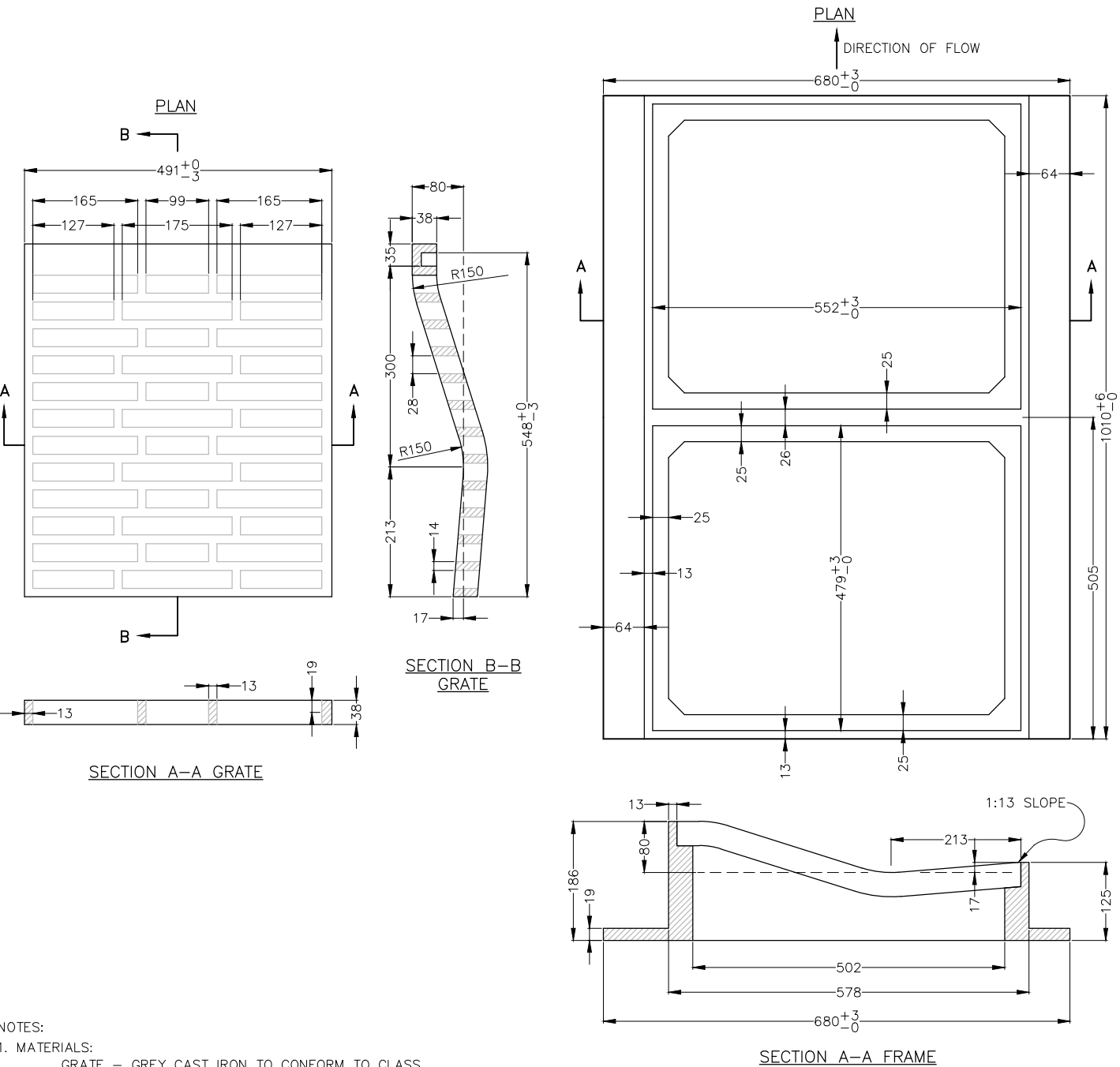


### FRAME & GRATING TYPE K-7

Approved:

Figure **F-19**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

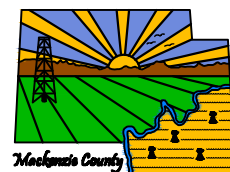


NOTES:

1. MATERIALS:
  - GRATE - GREY CAST IRON TO CONFORM TO CLASS 25B A.S.T.M. A48 (LATEST EDITION).
  - FRAME - DUCTILE IRON TO CONFORM TO A.S.T.M. A536 (LATEST EDITION) GRADE 80-55-06.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

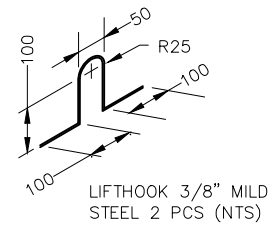
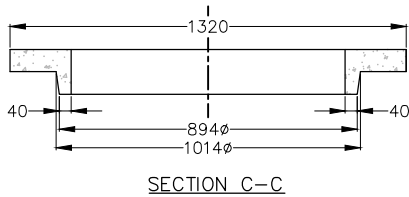
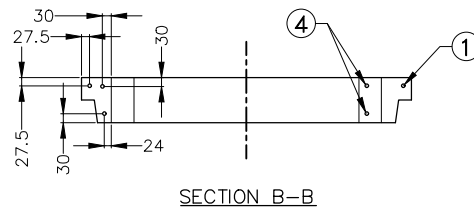
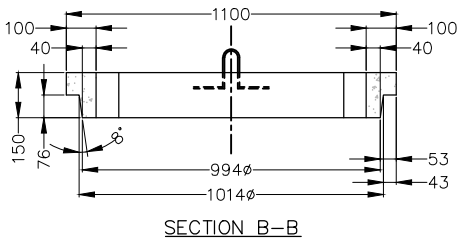
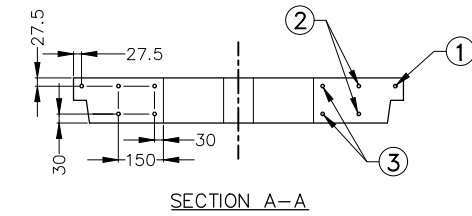
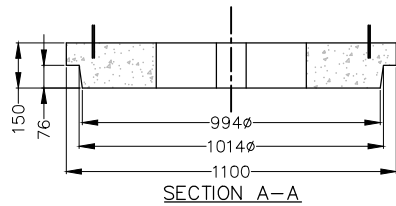
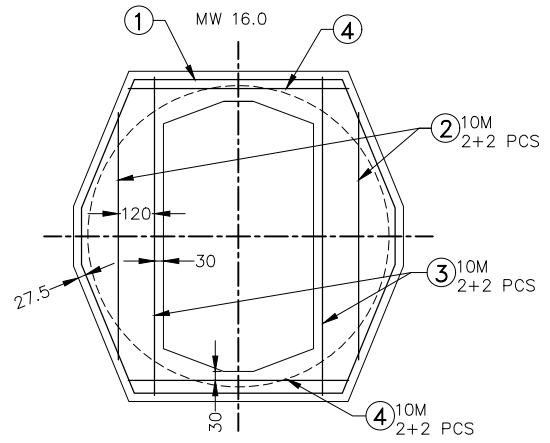
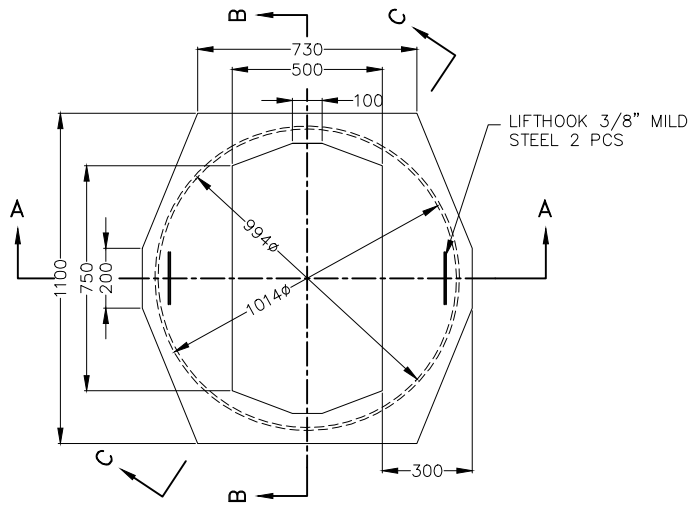


### K-7 DF&G CATCH BASIN

Approved: *[Signature]*

Figure **F-20**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

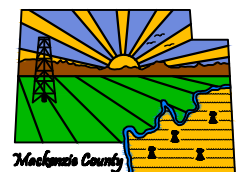


NOTES:

1. 25mm MINIMUM COVER.
2. 10M REINFORCING BARS @ 250 (OR EQUIVALENT STEEL AREA).
3. CONCRETE: 30 MP<sub>a</sub> AT 28 DAYS.
4. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
5. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

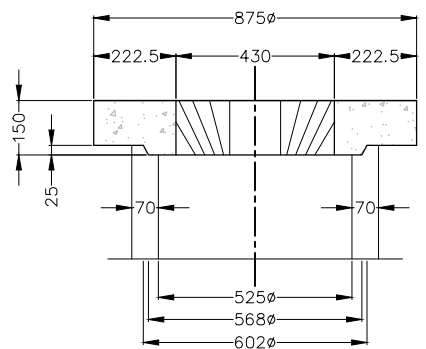
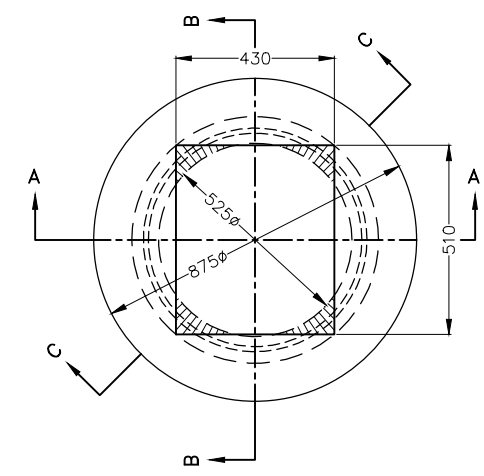


### K-7 DF&G SHOULDER RING

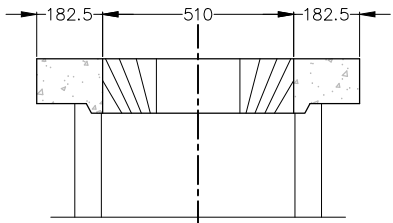
Approved:

Figure F-21

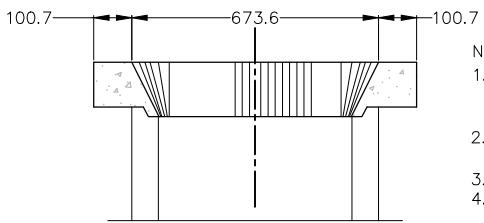
Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S



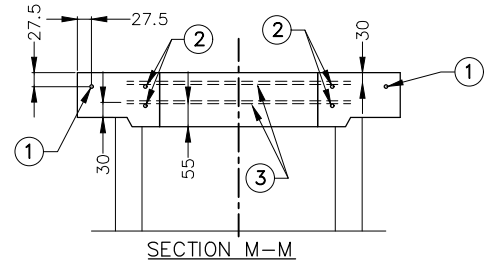
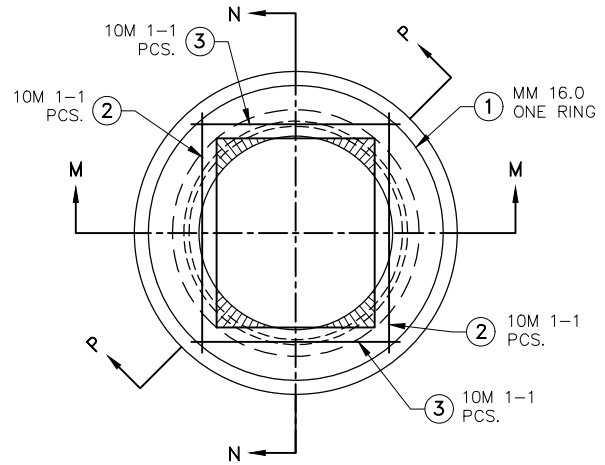
SECTION A-A



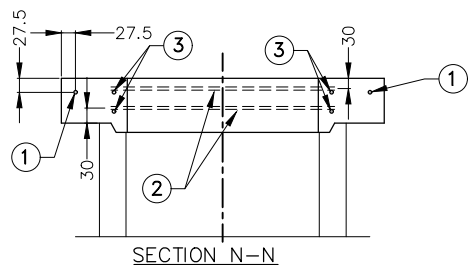
SECTION B-B



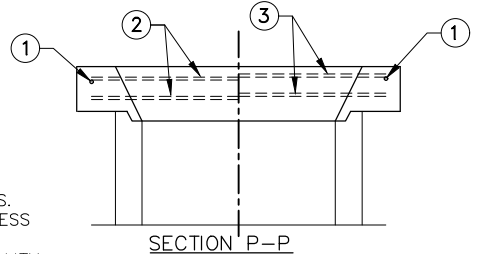
SECTION C-C



SECTION M-M



SECTION N-N

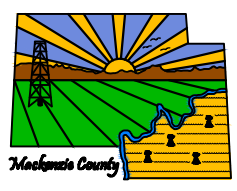



SECTION P-P

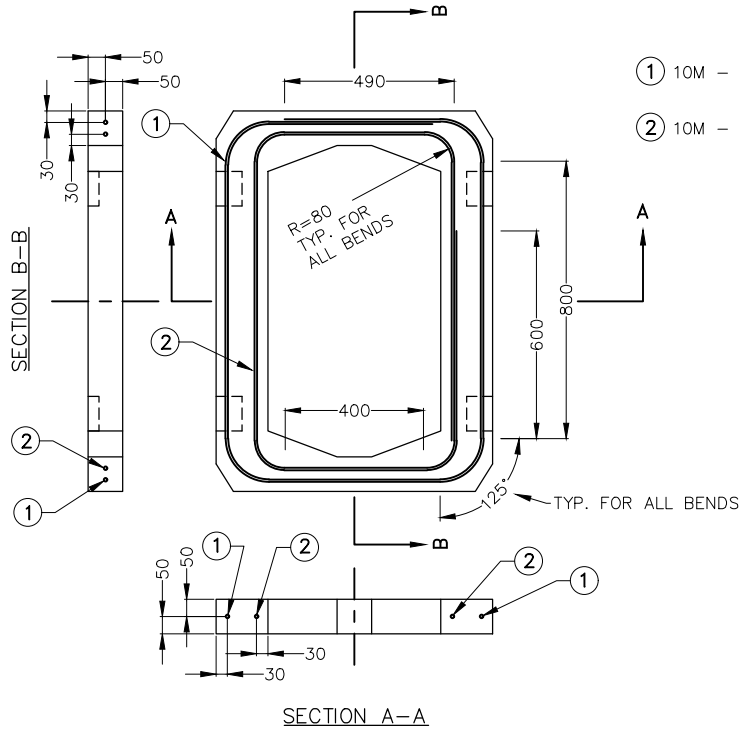
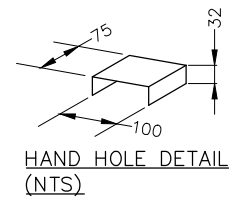
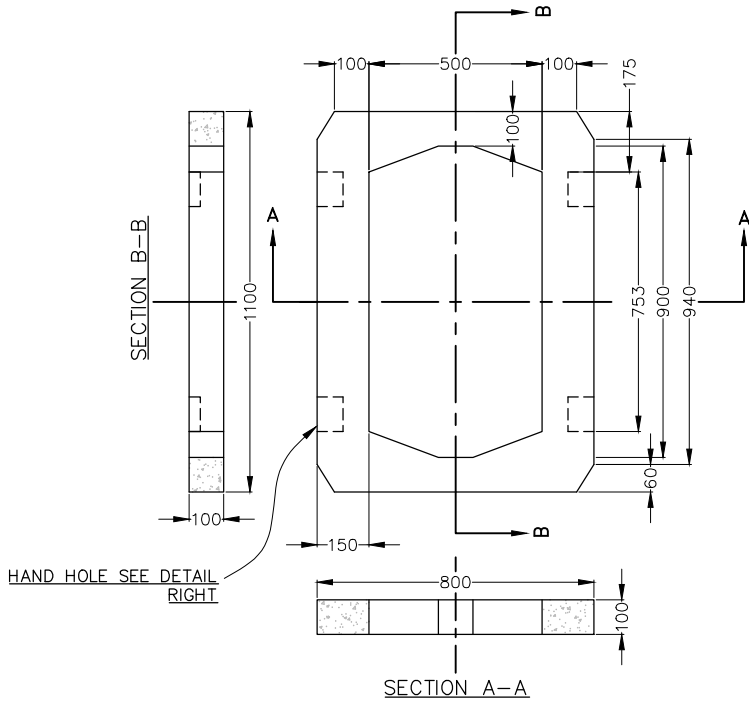
- NOTES:
1. MINIMUM 25mm COVER TO ALL RE-BARS EXCEPT WHERE NOTED ON DRAWING.
  2. 10M REINFORCING BARS @ 250 (OR EQUIVALENT STEEL AREA).
  3. CONCRETE: 30 MPa S.R. AT 28 DAYS.
  4. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
  5. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				Approved: 	Figure F-22
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		



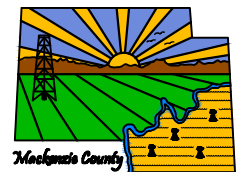
- ① 10M - 2 PIECES
- ② 10M - 2 PIECES

NOTES:

1. 25mm MINIMUM COVER.
2. 10M REINFORCING BARS @ 250 (OR EQUIVALENT STEEL AREA).
3. CONCRETE : 30 MPa S.R. AT 28 DAYS.
4. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
5. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

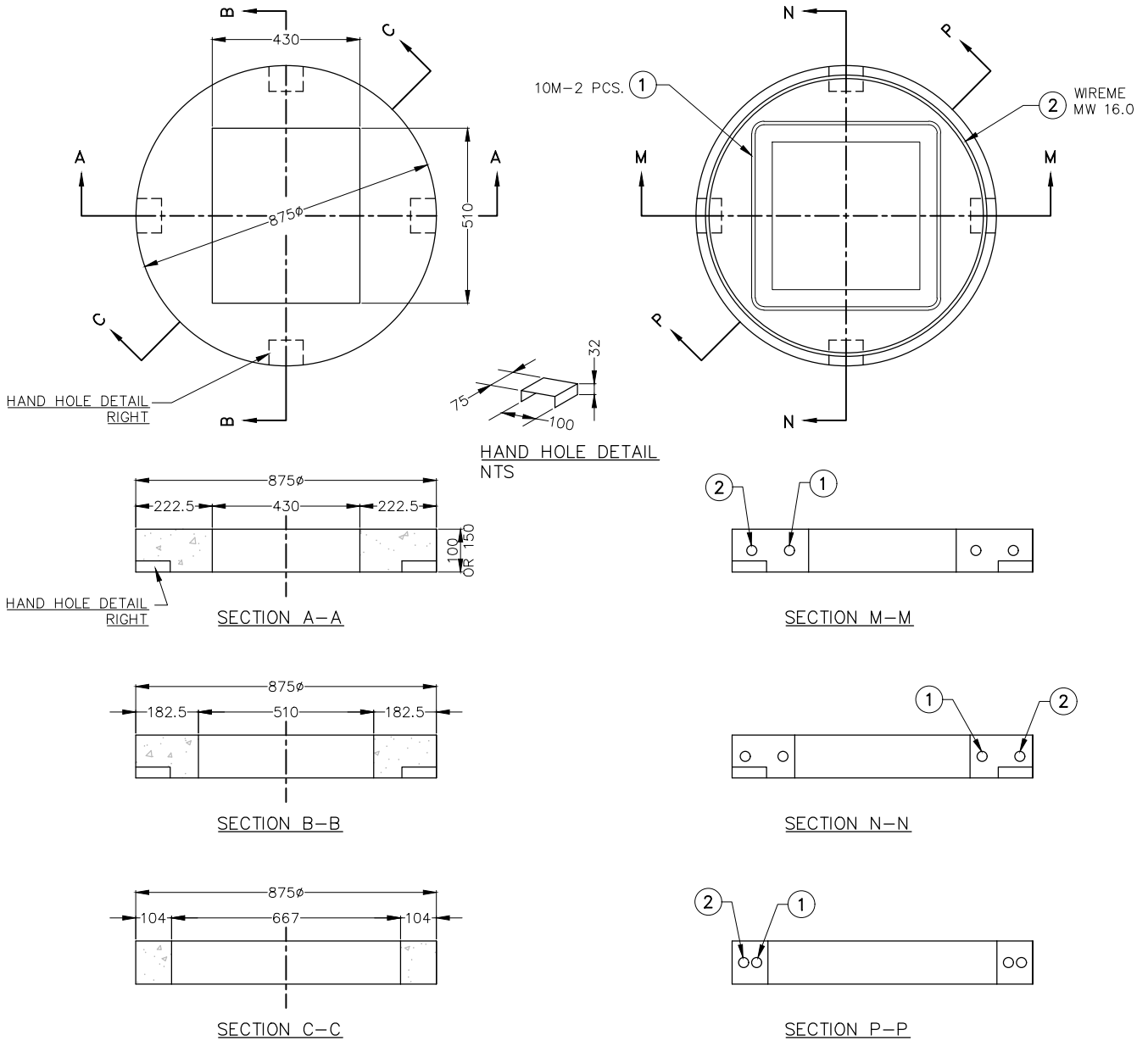


### K-7 DF&G NECK RING

Approved:

Figure **F-23**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

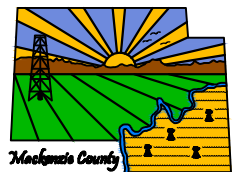


NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. 25mm MINIMUM COVER.
3. 10M REINFORCING BARS @ 250 (OR EQUIVALENT STEEL AREA).
4. CONCRETE: 30 MPa S.R. AT 28 DAYS.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



### K-7 SF&G NECK RING

Approved:

Figure

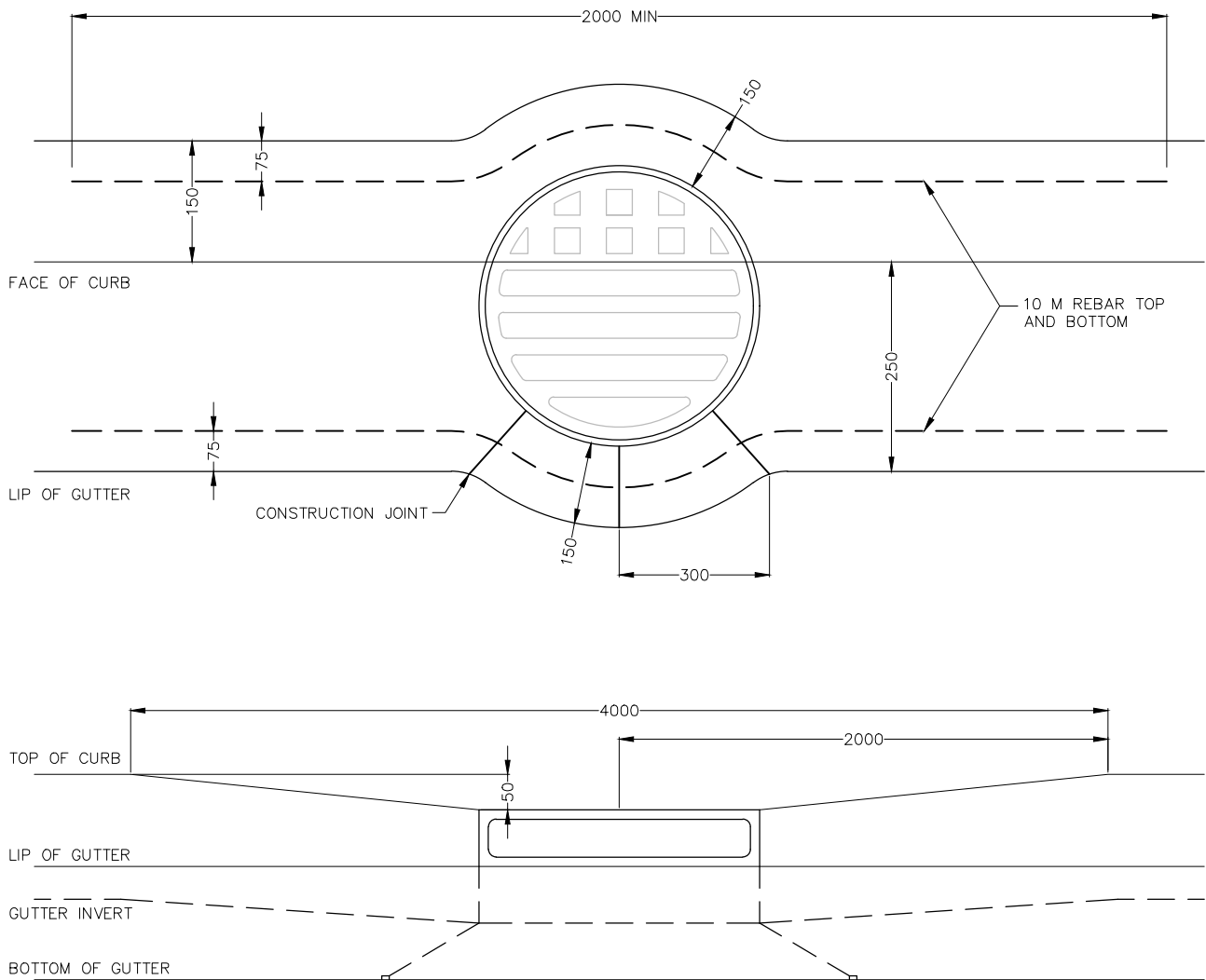
F-24

Rev.	
Rev.	
Rev.	
Rev.	2021-FEB-15
Date:	2010-AUG-31

File No.: GP60.33682  
 Drawn: K.P.L

Design:  
 Scale: N.T.S



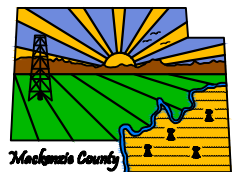


NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

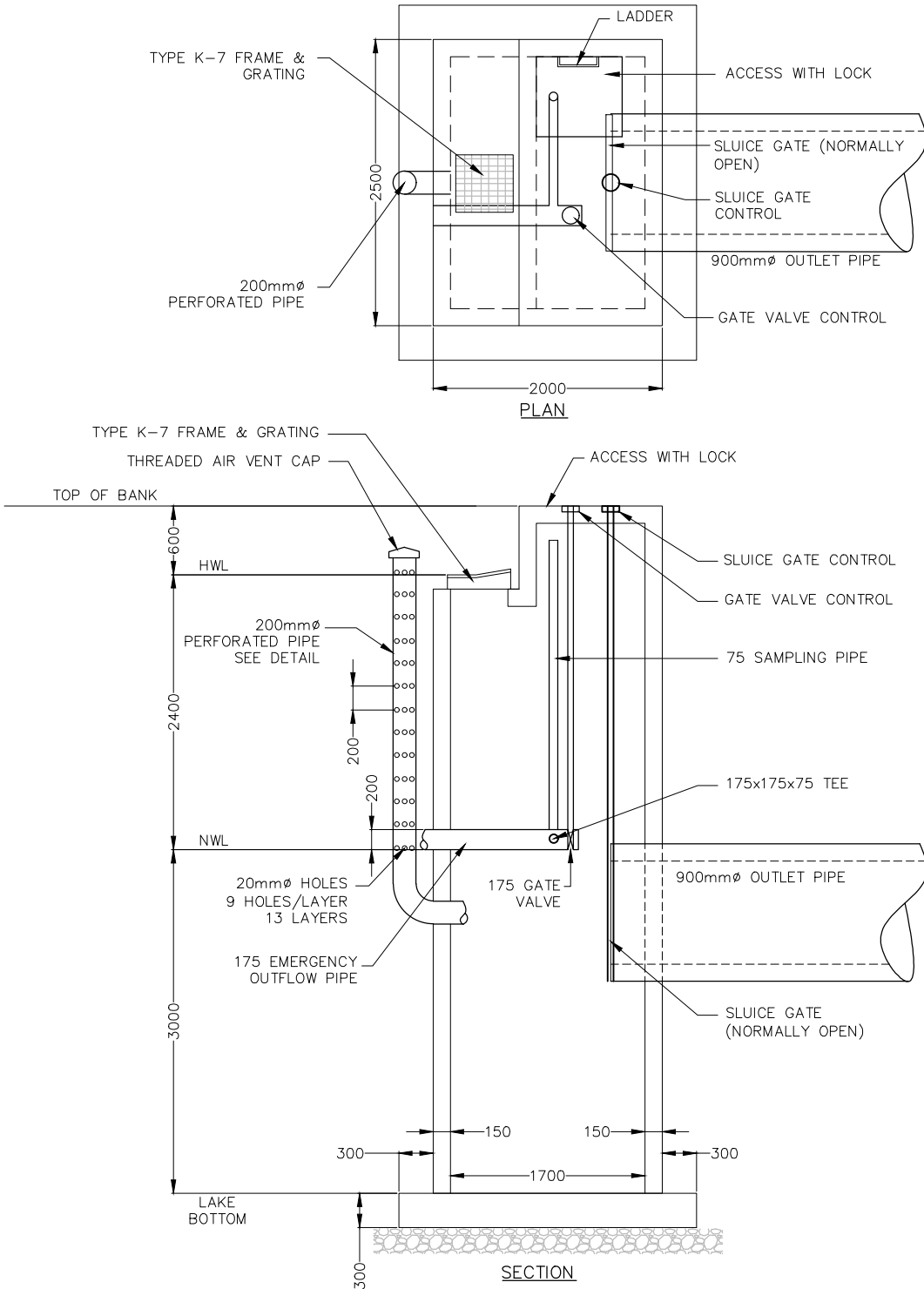


### TYPICAL CATCH BASIN INSTALLATION 150 CURB & 250 GUTTER

Approved:

Figure F-25

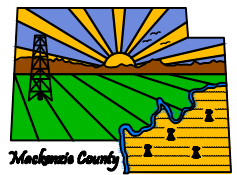
Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S



NOTE:  
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

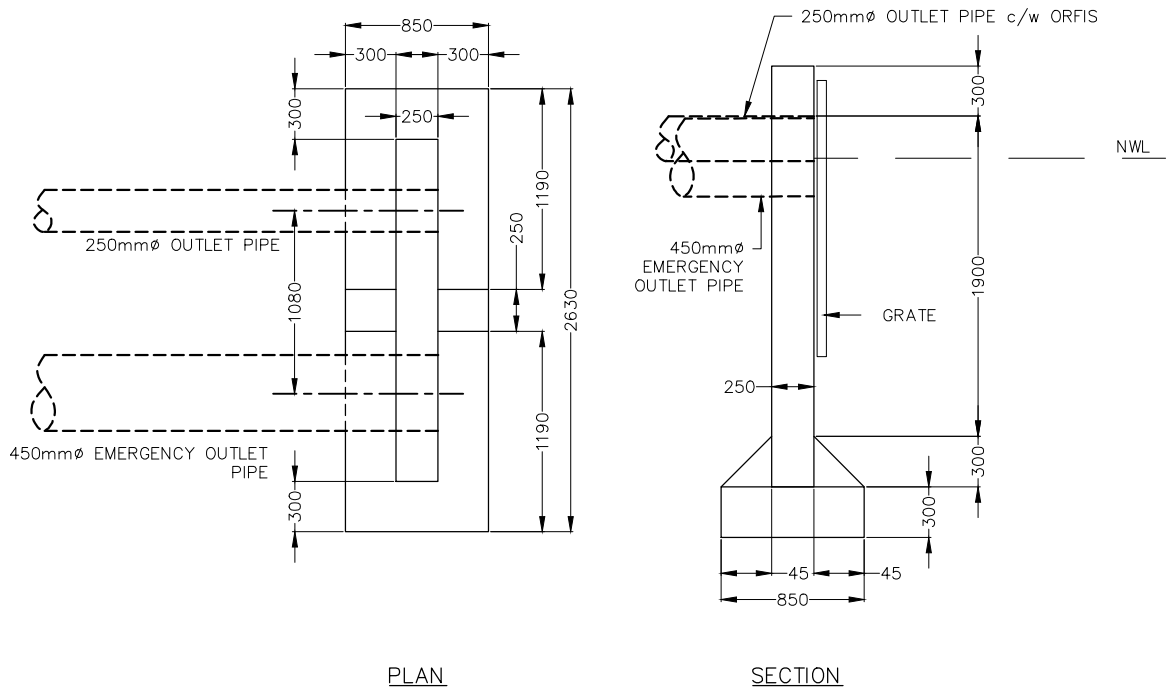


### STORM POND OUTLET STRUCTURE

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

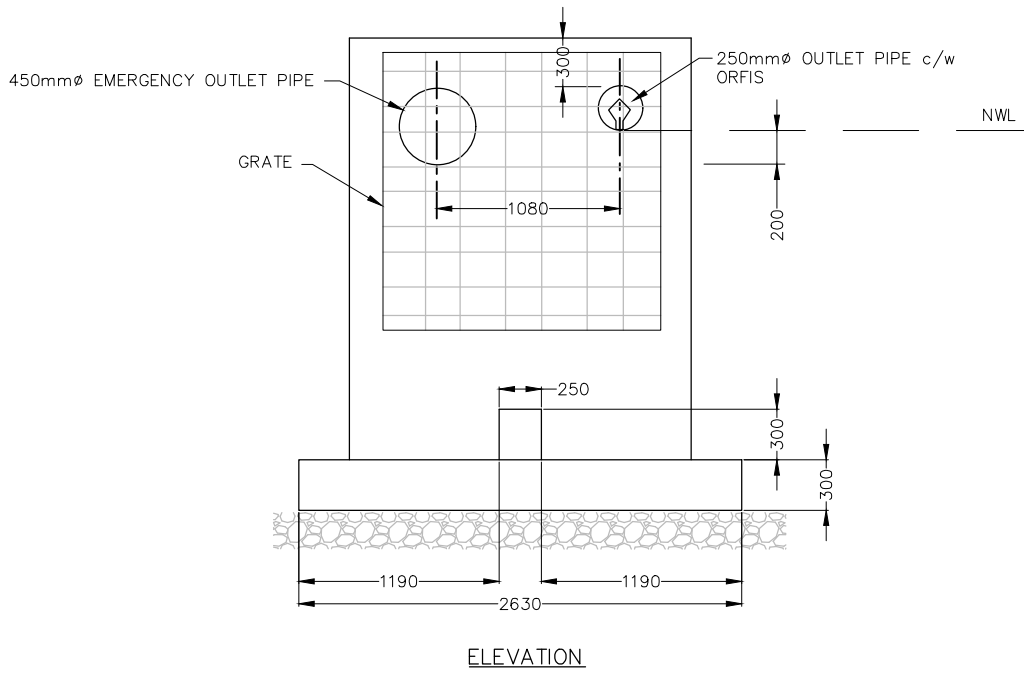
Approved:

Figure **F-26**



PLAN

SECTION

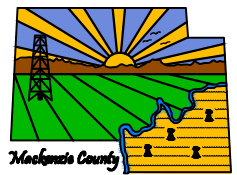



ELEVATION

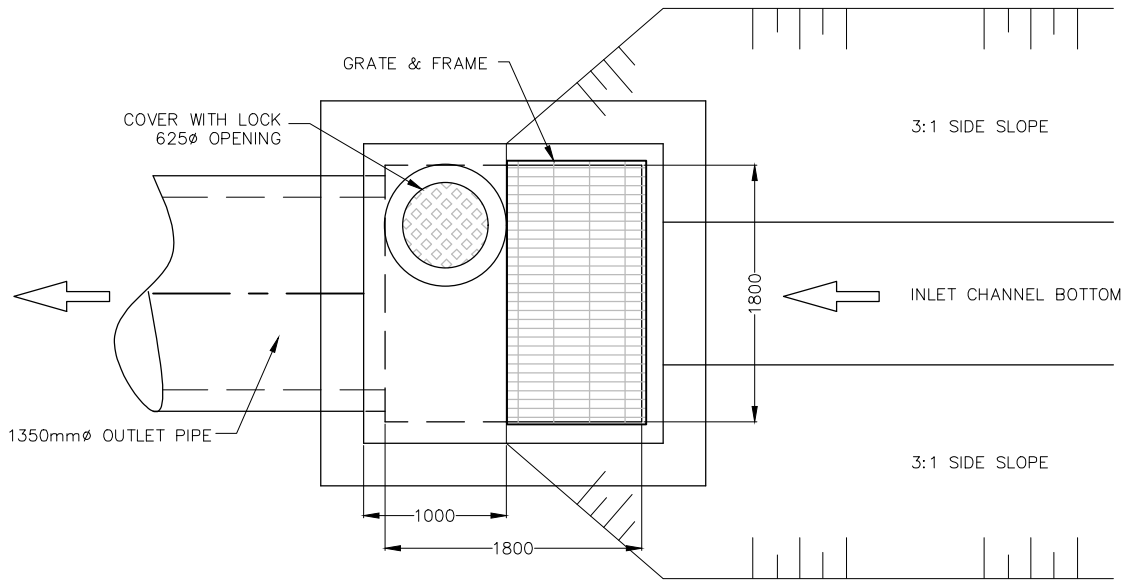
NOTE:  
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

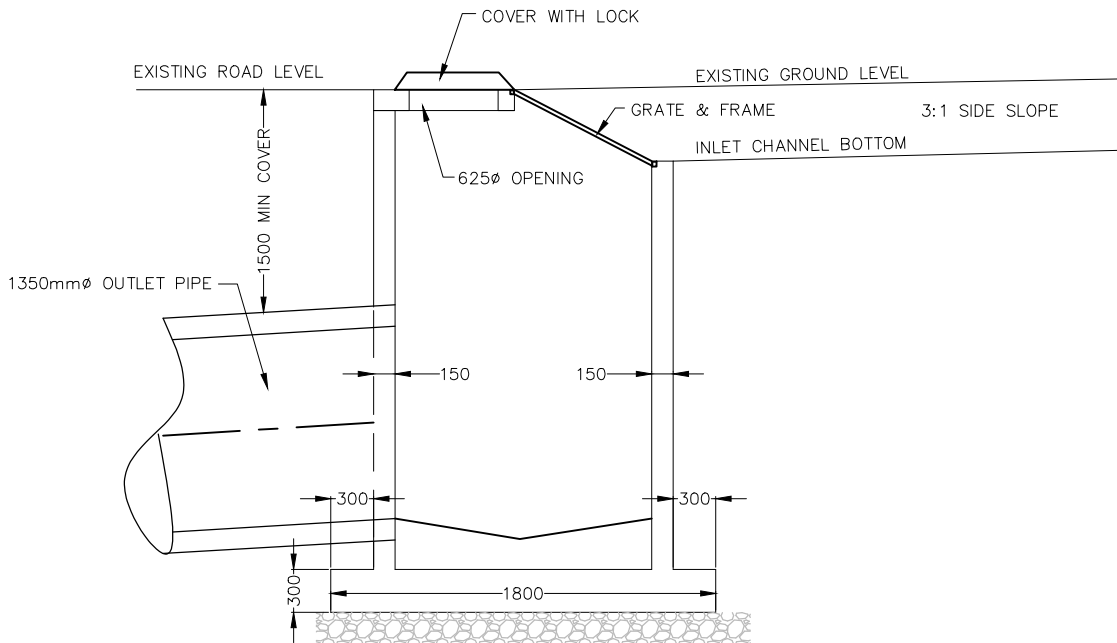
## General Municipal Improvements Standards



Rev.				STORM POND OUTLET CONTROL	Figure F-27
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:	Approved: 	
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		



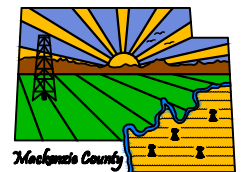
PLAN



NOTE:  
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

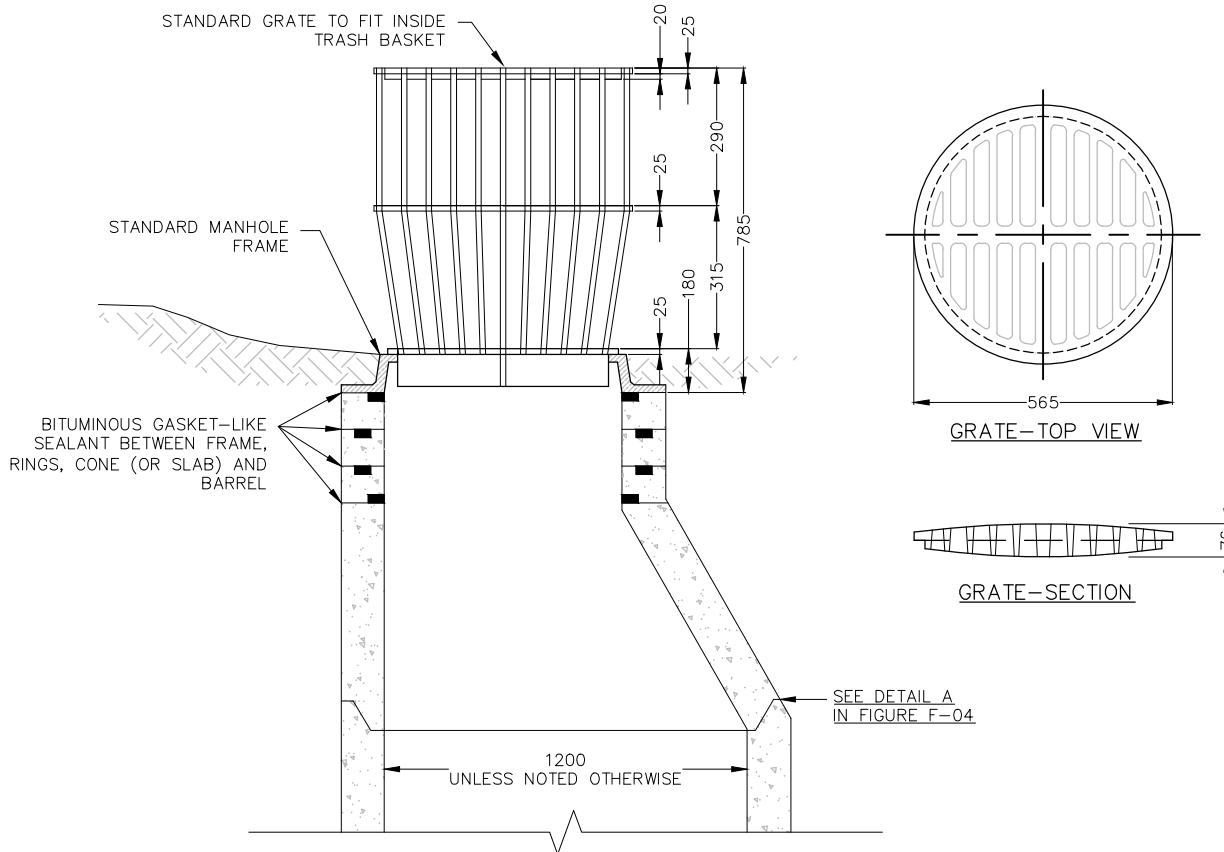
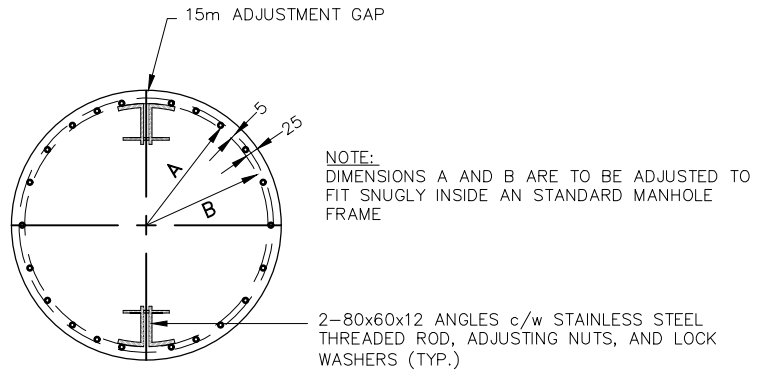
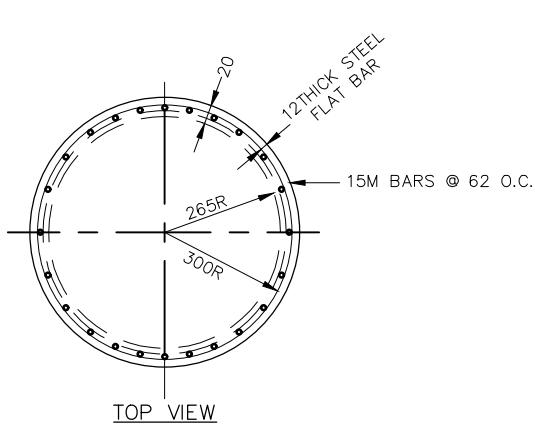


### SWALE INLET STRUCTURE

Approved: *[Signature]*

Figure F-28

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

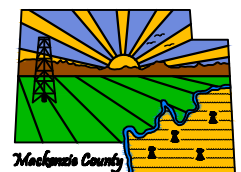


NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

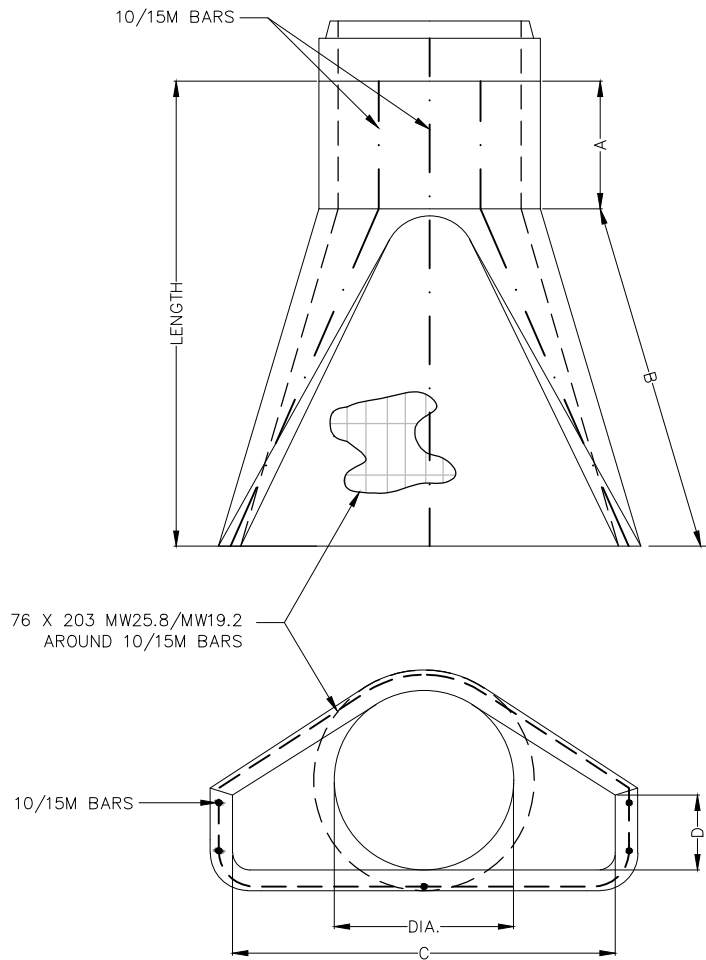


### GRATE C/W TRASH BASKET

Approved:

Figure F-29

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S



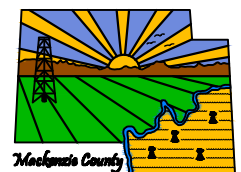
DIAMETER (mm)	ACTUAL DIMENSIONS			
	A	B	C	D
600	749	1168	1207	254
1050	889	1650	1981	533



NOTE : 1050mm CULVERT TO COME WITH GATE

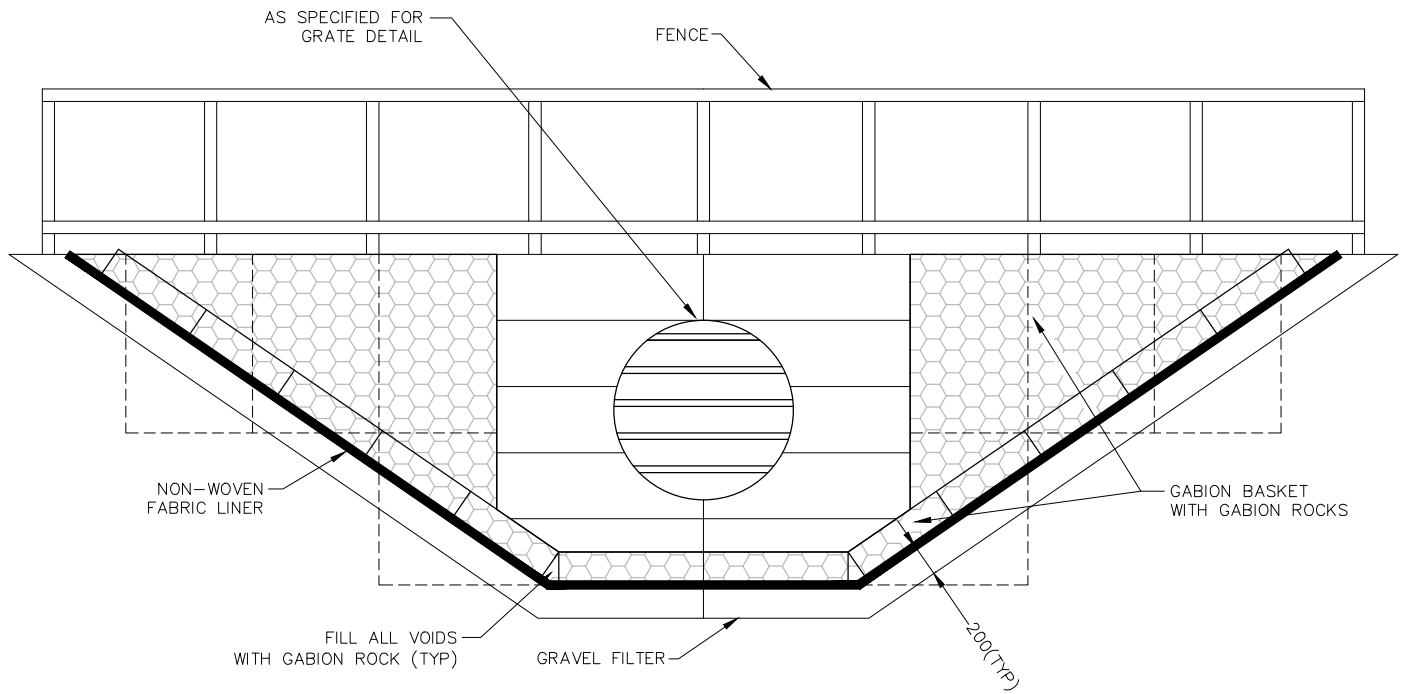
NOTE:  
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



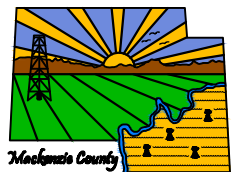
Rev.				<b>CONCRETE CULVERT FLARED END DETAIL</b>	Approved: 	Figure <b>F-30</b>
Rev.						
Rev.						
Rev.	2021-FEB-15	File No.: GP60.33682	Design:	Approved: 	Figure <b>F-30</b>	
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			



NOTE:  
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

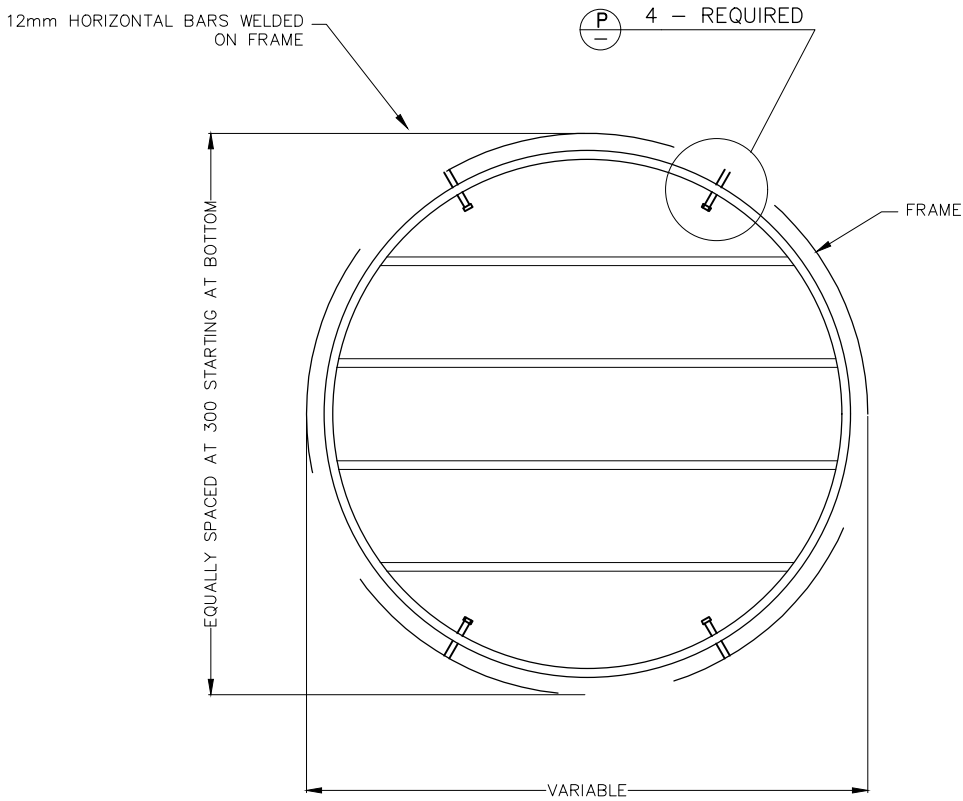
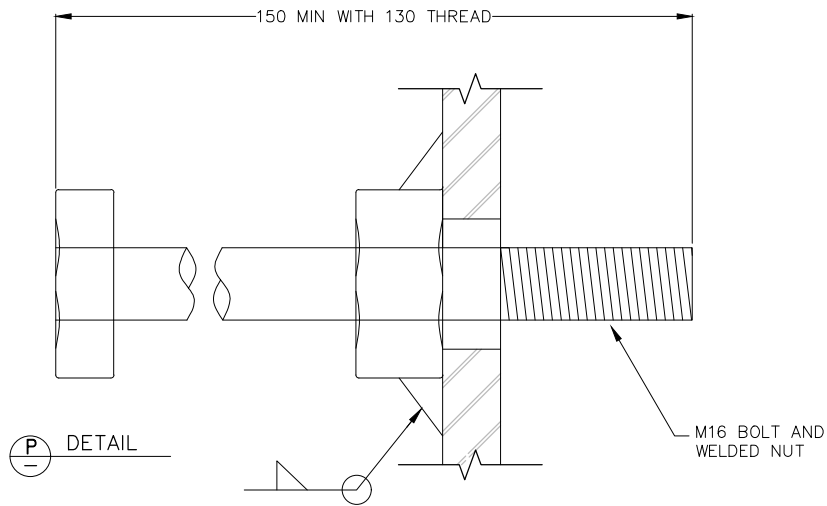


GABION BASKET DETAIL STORM SEWER  
OUTLET (OUTLETS GREATER THAN 0.9m $\phi$ )

Approved: *[Signature]*

Figure F-31

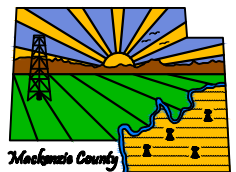
Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S



NOTE:  
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



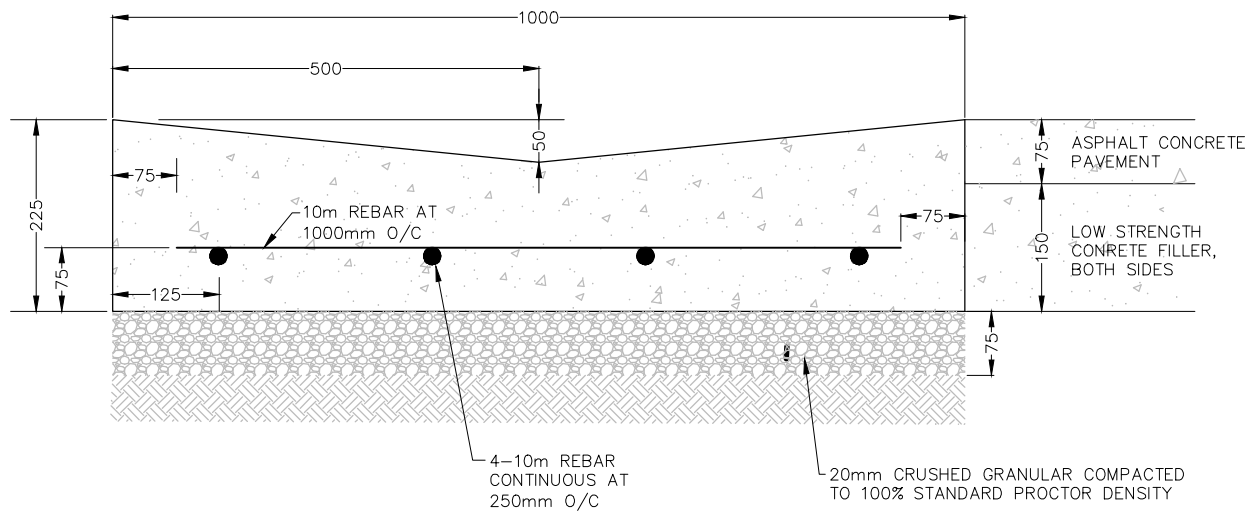
### PIPE GRATE DETAIL STORM SEWER OUTLET

Approved:

Figure **F-32**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S



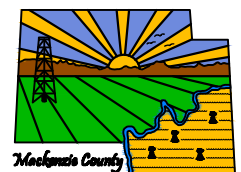


NOTES:

1. EXPANSION/CONTRACTION JOINT REQUIRED ON ONE END. IF DONE IN 2 POURS, ONLY CONSTRUCTION JOINT REQUIRED.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

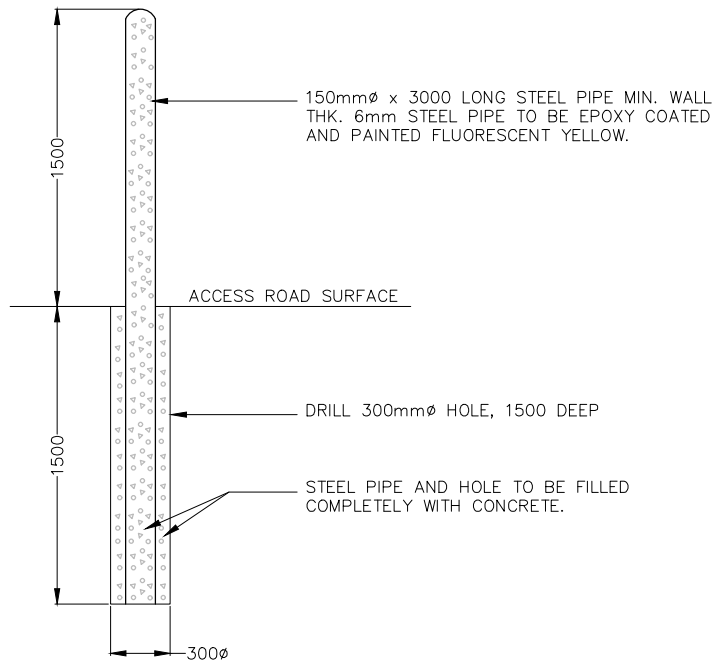
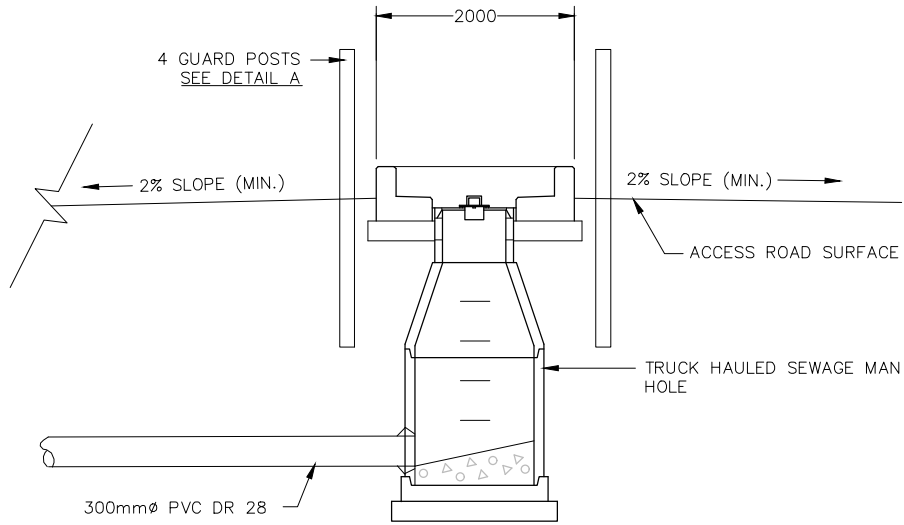


### 1000mm CONCRETE SWALE

Approved: *[Signature]*

Figure **F-33**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S



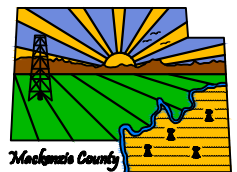
DETAIL A - GUARD POST

NOTES:


1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

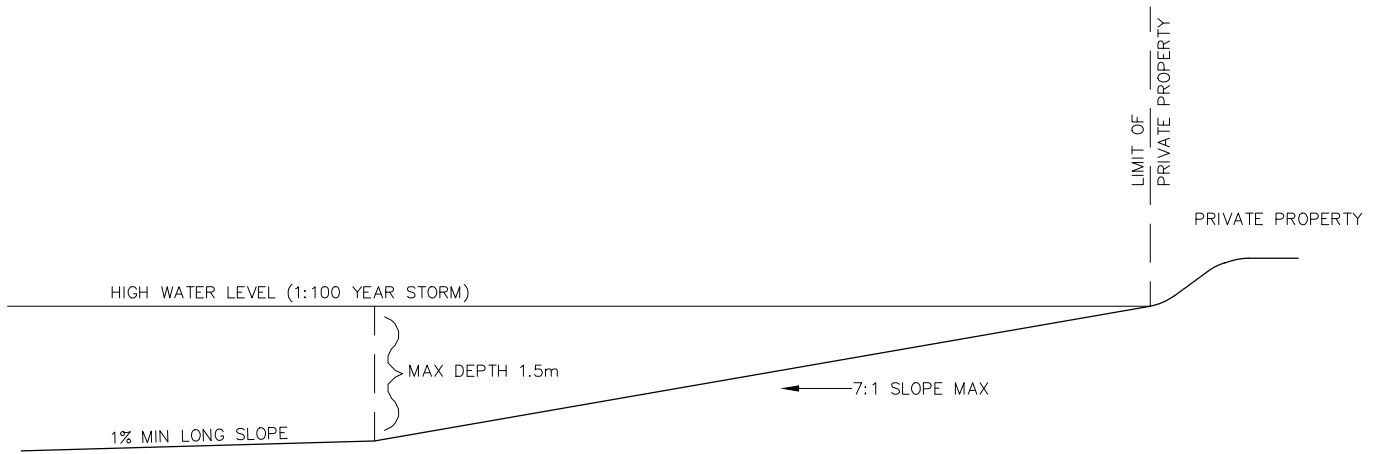
# MACKENZIE COUNTY

## General Municipal Improvements Standards



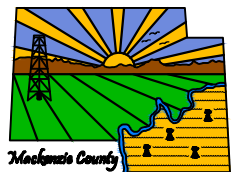
### GUARD POSTS

Rev.				Approved: 	Figure F-34
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		




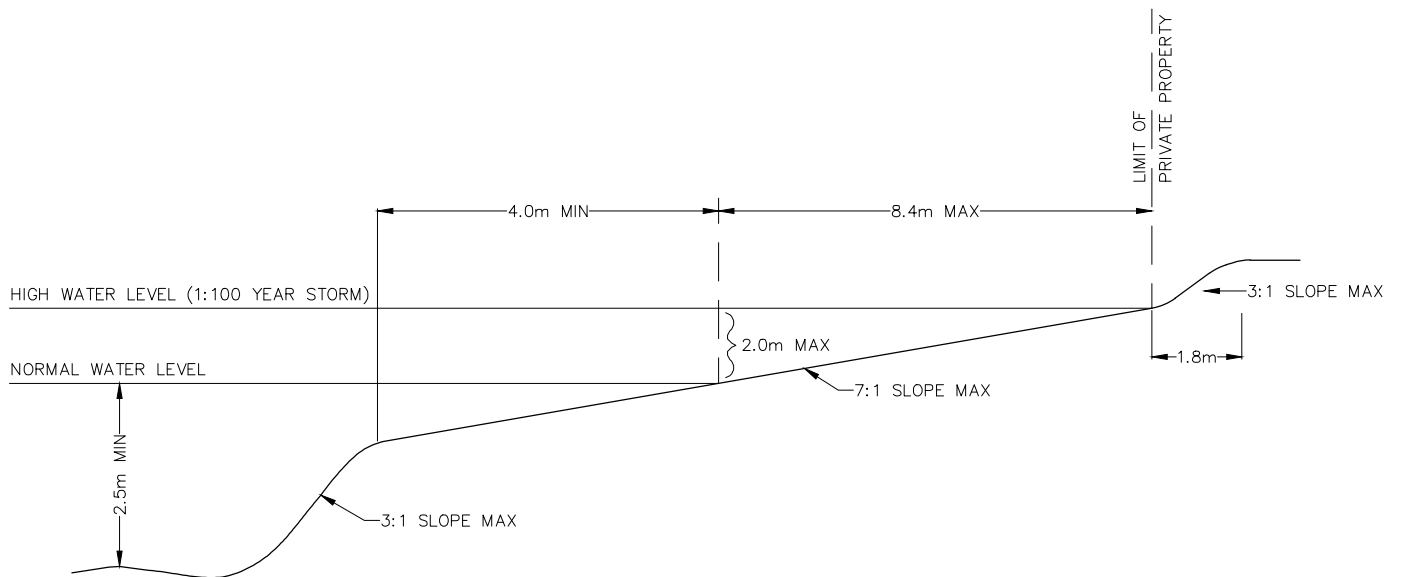
# MACKENZIE COUNTY

## General Municipal Improvements Standards



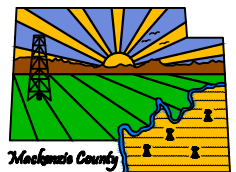
### TYPICAL DRY POND SECTION

Rev.				Approved: 	Figure F-35
Rev.					
Rev.					
Rev. 2021-FEB-15	File No.: GP60.33682	Design:			
Date: 2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			




# MACKENZIE COUNTY

## General Municipal Improvements Standards



### TYPICAL WET POND SECTION

Rev.				Approved: 	Figure F-36
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		

## SECTION G      TRANSPORTATION

### G.1 INTENT

- G.1.1** This section is intended to provide design and construction information for transportation infrastructure projects proposed as part of an urban or rural subdivision development, or the access road connecting such subdivision to the Municipality's road system, and which will meet the servicing requirements for commercial, industrial and residential subdivision. These standards have been developed to ensure cost efficiency and practicality to minimize the maintenance requirements associated with design and construction of transportation infrastructure projects.
- G.1.2** The guidelines and standards presented in this section shall only be considered as minimum requirements. It is the Developer's responsibility to design and construct Municipal Improvements according to accepted engineering practices and standards that address and meet the specific needs and site conditions of the subdivision. Site-specific conditions may warrant more stringent standards are met. The Developer, through their Consultant, is responsible to confirm whether minimum standards are appropriate for the specific proposed subdivision. For issues not referenced herein, the current Transportation Association of Canada (TAC) or Alberta Transportation (AT) standards shall be used.
- G.1.3** Road classification and designation shall be in accordance with the road classification system outlined in the Transportation Association of Canada (TAC) manual Geometric Design Standards for Canadian Roads and Streets and the Urban Supplement to the Geometric Design guide for Canadian Roads. Designations of a subdivision as "rural" or "urban" and individual street classification within the subdivision are to be based on functional use established by the Municipality.
- G.1.4** It is the Developer's responsibility, in addition to these standards, to satisfy all requirements and conditions required by the following acts and regulations:
- i. Public Lands Act
  - ii. Municipal Government Act
  - iii. Water Act
  - iv. Environmental Protection & Enhancement Act
  - v. Provincial Wetlands Policy
  - vi. Alberta Environment, Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems
  - vii. Alberta Highway Geometric Design Guide
  - viii. Transportation Association of Canada (TAC) Geometric Design Guidelines
  - ix. TAC Uniform Traffic Control Devices for Canadian Roads

- x. TAC Highway Lighting Design Guide
- xi. Municipality Bylaws
- xii. Fisheries Act
- xiii. Species at Risk Act
- xiv. Navigable Water Protection Act

## **G.2 GENERAL**

- G.2.1** For each proposed subdivision, the appropriate roadway classifications and design designation shall be determined during the planning stages in consultation with the Municipality. General guidelines identifying the roadway designations and minimum applicable requirements for each type of Land Use Districts are provided in Section C of these standards.
- G.2.2** Where conflicts or inconsistencies with these standards arise due to adoption of other transportation planning documents, the Developer shall be responsible for satisfying the more stringent requirements.
- G.2.3** Should the need arise where any of the following standards cannot be met, a written request describing the variance complete with supporting documentation shall be forwarded to the Municipality for review. The request will be reviewed, and a written reply returned with the final decision.
- G.2.4** The Developer shall be responsible for quality control testing related to the roadway construction including, but not necessarily limited to, sieve analysis, densities, mix designs, core sampling and concrete testing. Quality control shall be performed by an independent party and certified by a Professional Engineer licensed to practice in the Province of Alberta.

## **G.3 ROADWAYS LEVEL OF SERVICE**

- G.3.1** The Developer's Engineer shall be responsible for determining an estimated Annual Average Daily Traffic (AADT) generated by the proposed subdivision in order to determine the required cross sectional elements and pavement structure.
- G.3.2** Generally, local roads with an AADT of 200 or less are designed to have gravel surface finish. The Municipality may require provision for a wider sub-grade to allow for future base paving.

## **G.4 DESIGN CRITERIA**

- G.4.1** Traffic Analysis and Traffic Impact Assessments
- i. The Developer is responsible to carry out a traffic impact assessment when required by the Municipality. This assessment shall include a projection of the AADT over a 20-year design life for the internal subdivision roadways as well as any adjacent provincial highways or municipal roadways. This

traffic assessment shall also include, but will not be necessarily limited to, the following:

- a. Volume of daily traffic generated by the proposed subdivision at full development. If the planned subdivision is staged, then the assessment will also include daily traffic volumes at the end of each consecutive subdivision stage.
- b. Layout of the internal road system of the proposed subdivision with the accesses clearly marked.
- c. Location of the proposed access points.
- d. Sight distance assessments at the proposed access points.
- e. Full review of the proposed access points using Alberta Transportation Design guidelines, establishing whether or not intersectional improvements are required.
- f. Traffic signal warrant and pedestrian accommodation at major intersections for urban subdivisions.

**G.4.2** All off-site road improvements required as a result of the proposed subdivision shall be identified in the design stage by the Developer. An off-site levy will be assessed and charged to the Developer.

**G.4.3** The daily trip generation rate for single detached housing in the Municipality shall be ten (10) one-way trips per household. Trip generation rates for other types of subdivisions shall be justified by the Developer and approved by the Municipal Engineer.

## **G.5 DESIGN DESIGNATIONS**

**G.5.1** The Municipality uses two design designations identified as Rural and Urban Roadways. The cross-section elements for these design designations are shown in the attached drawings.

**G.5.2** For the purpose of these standards, all roadways within the Municipality other than primary and secondary highways, and several major grid roads, will be considered as local roads. Although several roadways may perform minor collector functions, the above design designations shall apply to most roadways within the Municipality.

**G.5.3** The roadway design shall be prepared considering the future requirements, economic factors, safety considerations, staging, and other roadway users not directly associated with the proposed subdivision.

**G.5.4** The selected design speed shall relate to the expected safe operating speed on the road after improvement. It shall reflect public expectations and include an allowance for safety. Typically, the design speed shall be 10 km/hr higher than the anticipated posted speed limit.

**G.5.5** Where parking is required, the shoulder width may be included as part of the parking lane. Deletion of parking requirements will be considered where lots do

not front on to the roadway (including lots with back lanes) and “No Parking” signs are provided by the Developer. Right-of-way widths shall not be reduced.

- G.5.6** Rear lanes (alleys) shall have a surfaced width of 5.6 m within a 6.0 m right-of-way and a minimum longitudinal grade of 0.6 %. If the rear lane is to have a gravel surface, the lane shall be cross sloped to one side at a minimum grade of 3.0 %. If the rear lane is to be paved, the lane shall have a centre swale and cross slopes of 2.5 %. Where rear lane traffic activity is expected to be high, wider surfaced widths and rights-of-way may be required by the Municipality.
- G.5.7** Urban roads are to be assumed to have curb and gutter. Parking lanes are required. The requirement for sidewalks will be reviewed by the Municipality on a subdivision specific basis.
- G.5.8** Geometric design requirements for rural roadways are shown in the Table G5.8-1:



**Table G5.8-1 Geometric Design Requirements for Rural & Urban Roadways**

Designation	Surface	AADT <sup>1</sup>	Truck Traffic	Min. ROW <sup>**</sup> (m)	Preferred ROW <sup>2</sup> (m)	Design Speed (km/h)	Posted Speed (km/h)	SSD <sup>3</sup> (m)	Crest k (m)	Sag k (m)	Min. Horiz. Radius (m)
Access Road 7.0m	Gravel	< 25	Negligent	20	30	40	30	65	7	11	
Rural Road 8.0m	Gravel	< 100	Minimal	20	30	60	50	85	15	20	90
Urban/Rural Hybrid Road 8.0m	ACP	< 200	Minimal	20	30	60	50	85	15	20	90
Paved Local Road 8.0m	ACP	< 200	Significant	30	40	60	50	85	15	20	90
Urban Local Road 9.0m	ACP	< 2000	Significant	20	20	60	50	85	15	20	90
Collector Road 9.0m	Gravel	> 200	Minimal	30	40	60	50	85	15	20	90
Arterial Road 10.0m	ACP	< 2000	Significant	40	40	70	60	140	35	30	190
Arterial Road 11.0m	ACP	> 2000	Significant	40	40	70	60	140	35	30	190

<sup>1</sup> Average Annual Daily Traffic      <sup>2</sup> Right-of-Way      <sup>3</sup> SSD (Stopping Sight Distance)

Note: The recommended design speeds are for internal roadway systems only.

Design characteristics of high speed roadways (with >60 km/h posted speed limit) shall be based on the latest Alberta Transportation standards.

**G.5.9** Roadway sub-grade and pavement structures design shall be based on results of a geotechnical investigation. A report shall be submitted specifying the required structure and all design factors including design traffic loading and the pavement design life. It is the Developer’s responsibility to design the subdivision roadways to meet or exceed these standards in accordance with good engineering practices and specific site conditions. The minimum pavement structure permitted for each roadway designation, both rural and urban, is provided in Table G5.9-1:

**Table G5.9-1 Minimum Pavement Design Standards**

<b>Roadway Designation</b>	<b>Asphaltic Concrete Pavement Thickness (mm)</b>	<b>Granular Base Thickness (mm)</b>	<b>Granular Sub-Base Thickness (mm)</b>	<b>Total Thickness of the Paving Structure (mm)</b>
Arterial	100	200	350	650
Industrial Collector	100	200	300	600
Residential Collector	75	100	200	375
Industrial Local	100	150	300	550
Residential Local	75	75	200	350

- ii. All pavement structures shall meet the following minimum requirements for the California Bearing Ratio (CBR):
  - a. Prepared sub-grade in a soaked condition: CBR > 4
  - b. Granular sub-base: CBR > 20
  - c. Granular base: CBR > 80
- iii. Where soils of a lower stability are present, an increase in pavement structure shall be required based on engineering calculations.
- iv. Any modification to the pavement standards must be substantiated by a geotechnical report and approved by the Municipality. The Developer’s Engineer shall also consider traffic volumes and axle loading.

**G.5.10 Vertical Alignment**

- i. The minimum gutter grades shall be 0.4 %, 0.5 % along tangents, 0.6 % around curb returns and 0.8 % on lanes. A maximum gradient of 4 % for 30 m from the curb return for all roadways connecting to any intersection.
- ii. The maximum longitudinal grade for all roadways shall be 6.0 %. All roadways shall be crowned or have a cross fall as shown in the applicable standard drawing. The standard cross fall grade is 2.5 %.

**G.5.11 Vertical Curves**

- i. Vertical curves shall be calculated according to TAC design guides using the TAC urban supplement as appropriate.

- ii. The minimum length of a vertical curve shall be 30 m on local roads, and greater than or equal to the design speed in km/h on collector and arterial roads.
- iii. Vertical curves are not required where the algebraic difference of the grades is less than 1.5.

#### **G.5.12** Horizontal Alignment

- i. The minimum degree of curvature of the centerline of the carriage way is dependent on the road classification and its design speed.
- ii. All horizontal curves shall be designed to meet TAC design guides, using the TAC urban supplement as appropriate.
- iii. Minimum edge of pavement radius for residential cul-de-sacs is 11 m. For industrial cul-de-sacs the minimum edge of pavement radius shall be 14 m.
- iv. Curb return radius requirements:
  - a. At residential local road intersections: 7.5 m
  - b. At residential collector road intersections: 12.5 m
  - c. At industrial and commercial road intersections: 15 m  
(to accommodate trucks turning)
  - d. For arterial road intersections, curb returns shall be designed to properly accommodate the design vehicle types and expected volumes of traffic.
  - e. Paraplegic ramps shall be required at all intersections which have sidewalks.

#### **G.5.13** Gravel Roadway Standard Specifications

- i. Gravel roads shall require the specific approval of the Municipality. Cross-sections and ditch design requirements are the same as for paved roadway standard:
  - a. Sub-grade – 1 m of acceptable material (clay or sand as approved by the Geotechnical Engineer) with no organic or any other deleterious materials.
  - b. Crown – 2.5 % to 3.0 %.
  - c. The source of granular material shall be approved by the Municipality. The size and gradation shall conform to the recommended standards outline below:

Sieve Size	Passing, %
20,000	100
10,000	35 - 77
5,000	15 - 55
1,250	0 - 30
80	0 - 12

- ii. The granular material shall have a minimum of 40 % two face fracture. Gradation properties of gravel for surfacing shall be specified and reviewed by the Developer's Engineer and accepted by the Municipal Engineer prior to commencing of work.
  - a. The estimated gravel application rates shall be as shown in the Table G5.13-1:

**Table G5.13-1 Gravel Surface Granular Material Application Rates (Estimated)**

<b>Roadway Finished Sub-grade Width (m)</b>	<b>Granular Material Application Rate (Estimated) (m<sup>3</sup>/km)</b>
7.0	300
8.0	350
9.0	400
10.0	450
11.0	500
12.0	550
13.0	600
14.0	650
15.0	700
16.0	750
17.0	800
18.0	850

- iii. Conditions of the sub-grade at the time of construction may warrant adjustments to the rates shown in the Table G5.13-1. The actual surface granular material application rate shall be determined by the Geotechnical Engineer on a project specific basis and soil conditions and shall be approved by the Municipality.
- iv. The gravel roadway surface will be graveled in two distinctive layers of granular material. Upon the Municipality approval, the Developer shall supply and place the first layer of gravel in accordance with the specified gradation and rate of application. No gravelling shall be permitted until the finished sub-grade has been tested, inspected and accepted by the Municipality.
- v. The application of the second layer shall not be permitted until the first layer is inspected and accepted by the Municipality.
- vi. All entrances to lots shall be graveled at a minimum rate of 8 m<sup>3</sup> per entrance, as measured from the shoulder of the roadway to the property line.

#### **G.5.14 Intersections and Approaches**

- i. Intersections and approaches shall be designed intersecting the roadways at 90 degrees wherever possible. The minimum angle of intersection for two roadways shall be 75 degrees unless otherwise approved by the

Municipality. The Developer shall also refer to the applicable Land Use Bylaw for additional standards.

- ii. Intersection design shall incorporate accepted sight distances based on the roadway classification and best engineering practice. Minimum intersection spacing shall be 60 m measured from centreline to centreline.
- iii. Intersection treatments shall be designed based on estimated 20-year traffic volumes. All necessary widening of existing rights-of-way shall be provided by the Developer.
- iv. Approaches shall be situated such that they do not access directly onto a roadway with an estimated AADT of greater than 4,000. Approaches shall be located and designed to access the parcel's most desirable building location. All approaches shall have the same paving structure as the adjoining roadway and be constructed to the property line or the right-of-way boundary.
- v. All rural residential subdivision lots and private properties accessed by local and collector roadways shall require construction of at least one approach to the property from the accessing roadway.
- vi. Residential and industrial approaches shall have 10 m wide finished top or pavement. Residential approaches shall have a width of 6 m at the property line and minimum radii of 5 m. Approaches shall have a minimum lateral clearance of 1.5 m from any surface feature, such as hydrants, power poles, curb cocks, etc. Approaches shall not be situated on a curb return.
- vii. For corner lots, the approaches shall access the roadway with a lesser traffic volume wherever possible. Wherever possible, approaches shall not be located within 100 m of an intersection.
- viii. For industrial lots, the selection of the approach location may be delayed until parking lot configurations are determined. A caveat on title will be required to inform future owners of their responsibility to pay for the installation while adhering to design recommendations.
- ix. Industrial approaches shall be constructed to the same minimum requirements and specifications as private approaches, with the exception that the width of the approach may be increased to accommodate the type of traffic through the approach. Geometric requirements for the industrial approaches shall be followed as:
  - a. Light industrial approach:
 

• Minimum turning radius	12 – 15 m
• Minimum road surface width	11.5 m
  - b. Heavy industrial approach:
 

• Minimum turning radius	15 m
• Minimum road surface width	15 m

- x. The following minimum culvert diameters shall be used at the intersections and approaches:
  - a. Residential approach 500 mm
  - b. Industrial approach 600 mm
  - c. Roadway centreline 600 mm
- xi. Culverts shall be corrugated steel or concrete reinforced Class III. Depth of cover shall meet manufacturer's requirements, with a minimum of 300 mm. The Developer shall also confirm that culvert sizing is consistent with the storm water management plan for the proposed subdivision, increasing the diameter as necessary to meet flow requirements.

#### **G.5.15 Cul-de-sacs**

- i. The maximum length for any cul-de-sac without a Public Utility Lot (PUL) shall be 120 m from the centreline of the intersecting street to the start of the bulb. Cul-de-sacs in excess of 120 m shall require a 6 m wide PUL allowing for emergency vehicle access and watermain looping.
- ii. The PUL provided to allow for emergency access shall not be utilized for storm water storage. The PUL shall be properly graded to ensure positive drainage toward the road and seeded or sodded to prevent erosion.
- iii. Cul-de-sacs shall be graded to drain towards the intersecting street unless a PUL is provided to allow drainage to escape.
- iv. The minimum cul-de-sac bulb radius for residential areas shall be 11 m measured to the face of curb or 18 m measured to the shoulder.

#### **G.5.16 Ditches**

- i. Ditches shall be designed to effectively convey site drainage from the area consistent with the approved storm water management plan. General ditch specifications are as follows:
  - a. Roadway ditches 4:1 side slopes, 3:1 back slope.
  - b. Drainage channels 3:1 side and back slopes.
  - c. 1 m wide ditch bottom within subdivisions, 3 m wide ditch bottom for rural sections outside of the proposed subdivision, or collector or arterial roads.
  - d. Maximum gradient 6 %, minimum gradient 0.5 %.
  - e. Ditch depth to be sufficient for drainage and snow storage requirements and to accommodate approach culverts, generally 1.0 m (0.6 m minimum).
- ii. Where roadway and ditch requirements result in a portion of the ditch or ditch back slope extending beyond the road right-of-way, the Developer shall be responsible to secure appropriate drainage easements in the name of the Municipality.

## G.6 CONSTRUCTION

### G.6.1 Clearing and Grubbing

- i. All clearing and grubbing work shall be done within the limits of rights-of-way, permanent and temporary working easements, and shall include the complete disposal of all buildings and structures, vegetation and other debris. All work shall be performed in accordance with current Federal, Provincial and Municipality fire and public safety regulations, Acts and laws and approved construction drawings and specifications.

### G.6.2 Earthwork

- i. Topsoil stripping and stockpiling: topsoil shall be stripped to its full depth on all road rights-of-way and excavation areas, and stockpiled for use in final grading and/or landscaping purposes, as shown on the Contract Drawings and Specifications.
- ii. All excavations shall be done within the limits of the proposed work, to the lines, grades and dimensions as shown on the Contract Drawings, noted in the Contract Documents or specifically approved otherwise. Surplus or unsuitable material shall be disposed of as determined by the Developer's Engineer and approved by the Municipality. Subsoil stripped shall be stockpiled in a topsoil-free area to prevent potential contamination.
- iii. Where sufficient quantity of suitable fill material is not available from excavation on the site, additional fill may be borrowed from other sources. The Developer shall be responsible for securing borrow sites, and all associated environmental approvals. All borrow sites will be reclaimed to the satisfaction of the Municipality meeting all specifications and regulations.
- iv. During the embankment construction, earth materials shall be placed in successive uniform layers not exceeding 300 mm loose thickness. Each layer shall be compacted to a minimum of 98 % of Standard Proctor Maximum Density, with the earth materials field moisture content being maintained within +/- 2 % of the Optimum Moisture Content, unless stated otherwise. Only native or imported earth material approved by the Municipal Engineer shall be used for embankment construction.
- v. Side slopes and back slopes shall not be steeper than 4:1. Where, in the opinion of the Municipality, such slopes are not sufficient for the native soil condition, the Developer shall provide suitable slopes acceptable to the Municipality.
- vi. All proposed routes for hauling materials and construction equipment shall be approved by the Municipality prior to commencement of the work.
- vii. All work shall be carried out so that excavated areas will drain to catch basins, manholes, or to a natural drainage course during construction. The Developer shall take necessary environmental control measures as specified by the Provincial regulations and Contract Drawings and Specifications.

**G.6.3 Sub-grade Preparation**

- i. In the areas excavated to the design sub-grade elevations, the top of the sub-grade shall be scarified to a minimum depth of 150 mm below the surface, graded and compacted to a minimum of 100% of Standard Proctor Maximum Density with the earth materials field moisture content being maintained within +/- 2% of the Optimum Moisture Content. The finished cut area shall conform to the lines, grades and dimensions as shown on the Contract Drawings.
- ii. In the areas filled to the design sub-grade elevations, any portion of fill more than 300 mm below the top of sub-grade shall be placed in successive uniform layers not exceeding 300 mm loose thickness and compacted to a minimum density of 98% of Standard Proctor Maximum Density with the earth materials field moisture content being maintained within +/- 2% of the Optimum Moisture Content. The top 300 mm shall be placed in successive uniform layers not exceeding 150 mm loose thickness and compacted to a minimum density of 100 % of Standard Proctor Maximum Density with the earth materials field moisture content being maintained within +/- 2% of the Optimum Moisture Content.
- iii. It is understood that the moisture content requirements will also depend on actual site conditions during construction and the soil types. It is the Developer's responsibility to exercise best engineering practices to achieve the requirements specified by the Municipality.
- iv. During placement and compaction of the earth materials, measures shall be taken by the Developer as to maintain the moisture content of the materials as specified. When a deficiency in moisture content exists, the soils shall be watered and thoroughly mixed prior to compaction until the specified moisture content is uniformly attained. When there is an excess of moisture, the soils shall be worked and aerated prior to compaction until the specified moisture content is reached. One-mould Proctor density testing shall not be permitted as an alternate testing procedure due to wet soil conditions. The Developer's Engineer shall be required to determine appropriate measures in order to meet the required moisture contents and densities.
- v. 80 mm granular sub-base material (as defined in Section G.6.4) shall be used to stabilize the sub-grade in areas where silty in-situ soil materials exist. The minimum structural requirements shall be shown on the detailed cross section drawings. After removal of unsuitable sub-grade soils, pit run materials shall be placed in the excavation in consecutive layers not exceeding 150 mm and compacted to 100% of Standard Proctor Maximum Density. Water shall be applied and mixed uniformly with the pit run materials prior to compaction until the moisture content is within 2% of the Optimum Moisture.



**G.6.4 Base Course**

- i. The sub-grade shall be finished to conform to the required section, grade and density prior to placement of base course material.
- ii. Granular materials shall consist of crushed gravel free from vegetation, clay or other extraneous materials and meet the following specifications:
  - a. Granular sub-base - 80 mm (3") crushed gravel. The gravel shall be crushed and meet the following grading requirements:

<b>Sieve Size Passing</b>	<b>Cumulative % by Weight</b>
80,000	100
50,000	80 - 100
25,000	50 - 75
5,000	25 - 55
80	2 - 10

At least 20 % by weight of material retained on the 5,000 sieve shall have at least one fractured face. Plasticity index shall not exceed 8.

- b. Granular base - 20 mm (3/4") crushed gravel. The gravel shall meet the following grading requirements:

<b>Sieve Size Passing</b>	<b>Cumulative % by Weight</b>
20,000	100
16,000	84 - 94
10,000	63 - 86
5,000	40 - 67
1,250	20 - 43
630	14 - 34
315	9 - 26
160	5 - 18
80	2 - 10

- c. The liquid limit shall not exceed 25 and the Plasticity Index shall not exceed 6. A minimum of 60 % by weight of material retained on the 5,000 sieve shall have at least two crushed faces. A tolerance of 3 % in the amount passing the 20,000 sieve will be permitted provided all oversize material passes the 25,000 sieve.
      - d. Base course granular material shall be placed, graded and compacted in a single layer when the compacted design thickness does not exceed 150 mm. When the design thickness exceeds 150 mm the base course granular material shall be placed, graded and compacted in successive layers each not exceeding 150 mm thick.
- iii. Each layer of granular material shall be compacted to 100 % of Standard Proctor density. Water shall be applied and mixed uniformly with the granular material prior to compaction until the moisture content is within 2% of the Optimum Moisture. If necessary, and as advised by the

Developer's Engineer, water shall be applied to the granular material during compaction to maintain the required uniform moisture content.

- iv. Compaction shall be reached by the use of pneumatic tire rollers, vibrating drum compactors or other approved types of compaction equipment. The Developer shall be responsible for supplying sufficient equipment as per current best construction practices and specifications in order to efficiently achieve the specified densities.
- v. Testing and inspection:
  - a. Field density tests shall be carried out for each 2,000 m<sup>2</sup> per each layer of granular base course with a minimum of one (1) test per day of placing operations.
  - b. The surface shall be such that when tested with a straight edge, the maximum deviation of the surface from the straight edge shall nowhere exceed 13 mm.
  - c. No segregation of rock or fine material shall exist in the completed base.
  - d. Areas suspected of being deficient or excessive in thickness shall be cored at the rate of three (3) cores per 1,000 m<sup>2</sup>. Base course thickness deficient by less than 6 mm will not be penalized. Areas deficient by more than 6 mm but less than 20 mm shall be paid for at an adjusted rate: the ratio of the square of the average thickness divided by the square of the design thickness. Areas deficient by more than 20 mm shall be rejected and the Developer shall re-construct the deficient areas at his own expense as directed by the Municipal Engineer.

#### **G.6.5 Prime Coat and Tack Coat**

- i. Definitions:
  - a. Prime coat shall be the application of bituminous material to sub-grade or previously prepared gravel base course prior to placing bituminous surfacing material.
  - b. Tack coat shall be the application of bituminous material to a previously constructed paving surface, of any type, in preparation for placing bituminous surfacing materials, and against curb gutter faces, manholes, valves and other appurtenances in the areas to be paved.
- ii. Prime coat:
  - a. The asphalt types may vary from MC 30 (medium curing asphalt), from SS-1 to SS-2 or SEP 1 emulsified asphalt primer, to suit the conditions of the base. The rate of application may vary from 0.5 - 1.5 litres/m<sup>2</sup> based on conditions of the base course, or as specified by the Municipality. The application rate shall permit good prime coat penetration into the base course without causing ponding of the prime coat on the surface.

- b. The material temperature at the time of application shall fall within the following limits:

MC 30:	50 - 70°C
SS 1:	24 - 54°C
SS 2:	24 - 54°C
SEP 1:	15 - 50°C

- c. The Contractor shall choose, in consultation with Developer's Engineer, between SEP.1, SEP.2, or SS1 for applications through August 31 and between MC-30, SEP-1, SEP-2 or SS1 after August 31.

iii. Tack coat:

- a. The asphalt for the tack coat may vary from SS-1 (emulsified asphalt), from RC 30 to RC 70 or RC 250 (rapid curing asphalts), depending on pavement conditions at the time of application. The rate of application may vary from 0.25 to 0.90 litres/m<sup>2</sup>, or as specified by the Municipality. The application rate shall ensure that uniform coverage is achieved and that the tack coat provides a good bond after curing.

- b. The material temperature at the time of application shall fall within the following limits:

SS 1:	24 - 54°C
RC 30:	50 - 70°C (after August 31)
RC 70:	75 - 98°C (after August 31)
RC 250:	100 - 110°C

#### **G.6.6 Seal Coat and Fog Coat**

i. Definitions:

- a. Seal coat shall consist of a surface treatment composed of a single application of bituminous material on an existing bituminous surface immediately followed by covering with aggregate.
- b. When a seal coat is applied without cover then it shall be referred to as a fog coat, a light application of slow-setting asphalt emulsion diluted with water. The emulsion shall be diluted with an equal amount of water and sprayed at the rate of 0.45 - 0.70 litres/m<sup>2</sup> or as specified by the Municipality, in order to renew old asphalt surfaces.

ii. Bituminous material:

- a. The liquid asphalt used for seal coating shall be rapid curing or emulsified asphalt. The actual grade and type of the material shall be determined to suit the surface conditions and shall be approved by the Municipality.

- b. Temperatures of applications for rapid curing asphalts shall fall within the following ranges:

RC 30:	50 - 70°C
RC 70:	75 - 90°C
RC 250:	100 - 110°C

- c. Temperatures of applications for emulsified asphalts shall fall within the following ranges:

RS 1k:	15 - 50°C
RS 2k:	15 - 50°C

- iii. Mineral aggregate:

- a. Chip seal aggregate shall be free from soft shale, organic or other deleterious matter and shall have at least one crushed face. The maximum moisture content in the chips shall be 1 % for RC asphalts applications and 3 % for RS asphalts applications.

- b. Sand seal shall meet the following gradation specifications:

Sieve Size Passing	Cumulative % by Weight
5,000	100
315	0-15
80	Less than 2

The maximum moisture content in the sand shall be 2 % for RC asphalts applications and 5 % for RS asphalts applications.

- c. Graded aggregate seal coat shall meet the following gradation specifications:

• Sieve Size Passing	Cumulative % by Weight
12,500	100
10,000	70 - 93
5,000	30 - 60
1,250	9 - 28
315	0 - 15
160	0 - 11
80	0 - 8

- a minimum of 60 % fraction on two sides for material passing the 5,000 sieve.

- iv. Application of bituminous material:

- a. Seal coats shall be applied during daylight hours when the shade temperature is 10°C or higher. No bituminous material shall be applied when the roadway surface is damp or wet, or when weather conditions

are such that the bitumen will become chilled before the cover aggregate can be spread and rolled. Work shall not be started without consent of the Municipality and shall be promptly terminated in the event of unfavorable surface or weather conditions. Prior to the application of the binder all dust, dirt and foreign matter will be swept from the surface for the full width of the area intended for seal coat.

- b. The approved bituminous material shall be uniformly applied on the properly prepared surfaces at a rate specified by the Municipality and within the following ranges:
  - Fog coat: 0.23 - 0.7 litres/m<sup>2</sup>  
(with a distributor having special fog nozzles for the purpose of applying a light spray)
  - Sand seal: 0.5 - 1.4 litres/m<sup>2</sup>
  - Chip seal: 0.9 - 1.8 litres/m<sup>2</sup>
  - Graded aggregate seal: 1.2 - 2.5 kg/m<sup>2</sup>
- c. The application of bituminous material shall not proceed until a supply of aggregate is immediately available to allow covering of the entire bitumen treated area in less than 5 minutes. The bitumen treated area shall be promptly covered with approved mineral aggregate at a rate of 5.5 - 11.0 kg/m<sup>2</sup> for sand, of 8.0 - 16.0 kg/m<sup>2</sup> for chips, and of 20 - 30 kg/m<sup>2</sup> for graded aggregate.
- v. Application of mineral aggregate material:
  - a. Special care shall be taken when spreading mineral aggregates in order to maintain uniform and secured cover. If, in the opinion of the Municipal Engineer, uniform distribution of the aggregate is not being achieved, the cover aggregate shall be alternately drag-broomed and rolled until it is uniformly bonded over the full width of the area of application.
  - b. Longitudinal laps may be from 150 to 250 mm in width, but there shall be no overlap at the end junction of the applications. In order to prevent lapping at transverse junctions, building paper or metal sheets shall be put over the treated surface, with sufficient offset back from the joint and onto the cover aggregate, so that sprayers operate at normal capacity until reaching the boundary to which the application is to be made. The bitumen application shall cease on building paper or metal sheets. Any paper used for covering joints shall be removed and disposed of.
  - c. Immediately after the mineral aggregate has been applied, the road surface shall be rolled sufficiently so that the maximum amount of cover aggregate will be "keyed". Rollers of a weight that crushes the mineral aggregate shall not be allowed. The Developer may use steel wheel, pneumatic tire or vibratory rollers. The minimum number of five (5) complete coverings by the rollers shall be carried out within 30 minutes of the application of the bituminous material. The speed of the rollers

shall be such that the suction of the tire shall not lift the aggregate from the sealed surface, or 8 km/hour, whichever is less.

- d. No traffic shall be permitted on the sealed roadway until after the rolling has been completed and the bituminous material has set to a degree satisfactory to the Municipality. No traffic shall be permitted on the sealed roadway until at least 24 hours after the application of the bituminous material.

#### **G.6.7 Asphaltic Concrete Pavement**

- i. Pavement design:
  - a. Asphaltic concrete pavement shall consist of mineral aggregate, filler and asphaltic binder. Pavement shall be placed and compacted to the specified thickness and shall conform to the lines, grades and cross sections as shown on the Contract Drawings.
  - b. All design parameters, including, but not limited to, traffic count, percentage of types of vehicles, California Bearing Ratio (CBR) shall be determined by the Developer's Engineer and shall be submitted to the Municipality.
  - c. The pavement structure shall be designed to carry the anticipated loadings and traffic capacity for a 20 year life. All roadways shall be paved with full depth asphalt or a structure with an equivalent strength.
  - d. Asphaltic concrete mix designs shall be Marshall Mix Designs and prepared by a recognized material testing laboratory. Mix designs shall be forwarded to the Municipality for review and approval.
  - e. No paving operations shall be allowed until the sub-grade has been tested, inspected and approved by the Municipality.
  - f. Asphalt materials, mixing, spreading and rolling shall conform to current specifications and good construction practices.
  - g. Staged construction for asphalt work may be required by the Municipality, with the final lift of asphalt placed during the construction season prior to issuance of the Final Acceptance Certificate. The Developer must make such minor temporary alterations as may be required to prevent drainage issues during the interim stage.
  - h. Type I Surface Course shall be used for all overlays, bottom and top lifts, for local, collector and arterial roadways. Type II Base Course may be used for bottom lifts for local, collector and arterial roadways. Type III Base Course may be used for bottom lifts of arterial roadways.

- ii. Mix design:
  - a. Mix designs shall be based on the Marshall Method and shall conform to the following requirements:
    - Compaction blows on each face: 75
    - Min. Marshall stability at 60°C: 6,700 N
    - Flow: 1.5 to 3 mm
    - Air voids (total mix): 3.5 - 4.5 %
    - Min. voids in mineral aggregates: 15 %
    - Asphalt content (total mix): 5 – 8 %
    - Min. retained stability: 75 %
  - b. The mix design shall be carried out by an accredited testing agency and shall be submitted to the Municipality for approval at least four (4) weeks prior to commencement of work.

iii. Materials:

- a. Asphaltic concrete pavements, both surface and base courses, shall consist of mineral aggregate, filler and asphaltic binder and shall be placed to the specified thickness and compacted to the specified density, conforming to the lines, grades and cross-sections shown on the Contract Drawings.
- b. Mineral Aggregates - when tested by means of laboratory sieve, the combined aggregates in the mix shall meet the following gradation:

Sieve Size Passing	Cumulative % by Weight		
	Type I	Type II	Type III
	Surface Course	Base Course	Base Course
20,000	-	-	100
16,000	-	100	90 - 100
12,500	100	80 - 92	-
10,000	83 - 92	70 - 84	56 - 84
5,000	55 - 70	50 - 65	35 - 64
2,500	38 - 55	37 - 52	21 - 49
1,250	26 - 45	26 - 45	11 - 34
630	18 - 38	18 - 38	8 - 30
315	12 - 30	12 - 30	5 - 21
160	8 - 20	8 - 20	3 - 15
80	4 - 10	4 - 10	2 - 8

- c. A minimum of 70 % of the surface course and 60 % of the base course material on the 5,000 sieve shall have at least 2 crushed faces.

d. Asphalt mix shall be uniform in character, shall not foam when heated to 177°C and shall meet the following requirements:

<b>ASTM Designation</b>	<b>AC-150/200(A)</b>	<b>AC-200/300(A)</b>
D2170 Penetration at 24° C, 100 gm, 5 sec.	150.0	200.0
D5 Ductility at 24° C (cm)	100.0	-
D113 Min. solubility in carbon tetrachloride (%)	99.5	99.5
D2042 Flash Point, Cleveland Open Cup	205.0	175
D2171 Thin Film Oven Test Penetration after test at 24° C, 100 gm, 5 sec., (% of original)	4.0	4.0
Ductility at 15.6°C, cm. min		100.0

e. Should the grading of the mineral aggregates supplied to the asphalt plant not meet the specified gradation, mineral filler shall be added in such quantities as will be required to meet the Specifications. Mineral filler shall consist of Portland cement, Pozzolan, commercially ground stone dust or other mineral dust approved by the Municipality. Mineral filler shall have a "Zero" Plasticity Index and shall conform to the following gradation requirements:

<b>Sieve Size Passing</b>	<b>Cumulative % by Weight</b>
400	100
160	90
63	70
45	62

f. Asphaltic mix design shall be based on the Marshall Method and shall conform to the following criteria, depending on traffic loading and mix type:

	<b><u>Type I</u></b>	<b><u>Type II</u></b>	<b><u>Type III</u></b>
Marshall Stability (min)	8,500	8,500	6,700
Flow Value	2 – 3.5	2 – 3.5	2 – 3.5
% Air Voids	3 – 5	3 – 5	3 – 5
% Voids in the Mineral aggregate	14	1	14
Asphalt Cement Grade	150/200A	150/200A	150/200A
Voids Filled with asphalt (%)	65 – 75	65 – 75	65 – 75
Retained Stability % (min)	70	70	70
Theoretical Film thickness (min)	8 – 8.5	8 – 8.5	7 – 8



- g. The mix design shall be performed by an accredited testing agency and shall be submitted to the Municipality for review and approval at least two (2) weeks prior to the commencement of paving operations. A separate and complete mix design shall be required for any change in the nature of the source of the material.
- iv. Tolerances:
  - a. The amount of bituminous material designated for the job shall be within 0.3 percentage points.
  - b. The temperature of asphaltic mixtures shall not vary from those specified by more than 9°C.
  - c. Hot plant-mixed materials shall be placed with sufficient time remaining to allow for compaction be completed during daylight hours, when the air temperature is above 2°C and rising, and the roadway surface is dry.
  - d. A minimum compacted thickness of hot mix asphaltic concrete on all roadways shall be 50 mm, unless specified otherwise. Asphalt pavement with excess thickness may be accepted if surface, grade tolerances and textures are met, and no additional payment will be made to the Developer. In areas where the specified asphalt pavement thickness is in question, three (3) cores shall be taken from each 1,000 m<sup>2</sup> of applicable mat and the average thickness of the three cores shall be considered as reference thickness for that area. If the average core thickness is deficient from the specified thickness, that area shall be assessed a payment reduction factor according to the Table G6.7-1:

**Table G6.7-1 Asphaltic Concrete Pavement Unit Price Reduction for Pavement Thickness**

<b>Thickness Deficiency (mm)</b>	<b>Payment Reduction Factor (%)</b>
0 - 5	0
6 - 9	10
10 - 12	25
13 - 15	50
> 15	Reject

- e. Each mat of hot-mix placed shall be compacted to a minimum of 98% of Marshall Density regardless of pavement type. The complete pavement shall have a tightly knit structure and be free from segregation and surface cracking. If the average core density is below the specified density, the represented area of mat may be accepted subject to the following payment reduction factors being applied to the unit price of the mix as shown in the Table 6.7-2 (based on the Alberta Transportation’s Standard Specification 3.50 “Asphalt Concrete Pavement – End Product Specification”):

**Table G6.7-2 A Unit Price Adjustment for Density Unit Price Adjustment**

<b>Lot Mean Density (% of Marshall Density)</b>	<b>Payment Reduction Factor (%)</b>
97.0 - 98.0	No reduction
96.9	0.05
96.8	0.20
96.7	0.45
96.6	0.80
96.5	1.20
96.4	1.75
96.3	2.40
96.2	3.10
96.1	4.00
96.0	4.90
95.9	5.90
95.8	7.05
95.7	8.25
95.6	9.55
95.5	11.00
95.4	12.50
95.3	14.10
95.2	15.80
95.1	17.60
95.0	19.50
94.9	21.50
94.8	23.60
94.7	25.80
94.6	28.10
94.5	30.50
94.4 or lower	Reject (Remove & Replace)

- f. No adjustments to the Contract price shall be made for asphaltic concrete pavements found to have excess densities beyond the values stipulated in the Contract Documents.
- g. Monetary compensations for deficient asphaltic concrete pavements assessed to the Developer do not relieve the Developer of the maintenance requirements stipulated in the Contract Documents.
- v. Construction:
- a. Asphaltic concrete mix shall not be placed:
- During periods of rain or when there is imminent danger of rain.
  - During excessive winds.

- When air temperature is 2°C or cooler, except in specific situations where, in the opinion of the Municipality, conditions warrant the risk involved.
- b. The prepared base shall be dry and clean of all loose or foreign materials. Where tack coat or asphalt sealer is applied, it shall be thoroughly cured prior to placing the asphaltic concrete mix. Where existing pavements are to be overlaid, a leveling course of hot asphaltic concrete mix may be required prior to placing the surface course, as specified by the Municipality. The leveling course shall be placed with a paving spreader and shall meet all of the requirements stated in this Section, unless otherwise approved by the Municipality.
- c. The asphaltic concrete mix shall be transported in vehicles equipped with protective covers and clean, tight, smooth-sided boxes. The inside surface of the box shall be lubricated with a light coating of soap or detergent solution; petroleum derivatives shall not be permitted. Any accumulation of dirt or asphaltic material in the box shall be thoroughly removed and cleaned before loading with hot asphaltic concrete mix. Trucks shall have an easily accessible 12 mm diameter hole in the side panel of the box located at a distance of 300 mm from the bottom for the purpose of checking temperatures of the asphaltic concrete mix.
- d. The delivered asphaltic concrete mix shall be spread at temperatures that, when measured in the hopper of the spreader, are not lower than 125°C or higher than 150°C. Unless otherwise permitted by the Municipality, the mix shall be spread by a mechanical self-powered paver equipped with an automatic leveling device, and capable of spreading the mix without segregation or tearing in thicknesses varying from 12 mm to 100 mm and widths from 2.5 m to 4.2 m, and to true line, grade and cross-section as shown on the Contract Drawings.
- e. Prior to roller compaction, the surface of the mat shall be checked and inequalities adjusted. Areas found to have fat spots, sandy accumulations or other irregularities shall be removed and replaced with fresh hot mix. Irregularities in alignment and grade shall be corrected by the addition or removal of the mix before rolling compaction. Prior to addition of the material, the surface shall be loosened up to ensure proper bonding. Edges against which additional pavement is to be placed shall be straight and as close to vertical as practical. The mat shall be worked on to achieve a true line and vertical face.
- vi. In small areas where the use of mechanical finishing equipment is not practical, the mix may be spread and finished manually, if so directed by the Municipality. Placing manually shall be performed carefully and the mix shall be distributed uniformly to avoid segregation of aggregates. Broadcasting of material shall not be permitted. During the spreading operation, all material shall be thoroughly loosened and uniformly distributed. Lumps shall be removed from the area. Following placing and

before compaction, the surface shall be inspected and all irregularities shall be corrected prior to compaction.

- vii. The Contractor shall provide heating equipment for keeping hand tools free from asphalt build up. Caution shall be exercised to prevent high heating temperatures which may burn the material. The temperature of the tools, when used, shall not be greater than the temperature of the mix being placed.
- viii. When constructing longitudinal joints between mats, a narrow strip along the edge of the mat that will be joined with another mat shall be left without rolling until the adjoining mat has been placed against it. The joint that is formed shall be compacted immediately after the adjacent mat has been placed and while the mix is still sufficiently warm to ensure proper bond between the mats.
- ix. When constructing transverse joints between mats, those shall be carefully formed, leveled and thoroughly compacted to provide a smooth surface with no bumps or dips. Joints shall be straight-edged or string-lined to assure smoothness and true alignment, and shall have a minimum of 1 m horizontal longitudinal offset from joints of nearest mats.
- x. In order to ensure that the surface of the previously placed mat does not cool prior to placing of the adjacent mat, the paver shall not advance from the beginning of the adjacent mat beyond the limits shown in the table below:

<b>Air Temperature, °C</b>	<b>Maximum Length of Advancement, (m)</b>
27	250
15 - 27	190
7 - 15	125
7	90

- a. When the surface course is being laid and the air temperature is below 7°C, an infrared heat generator shall be used in front of the spreader in order to heat the abutting joint. The heat generator shall be attached to the side of the asphalt paver and located so as to heat a minimum of 100 mm wide of the previously placed mat and a minimum of 100 mm wide of the adjoining mat. The heat generator shall provide a minimum of 120,000 KJ/hour of flameless heat energy flow and a minimum of 850°C unit face temperature in 1 m of exposed joint. Oxidized or carbonized bituminous materials forming as a result of infra-red heating shall not be accepted. Transverse joints shall be similarly heated using a portable infra-red heat generator with a minimum output of 60,000 KJ/hour with a minimum 850°C unit face temperature in 500 mm of exposed joint.
- b. Where directed by the Developer’s Engineer, the top surface of the joints shall be coated with the approved bituminous material or sealant. Where

previously placed mats are to be abutted, it shall be cut back to a point where the height of the vertical cut face equals the depth of the previously placed mat. The exposed edge of the existing pavement shall be coated with an approved bituminous material or sealant and fresh hot mix shall be placed against it, leveled and thoroughly compacted.

- xi. Testing and inspection:
  - a. The following standard tests shall be carried out for each 1,000 tonnes of asphalt placed pavement, to a minimum of two (2) sets of tests during each placing shift:
    - Marshall Stability, as per ASTM D1559.
    - Sieve Analysis, as per ASTM C136 & C117.
    - Bulk Specific Gravity, as per ASTM D2726.
    - Bitumen Content, as per ASTM D2172.
    - % Voids in the Mineral Aggregate (VMA), as per ASTM D2726.
    - Air Voids, as per ASTM D3203.
    - Core Densities (one (1) core per each 1,000 m<sup>2</sup> of constructed pavement).

## **G.7 RE-CYCLED ASPHALT**

### **G.7.1 General**

- i. Asphaltic concrete pavement surface re-cycling is a rehabilitation process in which the surface of the existing pavement is heated in place, scarified, re-mixed, re-placed and compacted.
- ii. Asphalts, recycling agents, freshly produced asphalt mix, aggregates, or a combination of these may be employed to obtain the desirable pavement characteristics. Emulsified asphalt or recycling agent can be applied to the surface prior to the placement of a new wearing course.
- iii. The surface recycling shall not be done during periods of rain, during excessive winds or when the ambient temperature is 2°C or cooler.

### **G.7.2 Cold Mix Re-cycling**

- i. Cold mix re-cycling is a process in which reclaimed asphaltic concrete pavement materials and/or reclaimed aggregate materials are combined with freshly produced asphalt and/or recycling agents to produce a cold base mix.
- ii. Cold mix re-cycling shall involve ripping, scarifying, pulverizing or crushing of the existing asphaltic concrete pavement, which is then either hauled to a central site for processing and upgraded with asphalt cement or emulsified, or it is treated in place. Prior to construction, representative samples of all materials shall be provided by the Contractor, and the asphalt content, asphalt consistency and aggregate gradation shall be determined through laboratory testing by the accredited agent. The materials shall then

be blended and a minimum mix design requirements shall be developed. Construction of an asphalt surface course over the cold mix pavement is optional and shall be as per Contract Drawings and Specifications.

**G.7.3 Hot Mix Re-cycling**

- i. Hot mix re-cycling is a process in which reclaimed asphaltic concrete pavement materials and/or aggregate materials are combined with freshly produced asphalt and/or recycling agents, and/or new aggregate as necessary, to produce a hot mix which conforms to the asphaltic concrete pavement standards.
- ii. The existing asphaltic concrete pavement shall be scarified by mechanical means and the material removed to a crushing plant where it is sized, or the material may be sized in place with rotating drum milling equipment or hammer mills, and then hauled to a central site for processing. This material contains both asphalt and aggregate. The gradation of the aggregate and the consistency of the extracted asphalt shall be determined through laboratory testing by the accredited agent. If determined necessary, soft asphalt or recycling agent shall be used to enhance the properties of weathered asphalt in the reclaimed asphalt pavement.

**G.7.4 Asphaltic Dust Abatement**

- i. General:
  - a. Asphaltic dust abatement consists of mixture of crushed aggregate and crude oil that is road mixed-in-place, spread, placed and graded upon the previously prepared roadway surface, compacted and finished as shown on the Contract Drawings and Specifications.
- ii. Materials:
  - a. The Developer shall submit the information about the source of aggregates and a representative sieve analysis test results for each type of aggregate to the Municipality for approval. The crushed aggregate, whether produced or processed, shall be tested by the accredited testing firm or agent in accordance with the current standard testing methods. The crushed aggregate shall be composed of sound, hard and durable particles of sand, gravel and rock, and shall be free from elongated particles, injurious quantities of flaky particles, soft shale, organic matter, clay lumps and other deleterious foreign matter. The aggregate shall meet the following specified gradation requirements:

Sieve Size,	Passing, %
16,000	100
12,500	89 - 100
10,000	78 - 94
5,000	55 - 70
1,250	26 - 45
630	18 - 38

315	12 - 30
160	8 - 20
80	4 - 10

- b. A maximum tolerance of 3 % in the amount passing the maximum size sieve shall be permitted, providing that 100 % of all oversized aggregate passes the sieve having openings no greater than 5 mm larger than the specified maximum size of the aggregate, and shall have a minimum two face fracture of 60 % for the size of aggregate greater than 5,000 µm.
- c. Crude oil shall be of pipeline quality and meet the following specifications:

Property	Unit	Specification
Absolute Density	@ 15°C	940 - 960
A.P.I. Gravity	@ 15°C	16 - 18.5
Pour Point	ASTM	24°C to -28°C
Water and sediment	% by volume	Max. 0.5 %
Total Sulphur	% by mass	Max. 4 %
Kinematic Viscosity:		
at 20°C	MM <sup>2</sup> /sec	1,010
at 40°C	MM <sup>2</sup> /sec-	241
at 60°C	MM <sup>2</sup> /sec	84
H <sub>2</sub> S	PPM	Max. 10
Spray Temperature	°C	Max. 25
Carbon Residue	Mass Fraction	0.128

## G.8 CONCRETE

### G.8.1 Intent

- i. This standard covers the manufacture and placing of concrete, reinforced concrete and related work for the construction of curbs, gutters, sidewalks, catch basins, duct lines, sewers and other ancillary structures associated with roadway construction but not including bridges.

### G.8.2 Materials

- i. Portland cement:
- a. Portland cement shall conform to the Standard Specifications for Portland cement (ASTM Designation C150), and shall be of the following types:
- Normal Type 10
  - High early strength Type 30

- Sulfate resistant
  - Concrete aggregates.
- Type 50
- b. Concrete aggregates shall conform to the Standard Specifications for Concrete Aggregates (ASTM Designation C33).
  - ii. Air entraining agent.
    - a. Air entraining agents shall conform to ASTM Standard Specification C260.
  - iii. Calcium chloride.
    - a. Normally, the use of calcium chloride admixtures shall not be permitted. During cold weather conditions, should the use be approved by the Municipality, calcium chloride shall conform to ASTM Standard Specification D098. The maximum calcium chloride admixture content shall be 2 % by weight of cement in Type 10 concrete only.
  - iv. Water.
    - a. Water used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalis, organic materials or other deleterious substances.
  - v. Metal reinforcement.
    - a. Reinforcing bars shall be deformed bars in accordance with ASTM Standard Specification A615.
  - vi. Cold drawn wire.
    - a. Cold drawn wire or welded wire fabric for concrete reinforcement shall conform to the requirements ASTM Standard Specification A82.
  - vii. Curing compound.
    - a. Curing compound shall be resin based impervious and shall conform to ASTM Standard Specification C309 Type ID - Type B. The curing compound shall contain white fugitive dye. The use of curing compounds shall not profoundly change the colour of the concrete. The curing compound shall produce a film on the concrete surface that is distinctly visible for a period of at least four (4) hours after application.
  - viii. Sealing solution.
    - a. Sealing compound shall be mixture of 50 % Kerosene or Varsol and 50 % boiled Linseed Oil or approved alternate.
  - ix. Retarding admixtures.
    - a. Retarding admixtures shall conform to ASTM Standard Specification C494.
  - i. Fly ash.



- a. Maximum fly ash content shall be 10 % by mass of cement. The use of fly ash in concrete shall not be permitted after September 1st.

### **G.8.3** Concrete mix design

- i. Concrete used for curbs, gutters, and sidewalks shall meet the following requirements:
  - a. Min. compressive strength at 28 days: 30 MPa
  - b. Max. size of coarse aggregate: 20 mm
  - c. Slump: 25 - 75 mm
  - d. Entrained air content: 5 - 8 %
- ii. All concrete shall achieve a compressive strength of 30 MPa in 7 days when placed after September 30th.

### **G.8.4** Composition and Proportioning

- i. The design of the concrete structure is based upon the assumption that concrete shall develop the specified compressive or flexural strength at 28 days and a 7 day test resulting in approximately 70 % of the 28-day strength.
- ii. Cement and aggregate shall be stored in such a manner as to prevent deterioration or intrusion of foreign matter; any material that has deteriorated or that has been damaged shall not be used for concrete.
- iii. Batching materials:
  - a. Cement shall be measured by weight and shall be weighed on a scale separate from those used for other materials.
  - b. Aggregate shall be measured by weight. Batch weights shall be based upon dry materials and shall be required weights of dry material plus the total weight of moisture (both absorbed and surface) contained in the aggregate.
  - c. Water shall be measured by volume or by weight. The device for the measurement of the quantity of water shall be readily adjustable and, under all operation conditions, shall have accuracy within 1 % of the quantity of water required for the batch. The device shall be so arranged that the measurement shall not be affected by variable pressures in the water supply line. Measuring tanks shall be equipped with outside taps and valves to provide for checking their calibration, unless other means are provided for readily determining the amount of water in the tank.
  - d. Powdered admixtures shall be measured by weight and paste, or liquid admixtures by weight or volume, within a limit of accuracy of 3 % of the required weight. All air entraining agents, or other admixtures, shall be introduced to the mix at the batching plant during the initial batching cycle. No admixtures shall be added at the job site.

**G.8.5 Concrete Classes**

Unless otherwise specified, all concrete used in roadway construction shall be one of the following classes as shown in Table G8.5-1: Classes of Concrete

<b>Class</b>	<b>Minimum 28 Day Compressive Strength (MPa)</b>	<b>Slump (mm)</b>	<b>Entrained Air Limits (%)</b>	<b>Max. Aggregate Size (mm)</b>
Class A: Exposed pavement	30	60 +/-10	5.5 - 8	28
Class B: Pavement base or unexposed use	30	60 +/-20	5.5 - 8	28
Class C: Exposed road associated works	30	60 +/-20	5.5 Up	28
Class D: General unexposed use	30	60 +/-20	5.5 - 8	28
Class E: Filler	10	80 +/-20	5.5 - 7	28

- i. No subscript shall be used when Normal Portland Cement is required. A subscript "30" attached to any of the above classes shall indicate that High Early Cement is specified. A subscript "50" attached to any of the above classes shall indicate that Sulphate Resistant cement is specified.
- ii. Any concrete placed after September 30 will not be accepted unless the specified 28-day minimum compressive strength is attained in seven (7) days after placing and sampling.

**G.8.6 Equipment**

- i. All equipment used for batching, mixing and hauling concrete shall conform to ASTM Standard Specification C 94.
- ii. Hauling:
  - a. When hauling equipment is used, concrete shall be delivered to the site and discharged into the work within 1.5 hours after introduction of the mixing water to the cement and aggregate mix.
  - b. All concrete shall be hauled using drum-type haulers capable of agitating or mixing the concrete within speed tolerances as specified by the equipment manufacturer.

**G.8.7 Forms**

- i. Forms, either of steel or wood, shall conform to the shape, lines and dimensions of the concrete as shown on the Contract plans. Lumber used to form future exposed concrete surfaces shall be dressed to a uniform thickness and shall be free from loose knots or other defects. Joints in forms shall be either horizontal or vertical. For unexposed surfaces and

rough work, undressed lumber shall be used. Lumber once used in forms shall have nails withdrawn and surfaces in contact with the concrete are to be thoroughly cleaned before being used again for forming for another concrete structure.

- ii. Forms shall be substantial and sufficiently tight to prevent leakage. They shall be properly braced or tied together so as to maintain position and shape. If adequate foundation for shores cannot be secured, trussed supports shall be provided.
- iii. Bolts and rods shall be used for internal ties. They shall be so arranged that when the forms are removed, no metal shall be within 25 mm of any surface. Wire ties shall be permitted only on light work. They shall not be used through surfaces where discoloration would be objectionable. Forms shall be set to line and grade, and so constructed and fastened as to produce true lines. Special care shall be used to prevent bulging of the form when placing concrete.
- iv. The inside of forms shall be coated with non-sustaining mineral oil or other approved material, or thoroughly wetted (except in freezing weather). Where oil is used, it shall be applied before the reinforcement is placed.
- v. Forms shall not be disturbed until the concrete has adequately hardened. Shoring shall not be removed until the concrete member has acquired sufficient strength to safely support its own weight and the load upon it.
- vi. In the case of sidewalks, monolithic curbs, gutters and walks, the Contractor shall backfill with 15 MPa concrete between pavement and walk edges as soon as possible after the removal of forms. The backfill shall be left 60 mm low to allow for bituminous asphaltic infill, as approved by the Municipality.

#### **G.8.8** Placing of Concrete

- i. The prepared sub-grade elevation shall be the design elevation of the bottom of the concrete structure. The sub-grade shall be compacted to the following minimum requirements:
  - a. Curbs, driveways  
and swales in travelled areas 100 % of Standard Proctor Density
  - b. Sidewalks 98 % of Standard Proctor Density
- ii. No more than 25 mm of cushion material shall be placed on the sub-grade.
- iii. Concrete shall be handled from the mixer to the place of final placing as rapidly as practicable by methods that shall prevent the separation or loss of the ingredients. The interval between placing successive batches shall not exceed 50 minutes. It shall be placed in the forms as nearly as practicable in its final position to avoid re-handling. The sequence of concrete placement shall be arranged so that concrete which has partially hardened shall not be subjected to injurious vibration.

- iv. The vertical height of free fall of concrete shall not exceed 1 m. For falls greater than 1 m, chutes or concrete pumps shall be used.
- v. During placement, concrete shall be sufficiently tamped and vibrated with suitable equipment to secure close bond with the reinforcement, eliminate entrapped air voids, and ensure a homogeneous structure with adequate consolidation. Particular care shall be given to placing and tamping along the faces of the forms to ensure a dense smooth surface. Vibrations shall be of sufficient duration to thoroughly compact the concrete, but the duration shall not be long enough to cause segregation. Vibrators shall not be used for moving concrete. After the initial set of the concrete the forms or concrete structure shall not be jarred and no strain shall be placed on the ends of projecting reinforcement.
- vi. If a section is to be continued at a later date, a construction joint shall be made with three (3) 10 mm diameter reinforcing bars equally spaced and extending a minimum of 0.5 m into both the existing and the future pour. Vibration shall be done by pencil vibrators and/or a vibrating screen, and shall be of sufficient duration only to prevent honeycombing.
- vii. The Developer shall submit the specifications of the proposed concrete slip form / extrusion equipment to the Municipality for review prior to use. The approved slip form / extrusion machine shall be so designed as to place, spread, consolidate, screed and finish the concrete in one (1) complete pass in such a manner that the minimum of hand finishing will be necessary to provide a dense and homogeneous concrete section. The machine shall shape, vibrate and/or extrude the concrete for the full width and depth of the concrete section being placed. The operation of the machine shall be continuous until a section or scheduled pour is completed. The interval between successive loadings of the concrete hopper shall not exceed 30 minutes. If the operations are delayed, or if the section is to be continued later, the machine shall be emptied and a joint constructed as outlined herein. A similar joint shall be constructed at the beginning of the extruded section. Excess concrete that has passed through the machine shall not be re-used.
- viii. No concrete shall be placed on frozen sub-grade, subbase or base. After September 30th, all concrete shall attain the specified strength in 7 days from placing. When the ambient temperature is less than 5°C, concrete delivered to the site shall have a temperature not less than 15°C. For concrete placed in conditions when the ambient temperature is expected to fall below 2°C, the Contractor shall completely cover the concrete and forms, maintaining an adequate air cushion between the concrete and cover, using approved insulating material. If, using insulation, temperature of 18°C cannot be maintained for 72 hours after placing, then concrete work shall cease.

- ix. Hot weather shall be considered to be an air temperature in the shade of 23°C or above. The concrete temperature at the time of placing in hot weather shall not exceed 30°C. In the event that this limit is exceeded, the concrete operations shall be suspended until the constituent materials of the concrete are cooled.

#### **G.8.9 Reinforcing**

- i. Reinforcing shall be installed as required by the Contract Drawings and Specifications. Where necessary, additional reinforcing steel shall be installed as required by the Municipality at no additional cost to the Municipality.
- ii. Lane crossings and commercial crossings shall be reinforced. Reinforcement bars shall be provided where concrete swales meet sidewalks, where concrete sidewalks are poured separately from the curb and gutter or when the pouring of concrete is suspended by more than 30 minutes. Reinforced joints shall contain one (1) 10M bar for every 300 mm of width of the structure, and the bars shall extend a minimum of 600 mm into both sides of the joint.

#### **G.8.10 Finishing**

- i. Working of the surface in the finishing operations shall be kept to a necessary minimum to produce the specified finish. The finished surface shall have a fine granular or sandy texture without exposed aggregate or entrapped air holes.
- ii. If there is evidence of excess water on the concrete surface, finishing shall be delayed until the excess water has evaporated.
- iii. A nylon bristle brush of an approved type shall be required. Surface grooves made by the broom shall not be more than 3 mm deep. Before brushing, all surplus water shall be removed from the brush.
- iv. A burlap finish shall be formed by dragging longitudinally in the direction of concrete placement a multiple ply burlap drag equal in length to the width of the concrete slab and having at least 1 m in contact with the concrete. The dragging shall be carefully done so as to produce a finished granular or sandy texture without disfiguring marks.
- v. Where approved by the Municipality, mortar consisting of cement and fine sand, mixed in the proportions used in the concrete, may be applied to extruded concrete to fill irregularities in the surface. This mortar shall not be applied after the concrete has attained its initial set, and at no time shall excess mortar be applied to cover the concrete surface.

#### **G.8.11 Curing**

- i. Exposed concrete surfaces shall be protected by using a resin base impervious membrane or another method of curing approved by the Municipality.

- ii. Resin base compound shall be applied under pressure to the concrete surface to form the impervious membrane. The application with a spray nozzle shall be done in such a manner as to cover the entire surface thoroughly and completely with a uniform film at a rate that shall depend on the roughness of the surface of the concrete but in no case shall be less than 0.25 litres/m<sup>2</sup> of concrete surface.
- iii. If moist curing is specified in the Contract Documents, after the concrete has set sufficiently, the exposed surfaces of the concrete shall be kept continuously moist using wet burlap or polyethylene film in contact with the concrete for at least seven (7) consecutive days after placing, when normal or sulfate resistant Portland cements are used, and for at least three (3) consecutive days, when high early strength cement is used.

#### **G.8.12 Surface Sealing**

- i. Two applications of an approved sealing solution shall be sprayed on all exposed concrete. The concrete shall be dry and swept clean when the solution is applied. First application shall be made within seven (7) days after placing the concrete. Second application shall be made immediately after the first has been absorbed and concrete surface regains its dry appearance. The first application shall give coverage of maximum of 9 m<sup>2</sup> of concrete surface per one (1) litre of sealant. The second application shall give coverage of maximum of 12 m<sup>2</sup> of concrete surface per one (1) litre of sealant.

#### **G.8.13 Joints**

- i. Stress relieving, contraction, construction and longitudinal joints shall be constructed where required as shown on the Contract Drawings and Specifications.
- ii. Where specified, stress relieving joints shall be constructed either by sawing or by installation of polyethylene separators. Sawn joints shall be saw cut as late as possible following concrete finishing but without permitting cracking to develop in the concrete. The time at which such saw cutting is to be undertaken shall be determined by the Contractor. The Contractor shall be wholly responsible for all concrete defects arising from the cutting operation. As an alternative to saw cutting, stress relieving joints may be formed by equipment capable of inserting polyethylene film into the fresh concrete in a straight line and to the depth specified.
- iii. Contraction joints shall be formed to fully control cracking. Surface joints shall not exceed 12 mm in depth. Generally, transverse contraction joints shall be formed every 3 m. Where specified, sawn joints shall be saw cut in such a manner that the edges are smooth and no aggregate is removed from the surface of the concrete. Formed contraction joints shall be constructed with plates penetrating the concrete to specified depth. The joint edges shall be finished with a 6 mm radius in both edges when the plates are removed.

- iv. Tooled joints in extruded concrete shall be formed to depth specified and finished to a 6 mm radius on both edges. The construction method shall be at the option of the Contractor but shall be subject to approval by the Municipality. The construction method used shall not affect the line and grade of the extruded structure.
- v. A surface joint, or a “dummy” joint, shall be constructed to the depth specified and finished to a 6 mm radius on both edges.
- vi. Construction joints shall be constructed with a formed Keyway or "Vee" as shown on the Contract Drawings. Edges shall be finished to a 6 mm radius. This joint is to be formed at a 10 mm depth.
- vii. When required, expansion joints shall be shown on the Contract Drawings.

#### **G.8.14** Testing and Inspections

- i. Slump, air content and compressive strength tests shall be performed on the concrete for each 150 m<sup>3</sup> placed for each class of concrete, with at least one (1) test for each day of placing concrete, unless otherwise specified.
- ii. Sampling and testing shall be performed in accordance with the following:
  - a. Compression test specimens: Standard method of "Making and Curing Concrete Test Specimens in the Field" in accordance with ASTM Specification C31.
  - b. Compression test: Standard Method of "Test for Compressive Strength of Cylindrical Concrete Specimens" in accordance with ASTM Specification C39.
  - c. Air content: Standard Method of "Test for Air Content of Freshly Mixed Concrete by the Pressure Method" in accordance with ASTM Specification C231.
  - d. Slump: Standard Method of "Test of Slump of Portland Cement Concrete" in accordance with ASTM Specification C143.
  - e. Sampling fresh concrete: Standard Method of "Sampling Fresh Concrete" in accordance with ASTM Specification C172.

#### **G.8.15** G.8.15 Curbs

- i. Concrete curb and gutter shall be constructed on all urban roadways according to the Contract Drawings and cross sections.
- ii. The vertical face curb and gutter cross section shall be used on all roadways fronting commercial properties or public lands such as parks and Public Utility Lots (PUL), and for all arterial roadways. Vertical face curbs shall also be used within the right-of-way when crossing pipelines unless separate vehicle barriers are provided to prevent unauthorized access.
- iii. The rolled face curb and gutter shall be used on all local and residential roadways allowing driveway access.

- iv. Curbs shall be constructed on prepared sub-grade, cement stabilized sub-grade, granular base course, soil cement or asphalt concrete. Curbs with a radius less than 40 m shall be constructed with flexible forms, well staked and braced to the design lines and grades.
- v. Curbs shall be constructed using Portland cement conforming to CSA A3000. Materials, production, delivery, placement and finishing shall conform to CSA A23.1. One (1) slump, air content and compressive strength test shall be required for every 60 m<sup>3</sup> of cast in place concrete. The minimum specified 28-day concrete compressive strength shall be 30 MPa. Air entrainment shall be within 6 – 8 % by volume.
- vi. Curb returns on all residential street intersections shall have a minimum radius of 9 m. Curb returns on all commercial and industrial street intersections shall have a minimum radius of 15 m and shall be designed to accommodate heavy truck turning movements.
- vii. The minimum gutter grade shall be at 0.5 % except for cul-de-sac bulbs, curb returns and catch basin approaches, which shall be at 0.8 %. The 0.5 % minimum grade shall be maintained throughout sag vertical curves to avoid the short length at near-horizontal grade.
- viii. For all urban cross sections, wick drains shall be placed below the curb between the sub-grade and granular base course. The wick drain shall be connected to the nearest catch basin.
- ix. Curbs shall be backfilled with suitable soil within seven (7) days of concrete placement and prior to placement of the roadway structure. The clay material shall be backfilled and compacted as specified by the Municipality to within 100 mm below the top of the curb to allow for the placement of topsoil material.

#### **G.8.16 Sidewalks**

- i. Sidewalks shall be accessible to all persons as well as being safe, functional and aesthetically pleasing as approved by the Municipality. Sidewalks installed for new subdivisions shall be integrated with the existing walkway system on intersecting roadways. Curb ramps shall be constructed at all curbed intersections.
- ii. Horizontal sidewalk alignment for separate sidewalks shall be at a constant offset from the adjacent roadway. Separate sidewalks shall be a minimum of 1.5 m wide, with the exception of mobile homes communities, where the minimum width of concrete sidewalk shall be 1.2 m. The requirements for sidewalks in commercial and industrial areas shall be reviewed on a site-specific basis in conjunction with the proposed use and other required services.
- iii. The granular base course under the sidewalk shall consist of 150 mm compacted thickness of Designation 2 Class 20 aggregate. The gravel base course under the sidewalk shall be compacted to 100 % of Standard Proctor Maximum Density.



- iv. Sidewalks shall be constructed using Portland cement conforming to CSA A3000. Materials, production, delivery, placement and finishing shall conform to CSA A23.1. One (1) slump, air content and compressive strength test shall be required for every 60 m<sup>3</sup> of cast in place concrete. The minimum specified 28-day concrete compressive strength shall be 30 MPa. Air entrainment shall be within 6 – 8 % by volume. All sidewalks shall be reinforced as per the Contract Drawings.
- v. Sidewalks shall be graded to facilitate positive drainage flow. The minimum grade shall be at 0.5 %. Wick drains shall be provided under monolithic sidewalk, curb and gutter structures.
- vi. Sidewalks shall be imprinted at beginning, end and intersections with the Contractor's stamp indicating year of construction. Sidewalks shall also be imprinted with a "CC" at all curb cock locations.

## **G.9 PAVED PATHWAYS, GRANULAR WALKWAYS AND WOODCHIP MULCH HIKING TRAILS**

- G.9.1** It is the Developer's responsibility to design and construct walkways and trails as required by the Development Agreement. Where a walkway or trail is required to be incorporated into a proposed subdivision, the alignments and locations within the subdivision shall allow for adequate public access to parks, recreational areas and environmental and municipal reserves. Rest areas are to be incorporated into the right-of-way width for every 800 m of length of walkway or trail. Rest areas shall incorporate a bench and a waste receptacle as approved by the Municipality.
- G.9.2** Wherever possible, walkways and trails shall be centered within the right-of-way. Walkways and trails may be offset from the centreline in situations where this will prevent conflicts with utilities sharing the same right-of-way. Where the walkway or trail is located within an existing utility right-of-way, the Developer shall be responsible for obtaining necessary permits and agreements from the proper authority. Where the walkway or trail right-of-way is not shared with other utilities, R.O.W shall be a minimum of 6 m wide with a minimum clearance of 2 m from the edge of the walkway or trail to the property line.
- G.9.3** Top of bank walkways and trails shall be designed and constructed so as not to impede natural and post subdivision drainage down the embankment. Grading shall ensure that concentrated overland flows are not generated anywhere along the bank unless an engineered outlet structures is present.
- G.9.4** Where walkways and trails cross drainage swales, ditches or natural drainage courses, culverts or footbridges shall be designed to accommodate a 1:25 year storm without overtopping. Culverts and footbridges shall require approval by Alberta Environment and applicable Federal Agencies.
- G.9.5** Walkway and trail grading shall ensure positive drainage with a minimum crown or cross fall grade of 2 %. Grading shall be designed in order to incorporate the overall drainage pattern of the proposed and adjacent subdivisions.

- G.9.6** The walkway sub-grade shall be compacted to a minimum 95 % of Standard Proctor Density for a minimum depth of 150 mm. Surfacing material shall be approved by the Municipality prior to installation.
- G.9.7** The asphalt and other materials for paved pathways, mixing, placing and compaction shall conform to the current standards and specifications.
- G.9.8** For granular walkways, the excavation is to be lined with a geotextile fabric liner prior to placement of the granular material. The edge return for the geotextile fabric shall be anchored 0.06 m below excavation depth. The granular material shall be spread uniformly and compacted to 95 % of Standard Proctor Density.
- G.9.9** For woodchip mulch hiking trails, the excavation is to be lined with a geotextile fabric liner prior to placement of the woodchip mulch. The edge return for the geotextile fabric is to be anchored 0.06 m below excavation depth. The woodchip mulch shall be spread uniformly with a minimum 2 % crown or cross fall and smooth roller compacted in-place ensuring a uniform depth and surface appearance.
- G.9.10** Where walkway or trail is planned through wooded areas, the minimum width shall be 1.5 m or as specified by the Municipality. The minimum headroom clearance at the center line of the walkway or trail shall be 2.5 m. Vegetation shall be cleared for a minimum of 0.6 m outside from either edge of the walkway or trail.

## **G.10 TRAFFIC CONTROL DEVICES**

### **G.10.1 General**

- i. A traffic control device is a sign, signal, marking, barrier or other device placed upon, over or adjacent to a roadway that is intended to regulate, warn, or guide the roadway user. Traffic control devices shall be manufactured and installed in accordance with the latest version of the *"Manual of Uniform Traffic Control Devices for Canada"*.
- ii. Traffic control devices intended for use within and, if needed, adjacent to the proposed subdivision shall be justified, assigned and designed by the Professional Engineer and shall be approved by the Municipality prior to installation.
- iii. Traffic control devices shall be kept serviceable year-round for the safe movement of traffic in day, night and adverse weather driving conditions. No traffic control device, nor its support, shall bear any commercial advertising.
- iv. Temporary traffic control devices shall be installed to provide roadway users and pedestrians with adequate warning of construction or otherwise unusual and hazardous conditions. It shall be the Developer's responsibility to design a plan showing temporary traffic control devices, types, locations, spacing and other characteristics and submit it to the Municipality for approval. Whenever possible, such plan shall be a part of the proposed

subdivision engineering design approved prior to commencing of construction. During construction period, should changes or updates to such plan become necessary, the submission of changes to the Municipality for approval shall be at least 72 hours prior to construction activity taking place or otherwise normal traffic flow disruption within or adjacent to the proposed subdivision.

### **G.10.2** Traffic Signs

- i. Traffic signs inform roadway users of traffic regulations, changing roadway characteristics, warn about road hazards and provide necessary information for route selection. Simplicity in design, care in placement and a standard of maintenance are essential. Traffic signs shall be installed only when justified and approved by the Municipality and according to the Contract Drawings and Specifications. Signs shall be placed so as not to obstruct the view of oncoming vehicles.
- ii. Materials:
  - a. Traffic signs made of treated ferrous and non-ferrous metal and waterproof resin bonded plywood are suitable for use in permanent signs. Wooden boards may be approved for use to construct large signs and temporary and seasonal signs. Information sign panels shall be constructed with high intensity reflective surface as per latest standards.
  - b. Where applicable, it is encouraged that all signs be placed on existing supports used for other purposes, such as traffic signals or street lights. If sign posts are required, they shall be made of galvanized steel as approved by the Municipality and shall have breakaway coupling installed 50 mm above ground level or sign base. Stainless steel fasteners shall be used to attach signs to their supports. Damaged signs shall not be allowed for installation.
  - c. Sign posts shall be 50 mm diameter schedule 40 galvanized steel posts.
- iii. Sign posts shall be located horizontally at 3 m offset from the shoulder of the roadway and at least 0.3 m from the curb. Sign posts shall be installed vertical and the signs shall be levelled. The bottom of the sign shall be from 1.5 m to 2.5 m above the top surface of the nearest travel lane, with the preferred height at 2.0 m, whenever possible. Signs shall be positioned with best possible visibility for roadway users in mind. Stop signs and yield signs shall be positioned in line with the nearest property line of the intersecting roadway allowance.
- iv. Street identification signs shall be located within 10 m of the intersection in the direction of the near-side approaching traffic. Street identification signs shall be offset at least 1 m from the edge of the road and mounted 3.0 - 3.5 m above the finished roadway surface. Street identification signs shall be a minimum size of 15 cm x 60 cm and a maximum of 15 cm x 90 cm. The lettering shall be 10 cm high. If the street identification does not fit on the maximum sign size, two or more signs may be joined with an end bracket

and H-clip. Signs shall have silver reflective lettering with a green reflective background. Street identification sign locations shall be approved by the Municipality and included in the Development Agreement.

- v. It is the Developer's responsibility to design, supply and install a Municipal Address Sign. The Municipal Address Sign shall be positioned within the roadway right-of-way adjacent to the first lot on the right hand side at the main entrance to the proposed subdivision. The sign design and proposed location shall be submitted to the Municipality for approval prior to installation.

### **G.10.3 Pavement Markings**

- i. Pavement markings are traffic control devices placed on the pavement surface to delineate and clarify traffic and pedestrian movement by regulating, warning and conveying information to roadway users without diverting attention from the roadway. Refer to the *"Manual of Uniform Traffic Control Devices for Canada"* for pavement marking details.
- ii. Temporary traffic marking materials shall be either industrial traffic marking paint or thermoplastic material unless otherwise approved by the Municipality. Permanent traffic markings, required for issuance of the FAC, shall be thermoplastic material.
- iii. Pavement markings shall conform to the following:
  - a. Color: yellow (solid) lines shall delineate the separation of opposing traffic flows. White lines shall delineate the separation of traffic flows in the same direction. All lateral pavement markings shall be white.
  - b. Pattern: solid longitudinal lines shall indicate that lane changing is not permitted. Broken longitudinal lines shall indicate that lane changing is permitted. The line to gap ratio for broken lines shall be 3:6. Lateral pavement markings shall indicate the limits of the roadway user's right-of-way concerning stopping, pedestrian crosswalks, no parking areas and other requirements and limitations.

### **G.10.4 Vehicular Barriers**

- i. While vehicular barriers are designed and installed to reduce the hazard of errant vehicles leaving the roadway surface, they themselves shall also be considered as potential hazards. Installation of the vehicular barriers shall be warranted only where the severity of a potential accident prevented by the vehicular barrier is greater than the hazard presented by the presence of the traffic barrier itself. The purpose of the vehicular barriers is to shield those hazards that cannot be eliminated.
- ii. Vehicular barriers shall be designed by the Professional Engineer and approved by the Municipality prior to installation. Vehicular barriers shall be considered for installation at the following locations:
  - a. across the end of a walkway that terminates in a lane,

- b. across the end of a lane cul-de-sac that abuts a roadway,
- c. along a lane that parallels an adjacent roadway,
- d. near permanent water bodies,
- e. at areas showing a significant and hazardous difference in grade separation,
- f. bridge abutments,
- g. retaining walls, and
- h. as a longitudinal divider on narrow medians.

## **G.11 STREET LIGHTING**

### **G.11.1 General**

- i. The street lighting design shall be in accordance with the current Guide for the Design of Roadway Lighting published by the Transportation Association of Canada (TAC), as well as applicable standards published by the Illuminating Engineering Society of North America (IES). IES standards are acceptable within local road areas only. Arterial/Collector roads shall be to TAC guidelines.
- ii. Street lighting for existing developments and subdivisions, access roads and playgrounds shall conform to these standards. All roadway lighting systems shall be installed in strict compliance with the Canadian Electrical Code.
- iii. It is the Developer's responsibility to ensure that design and construction conform to all current requirements and to arrange with the local power utilities operators for necessary approvals and power connections.
- iv. The Developer shall submit the design drawings and specifications prepared by a qualified Professional Engineer showing the layout, spacing, types and heights of light poles, luminary wattages and other relevant information. The Street Lighting Plan shall include all surface and underground features and utilities, both existing and proposed for installation. The layout, as well as products and materials proposed for supply and installation are subject to approval by the Municipal Engineer prior to commencing the work.

### **G.11.2 Design and Installation**

- i. It is the Developer's responsibility to work with the power service supplier for the design, supply and installation of the street lighting system. The proposed street lighting system standards and specifications shall be readily available from approved manufacturer. The lighting system design shall ensure the proper illumination of conflict areas such as intersections and crosswalks. The design shall be prepared with public safety in mind. Street lights shall be so located as to not interfere with proposed driveways, lanes and motorist's lines of vision, and shall be in line with the extension of common property lines, wherever possible.

- ii. The street lighting system design shall be optimized to allow for the least possible energy consumption while still maintaining compliance with current safety standards. The Municipality encourages the use of the highest efficiency luminary equipment and lamps available at the time of installation.
- iii. Lots configuration and roadways pattern shall dictate the light poles layout. Wherever possible, light poles shall be located at the projection of lot lines. Light pole locations shall not conflict with other utilities, features or approaches. Locations, spacing and light pole setbacks shall be determined by a Professional Engineer based on the optimum spacing/height/light distribution combination and shall conform to the minimum standards published by the TAC.
- iv. Corrosive resistant street light poles complete with fixtures and concrete pedestals only shall be used unless otherwise approved in writing. Pole types shall be consistent with adjacent subdivisions. All poles within a proposed new subdivision shall be of the same type and height. All poles shall be resistant to climatic and environmental conditions encountered within the Municipality. The use of decorative poles shall be subject to approval by the Municipality. Proposed decorative poles and luminaries shall share common optical systems and components as other decorative items found in existing subdivisions within the Municipality. A submission of samples may be required by the Municipality prior to approval.
- v. Breakaway poles shall not be required for design speeds of less than 80 km/h. Yielding poles are recommended for all roadways with a design speed less than 80 km/h and pole setback of less than 4 m from edge of pavement. Steel poles shall be galvanized and powder coated. Aluminum poles shall be powder coated. Composite poles shall be manufactured by the pultrusion method.
- vi. Pole foundations shall be designed based on the site specific soil conditions. The foundations shall be designed to withstand all loading, wind loading in particular.
- vii. Wherever possible, street light cables shall be installed underground. Cables crossing all roadways or driveways shall be placed in direct-burial type rigid plastic pipe using one pipe per individual cable unless noted otherwise.
- viii. Where roadways are designated for widening within five years of the proposed light poles installation, the poles setback shall allow for such widening avoiding or minimizing the future light poles removal and re-installation.
- ix. Luminaries requirements shall be as follows:
  - a. complete with IP66 Certified Sealsafe optical chamber,
  - b. luminaries' optical systems shall have a seal value R rating of greater than 600,

- c. luminaries shall be tool free type, and
- d. luminaries shall be complete with a ¼ turn shutter system for lamp replacement.

### **G.11.3 Operations**

- i. The responsibility for energizing the street lighting system shall be with the Municipality, after the completion of construction, testing, inspection and acceptance of the work. Energizing the street lighting system will occur once occupancy of buildings begins, or earlier if required to enhance pedestrian and traffic safety along high traffic corridors.

## **G.12 DRAINAGE AND CULVERTS**

**G.12.1** It is the Developer's responsibility to design and construct a drainage system that will meet the flow requirements as per the County's GMIS.

**G.12.2** Ditches shall have a flat bottom, and width shall be as per applicable design standard. Ditches for rural roadways shall have back slope no steeper than 2:1. Ditch grades shall match the roadway grades wherever practical. Ditch grades shall have a minimum grade of 0.5 % wherever possible. Grades less than 0.5 % shall be subject to review and approval by the Municipal Engineer. Drainage channels shall be provided with means of erosion control as necessary. All drainages shall be seeded.

**G.12.3** Culvert design and sizing shall be the responsibility of the Developer's Engineer. Culverts and ditches shall be designed to accommodate a 1:25 year rainfall event. Ditches shall be allowed to back up during such an event to the top of the sub-grade elevation. Culverts shall be new galvanized corrugated steel pipe with a minimum wall thickness of 1.6 mm or as required to meet the loading criteria.

**G.12.4** Minimum pipe diameters for various uses are as follows:

- |                         |        |
|-------------------------|--------|
| i. Residential approach | 500 mm |
| ii. Industrial approach | 600 mm |
| iii. Roadway centreline | 600 mm |

**G.12.5** Culverts shall have appropriate end treatments depending on application. Inverts shall be extended to the toe of the side slope. The culvert grade shall not be less than the ditch grades at the inlet and outlet. Culverts shall have a sufficient amount of cover to protect against damage from the expected traffic loading. Minimum cover shall be 300 mm or one-half the diameter of the culvert, whichever is greater, as measured from the finished shoulder grade to the top of the culvert.

### **G.12.6 Low Level Crossing**

- i. Low level crossings allow normal water flows to pass through the culverts, keeping the crossing surface free of standing water for most of the year. High flows, i.e. spring runoffs, flow over the top of the crossing, as the culverts are not designed large enough to carry these flood-type runoff

events. The crossing surface shall be constructed of erosion resistant materials to withstand the effect of water flowing over the top of the crossing. The crossing culverts shall be designed to carry normal flows based on available historical stream flow data.

- ii. The crossing location shall be determined in relation to potential water back-up effects created by the crossing installation. Neighbouring properties, roadways, etc. shall not be affected as a result of water back-up. A topographic survey of the water stream crossing area shall be done to ensure proper installation of the crossing and its future operational success.
- iii. If a high flow velocity crossing is proposed on a water stream where fish migration takes place, proper design consideration shall be given as to propose different elevations or larger diameter culverts with baffles to reduce flow velocities.
- iv. The proposed culverts shall be designed long enough to allow construction of stable and erosion resistant slopes at both upstream and downstream ends. Approved filter cloth shall be placed over the sub-grade prior to installation of the culverts and is to be extended up over the end wall slopes under the erosion-resistant surface (i.e. rock riprap) and onto the top surface of the crossing immediately below the erosion-resistant top. Fill materials around the culverts shall be placed in consecutive layers with thickness of each layer not exceeding 150 mm. Each layer shall be compacted to the degree specified by the Municipality. Thickness of fill above the culverts is to be selected by the design professional, and shall provide an adequate base for the surface structure construction.
- v. If deemed to be necessary to protect downstream ecosystems, the watercourse shall be diverted or dammed up while construction takes place. Control measures shall be implemented at the construction site to prevent sediments and deposits from entering the watercourse.
- vi. If necessary, the watercourse bed shall be excavated and shaped to obtain a firm bed to place the culvert on. The design elevation of base (invert) of the culvert shall be set at or slightly below the bottom of the watercourse. The structure shall be keyed into the banks of the watercourse at least 450-600 mm to prevent erosion. The approved filter cloth shall be placed over the culvert bed prior to placing of the fill materials. The filter cloth shall be extended up over the end-wall slopes of the crossing, and shall be placed over the sub-grade immediately under the erosion-resistant surface structure. The erosion resistant surface structure shall be constructed above the culverts, extending down over the crossing end walls and around the culverts.
- vii. If a cast-in-place concrete surface structure is selected, it shall have steel reinforcement and top surface roughened to provide for better traction. Erosion protection, i.e. in the form of rock riprap, shall be extended along the watercourse bed at both upstream and downstream ends of the culverts to withstand the scouring action of water entering and exiting the culverts.



- viii. The culverts shall be installed providing longitudinal downstream slope equivalent to the original watercourse downstream gradient within the crossing area. If more than one culvert is used to construct the crossing, a minimum lateral spacing between culverts of 300 mm shall be maintained.

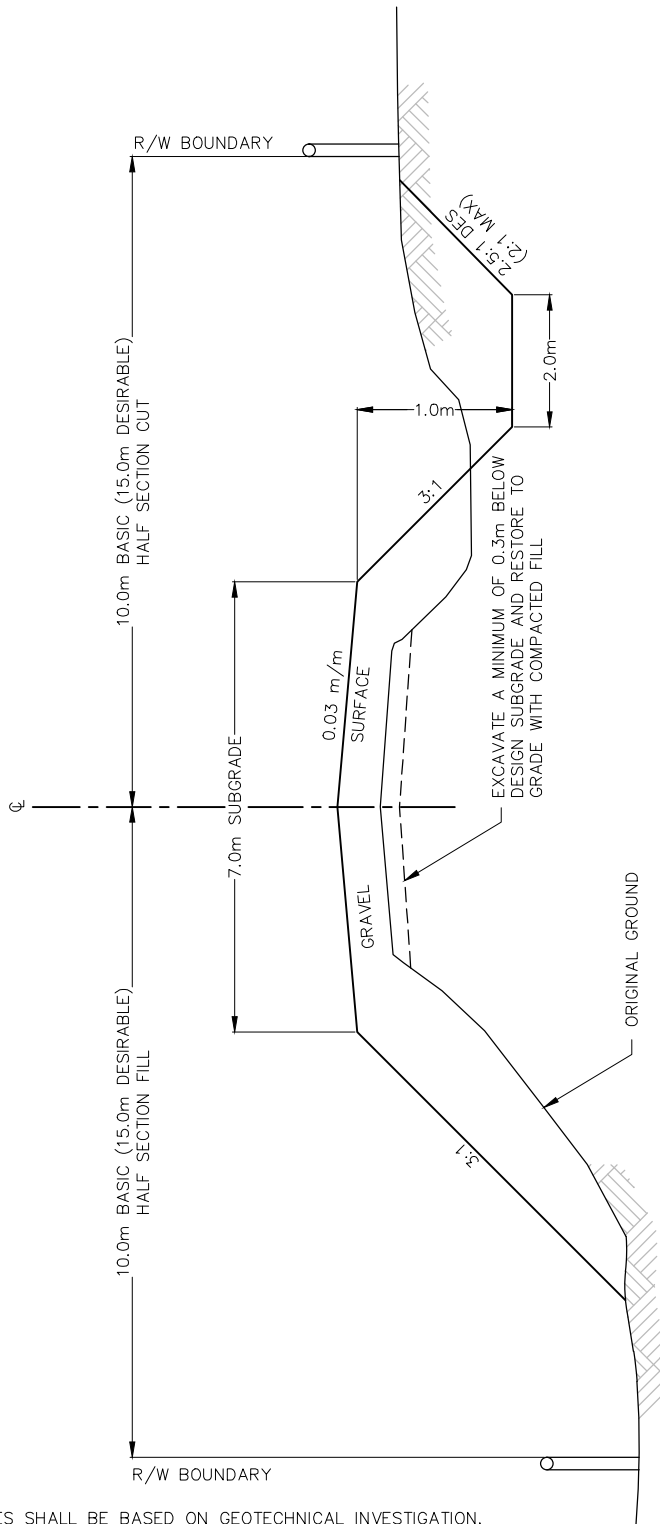
**G.13 LIST OF DRAWINGS**

- G-01 Typical Cross Section for Grading & Gravel Surfacing (RLU-207G)
- G-02 Typical Cross Section for Grading & Gravel Surfacing (RLU 208G(a))
- G-03 Typical Cross Section & Utilities Layout – Urban/Rural Hybrid 8.0m
- G-04 Typical Cross Section for Asphalt Concrete Pavement Surfacing (Local Road 8.0m)
- G-05 Typical Cross Section & Utilities Layout – Urban 9.0m
- G-06 Typical Cross Section for Grading & Gravel Surfacing (RLU-209G)
- G-07 Typical Cross Section for Asphalt Concrete Pavement Surfacing (Arterial 10.0m)
- G-08 Typical Cross Section for Asphalt Concrete Pavement Surfacing (Arterial 11.0m)
- G-09 Typical Cul-De-Sac Detail Urban & Rural Standard
- G-10 Residential/Industrial Approach Standard
- G-11 Major Intersection Layout Industrial – Rural Standard
- G-12 Private Access with Culvert
- G-13 Emergency Lane Access Detail
- G-14 Hand Placed Rip-Rap for Pipe Culverts
- G-15 Typical Views of a Ditch Block
- G-16 Roll Face Monolithic Walk & Gutter
- G-17 1.5m Monolithic Walk with 150 Curb & Gutter
- G-18 150 Curb with 250 Gutter
- G-19 150 Curb with 500 Gutter
- G-20 Roll Face Curb and Gutter
- G-21 500mm & 1000mm Concrete Gutter (Swale)
- G-22 Depressed Curb & Gutter for Catch Basin
- G-23 1.2m or 1.5m Separate Sidewalk
- G-24 Reconstruction of Sidewalk
- G-25 Typical Match of New Overlay and Existing Curb & Gutter
- G-26 Lane or Commercial Crossing (Hand Placed)
- G-27 Bus Stop Pad – Rolled Mono Gutter and Walk
- G-28 1000mm Concrete Swale Plan & Section
- G-29 Curb Ramp Locations
- G-30 Concrete Sidewalk Ramp for Wheelchair or Bicycle on Tangent (Type 1)
- G-31 Concrete Sidewalk Ramp for Wheelchair or Bicycle on Corner (Type 2)
- G-32 Curb & Median (Gravel Base)
- G-33 Curb and Median (Asphalt Base-Pin on)
- G-34 Concrete Walkway
- G-35 Granular Walkway
- G-36 Hiking Trail
- G-37 Paved Walkway/Bike Path
- G-38 Combination Standard Curb & Gutter with Paving Stone Sidewalk
- G-39 Paving Stone Walkway Detail
- G-40 Typical Mailbox Pullout Locations
- G-41 Sign Mounting Details
- G-42 Sign Post Anchor Detail
- G-43 Typical Traffic Sign Layout Rural Standard
- G-44 Typical Bollard Layout and Installation
- G-45 T-Bollard Assembly Detail

- G-46 T-Bollard in Emergency Access
- G-47 Collapsible Bollard
- G-48 Post & Cable Detail
- G-49 Utility Lot Barrier (10 metre)
- G-50 Utility Lot Barrier (15 Metre)
- G-51 Emergency Knock-Down Post (Retrofit)
- G-52 Low Level X-ing No Culvert
- G-53 Low Level X-ing with Culvert
- G-54 Low Level X-ing with Culvert
- G-55 Low Level X-ing with Culvert
- G-56 Low Level X-ing with Culvert

**END OF SECTION**





NOTE:  
THIS STANDARD IS INTENDED FOR LOW VOLUME ROADS THAT WILL BE GRAVEL SURFACED ONLY AND WILL HAVE LITTLE OR NO TRUCK TRAFFIC. TYPICALLY THIS 7.0m ROADWAY IS USED ON ROADS WITH AADT < 25.

**FILL SECTION**

- 3:1 SLOPE FOR ALL FILLS
- ON FILLS GREATER THAN 8.0m THE USE OF GUARDRAIL SHOULD BE CONSIDERED
- WHERE GUARDRAIL IS INSTALLED A 2:1 SIDESLOPE IS ADEQUATE

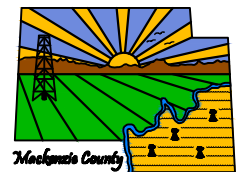
**CUT SECTION**

- WIDTH OF DITCH - 2.0m STANDARD;
- V-DITCH MINIMUM
- BACKSLOPE VARIABLE UP TO 2:1 MAX

NOTE:  
1. ROADWAY STRUCTURES SHALL BE BASED ON GEOTECHNICAL INVESTIGATION.  
MINIMUM DESIGN STANDARDS FOUND IN SECTION G.5 - DESIGN DESIGNATIONS.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

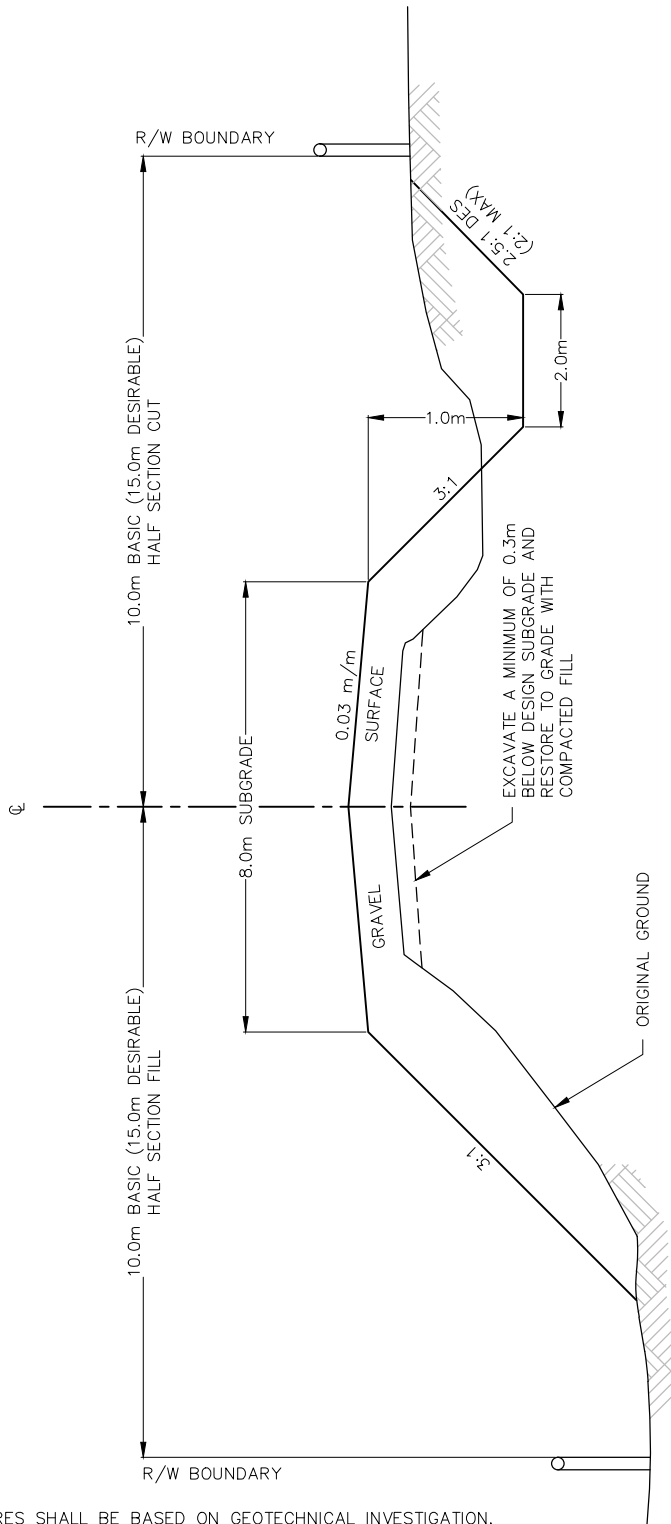


### TYPICAL CROSS SECTION FOR GRADING & GRAVEL SURFACING (RLU-207G)

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

Approved:

Figure **G-01**



NOTE:  
THIS STANDARD IS INTENDED FOR LOW VOLUME LOCAL ROADS THAT WILL BE GRAVEL SURFACED ONLY. TYPICALLY THIS 8.0m ROADWAY IS FOR ROADS WITH AN AADT < 100.

**FILL SECTION**

- 3:1 SLOPE FOR ALL FILLS
- ON FILLS GREATER THAN 8.0m THE USE OF GUARDRAIL SHOULD BE CONSIDERED
- WHERE GUARDRAIL IS INSTALLED A 2:1 SIDESLOPE IS ADEQUATE

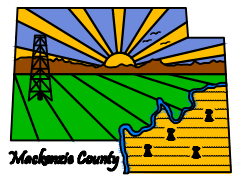
**CUT SECTION**

- WIDTH OF DITCH – 2.0m STANDARD; V-DITCH MINIMUM
- BACKSLOPE VARIABLE UP TO 2:1 MAX

NOTE:  
1. ROADWAY STRUCTURES SHALL BE BASED ON GEOTECHNICAL INVESTIGATION.  
MINIMUM DESIGN STANDARDS FOUND IN SECTION G.5 – DESIGN DESIGNATIONS.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

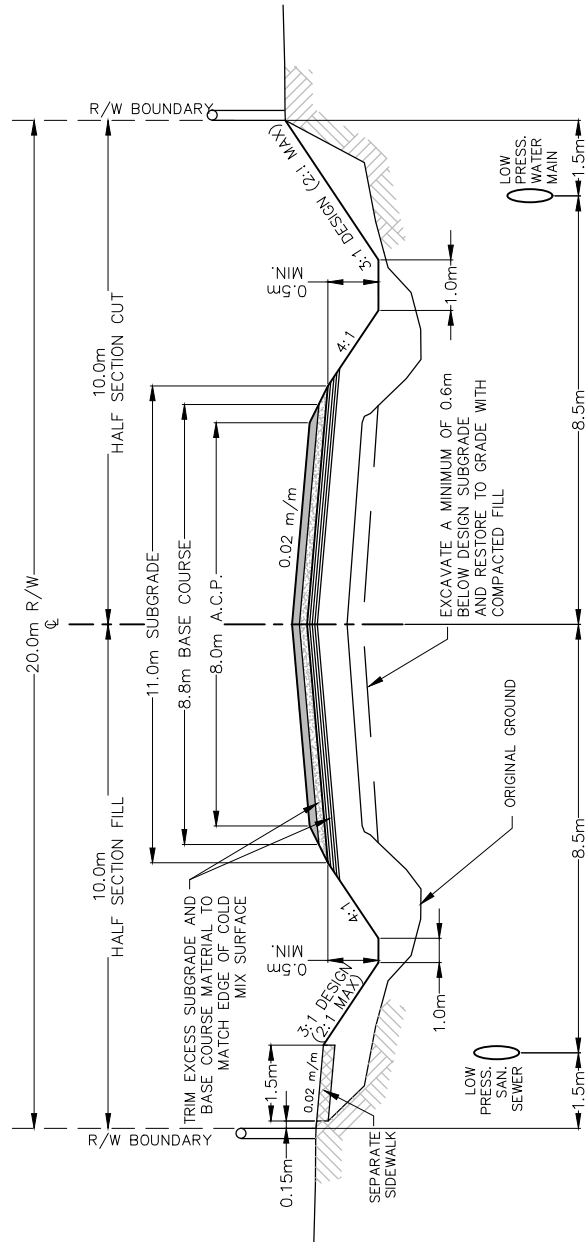


### TYPICAL CROSS SECTION FOR GRADING & GRAVEL SURFACING (RLU-208G(a))

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

Approved:

Figure **G-02**



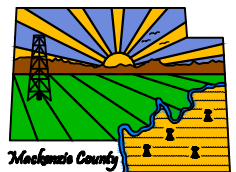
NOTE:  
THIS STANDARD AND SURFACING  
STRUCTURE IS INTENDED FOR LOW  
VOLUME ROADS (AADT < 200).

NOTE:


- ROADWAY STRUCTURES SHALL BE BASED ON GEOTECHNICAL INVESTIGATION.  
MINIMUM DESIGN STANDARDS FOUND IN SECTION G.5 – DESIGN DESIGNATIONS.

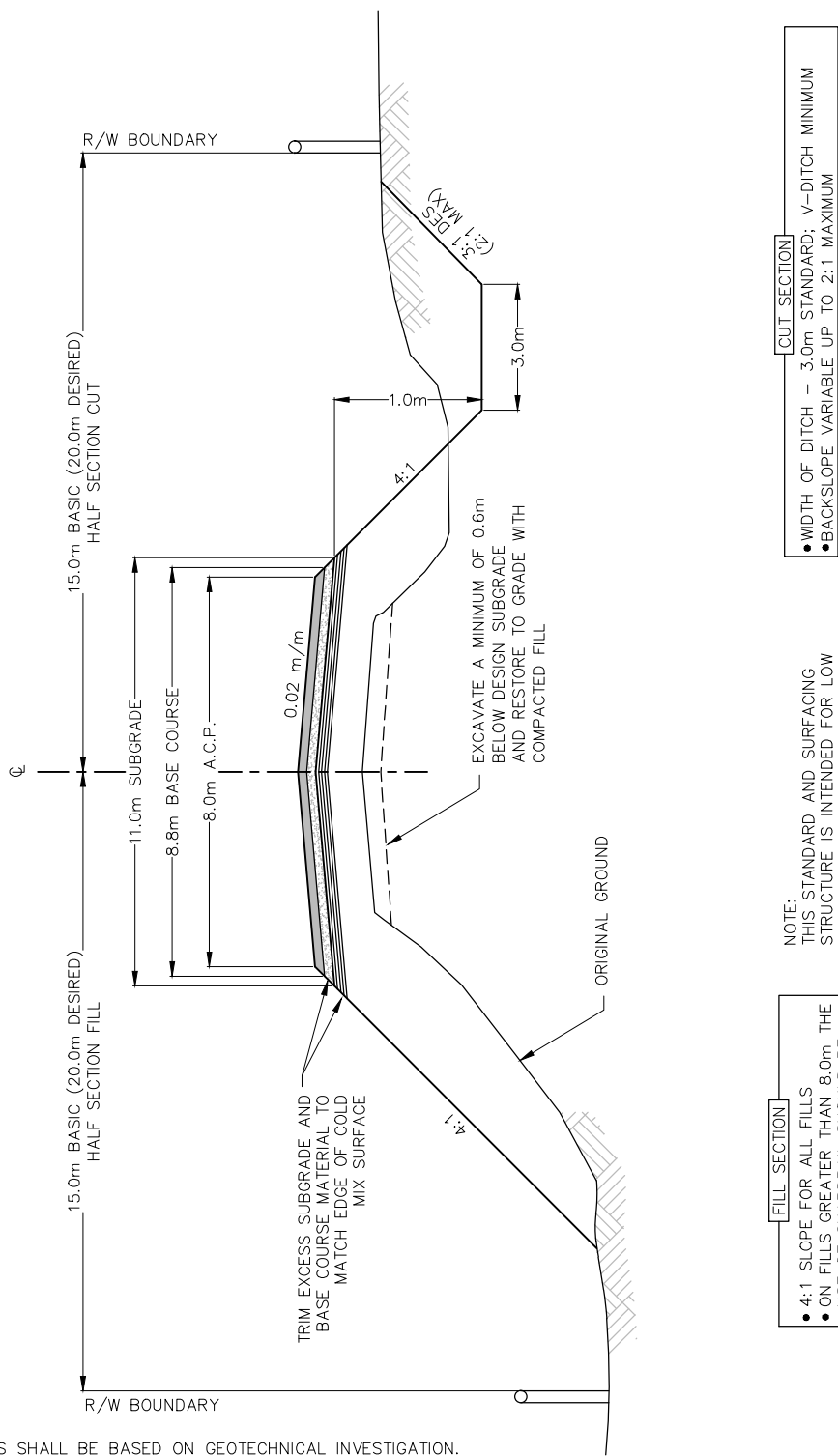
# MACKENZIE COUNTY

## General Municipal Improvements Standards



### TYPICAL CROSS SECTION & UTILITIES LAYOUT – URBAN/RURAL HYBRID 8.0m

Rev.				Approved: 	Figure <b>G-03</b>
Rev.					
Rev.					
Rev.	File No.: GP60.33682	Design:			
Date: 2021-FEB-15	Drawn: S.A.M.	Scale: N.T.S			



**CUT SECTION**

- WIDTH OF DITCH - 3.0m STANDARD; V-DITCH MINIMUM
- BACKSLOPE VARIABLE UP TO 2:1 MAXIMUM

**NOTE:**  
THIS STANDARD AND SURFACING STRUCTURE IS INTENDED FOR LOW VOLUME ROADS (AADT < 200).

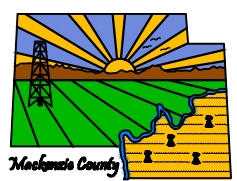
**FILL SECTION**

- 4:1 SLOPE FOR ALL FILLS
- ON FILLS GREATER THAN 8.0m THE USE OF GUARDRAIL SHOULD BE CONSIDERED
- WHERE GUARDRAIL IS INSTALLED A 2:1 SIDESLOPE IS ADEQUATE

**NOTE:**  
1. ROADWAY STRUCTURES SHALL BE BASED ON GEOTECHNICAL INVESTIGATION.  
MINIMUM DESIGN STANDARDS FOUND IN SECTION G.5 - DESIGN DESIGNATIONS.

# MACKENZIE COUNTY

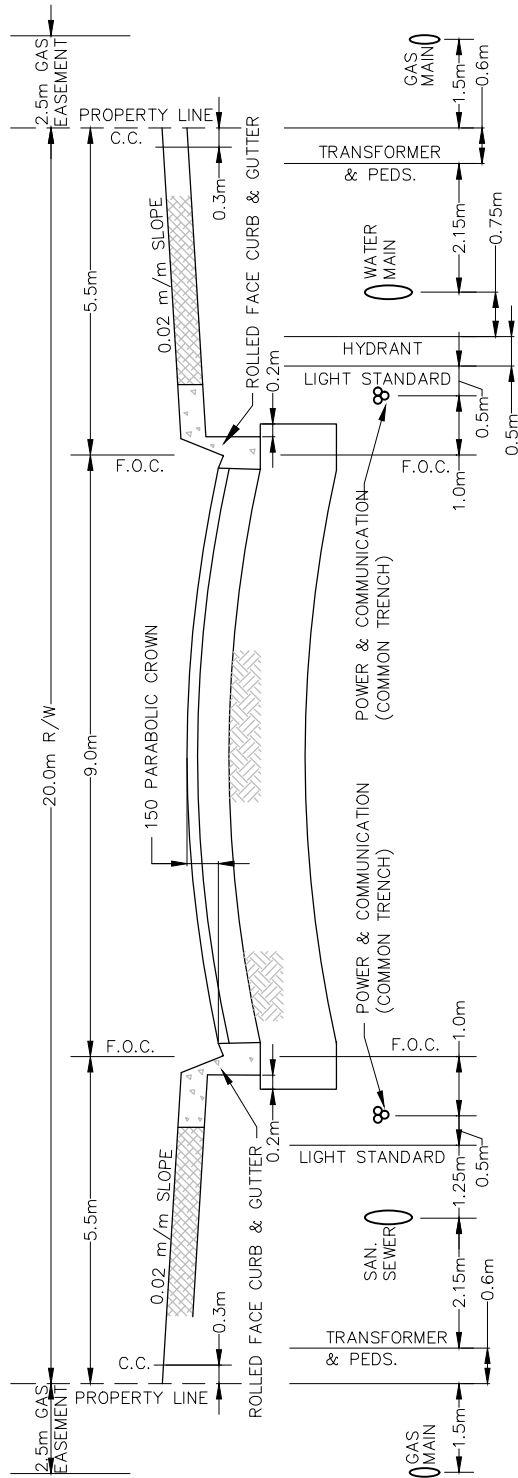
## General Municipal Improvements Standards



Rev.				Approved: <i>[Signature]</i>	Figure <b>G-04</b>
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		

TYPICAL CROSS SECTION FOR ASPHALT CONCRETE PAVEMENT SURFACING (PAVED LOCAL ROAD 8.0m)



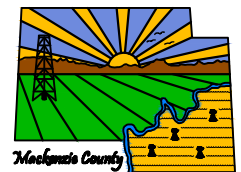


- NOTES:
1. THIS STANDARD AND SURFACING STRUCTURE IS INTENDED FOR LOCAL ROADS WITH AN AADT < 2000
  2. WICK DRAIN SHALL BE PLACED BELOW THE CURB BETWEEN THE SUBGRADE AND BASE COURSE AND CONNECTED TO THE NEAREST CATCH BASIN.

NOTE:  
 1. ROADWAY STRUCTURES SHALL BE BASED ON GEOTECHNICAL INVESTIGATION.  
 MINIMUM DESIGN STANDARDS FOUND IN SECTION G.5 - DESIGN DESIGNATIONS.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

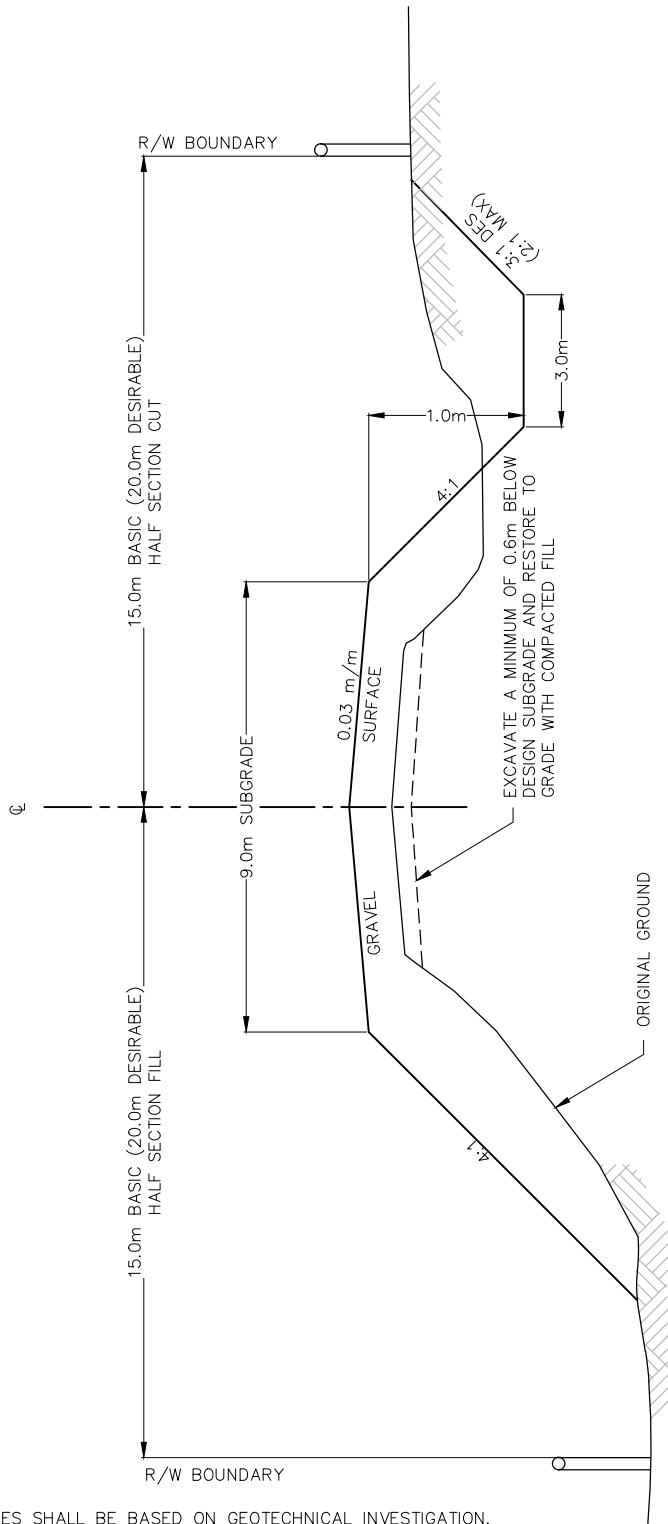


### TYPICAL CROSS SECTION & UTILITIES LAYOUT - URBAN 9.0m

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

Approved: *[Signature]*

Figure **G-05**



NOTE:  
 1. ROADWAY STRUCTURES SHALL BE BASED ON GEOTECHNICAL INVESTIGATION.  
 MINIMUM DESIGN STANDARDS FOUND IN SECTION G.5 – DESIGN DESIGNATIONS.

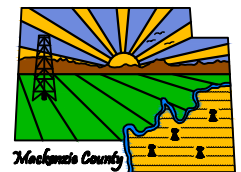
NOTE:  
 THIS STANDARD IS INTENDED FOR LOW VOLUME LOCAL ROADS WHICH WILL BE GRAVEL SURFACED ONLY. THIS 9.0m ROADWAY IS TYPICALLY USED FOR AADT > 200.

- FILL SECTION**
- 4:1 SLOPE FOR ALL FILLS
  - ON FILLS GREATER THAN 8.0m THE USE OF GUARDRAIL SHOULD BE CONSIDERED
  - WHERE GUARDRAIL IS INSTALLED A 2:1 SIDESLOPE IS ADEQUATE

- CUT SECTION**
- WIDTH OF DITCH – 3.0m STANDARD; V-DITCH MINIMUM
  - BACKSLOPE VARIABLE UP TO 2:1 MAX

# MACKENZIE COUNTY

## General Municipal Improvements Standards

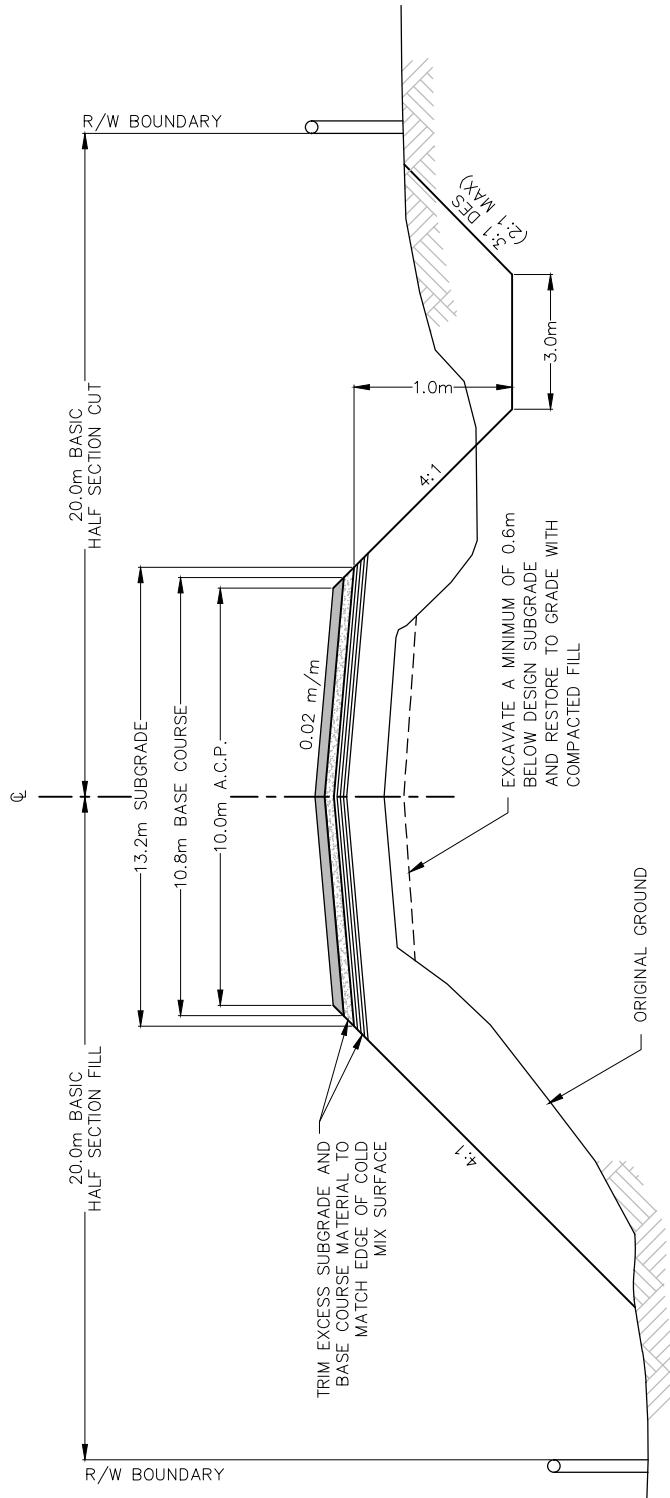


### TYPICAL CROSS SECTION FOR GRADING & GRAVEL SURFACING (RLU-209G)

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

Approved:

Figure **G-06**



**CUT SECTION**

- WIDTH OF DITCH – 3.0m STANDARD; V–DITCH MINIMUM
- BACKSLOPE VARIABLE UP TO 2:1 MAXIMUM

**NOTE:**  
THIS STANDARD AND SURFACING STRUCTURE IS INTENDED FOR LOCAL ROADS WITH AN AADT < 2000.

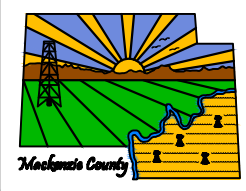
**FILL SECTION**


- 4:1 SLOPE FOR ALL FILLS
- ON FILLS GREATER THAN 8.0m THE USE OF GUARDRAIL SHOULD BE CONSIDERED
- WHERE GUARDRAIL IS INSTALLED A 2:1 SIDESLOPE IS ADEQUATE

**NOTE:**  
1. ROADWAY STRUCTURES SHALL BE BASED ON GEOTECHNICAL INVESTIGATION.  
MINIMUM DESIGN STANDARDS FOUND IN SECTION G.5 – DESIGN DESIGNATIONS.

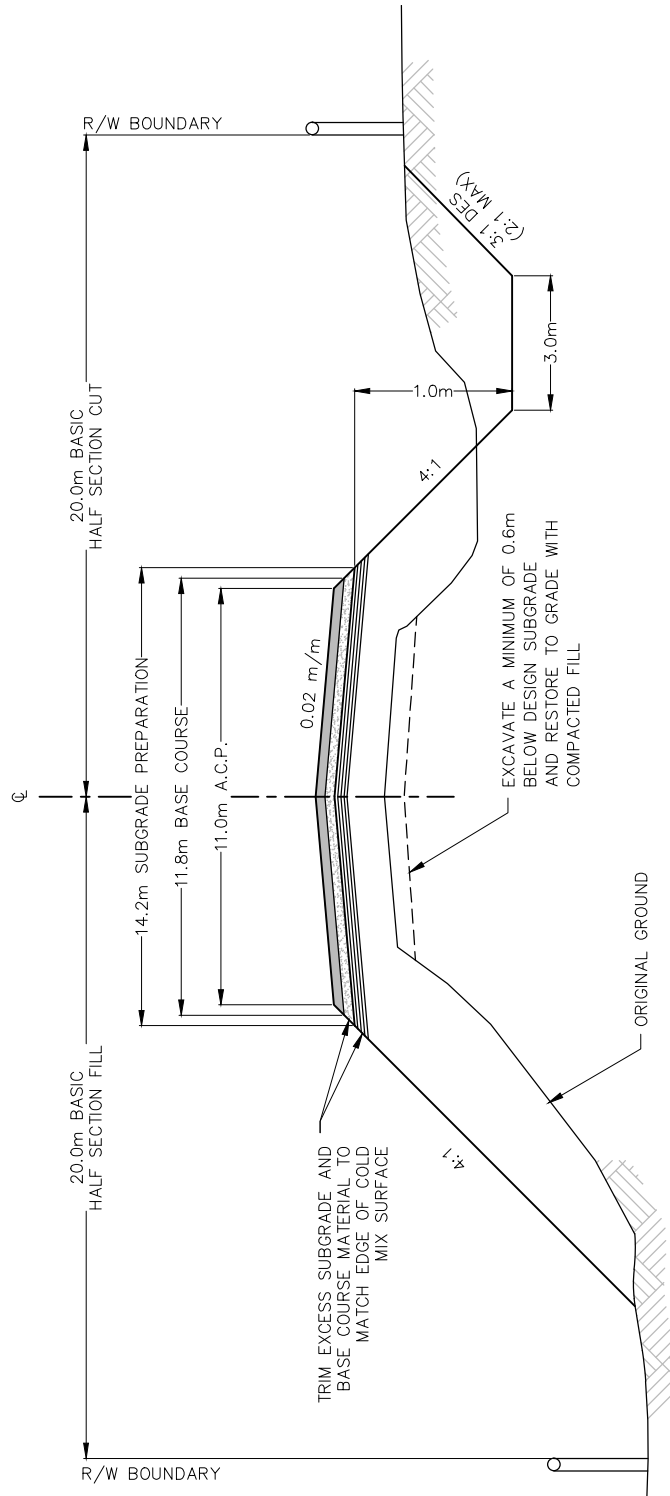
# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				Approved: 	Figure <b>G-07</b>
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		

TYPICAL CROSS SECTION FOR ASPHALT CONCRETE PAVEMENT SURFACING (ARTERIAL 10.0m)



**CUT SECTION**

- WIDTH OF DITCH - 3.0m STANDARD; V-DITCH MINIMUM
- BACKSLOPE VARIABLE UP TO 2:1 MAXIMUM

**FILL SECTION**

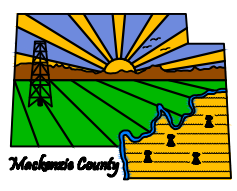
- 4:1 SLOPE FOR ALL FILLS
- ON FILLS GREATER THAN 8.0m THE USE OF GUARDRAIL SHOULD BE CONSIDERED
- WHERE GUARDRAIL IS INSTALLED A 2:1 SIDESLOPE IS ADEQUATE

**NOTE:**  
THIS STANDARD AND SURFACING STRUCTURE IS INTENDED FOR LOCAL ROADS WITH AN AADT > 2000.

**NOTE:**  
1. ROADWAY STRUCTURES SHALL BE BASED ON GEOTECHNICAL INVESTIGATION.  
MINIMUM DESIGN STANDARDS FOUND IN SECTION G.5 - DESIGN DESIGNATIONS.

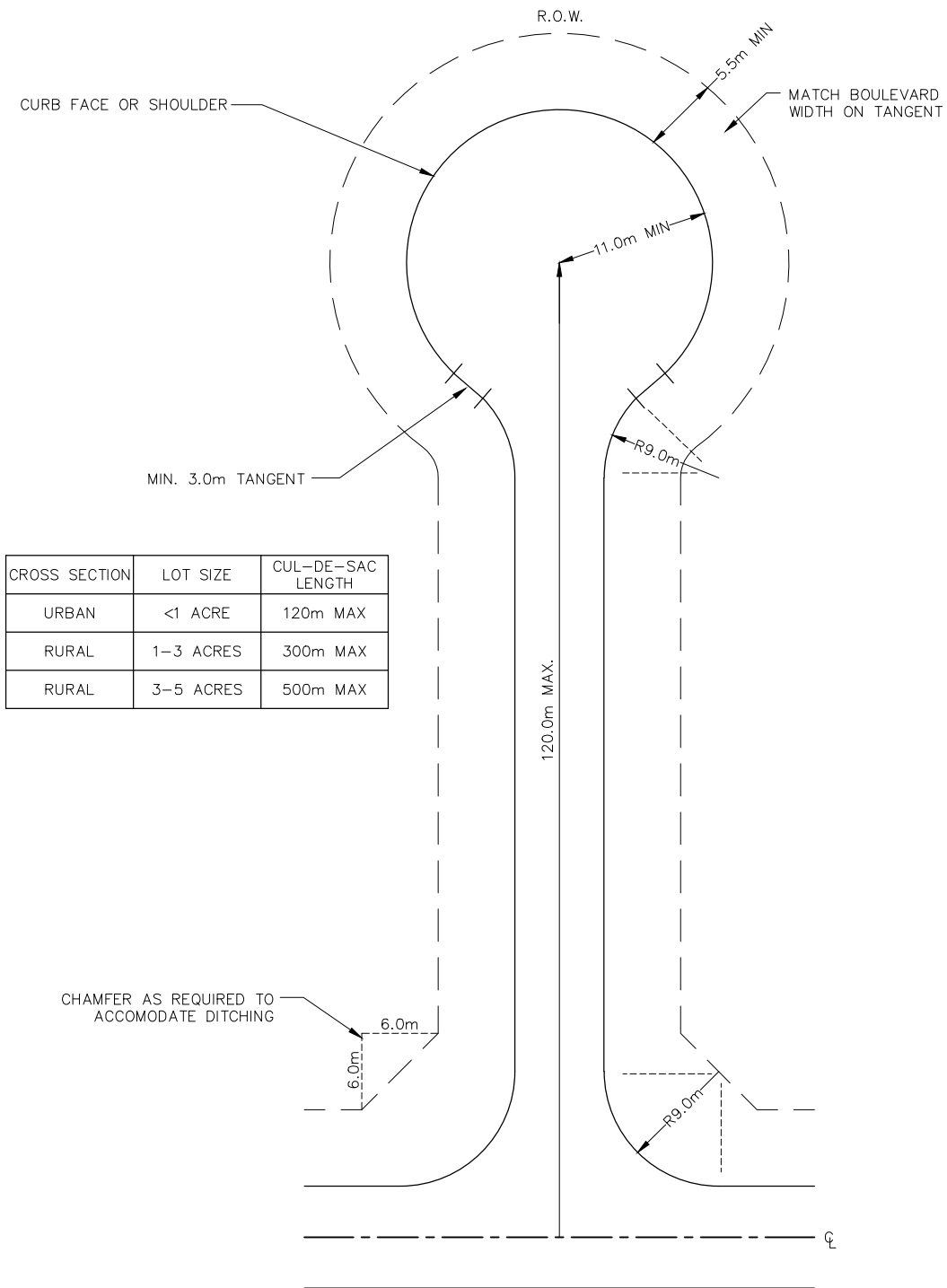
# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				Approved: <i>[Signature]</i>	Figure <b>G-08</b>
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		

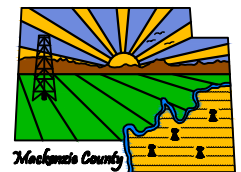
TYPICAL CROSS SECTION FOR ASPHALT CONCRETE PAVEMENT SURFACING (ARTERIAL 11.0m)



CROSS SECTION	LOT SIZE	CUL-DE-SAC LENGTH
URBAN	<1 ACRE	120m MAX
RURAL	1-3 ACRES	300m MAX
RURAL	3-5 ACRES	500m MAX

# MACKENZIE COUNTY

## General Municipal Improvements Standards



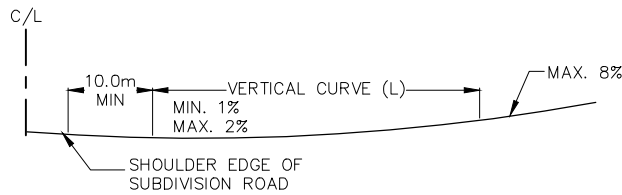
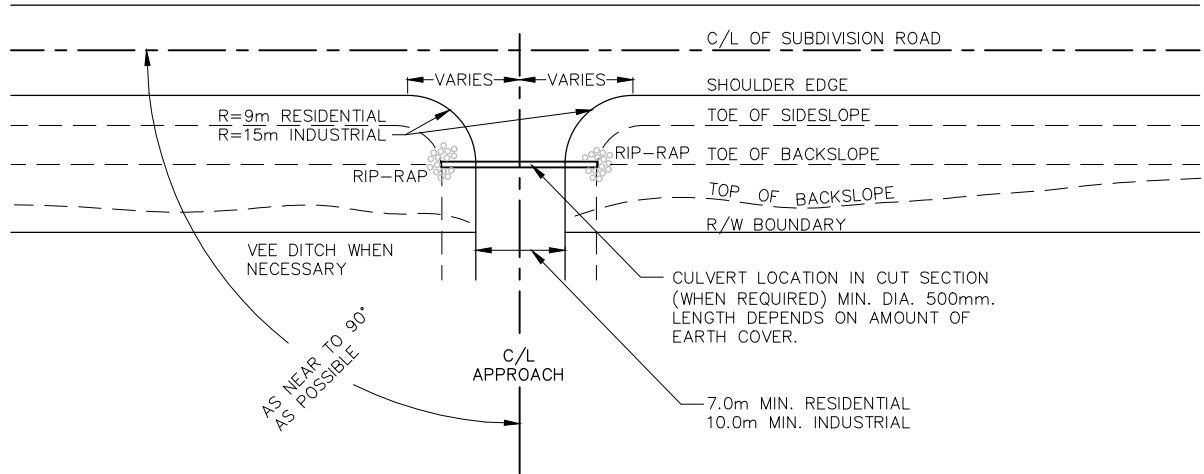
### TYPICAL CUL-DE-SAC DETAIL URBAN & RURAL STANDARD

Rev.	
Rev.	
Rev.	
Rev.	2021-FEB-15
Date:	2010-AUG-31

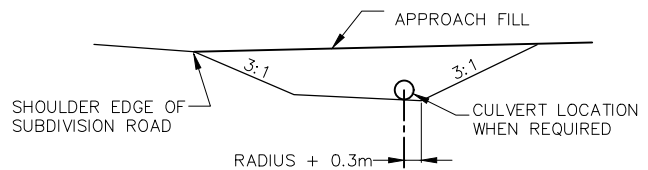
File No.:	GP60.33682
Design:	
Drawn:	K.P.L
Scale:	N.T.S

Approved:	
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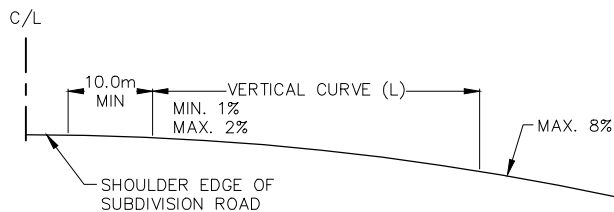
Figure	G-09
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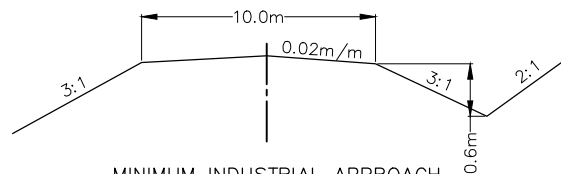
PROFILE – APPROACH IN CUT



DETAIL OF DITCH & CULVERT LOCATION

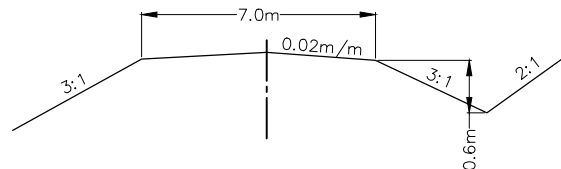


PROFILE – APPROACH IN FILL



MINIMUM INDUSTRIAL APPROACH CROSS SECTION

MINIMUM LENGTH OF VERTICAL CURVE		
ALGEBRAIC DIFFERENCE IN GRADIENT (%)	LENGTH L (METRES)	
	CREST	SAG
1	5	7.5
2	12	15
3	18	23
4	25	30
5	30	38
6	37	46
7		46
8		46
9		46

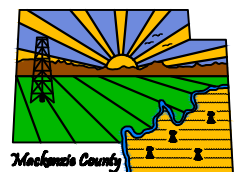


MINIMUM RESIDENTIAL APPROACH CROSS SECTION

NOTE  
ALL ENTRANCES ARE TO BE FROM THE INTERNAL ROAD SYSTEM AND ARE TO PROVIDE REASONABLE ACCESS TO THE LOTS, EACH LOT IS TO HAVE A PRIVATE APPROACH.

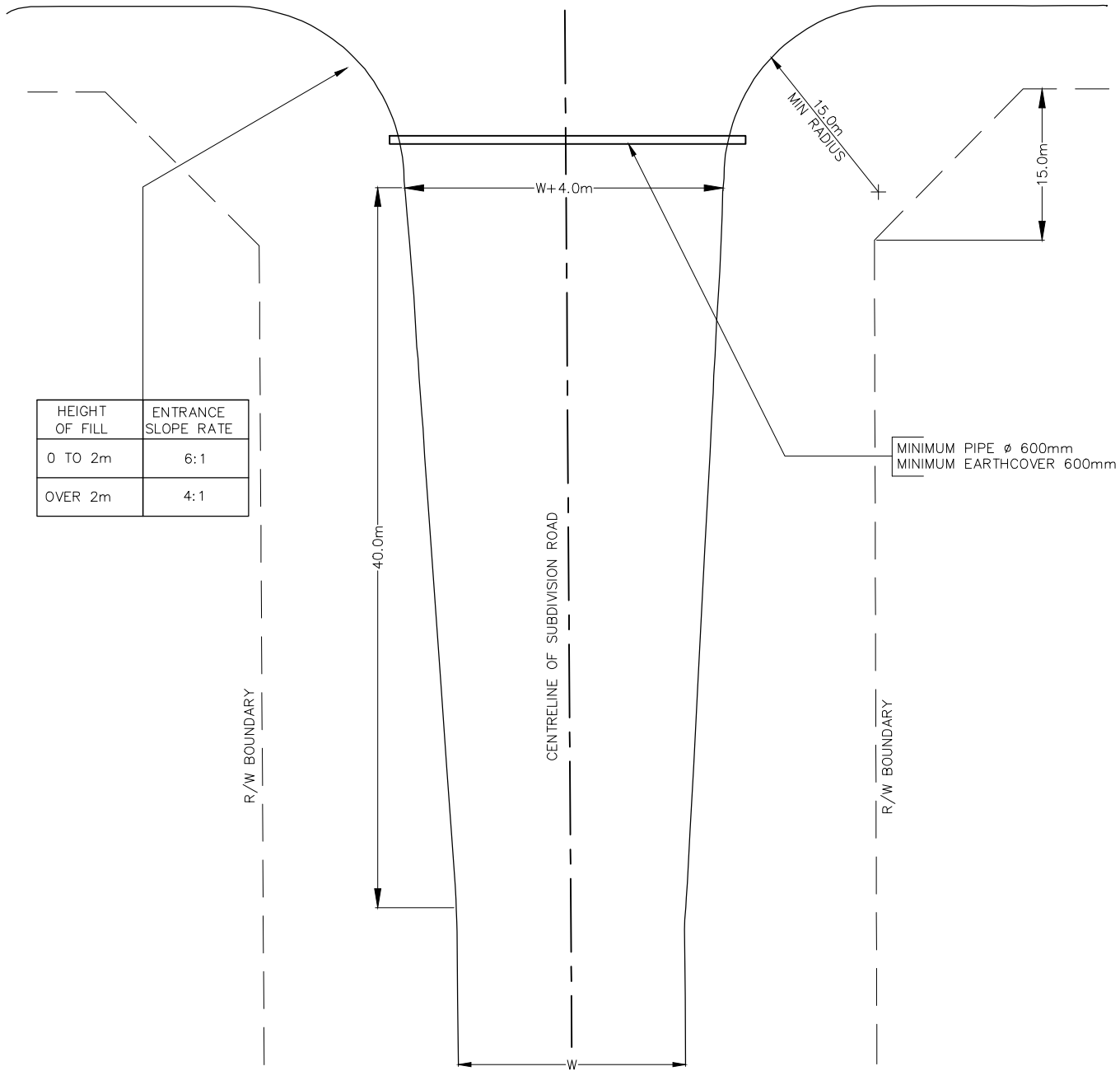
# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				RESIDENTIAL / INDUSTRIAL APPROACH STANDARD	Approved:	Figure <b>G-10</b>
Rev.						
Rev.						
Rev.	2021-FEB-15	File No.: GP60.33682	Design:	Approved:	Figure <b>G-10</b>	
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			

CENTRELINE OF ROADWAY ALLOWANCE



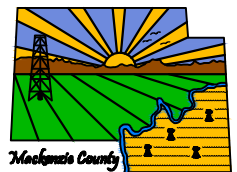
HEIGHT OF FILL	ENTRANCE SLOPE RATE
0 TO 2m	6:1
OVER 2m	4:1

MINIMUM PIPE Ø 600mm  
MINIMUM EARTHCOVER 600mm

W = FINISHED WIDTH

# MACKENZIE COUNTY

## General Municipal Improvements Standards

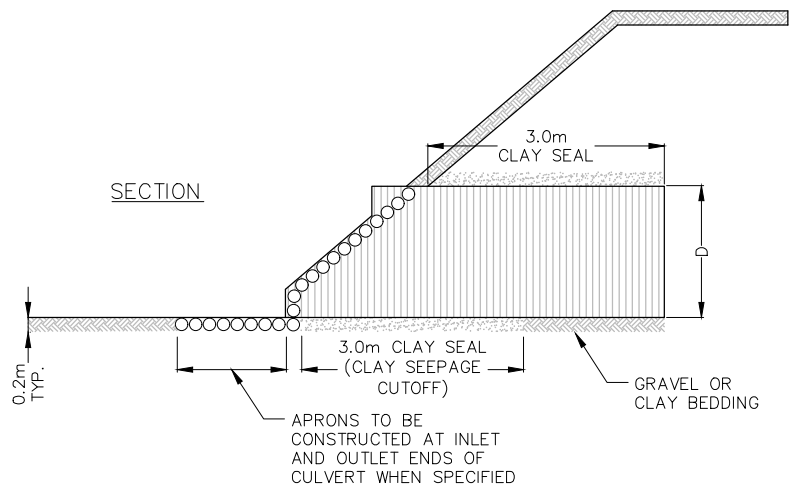
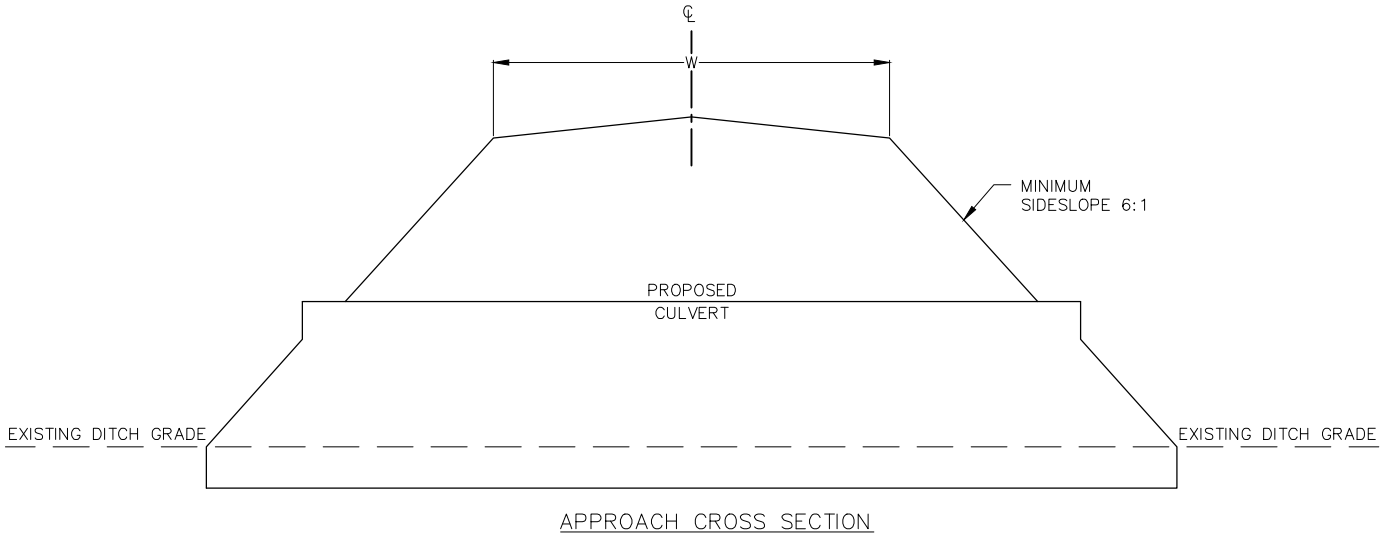


### MAJOR INTERSECTION LAYOUT INDUSTRIAL – RURAL STANDARD

Rev.			
Rev.			
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Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

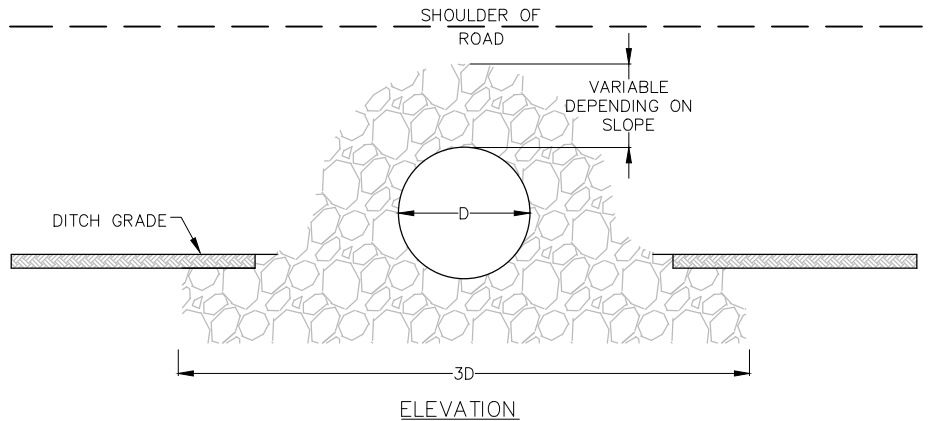
Approved: *[Signature]*

Figure **G-11**



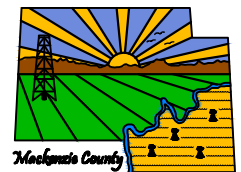
**NOTES:**

1. THE SIDE SLOPES OF THE APPROACH SHALL BE A MINIMUM OF 6:1 ON APPROACHES TO ALL ROADS.
2. THE MINIMUM CULVERT DIAMETER IS 500mm WITH A 300mm DEPTH OF COVER OVER C.S.P. IS PREFERRED. THE CULVERT SHALL BE ALIGNED WITH THE BACK OF THE DITCH BOTTOM. THE CULVERT IS TO BE COUNTERSUNK 20% OF THE PIPE DIAMETER BELOW THE DITCH BOTTOM.
4. THE CULVERT SHALL BE OF SUCH LENGTH AS TO PROVIDE A NEAT, FINISHED APPEARANCE WITHOUT EXCESS EXPOSED PIPE. STRAIGHT END CULVERTS ARE NOT ACCEPTABLE.
5. ROCK RIP-RAP, AS APPROVED BY THE COUNTY, SHALL BE HAND LAID AT BOTH ENDS OF THE CULVERT IN ACCORDANCE WITH THE DRAWING G-16.



# MACKENZIE COUNTY

## General Municipal Improvements Standards



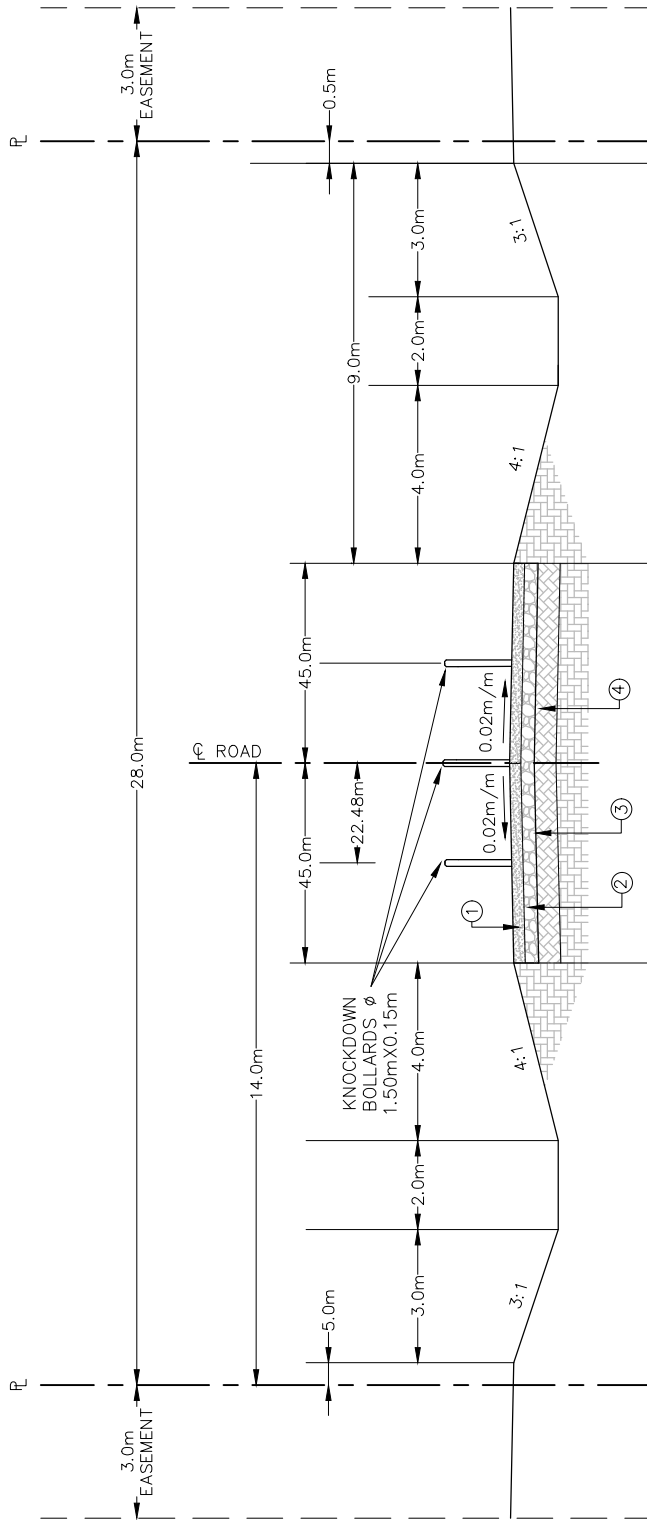
### PRIVATE ACCESS WITH CULVERT

Approved:

Figure **G-12**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

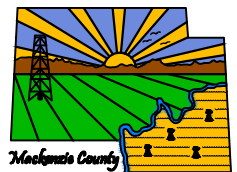




- NOTES:
- 50mm DEPTH COMPACTED GRAVEL/SHALE 10mm - 20mm DIAMETER.
  - 75mm DEPTH 20mm DIAMETER CRUSHED GRAVEL BASE COMPACTED TO 98% S.P.D.
  - WOVEN FABRIC UNDER GRAVEL (TENSAR SSI GEOGRID/NILEX 2006 AMOCO GEOTEXTILE OR APPROVED EQUIVALENT).
  - 150mm DEPTH SUBGRADE COMPACTED TO 98% S.P.D. ON:  
 A) NATIVE SUBGRADE - FREE OF TOPSOIL, ROOTS AND/OR DEBRIS.  
 B) COMMON FILL - CLEAN CLAY OR GRANULAR MATERIAL PLACED OVER APPROVED SUBGRADE AND COMPACTED TO 98% S.P.D.
  - ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.
  - MUNICIPALITY MAY ACCEPT ALTERNATE EASEMENT WIDTH.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



### EMERGENCY LANE ACCESS DETAIL

Rev.	
Rev.	
Rev.	
Rev.	2021-FEB-15
Date:	2010-AUG-31

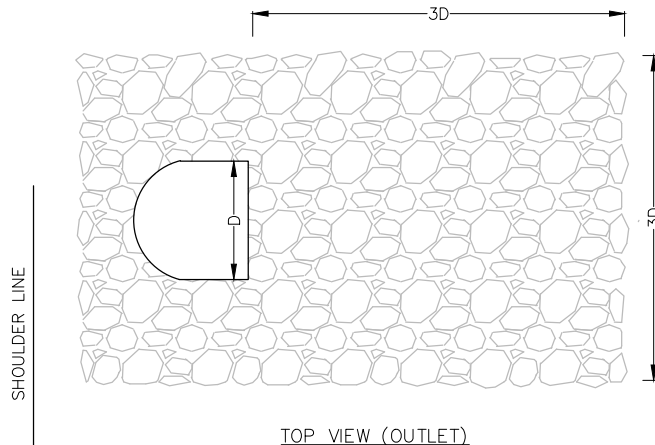
File No.: GP60.33682  
 Drawn: K.P.L.

Design:  
 Scale: N.T.S.

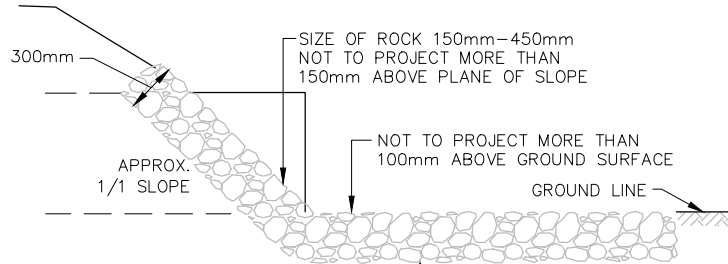
Approved:

Figure

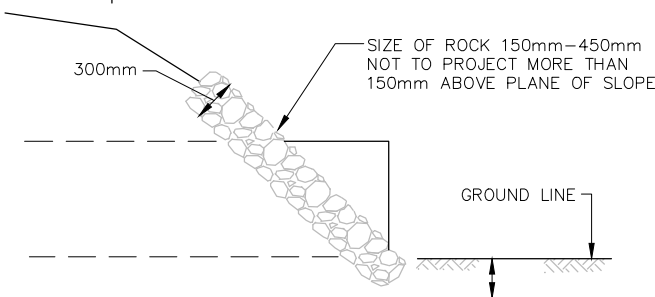
G-13



TOP VIEW (OUTLET)

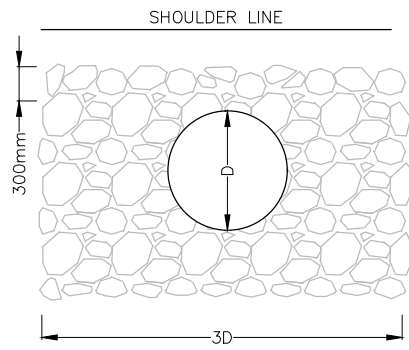


SIDE VIEW (OUTLET)

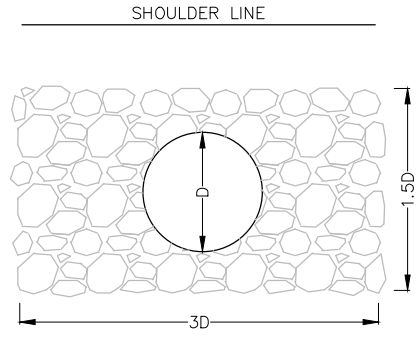


SIDE VIEW (INLET)

DIAMETER OF PIPE D	EQUIVALENT SIZE OF PIPE ARCH
400mm	450mmX340mm
500mm	580mmX390mm
600mm	680mmX480mm
800mm	930mmX645mm
1000mm	1160mmX800mm
1200mm	1425mmX960mm
1400mm	1660mmX1090mm
1600mm	1870mmX1230mm
1800mm	2130mmX1400mm



FRONT VIEW (OUTLET)



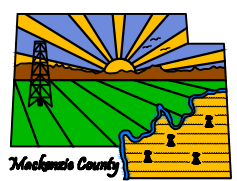
FRONT VIEW (INLET)

DIAMETER OF PIPE - D	300mm	500mm	600mm	800mm	1000mm	1200mm	1400mm	1600mm	1700mm	1800mm
* QUANTITY	1	2	3	5	10	13	16	20	28	33
APRON DEPTH	300mm	500mm			600mm			750mm		

\*TOTAL QUANTITY OF RIP-RAP IN CUBIC METRES

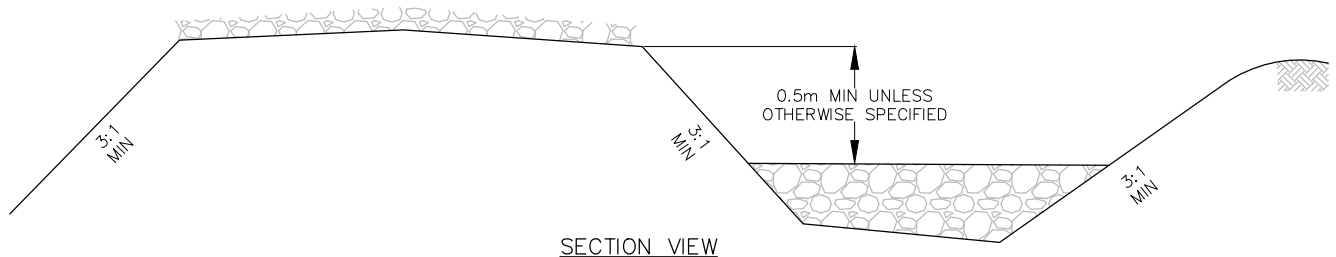
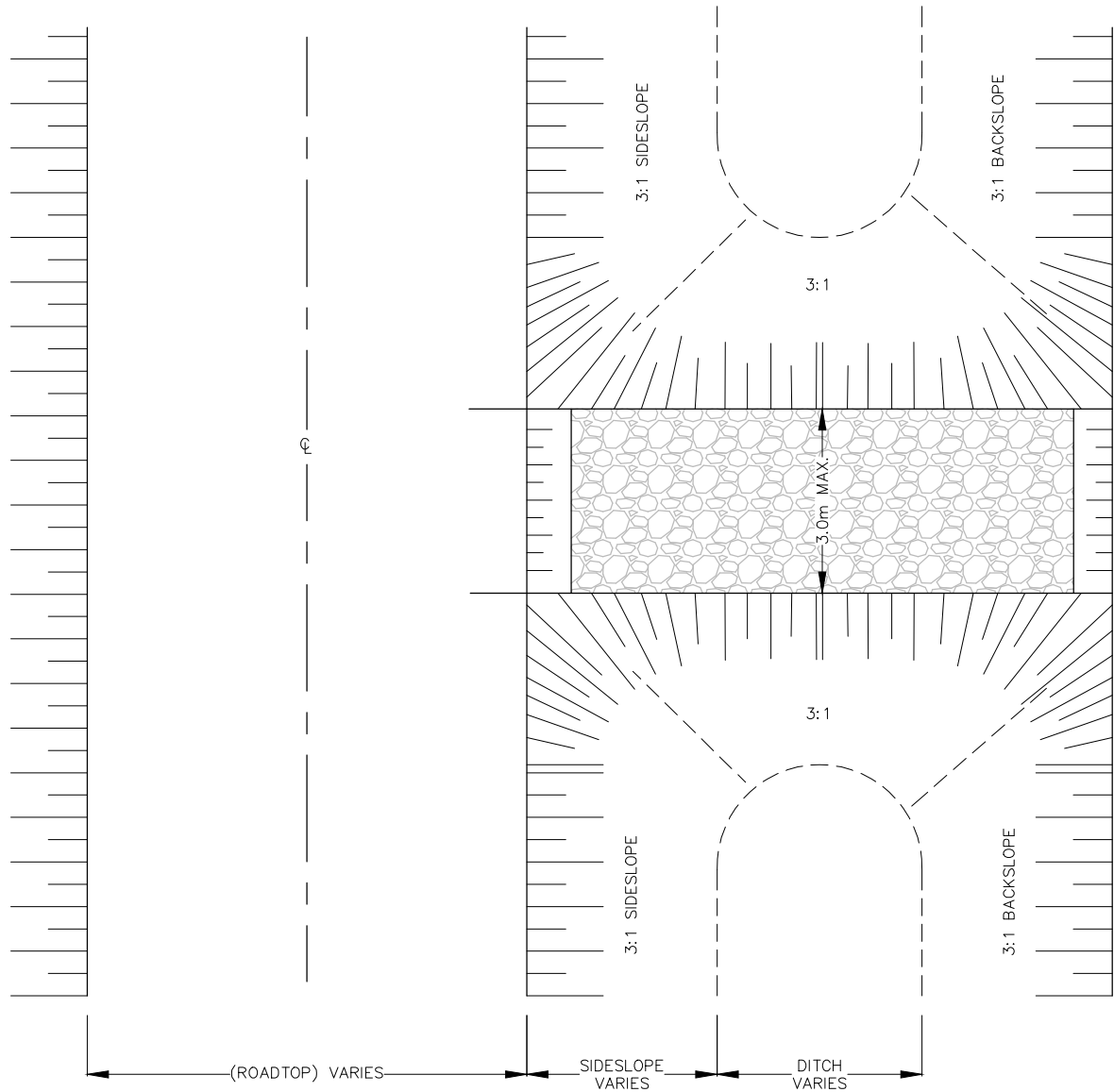
# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				<b>HAND PLACED RIP-RAP FOR PIPE CULVERTS</b>	Approved:	Figure <b>G-14</b>
Rev.						
Rev.						
Rev.	2021-FEB-15	File No.: GP60.33682	Design:			
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			

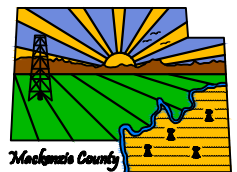
PLAN VIEW




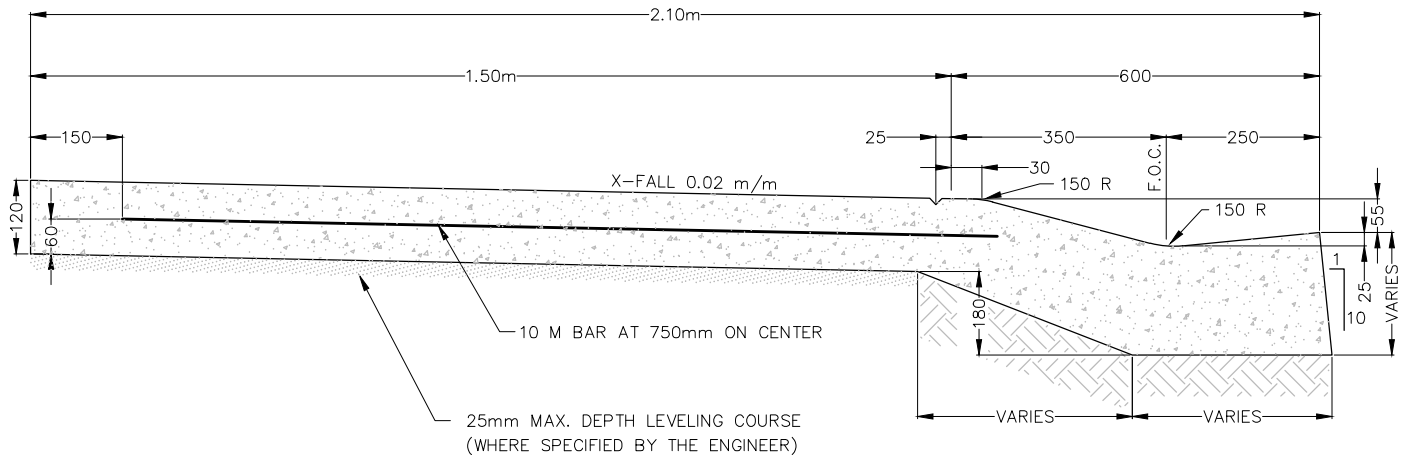
SECTION VIEW

# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				Approved: 	Figure <b>G-15</b>
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		

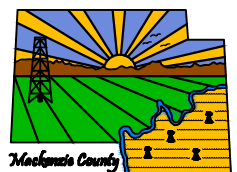


NOTES:

1. DEPTH OF GUTTER FACE TO MATCH ROAD STRUCTURE.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

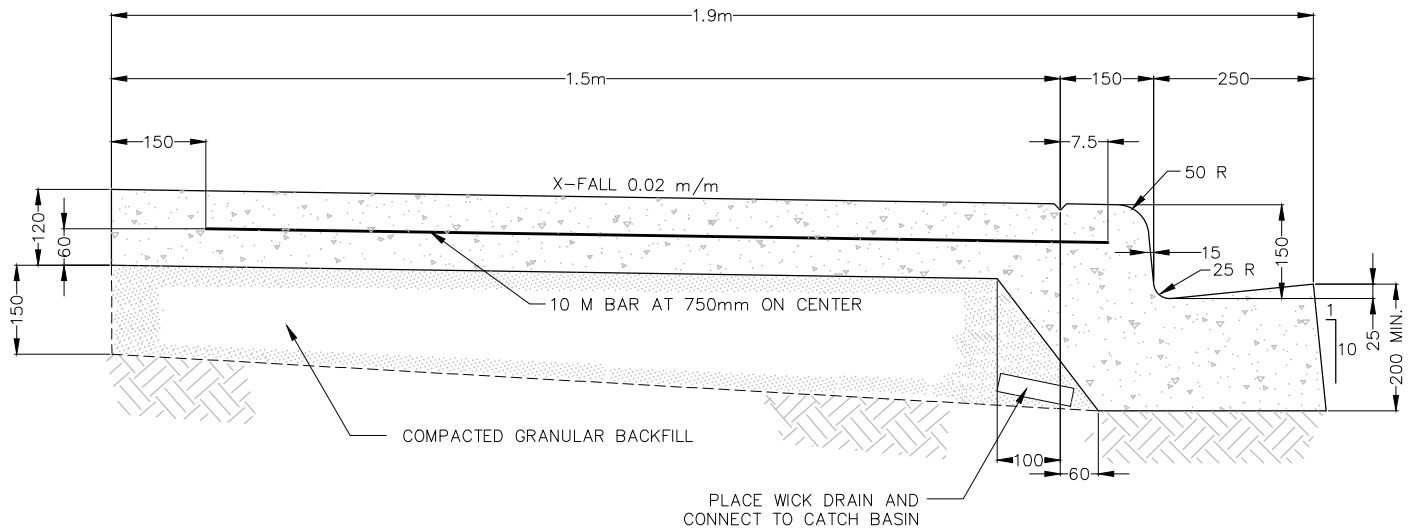


### ROLL FACE MONOLITHIC WALK & GUTTER

Approved:

Figure **G-16**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

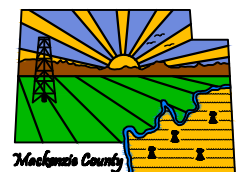


NOTES:

1. DEPTH OF GUTTER FACE TO MATCH ROAD STRUCTURE.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



### 1.5m MONOLITHIC WALK WITH 150 CURB & GUTTER

Approved:

Figure

G-17

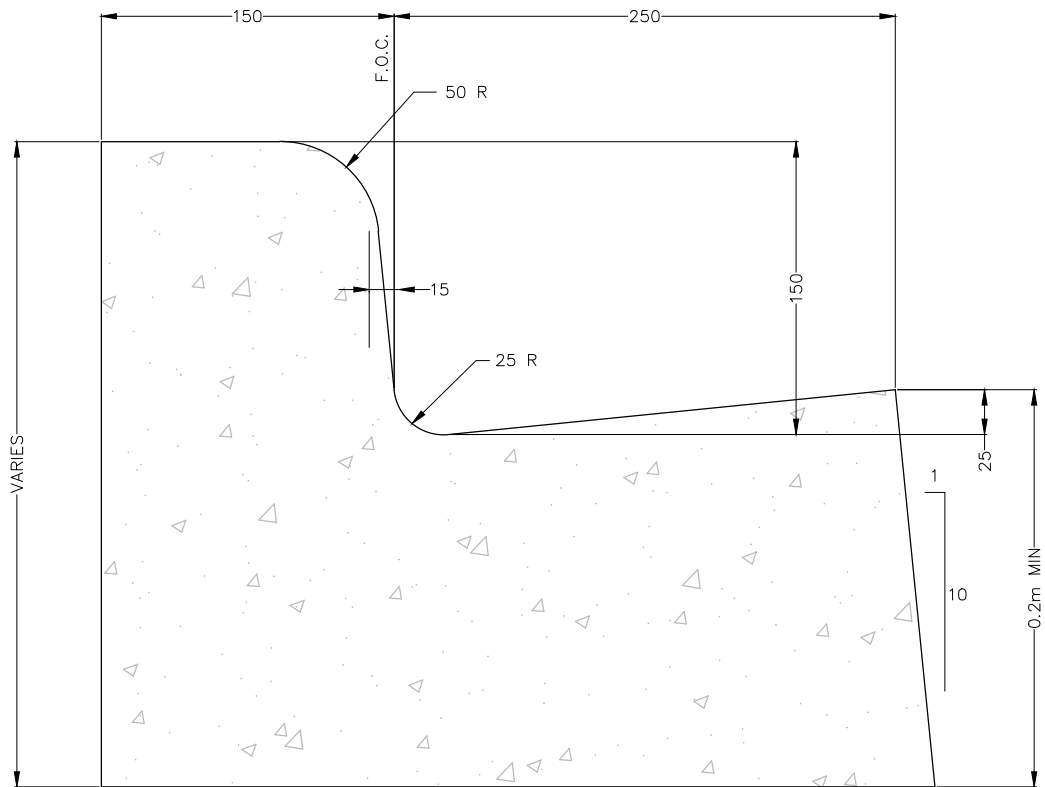
Rev.	
Rev.	
Rev.	
Rev.	2021-FEB-15
Date:	2010-AUG-31

File No.: GP60.33682

Drawn: K.P.L.

Design:

Scale: N.T.S.

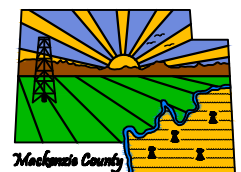


NOTES:

1. DEPTH OF GUTTER FACE TO MATCH DEPTH OF ROAD STRUCTURE.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

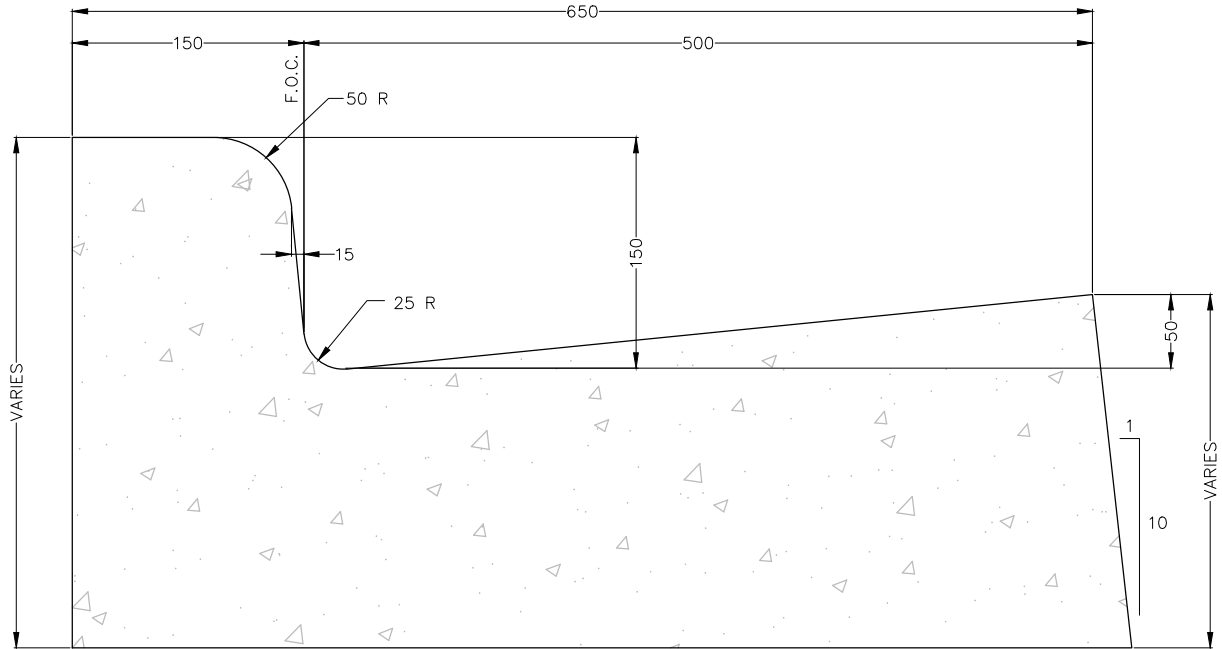


150 CURB WITH 250 GUTTER

Approved:

Figure **G-18**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L.	Scale: N.T.S.

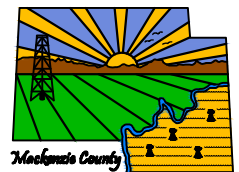




NOTES:

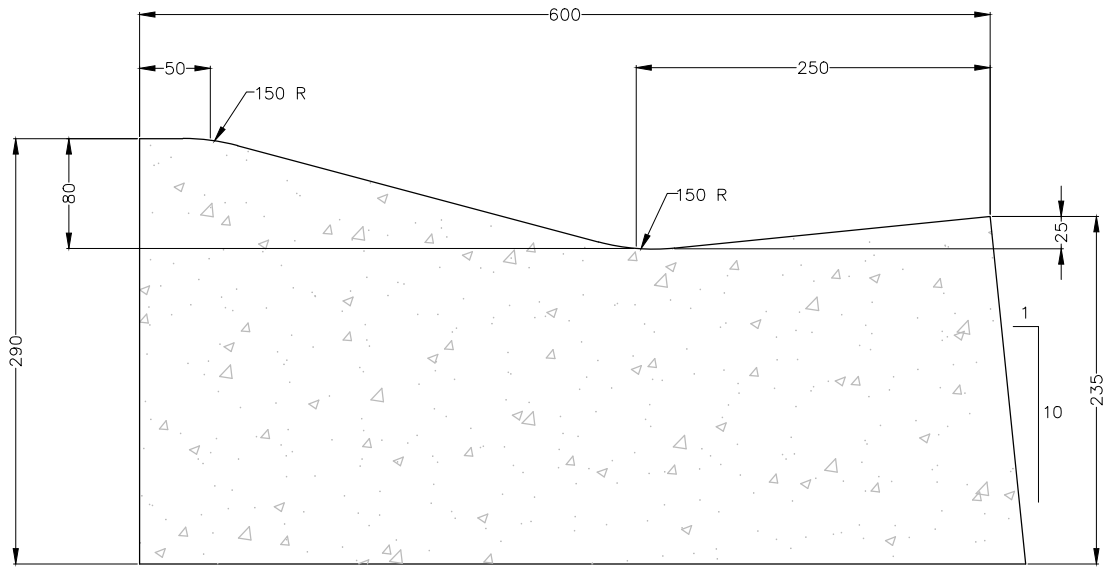
1. DEPTH OF GUTTER FACE TO MATCH DEPTH OF ROAD STRUCTURE.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				150 CURB WITH 500 GUTTER	Approved: 	Figure <b>G-19</b>
Rev.						
Rev.						
Rev.	2021-FEB-15	File No.: GP60.33682	Design:	Approved: 	Figure <b>G-19</b>	
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			

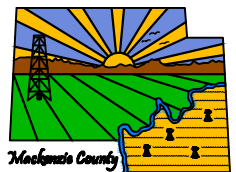



NOTES:

1. DEPTH OF GUTTER FACE TO MATCH DEPTH OF ROAD STRUCTURE.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

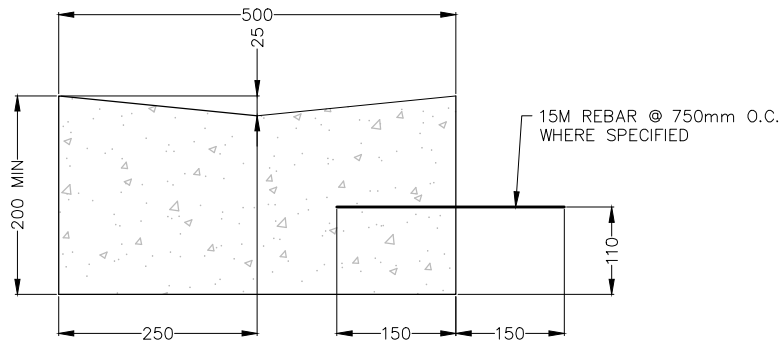
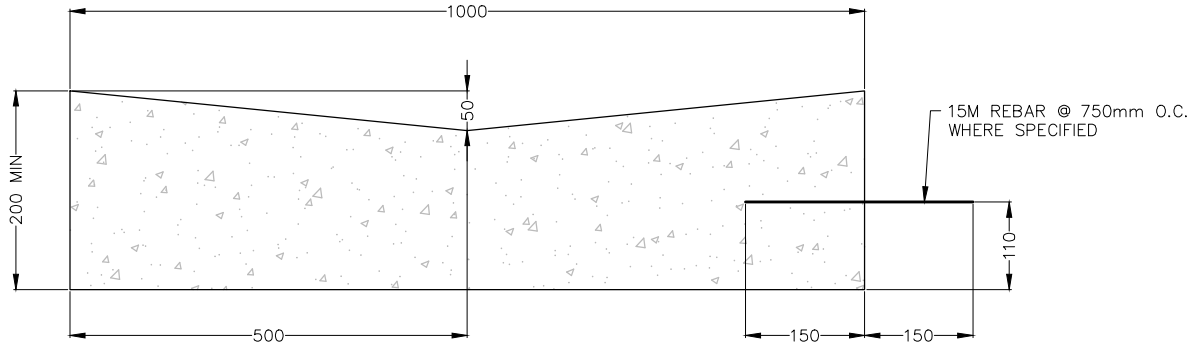
# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				<b>ROLL FACE CURB AND GUTTER</b>	Approved: 	Figure <b>G-20</b>
Rev.						
Rev.						
Rev.	2021-FEB-15	File No.: GP60.33682	Design:			
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			



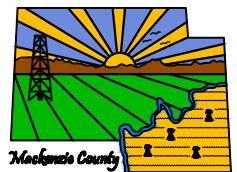


NOTES:

1. DEPTH OF GUTTER FACE TO MATCH ROAD STRUCTURE.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

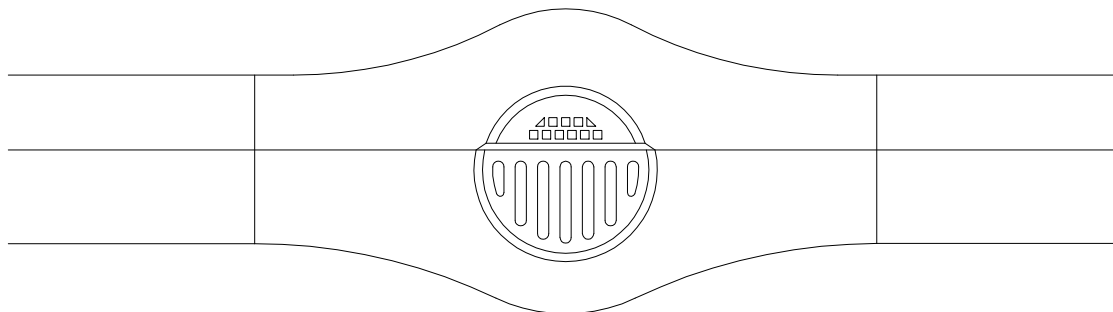
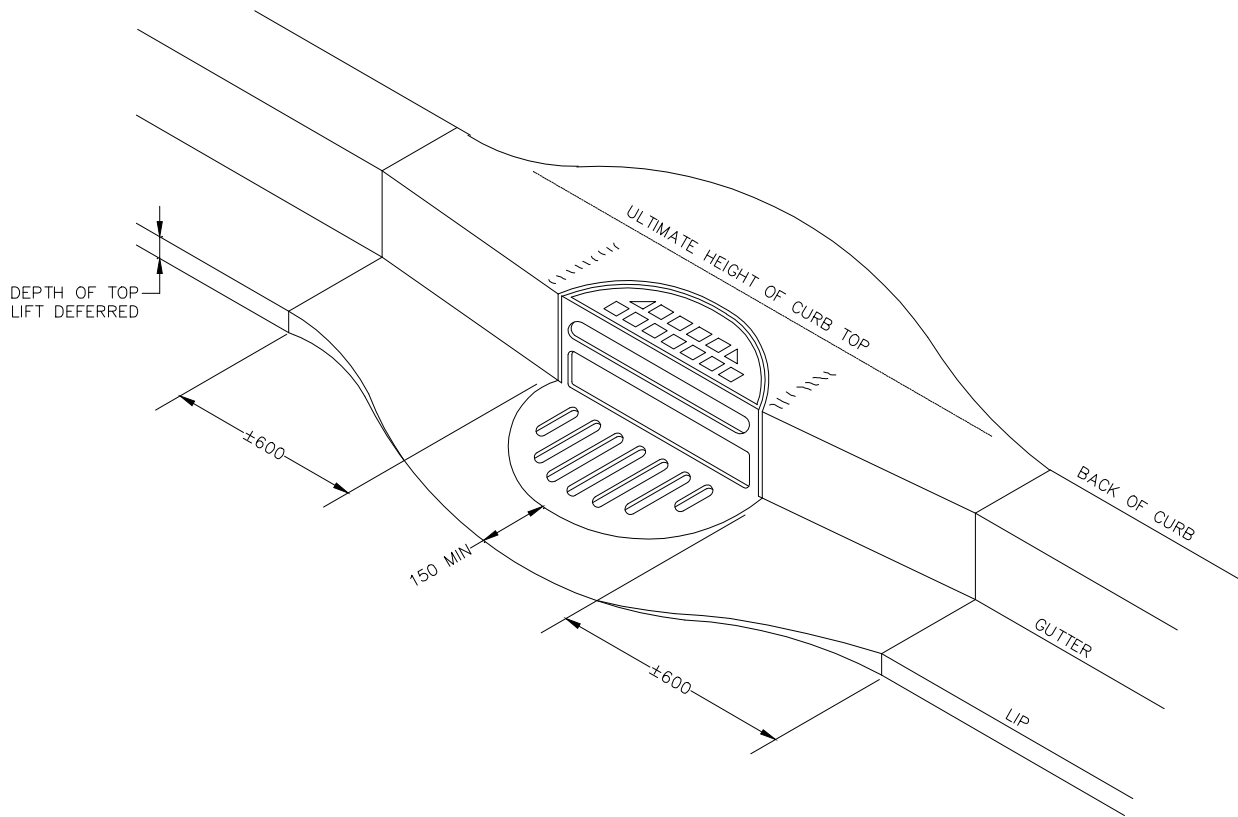


### 500mm & 1000mm CONCRETE GUTTER (SWALE)

Approved:

Figure **G-21**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S



PLAN VIEW

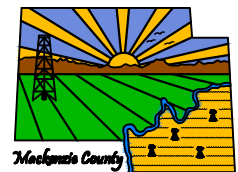
CATCH BASIN WHEN ASPHALT TOP LIFT IS DEFERRED

NOTES:

1. TYPICAL CURB & GUTTER TREATMENT AT CATCH BASIN. LOCATION TO BE DETERMINED BY ENGINEER.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

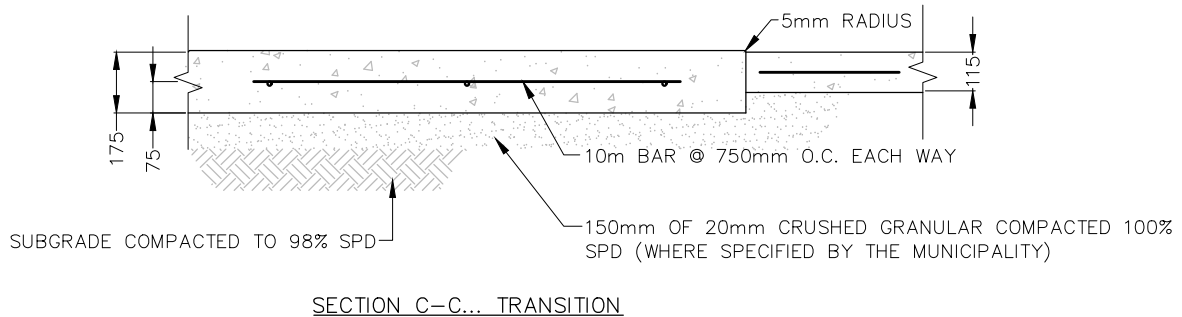
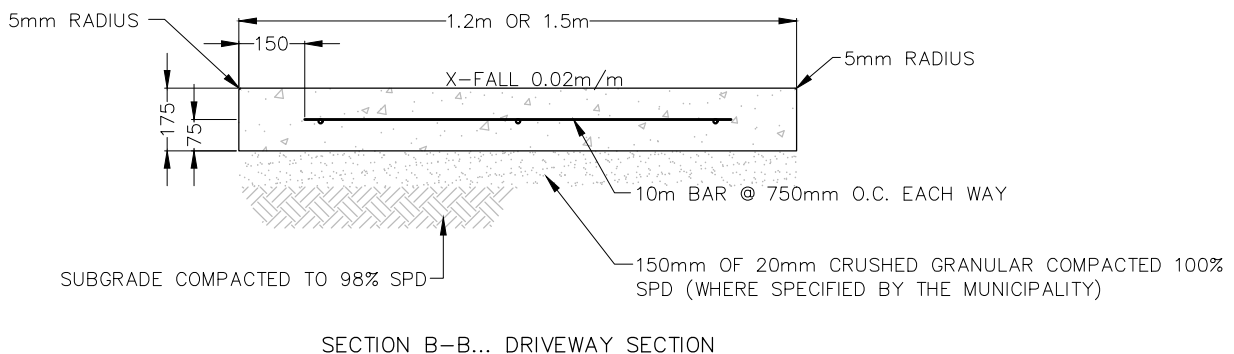
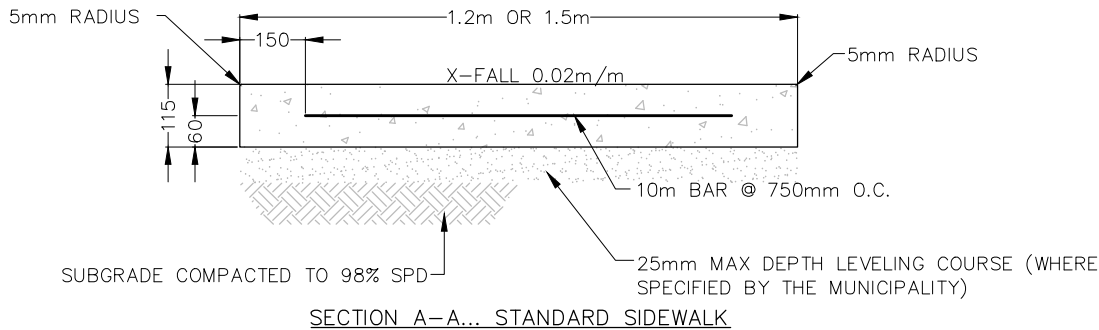
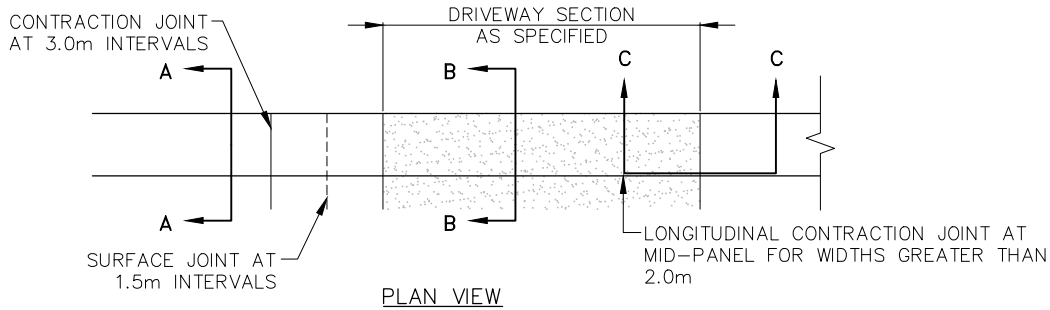


### DEPRESSED CURB & GUTTER FOR CATCH BASIN

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

Approved:

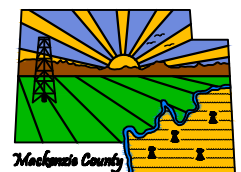
Figure **G-22**



NOTES:  
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

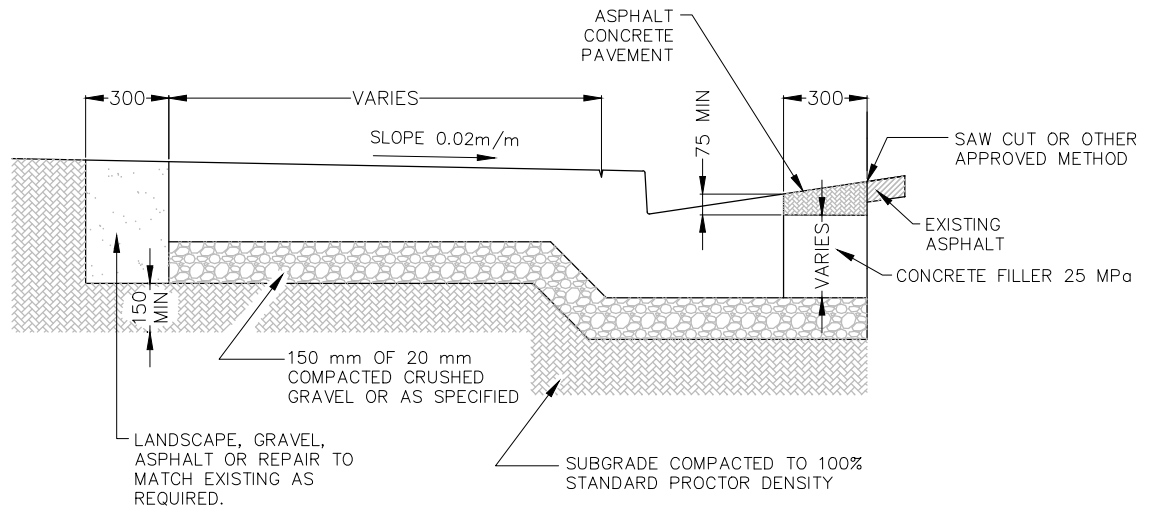


1.2m OR 1.5m SEPARATE SIDEWALK

Approved: *[Signature]*

Figure **G-23**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2014-JUN-25	Drawn: K.P.L	Scale: N.T.S

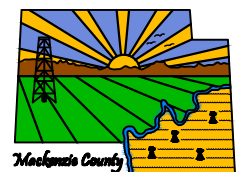


NOTES:

1. PLACE PAVING STONE OR CONCRETE SIDEWALK AS PER PLANS.
2. USE APPROPRIATE CURB AND GUTTER AS PER CONCRETE STRUCTURES DRAWINGS.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
4. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

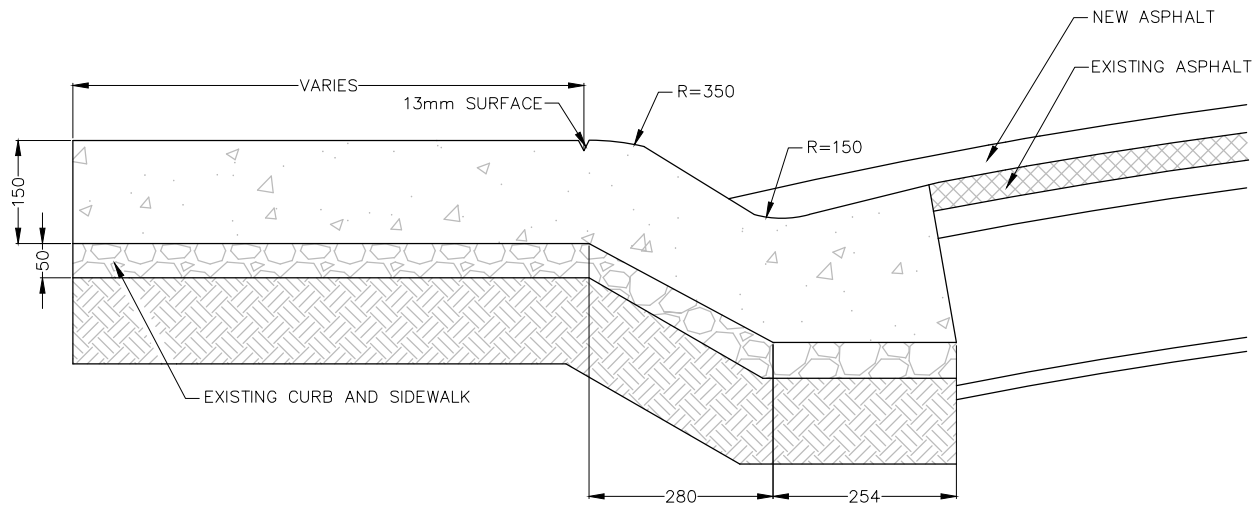


### RECONSTRUCTION OF SIDEWALK

Approved:

Figure **G-24**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

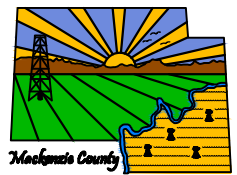


NOTES:

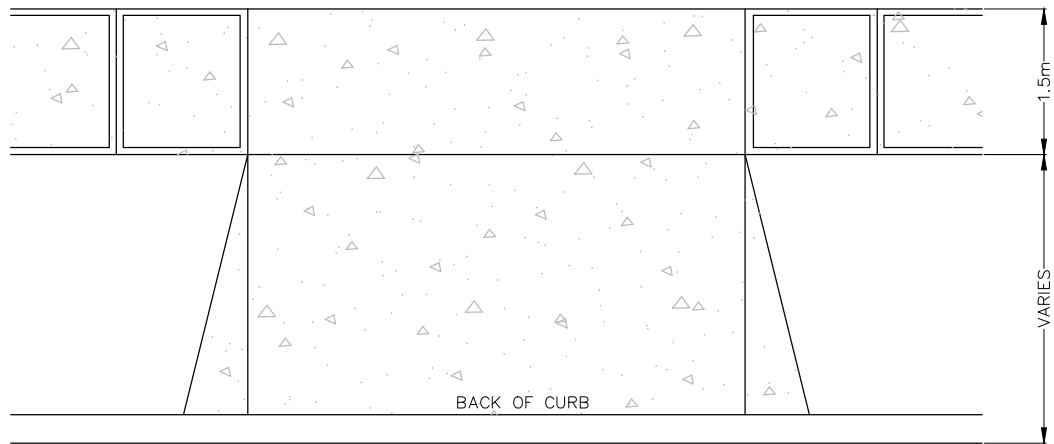
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

# MACKENZIE COUNTY

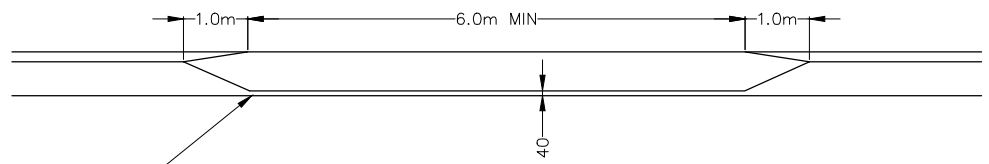
## General Municipal Improvements Standards



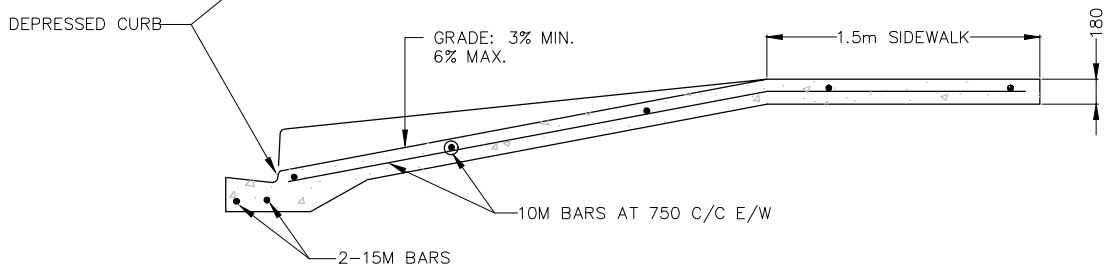
Rev.				TYPICAL MATCH OF NEW OVERLAY AND EXISTING CURB & GUTTER	Figure <b>G-25</b>
Rev.					
Rev.					
Rev. 2021-FEB-15	File No.: GP60.33682	Design:	Approved:		
Date: 2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			



PLAN



ELEVATION



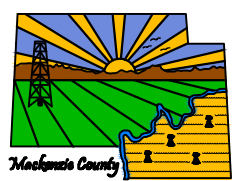
SECTION

NOTES:

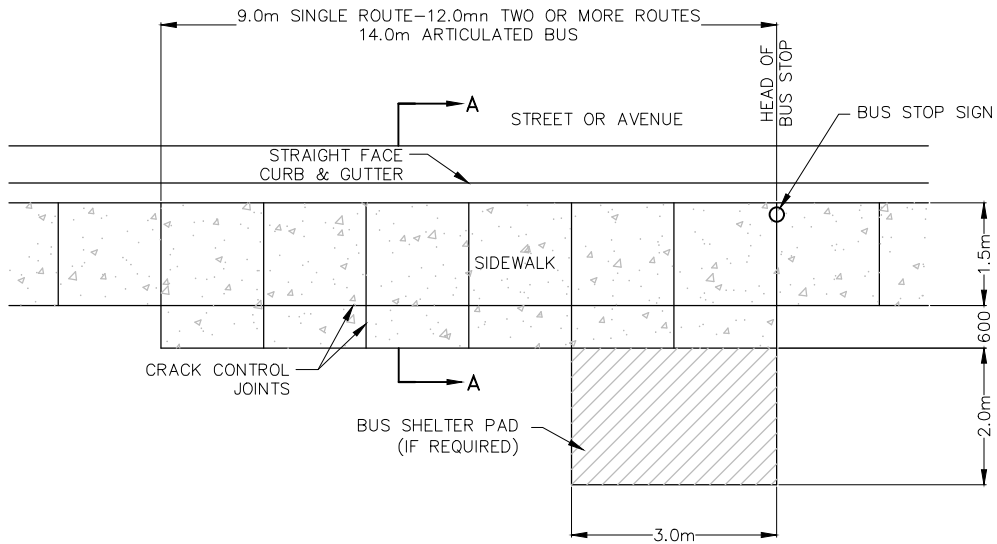
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. 30 MPa TYPE 50 SR CONCRETE.
3. SUBGRADE TO BE COMPACTED TO 98% SPD.
4. 100mm DEPTH OF GRANULAR COMPACTED TO 100% S.P.D. TO BE PLACED BELOW THE CONCRETE.
5. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

# MACKENZIE COUNTY

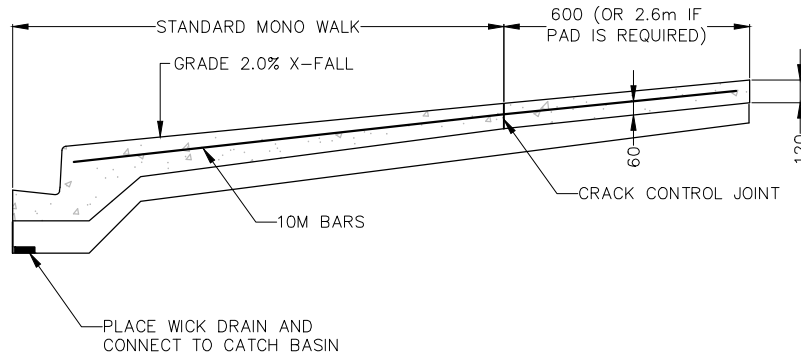
## General Municipal Improvements Standards



Rev.				LANE OR COMMERCIAL CROSSING (HAND PLACED)	Approved:	Figure <b>G-26</b>
Rev.						
Rev.						
Rev.	2021-FEB-15	File No.: GP60.33682	Design:			
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			



PLAN VIEW



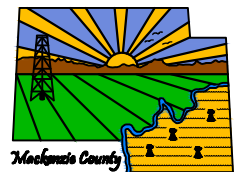
SECTION A-A


NOTES:

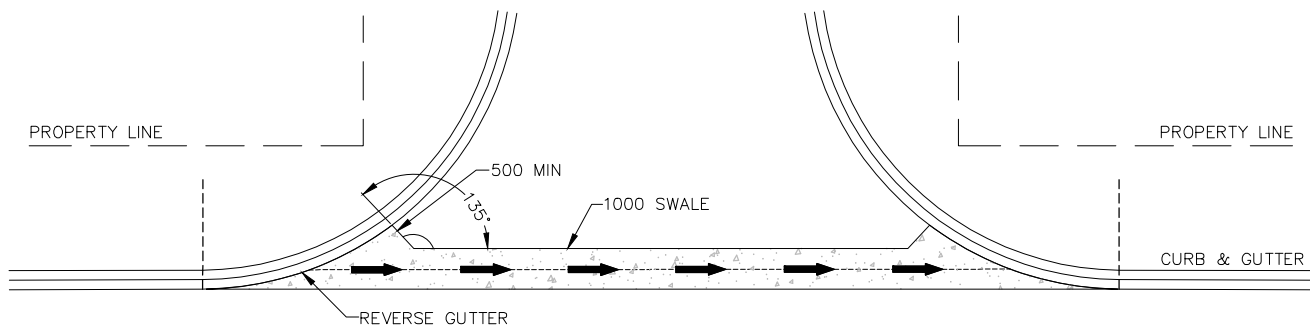
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

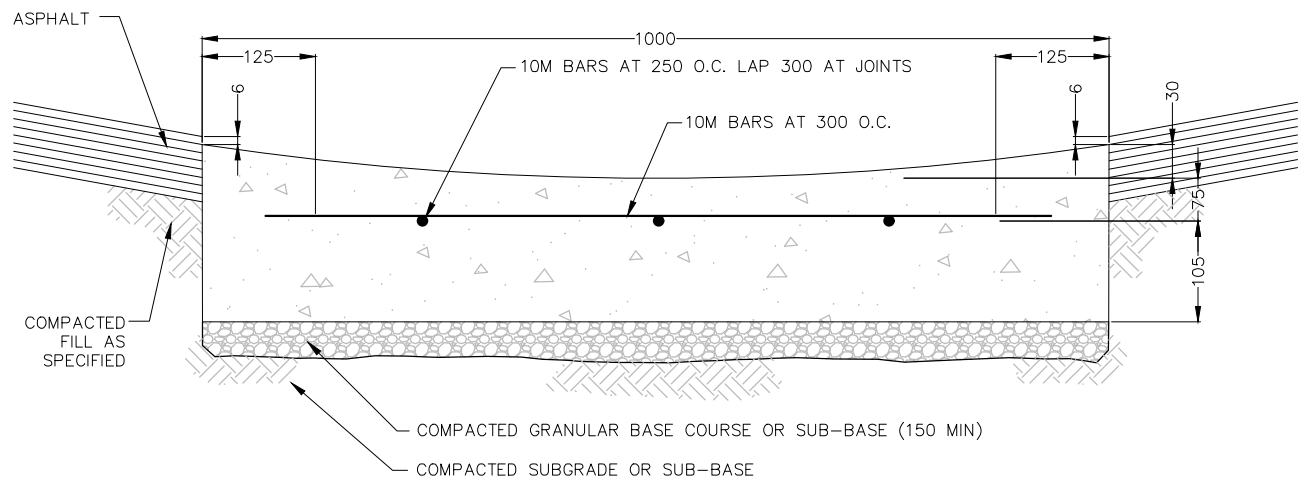
## General Municipal Improvements Standards



Rev.				<b>BUS STOP PAD ROLLED MONO GUTTER AND WALK</b>	Approved: 	Figure <b>G-27</b>
Rev.						
Rev.						
Rev.	2021-FEB-15	File No.: GP60.33682	Design:			
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			



PLAN



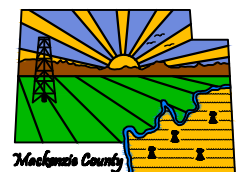
SECTION

NOTES:


1. CONTRACTION JOINTS SPACED AT 3m INTERVAL.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

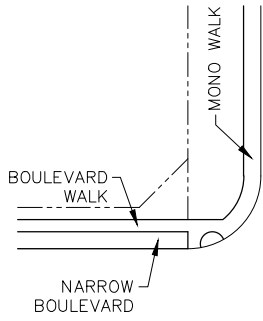
## General Municipal Improvements Standards



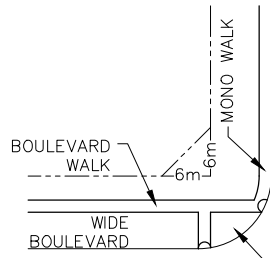
### 1000mm CONCRETE SWALE PLAN & SECTION

Rev.				Approved: 	Figure <b>G-28</b>
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2014-JUN-25	Drawn: K.P.L	Scale: N.T.S		

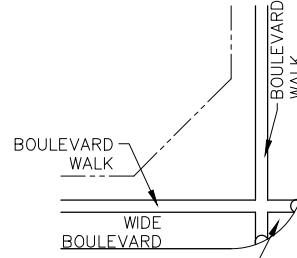
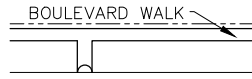




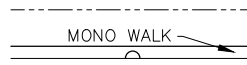
RAMP TYPE A



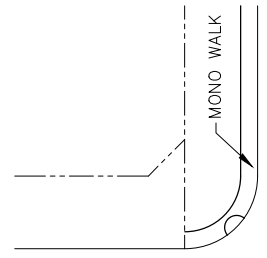
RAMP TYPE B



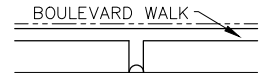
RAMP TYPE B



CONCRETE IF LESS THAN 3.0m<sup>2</sup> USE RAMP TYPE A



RAMP TYPE A



LOCATE RAMP DIRECTLY ACROSS FROM CORNER RAMPS

RAMP TYPE C



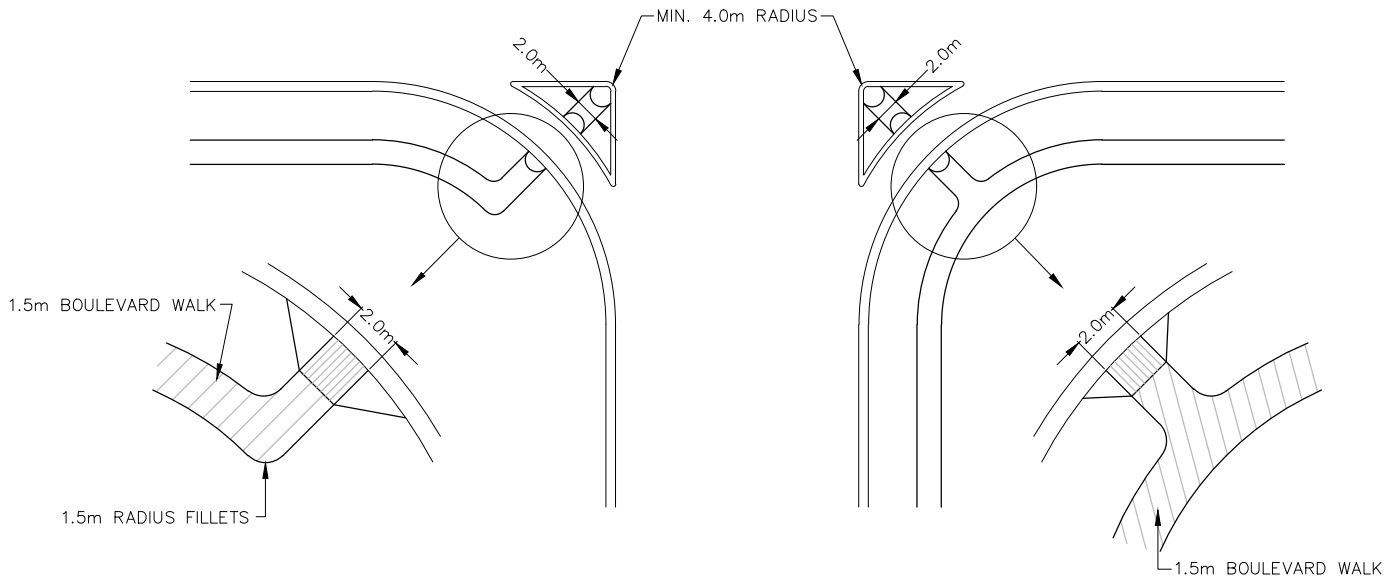
LOCATE RAMP DIRECTLY ACROSS FROM CORNER RAMPS

RAMP TYPE D

RAMP TYPE C

RAMP TYPE D

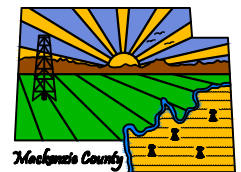
TANGENT LAYOUT



RAMP TYPE D INTERSECTION LAYOUT

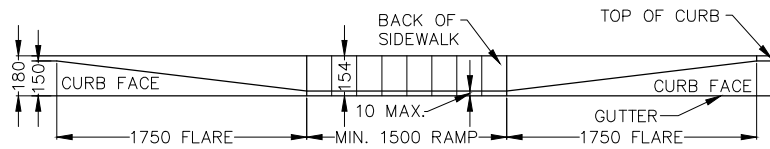
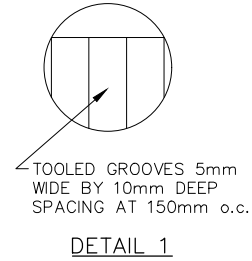
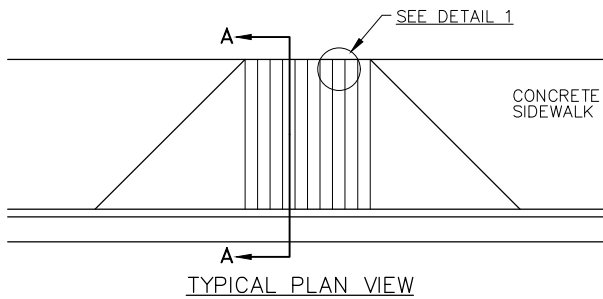
# MACKENZIE COUNTY

## General Municipal Improvements Standards

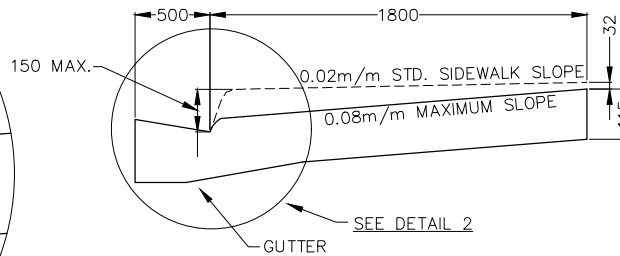
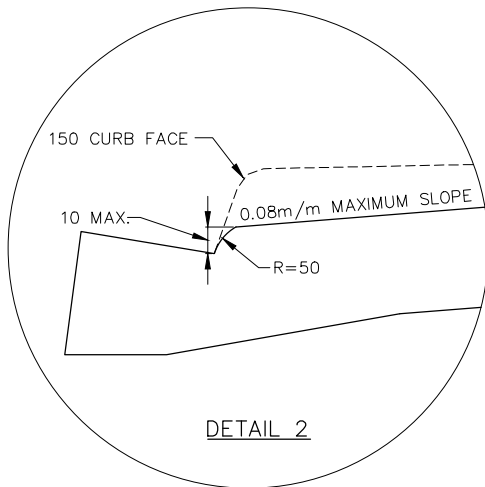


### CURB RAMP LOCATIONS

Rev.				Approved:	Figure G-29
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		



TYPICAL ELEVATION



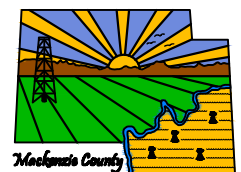
TYPICAL CROSS SECTION (A-A)

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. RAMP FOR USERS OF WHEELCHAIRS/BICYCLES SHOULD BE LOCATED AT ALL JUNCTIONS OF CROSSWALKS AND SIDEWALKS. RAMP MUST BE LOCATED WITHIN A SIDEWALK.
3. GROOVES ON SIDEWALK RAMP ARE TO ALERT PERSONS WHO ARE VISUALLY IMPAIRED OF THE CURB-CUT AND A STREET CROSSING.
4. WHERE CROSSWALKS ARE CONTROLLED BY SIGNALS WITH A PUSH-BUTTON SYSTEM, THE SIDEWALK AND RAMP MUST ALLOW ACCESS FOR WHEELCHAIR TO PUSH BUTTON.
5. MINIMUM WIDTH OF RAMP IS 1500mm. IT MAY BE NECESSARY TO BUILD WIDER RAMP IN BUSY URBAN AREAS WHERE VOLUME OF PEDESTRIAN TRAFFIC IS HIGH.
6. MAXIMUM RAMP SLOPE IS 0.08m/m.
7. WHERE THE SIDEWALK IS LESS THAN 1800mm WIDE, THE 0.08m/m MAX. SLOPE SHOULD NOT BE EXCEEDED AND THEREFORE THE BACK OF THE SIDEWALK MUST BE LOWERED ACCORDINGLY.
8. 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.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

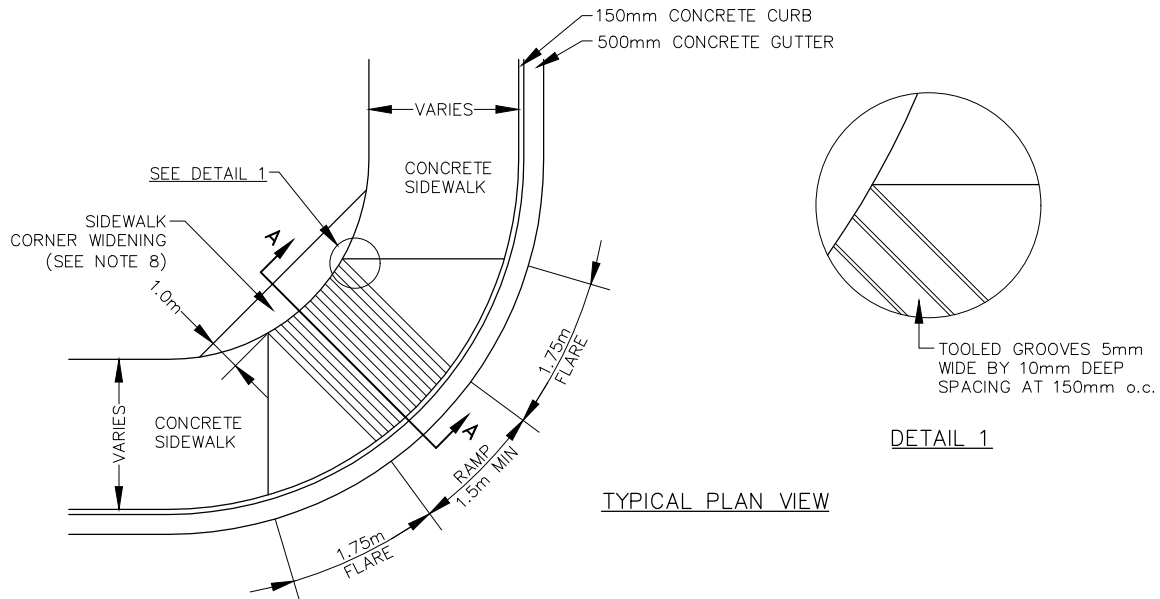


### CONCRETE SIDEWALK RAMP FOR WHEELCHAIR OR BICYCLE ON TANGENT (TYPE 1)

Approved:

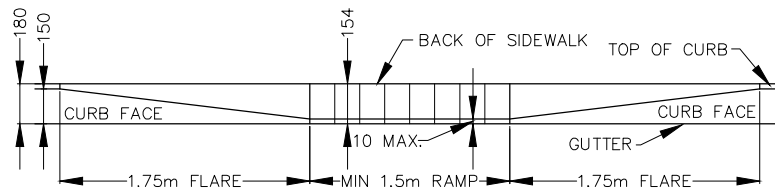
Figure **G-30**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

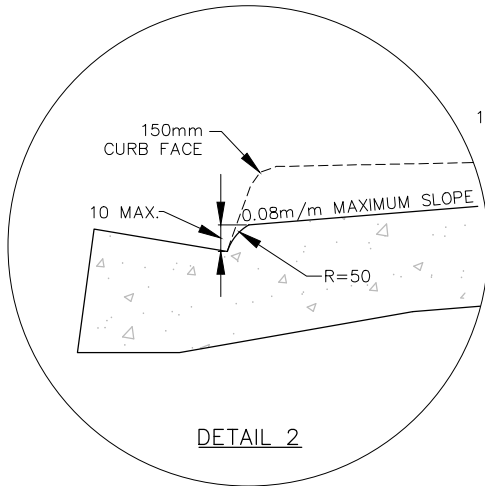


DETAIL 1

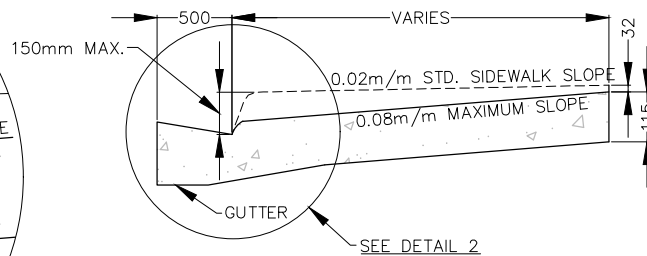
TYPICAL PLAN VIEW



TYPICAL ELEVATION



DETAIL 2



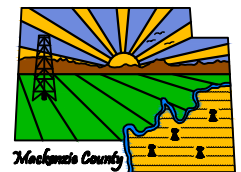
TYPICAL CROSS SECTION (A-A)

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. RAMPS FOR USERS OF WHEELCHAIRS/BICYCLES SHOULD BE LOCATED AT ALL JUNCTIONS OF CROSSWALKS AND SIDEWALKS. RAMPS MUST BE LOCATED WITHIN A SIDEWALK.
3. GROOVES ON SIDEWALK RAMPS ARE TO ALERT PERSONS WHO ARE VISUALLY IMPAIRED OF THE CURB-CUT AND A STREET CROSSING.
4. WHERE CROSSWALKS ARE CONTROLLED BY SIGNALS WITH A PUSH-BUTTON SYSTEM, THE SIDEWALK AND RAMPS MUST ALLOW ACCESS FOR WHEELCHAIR TO PUSH BUTTON.
5. MINIMUM WIDTH OF RAMP IS 1500mm. IT MAY BE NECESSARY TO BUILD WIDER RAMPS IN BUSY URBAN AREAS WHERE VOLUME OF PEDESTRIAN TRAFFIC IS HIGH.
6. MAXIMUM RAMP SLOPE IS 0.08m/m.
7. WHERE THE SIDEWALK IS LESS THAN 1800mm WIDE, THE 0.08m/m MAX. SLOPE SHOULD NOT BE EXCEEDED AND THEREFORE THE BACK OF THE SIDEWALK MUST BE LOWERED ACCORDINGLY.
8. 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.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

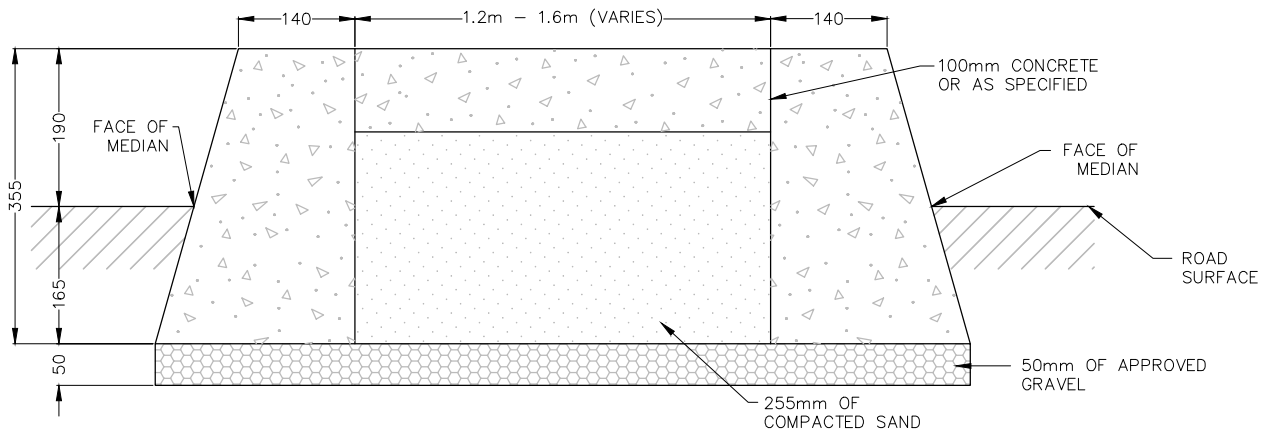


### CONCRETE SIDEWALK RAMP FOR WHEELCHAIR OR BICYCLE ON CORNER (TYPE 2)

Approved:

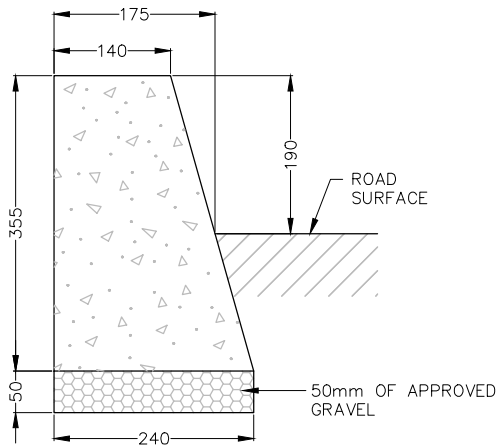
Figure **G-31**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

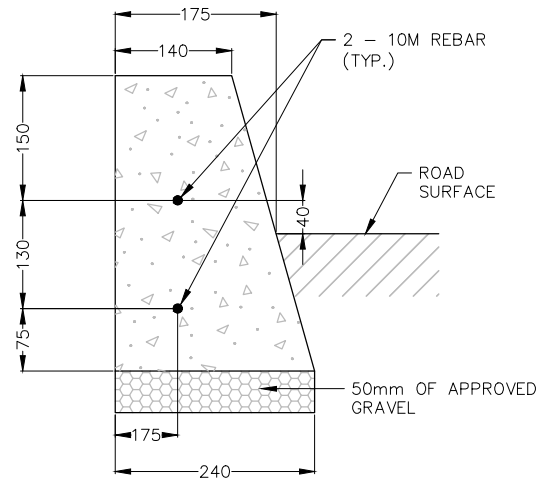


MEDIAN DETAIL

STANDARD SECTION



REINFORCED SECTION

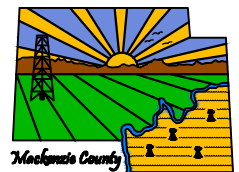


STANDARD CONCRETE CURB

- NOTE:
1. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.
  2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

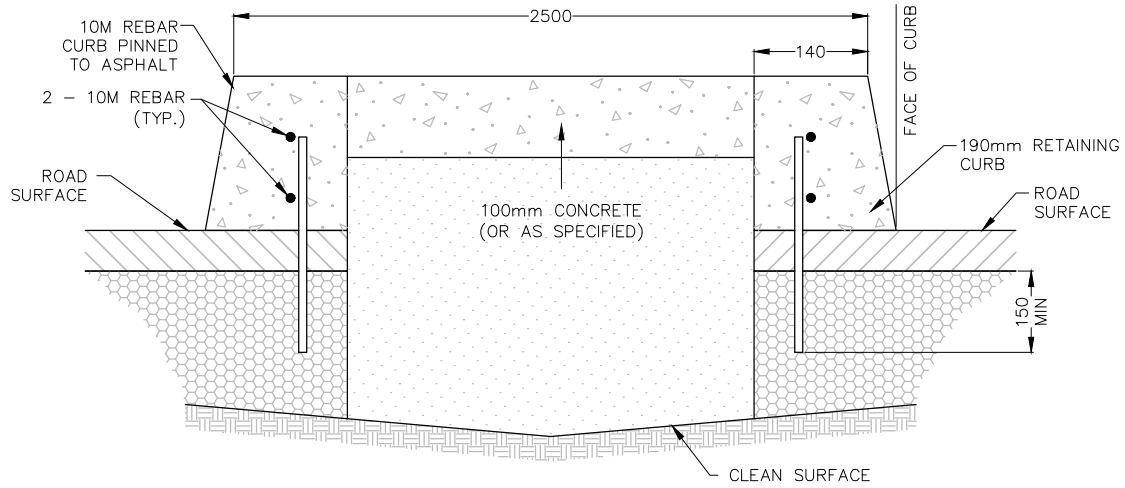


### CURB & MEDIAN (GRAVEL BASE)

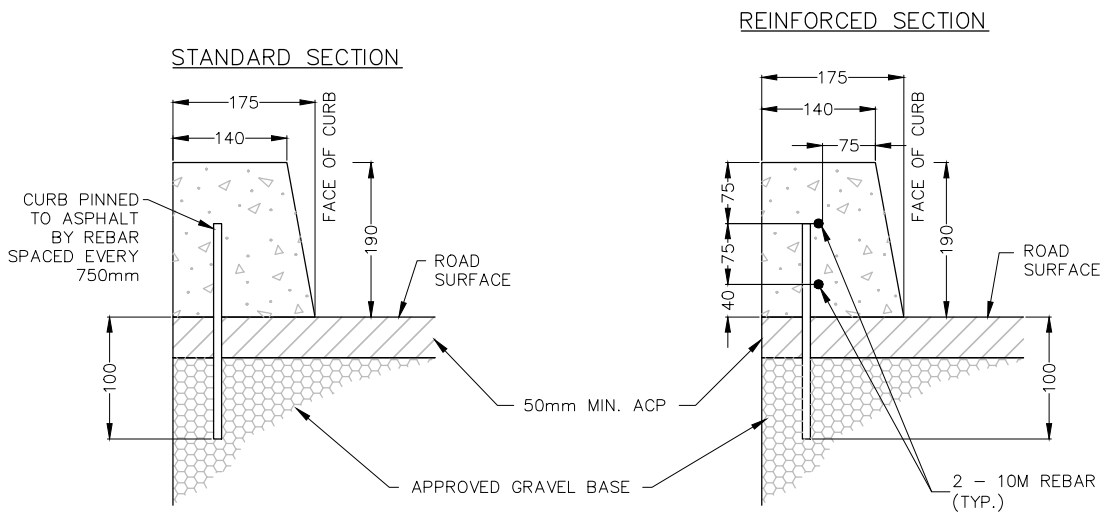
Approved: *[Signature]*

Figure **G-32**

Rev.			
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Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S



MEDIAN DETAIL (PIN-ON CURBS)



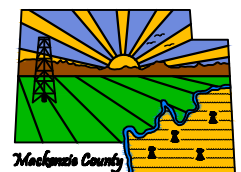
CONCRETE CURB (PIN-ON)

NOTES:


1. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

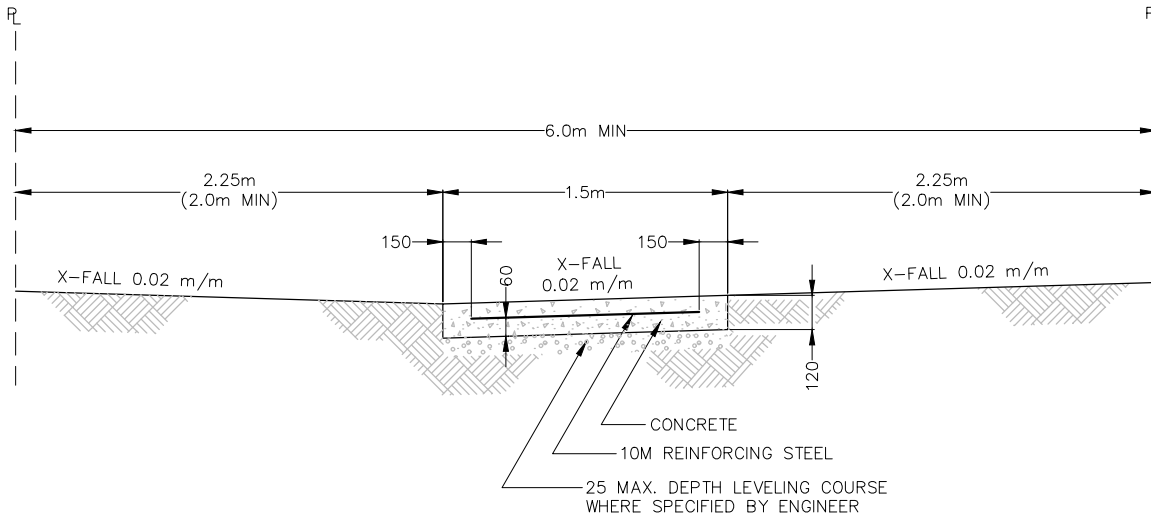
# MACKENZIE COUNTY

## General Municipal Improvements Standards

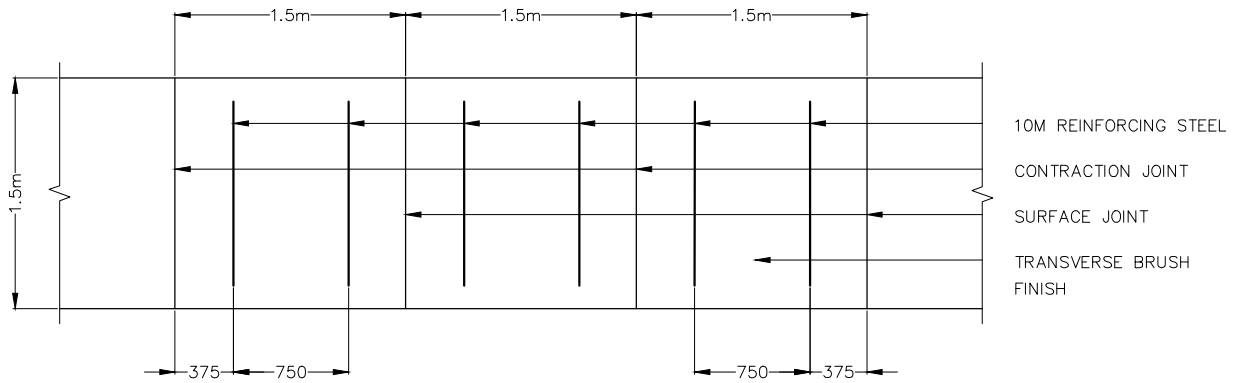


### CURB AND MEDIAN (ASPHALT BASE-PIN ON)

Rev.				Approved: 	Figure <b>G-33</b>
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		



TYPICAL SECTION



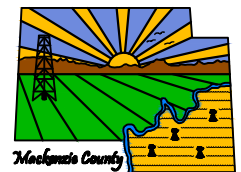
PLAN VIEW

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

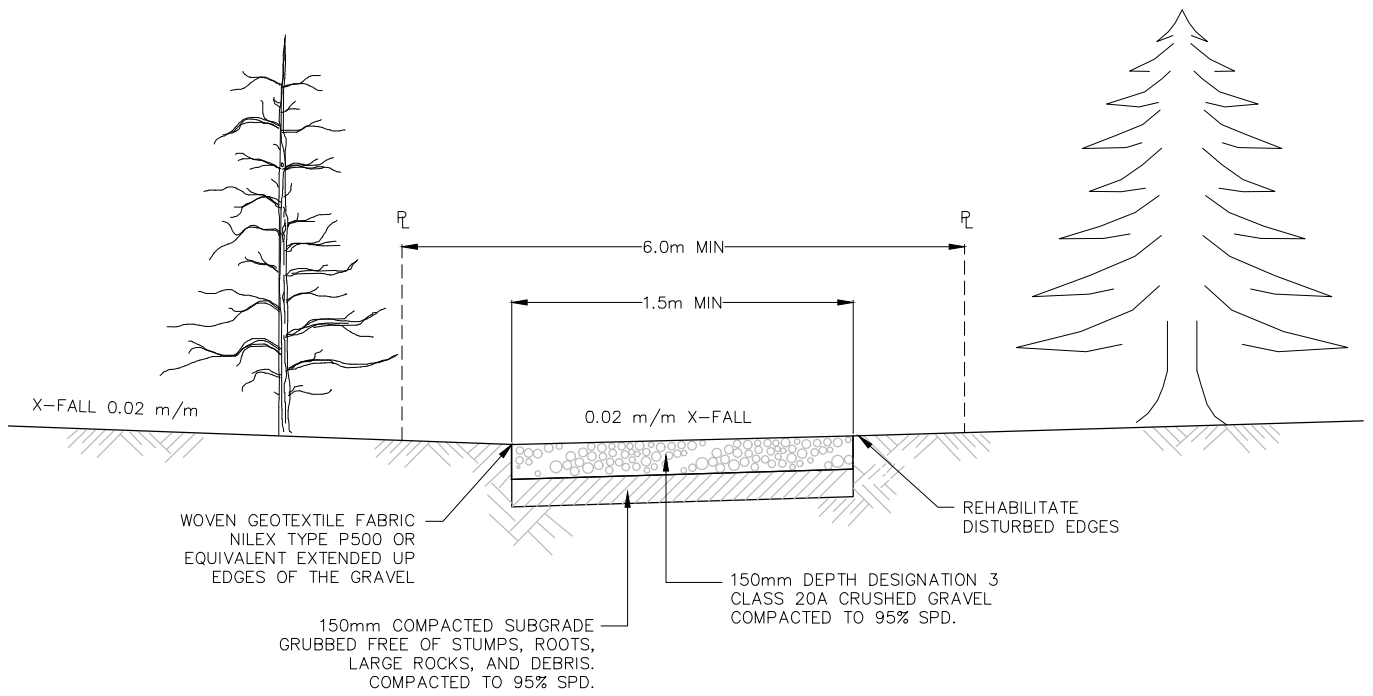


### CONCRETE WALKWAY

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

Approved:

Figure **G-34**

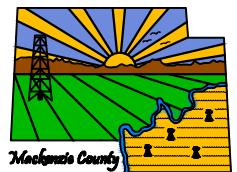




TYPICAL SECTION

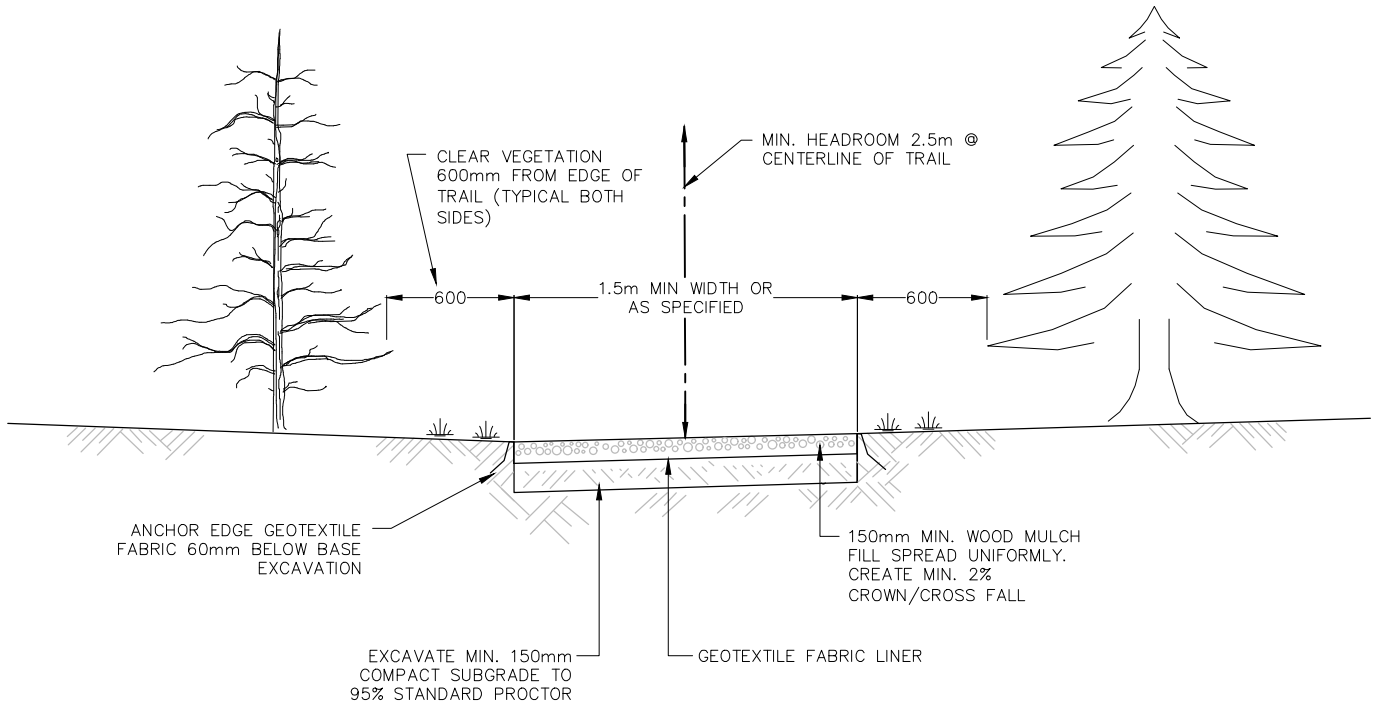
NOTE:  
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				GRANULAR WALKWAY	Approved: 	Figure <b>G-35</b>
Rev.						
Rev.						
Rev.	2021-FEB-15	File No.: GP60.33682	Design:	Approved: 	Figure <b>G-35</b>	
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			

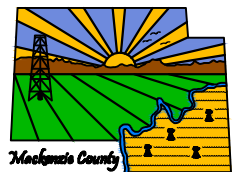


TYPICAL SECTION

NOTE:  
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

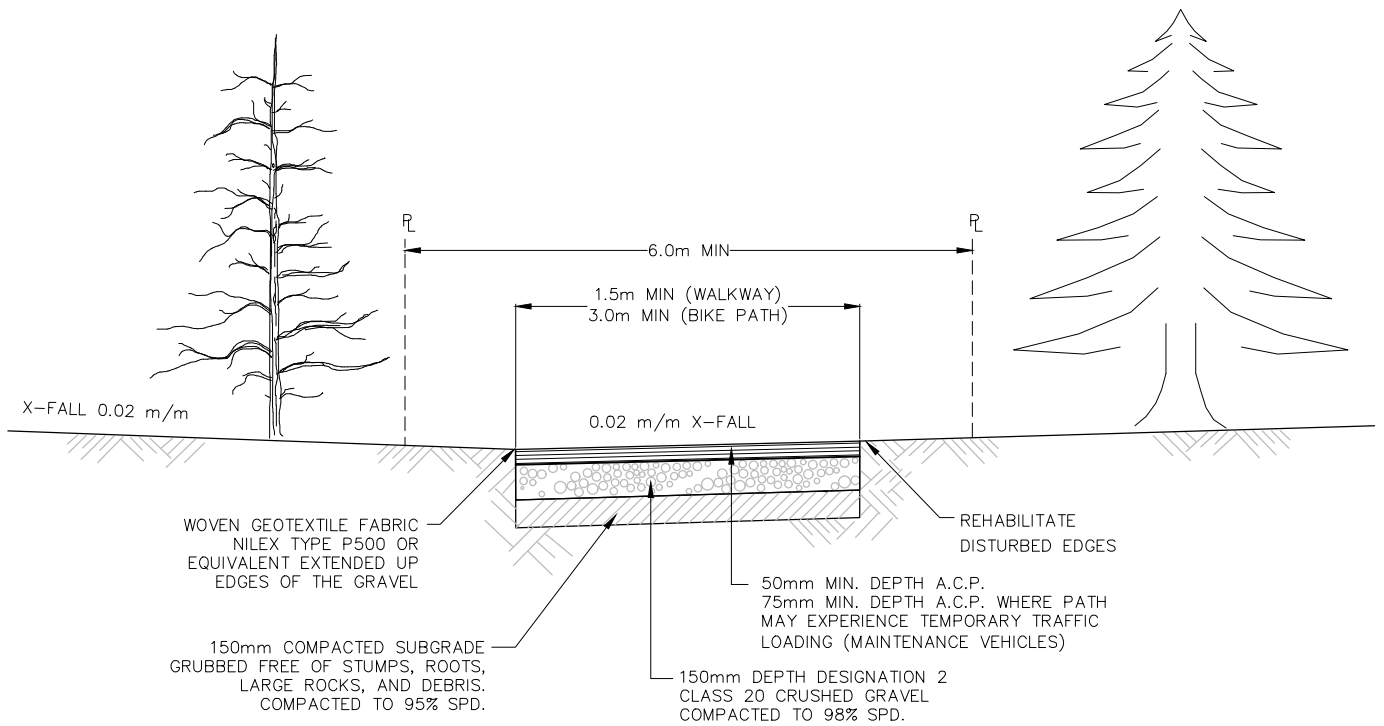
# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				HIKING TRAIL	Figure <b>G-36</b>
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:	Approved:	
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		



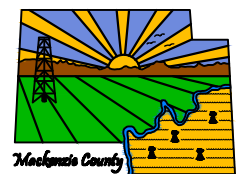


TYPICAL SECTION

NOTE:  
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

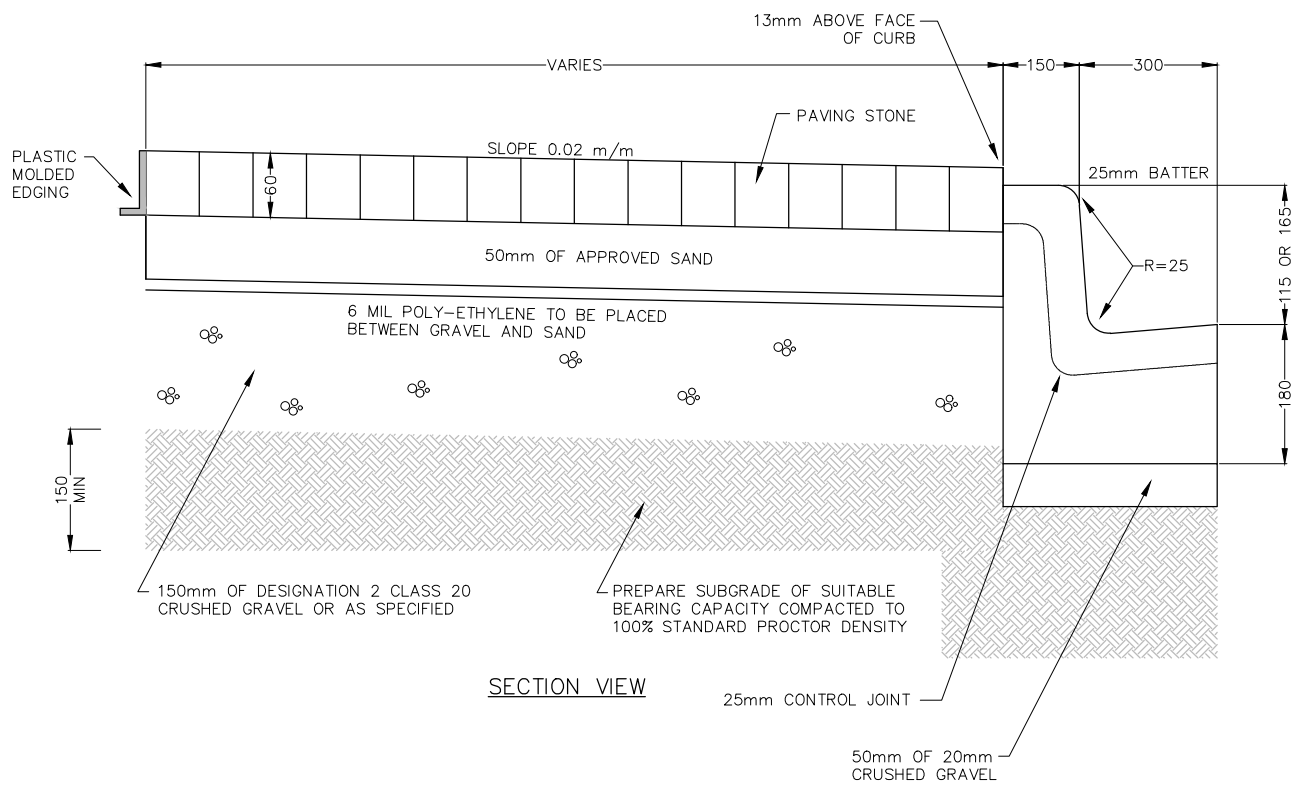
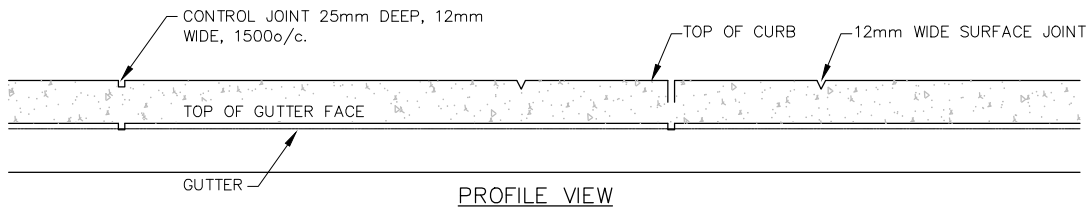
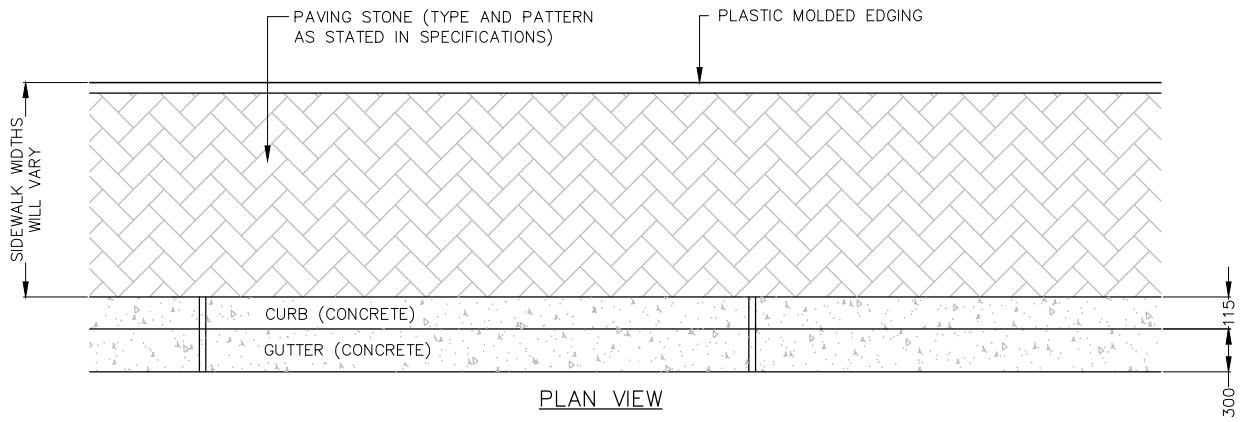


### PAVED WALKWAY / BIKE PATH

Approved:

Figure **G-37**

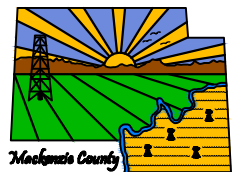
Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S



NOTE:  
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

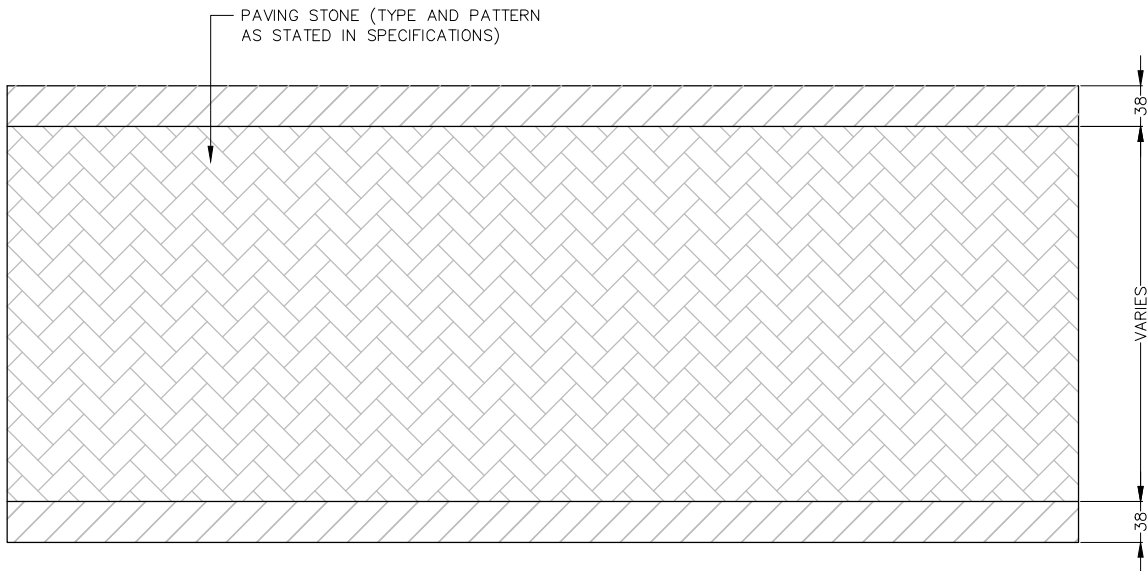


### COMBINATION STANDARD CURB & GUTTER WITH PAVING STONE SIDEWALK

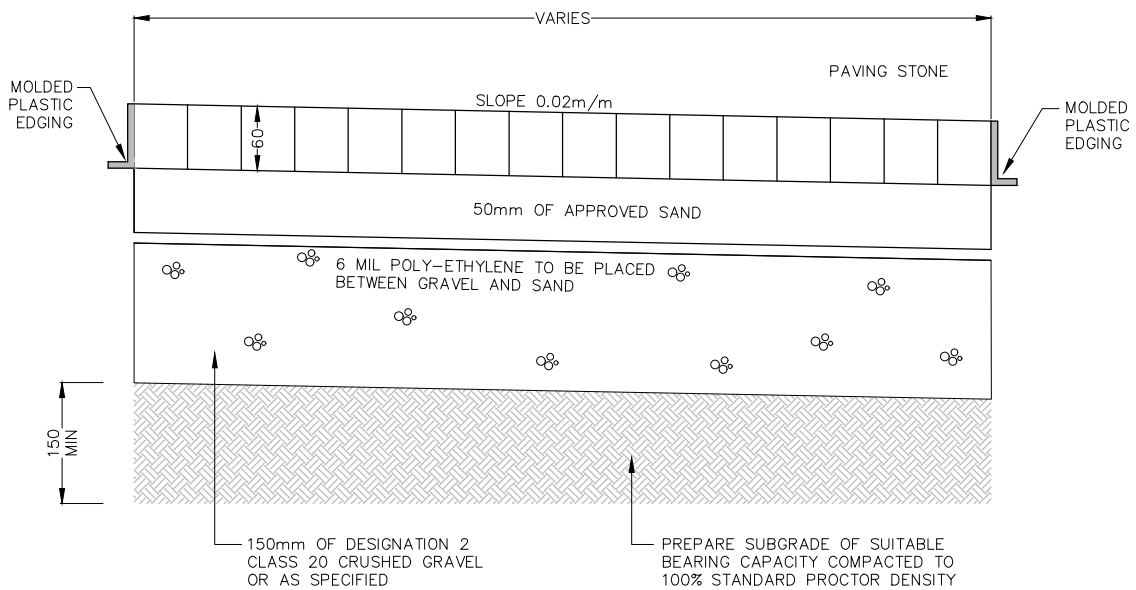
Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

Approved:

Figure **G-38**



PLAN VIEW

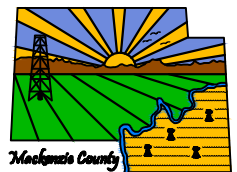


SECTION VIEW

NOTE:  
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

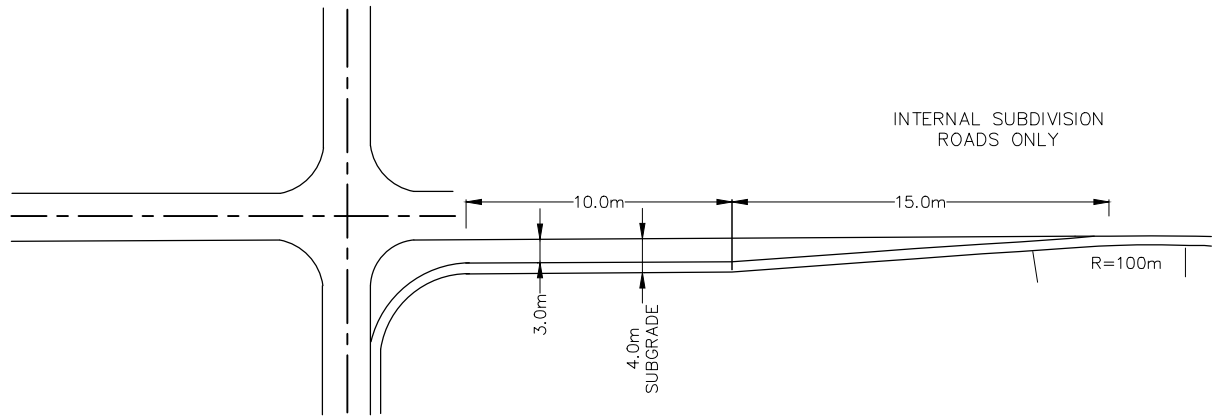


### PAVING STONE WALKWAY DETAIL

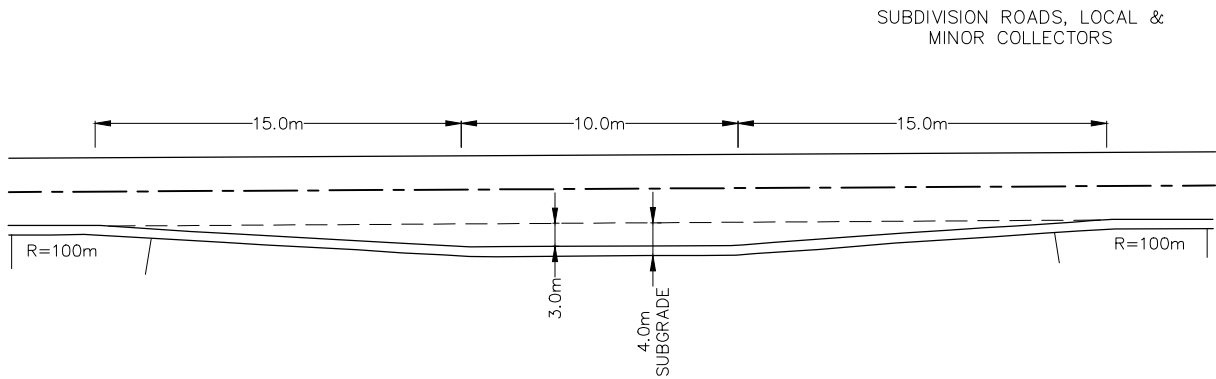
Approved:

Figure **G-39**

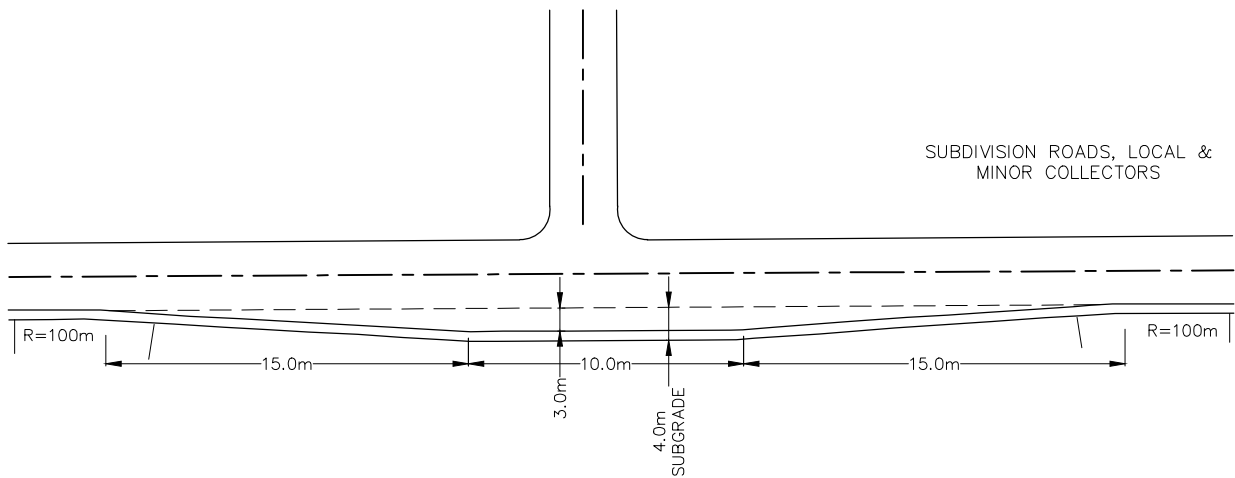
Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S



CORNER LOCATION



MID BLOCK LOCATION

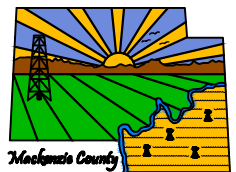


TEE LOCATION

NOTE:  
ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

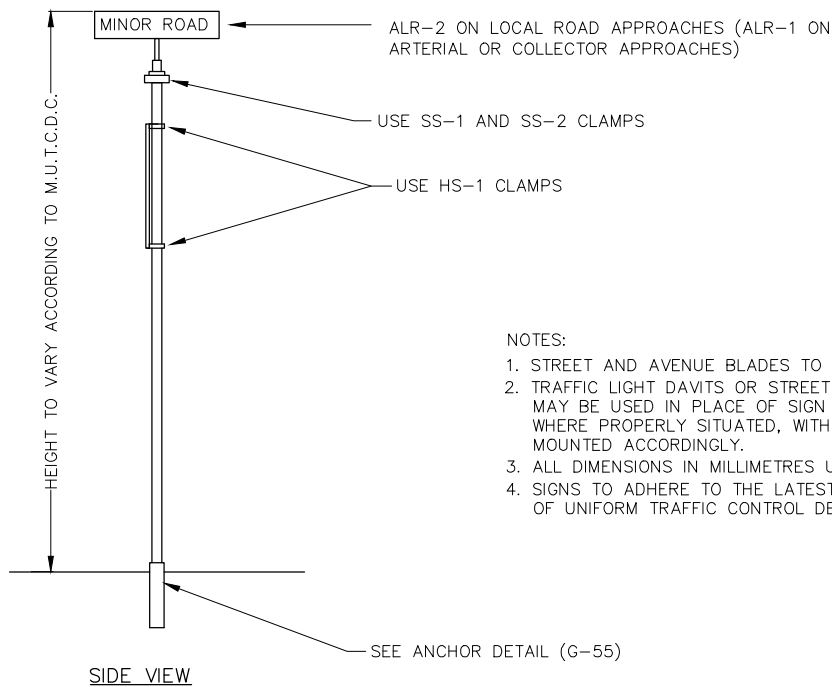
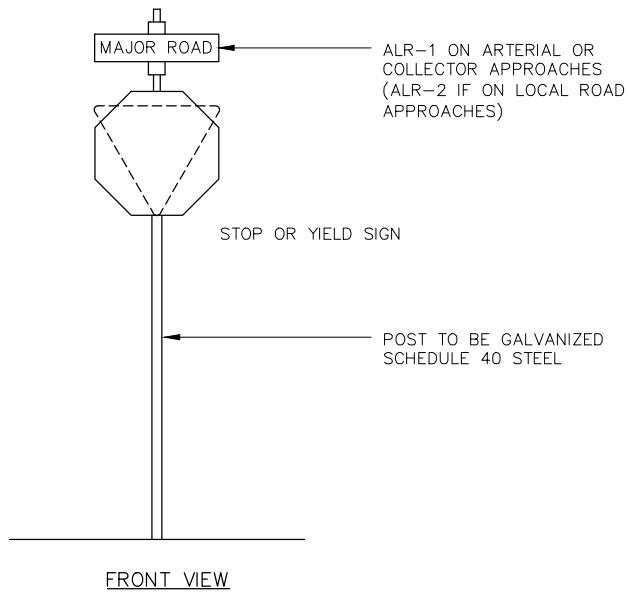


### TYPICAL MAILBOX PULLOUT LOCATIONS

Approved:

Figure **G-40**

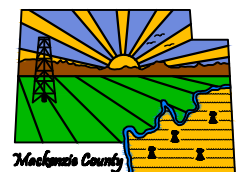
Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S



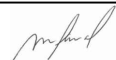
- NOTES:
1. STREET AND AVENUE BLADES TO FACE BOTH SIDES.
  2. TRAFFIC LIGHT DAVITS OR STREET LIGHT POLES MAY BE USED IN PLACE OF SIGN POSTS WHERE PROPERLY SITUATED, WITH SIGN FACES MOUNTED ACCORDINGLY.
  3. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
  4. SIGNS TO ADHERE TO THE LATEST EDITION OF THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES FOR CANADA.

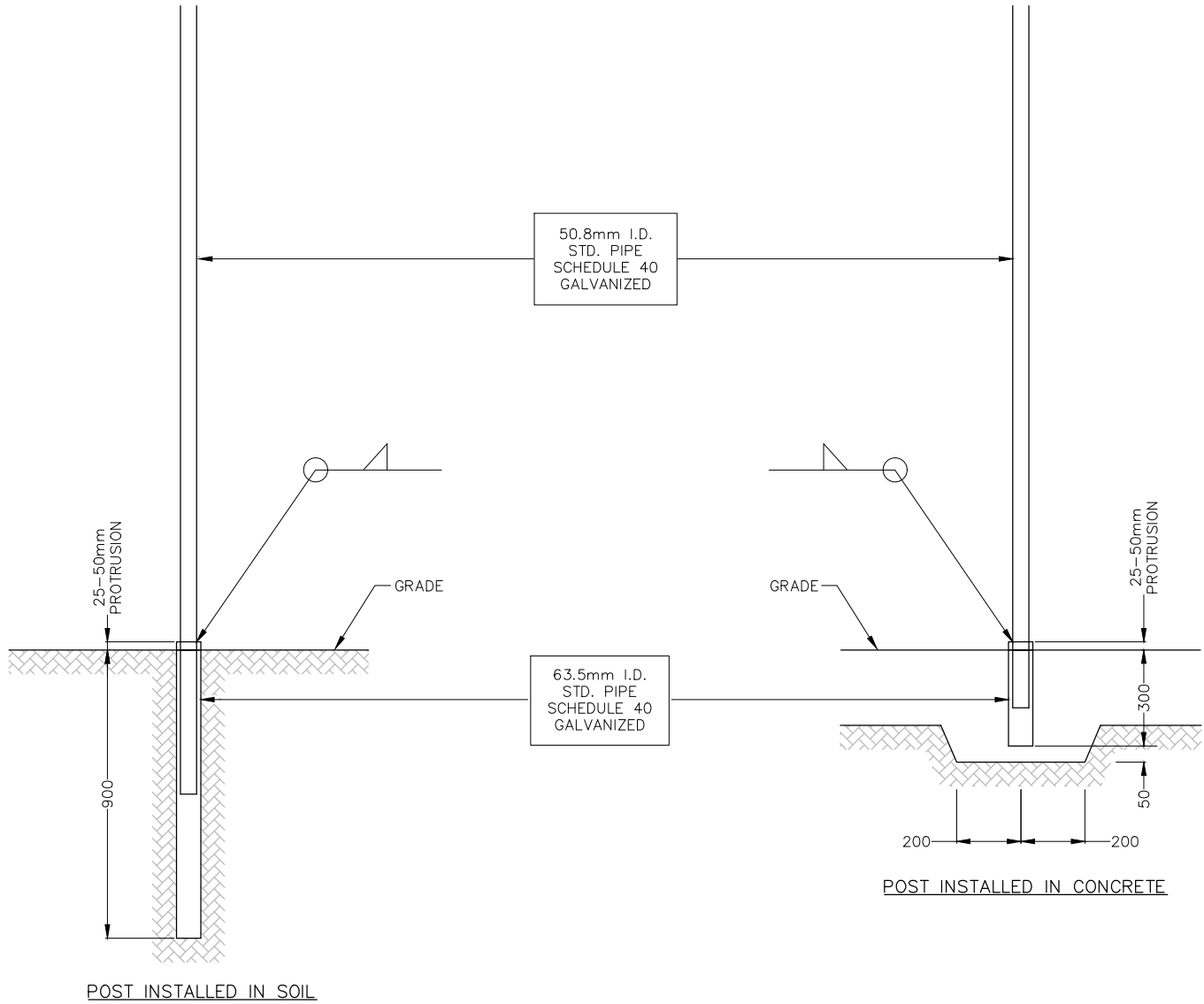
# MACKENZIE COUNTY

## General Municipal Improvements Standards



### SIGN MOUNTING DETAILS

Rev.				Approved: 	Figure G-41
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		

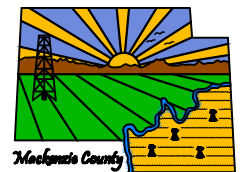


NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

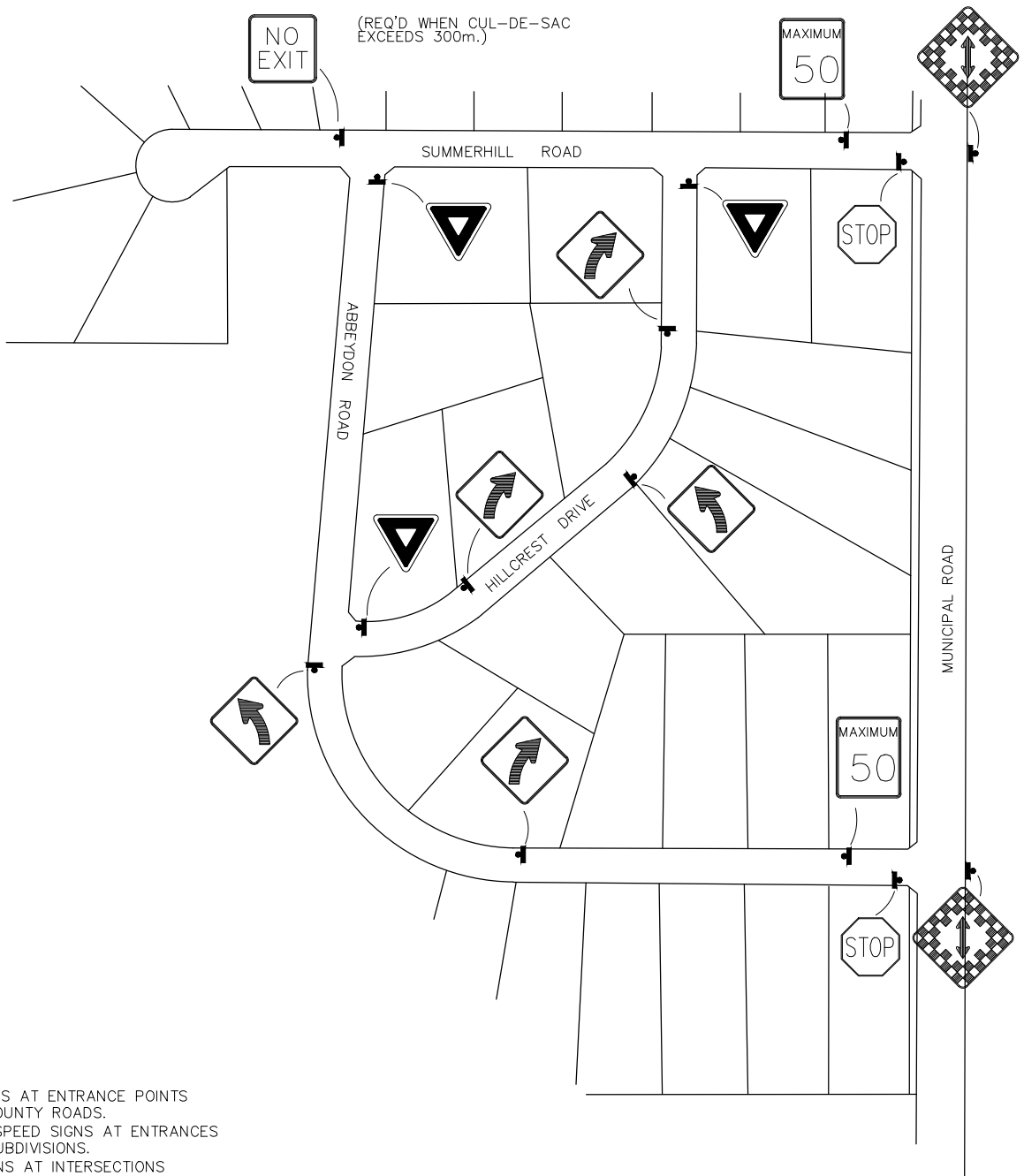


### SIGN POST ANCHOR DETAIL

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

Approved:

Figure **G-42**

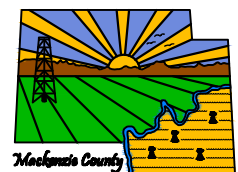


NOTES:


1. STOP SIGNS AT ENTRANCE POINTS TO ALL COUNTY ROADS.
2. 50Km/h SPEED SIGNS AT ENTRANCES TO ALL SUBDIVISIONS.
3. YIELD SIGNS AT INTERSECTIONS WITHIN SUBDIVISION.
4. TURNING SIGNS AT BEGINNING OF CURVE.
5. ANY OTHER TRAFFIC SIGNS DEEMED NECESSARY BY THE MUNICIPALITY.
6. STANDARD AND INSTALLATION SHALL CONFORM TO RTAC.
7. ALL SIGNS SHALL BE REFLECTORIZED.
8. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

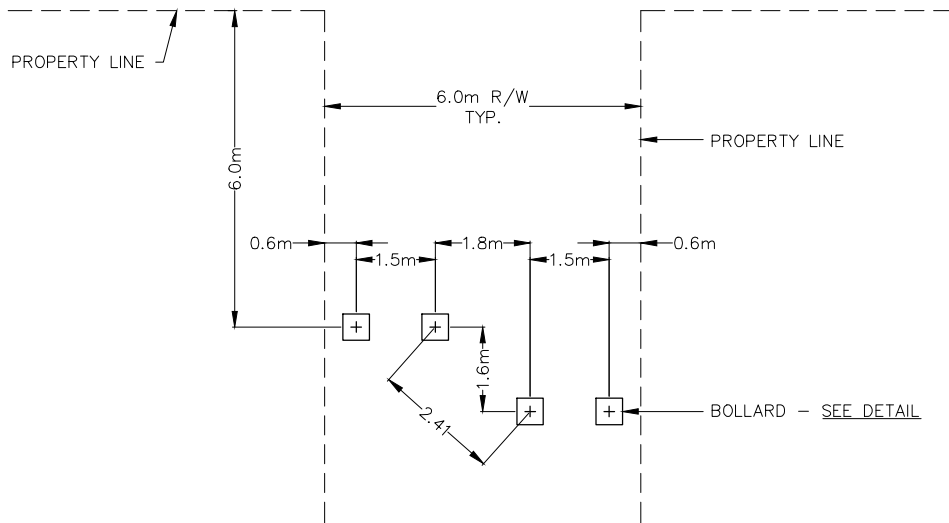
# MACKENZIE COUNTY

## General Municipal Improvements Standards



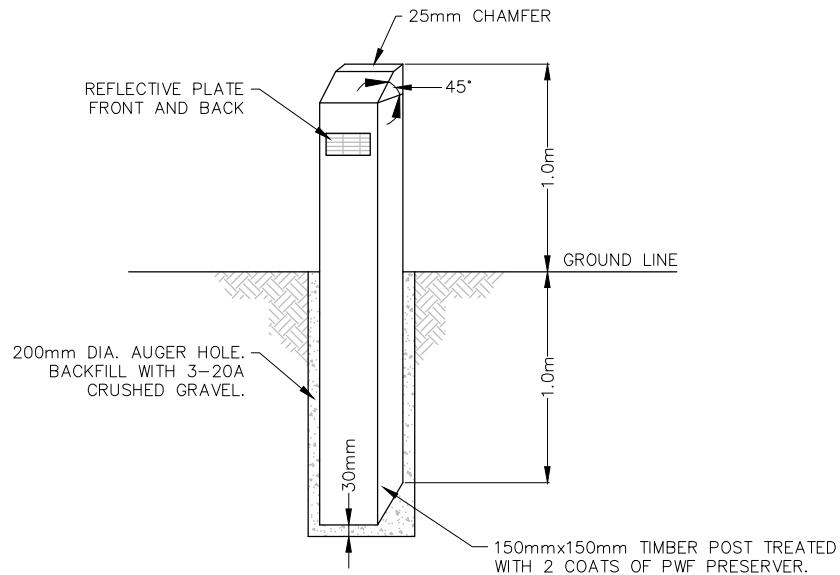
### TYPICAL TRAFFIC SIGN LAYOUT RURAL STANDARD

Rev.				Approved: 	Figure G-43
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		



TYPICAL BOLLARD LAYOUT

HAND TREAT ALL CUTS WITH PWF PRESERVER.



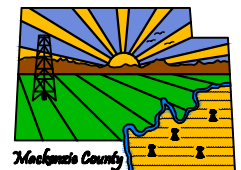
BOLLARD DETAIL

NOTES:

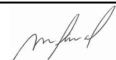
1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

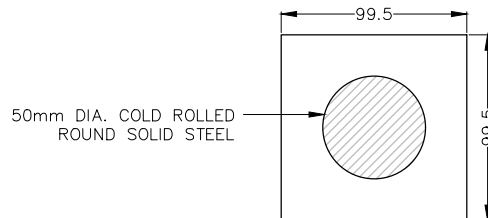
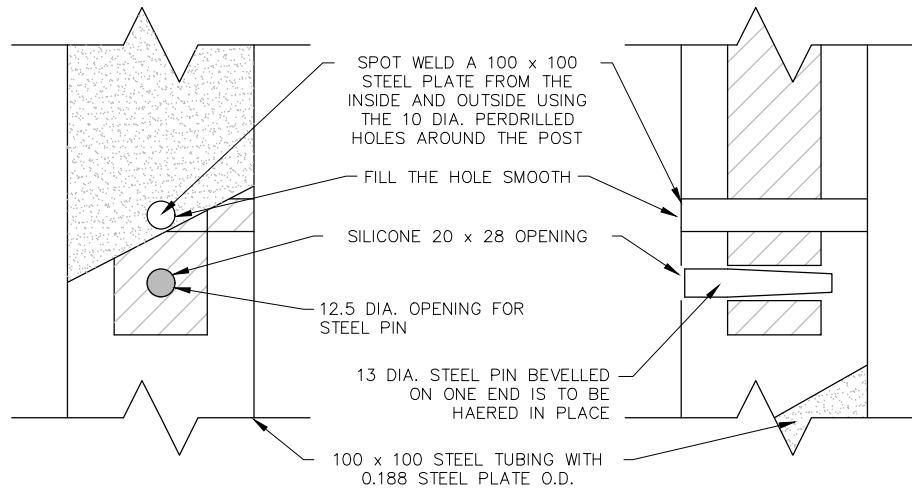
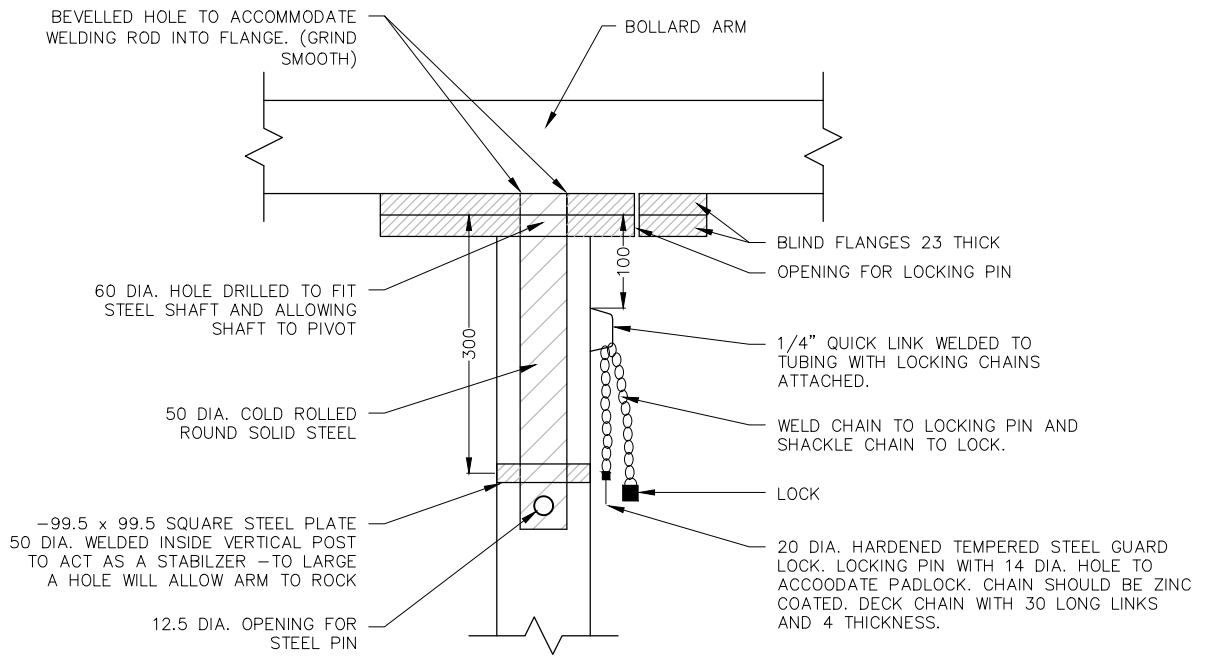
## General Municipal Improvements Standards



### TYPICAL BOLLARD LAYOUT AND INSTALLATION

Rev.				Approved: 	Figure G-44
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		



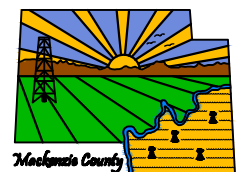


\* NOTE: ALL METAL TO BE GALVANIZED POWDER COATING OPTIONAL. COLOUR TO BE APPROVED BY MACKENZIE COUNTY.

NOTE:  
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



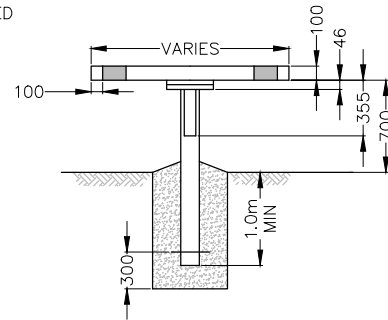
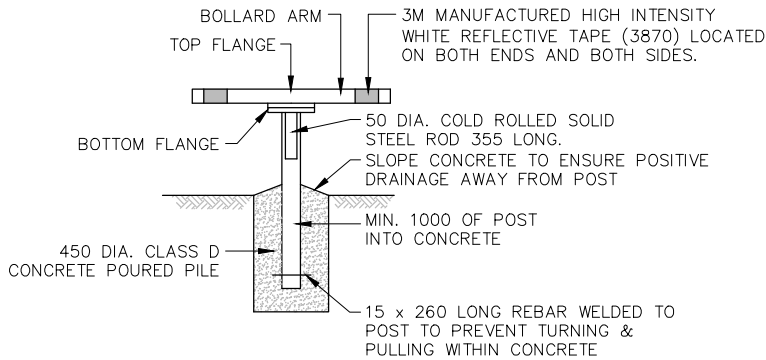
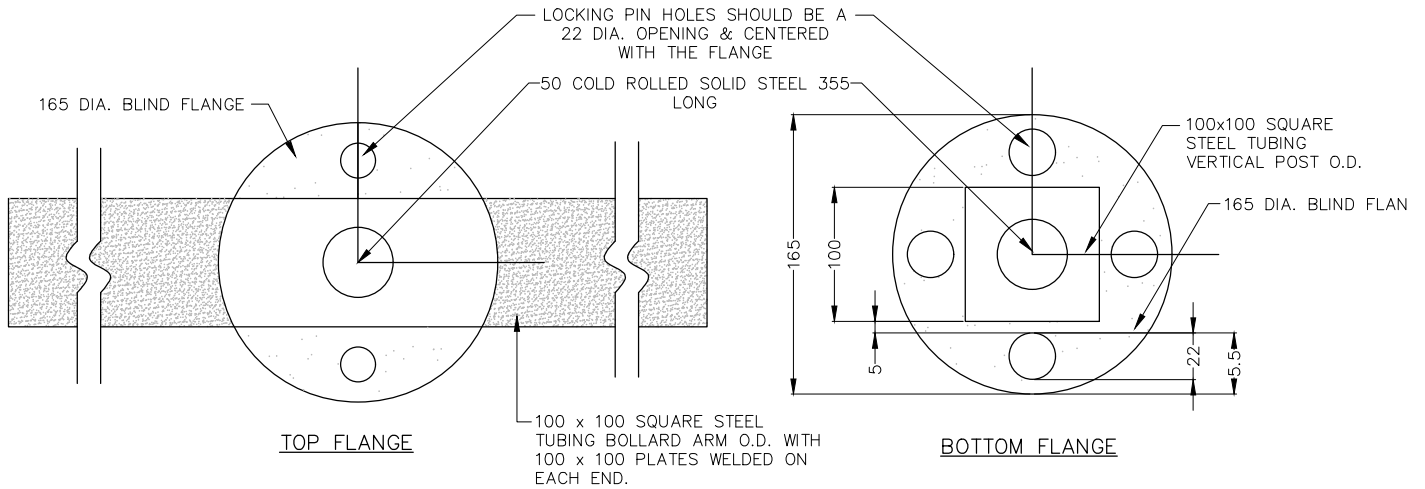
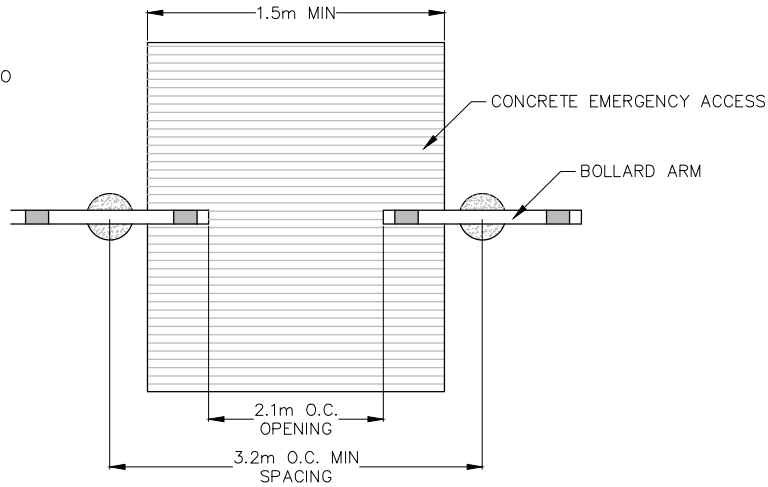
### T-BOLLARD ASSEMBLY DETAIL

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

Approved:

Figure **G-45**

NOTE: ALL METAL TO BE GALVANIZED  
POWDER COATING OPTIONAL. COLOUR TO  
BE APPROVED BY MACKENZIE COUNTY.

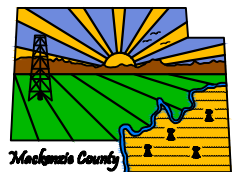


NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



### T-BOLLARD IN EMERGENCY ACCESS

Approved:

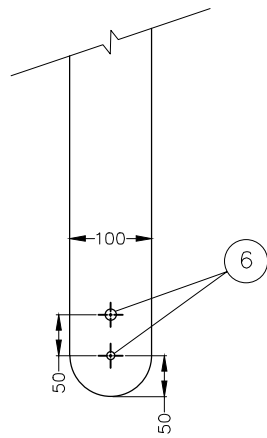
Figure

G-46

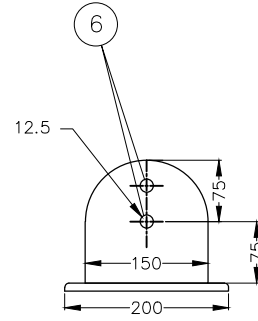
Rev.	
Rev.	
Rev.	
Rev.	2021-FEB-15
Date:	2010-AUG-31

File No.: GP60.33682  
Drawn: K.P.L

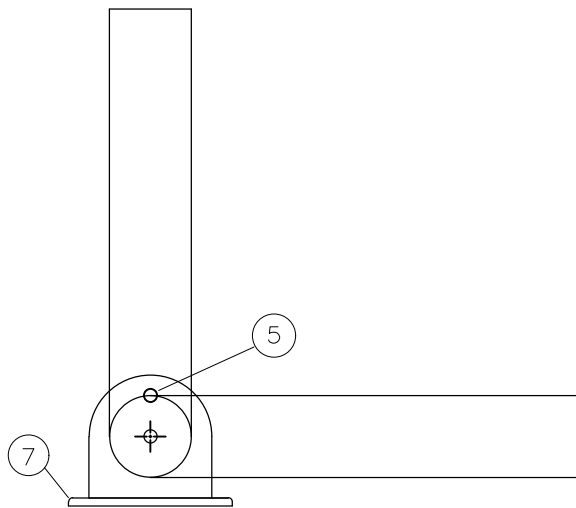
Design:  
Scale: N.T.S



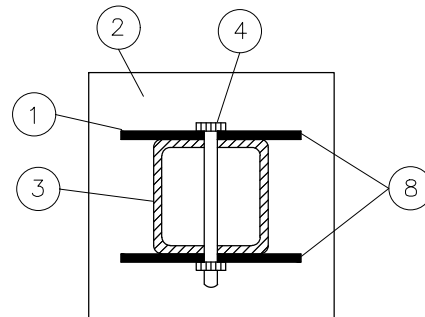
BOLLARD SECTION



BASE DETAIL



SIDE ELEVATION



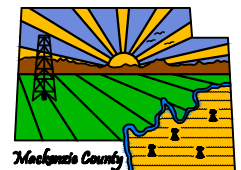
BASE CROSS SECTION

NOTES:

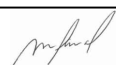
1. 12mm STEEL FLANGES WELDED TO BASE PLATE.
2. 200mm x 200mm x 12mm STEEL BASE PLATE c/w 4-19mm x 250mm STEEL ANCHOR OR TUBE WELDED TO BOTTOM.
3. 100mm x 100mm STEEL BOLLARD c/w TOP PLATE. 760mm IN LENGTH (YELLOW IN COLOR).
4. 12mm x 150mm BOLT c/w WASHERS AND NYLON LOCKING NUT.
5. 20mm x 150mm CLEVIS PIN.
6. HOLES DRILLED AS SHOWN.
7. CHAMFER TOP EDGES OF BASE PLATE.
8. TACK WELD.
9. SPECIFIC ANCHORING TO BE PRESCRIBED BY ENGINEER.
10. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

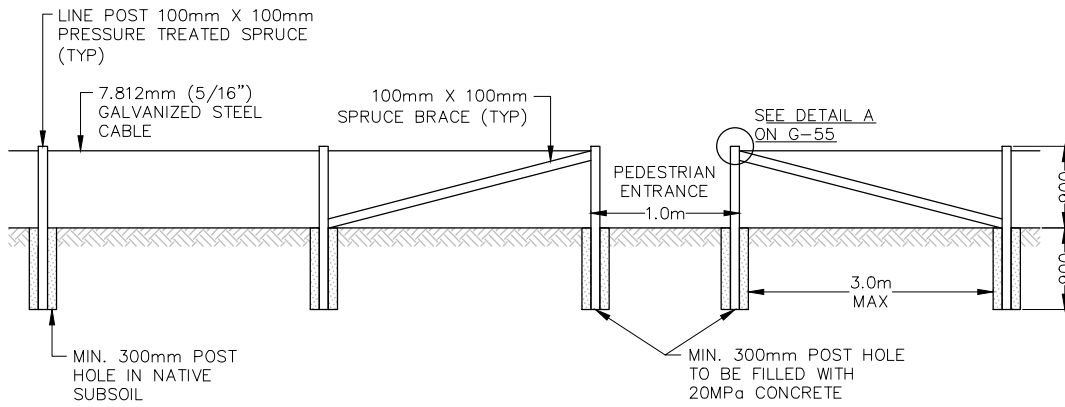
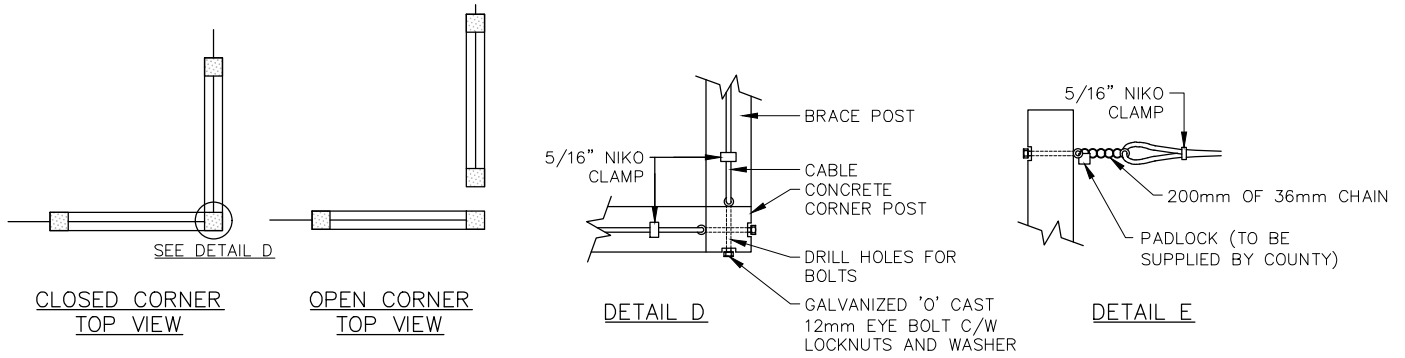
# MACKENZIE COUNTY

## General Municipal Improvements Standards

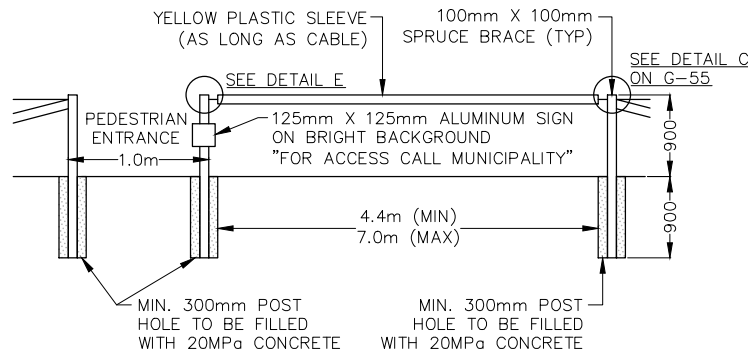


### COLLAPSIBLE BOLLARD

Rev.				Approved: 	Figure G-47
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		



**TYPICAL LONGITUDINAL SECTION  
C/W PEDESTRIAN ENTRANCE**



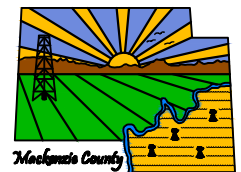
**TYPICAL VEHICLE ENTRANCE GATE**

**NOTES:**

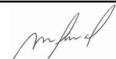
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

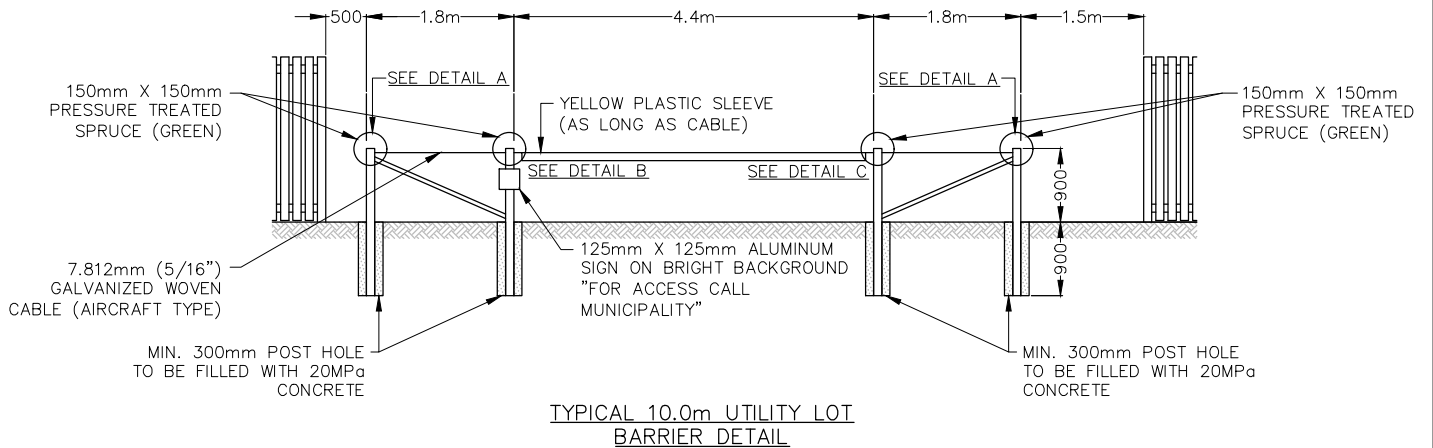
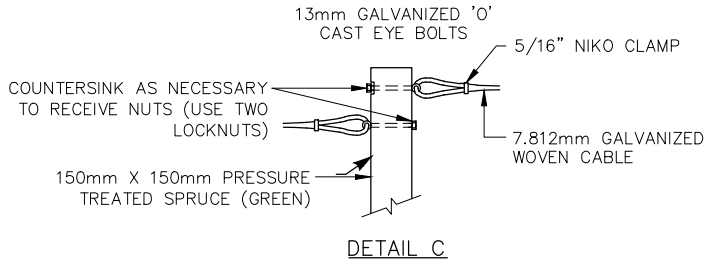
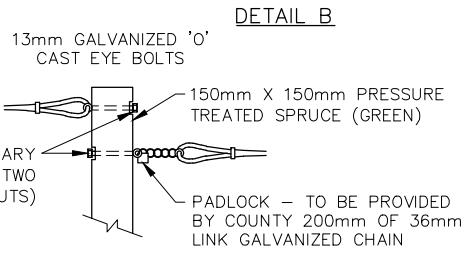
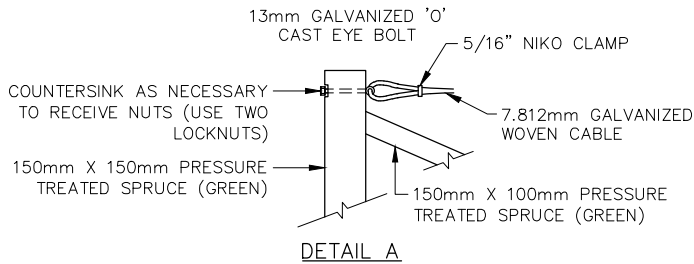
# MACKENZIE COUNTY

## General Municipal Improvements Standards



### POST & CABLE DETAIL

Rev.				Approved: 	Figure <b>G-48</b>
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		

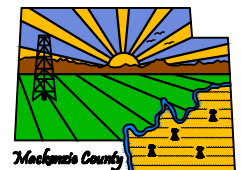


NOTES:

1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.
3. 'O' BOLTS AND CABLE CLAMPS TO BE GALVANIZED EQUIVALENT TO PREVENT CORROSION.
4. DOUBLE LOCKNUTS ON 'O' BOLTS AND LOCKNUTS ON CABLE.
5. BARRIER DETAILS ARE TYPICAL AND MAY VARY SLIGHTLY DEPENDING ON ACTUAL FIELD DIMENSIONS.
6. PADLOCK TO BE SUPPLIED AT COST BY THE MUNICIPALITY.
7. SIGN TO BE INSTALLED.
8. FOR ACCESS CALL MUNICIPALITY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

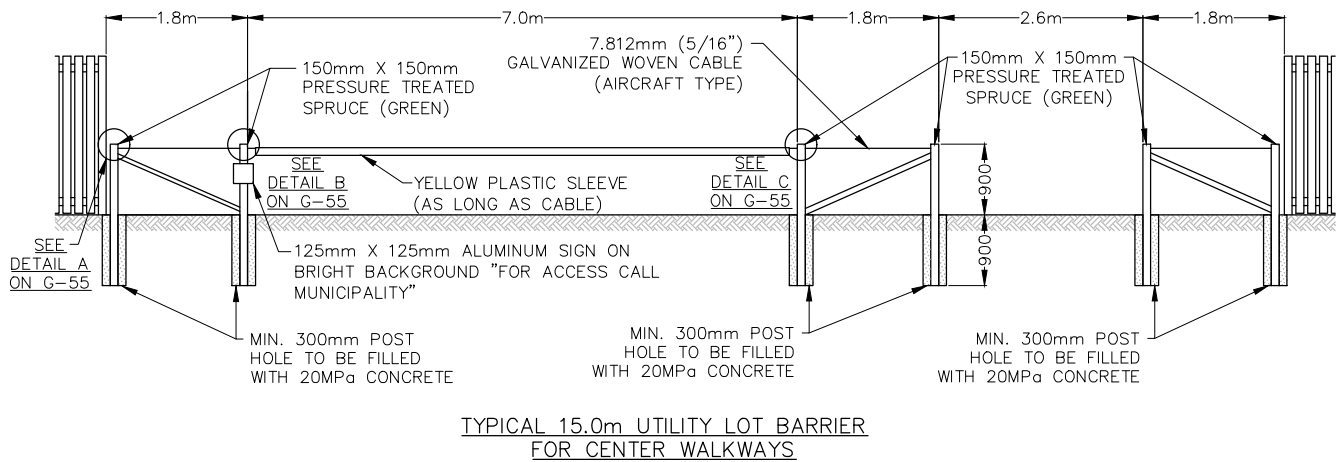
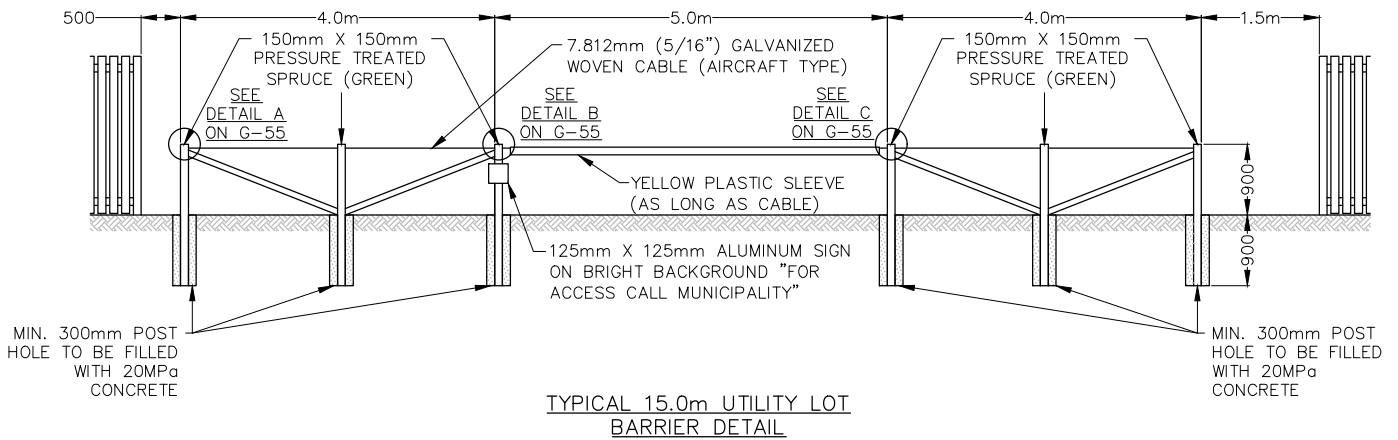


### UTILITY LOT BARRIER (10 METRE)

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

Approved:

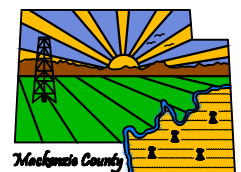
Figure **G-49**



- NOTES:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
  2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

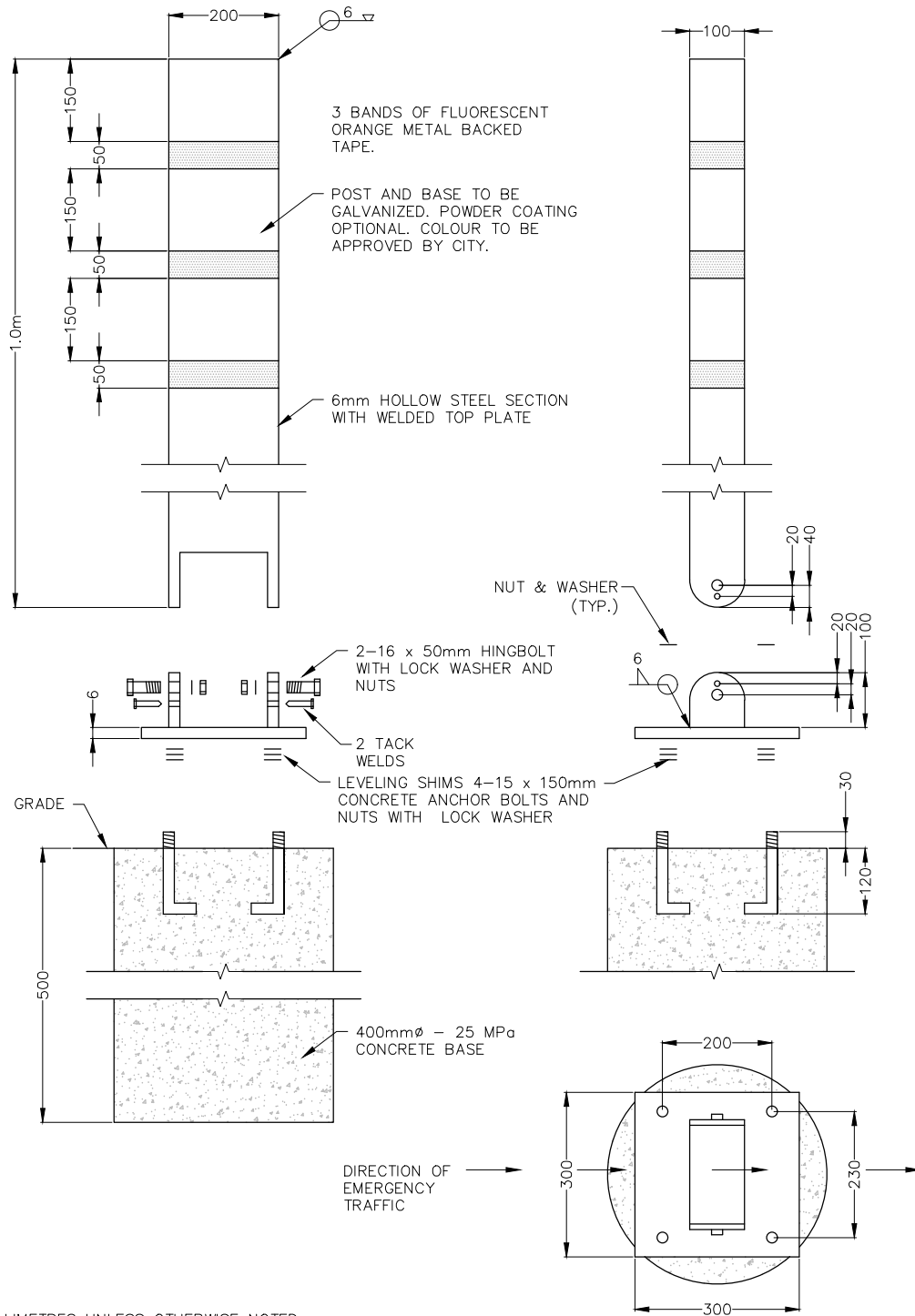


### UTILITY LOT BARRIER (15 METRE)

Approved:

Figure **G-50**

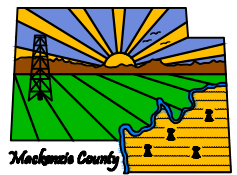
Rev.			
Rev.			
Rev.			
Rev. 2021-FEB-15	File No.: GP60.33682	Design:	
Date: 2010-AUG-31	Drawn: K.P.L	Scale: N.T.S	




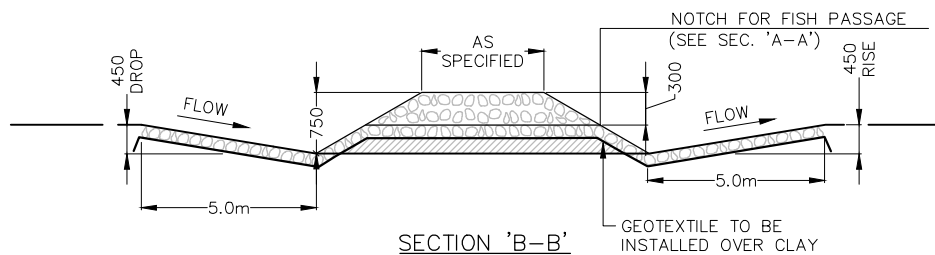
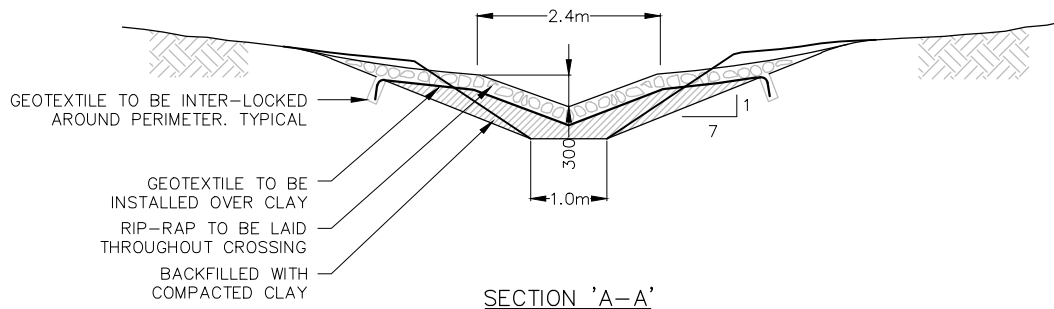
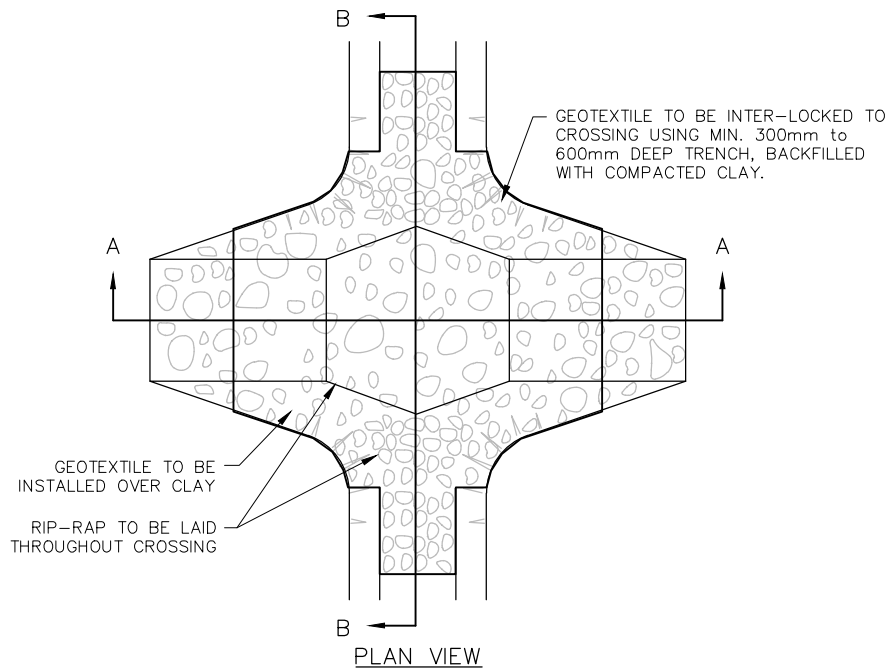
- NOTES:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
  2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				EMERGENCY KNOCK-DOWN POST (RETROFIT)	Approved: 	Figure <b>G-51</b>
Rev.						
Rev.						
Rev.	2021-FEB-15	File No.: GP60.33682	Design:			
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			

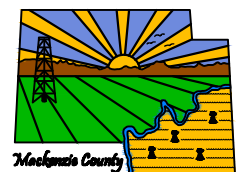


NOTES:

1. GEOTEXTILE OVERLAPS TO BE A MIN. OF 300mm.
2. ROCKED LINED CROSSING: USE 150mm-200mm ROCK, MAT THICKNESS 300mm.
3. EXTEND TO FULL WIDTH, LENGTH & SIDESLOPE OF CROSSING AS WELL AS UPSTREAM & DOWNSTREAM. SPRAY SLURRY MIX CONCRETE (5MPa) TO FILL VOIDS (TOP ONLY).
4. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



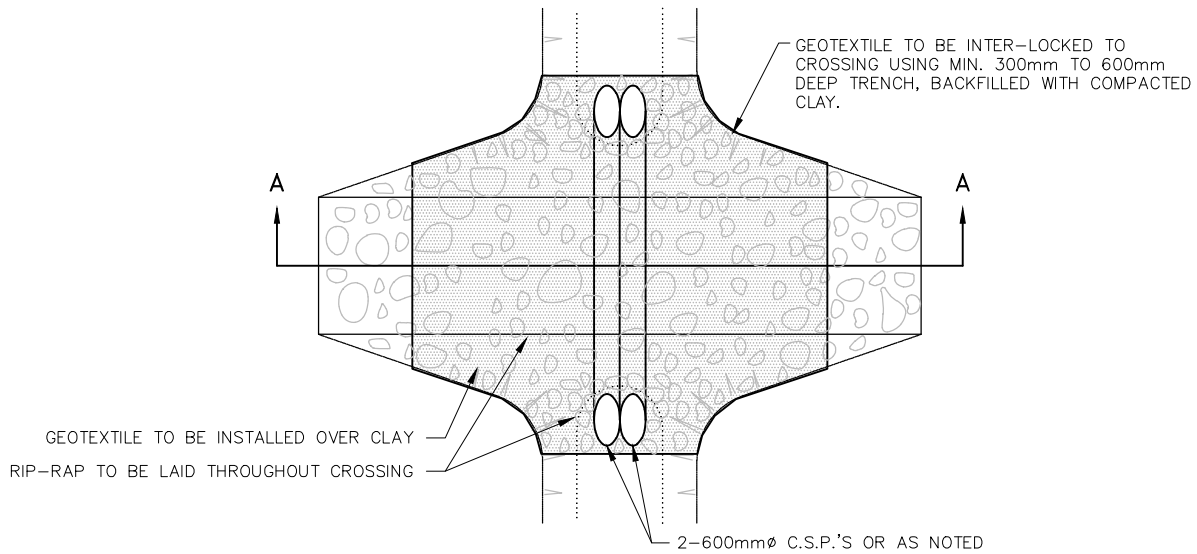
### LOW LEVEL X-ING NO CULVERT

Approved:

Figure **G-52**

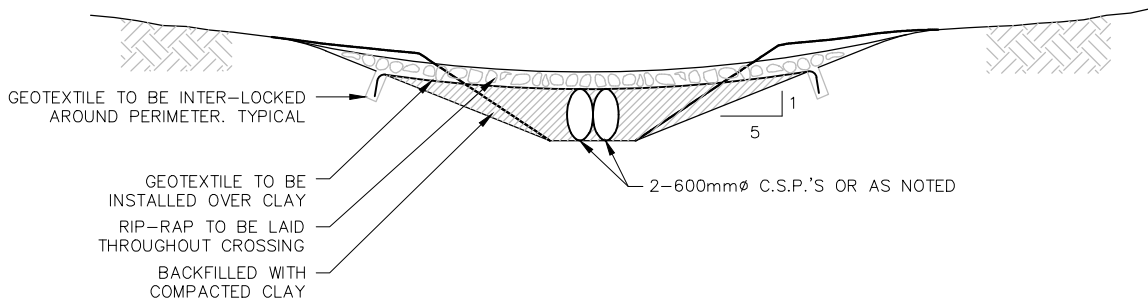
Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S





NOTE: GEOTEXTILE OVERLAPS TO BE A MIN. OF 300mm

PLAN VIEW

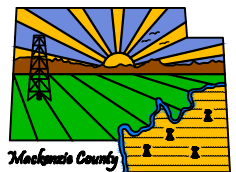


SECTION A-A

NOTE:  
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

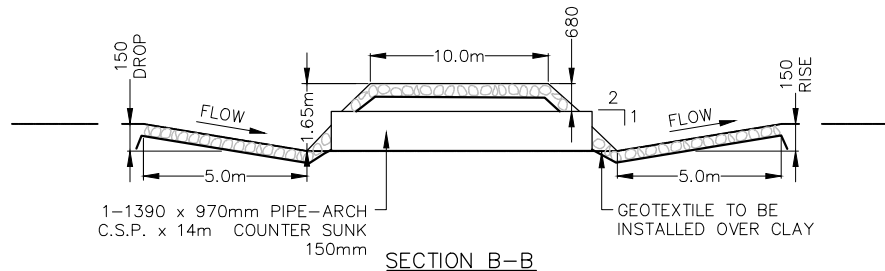
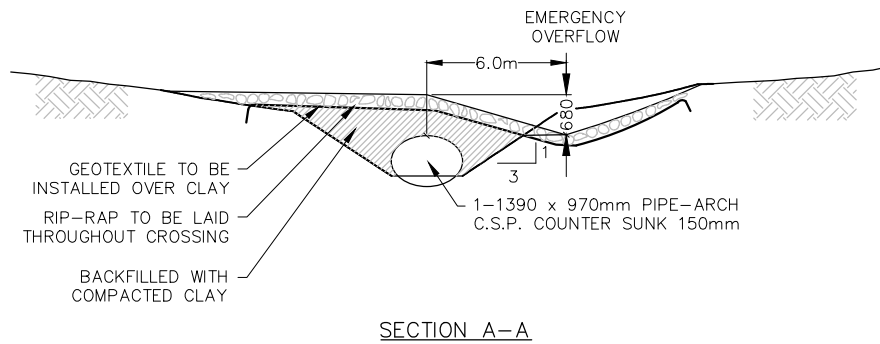
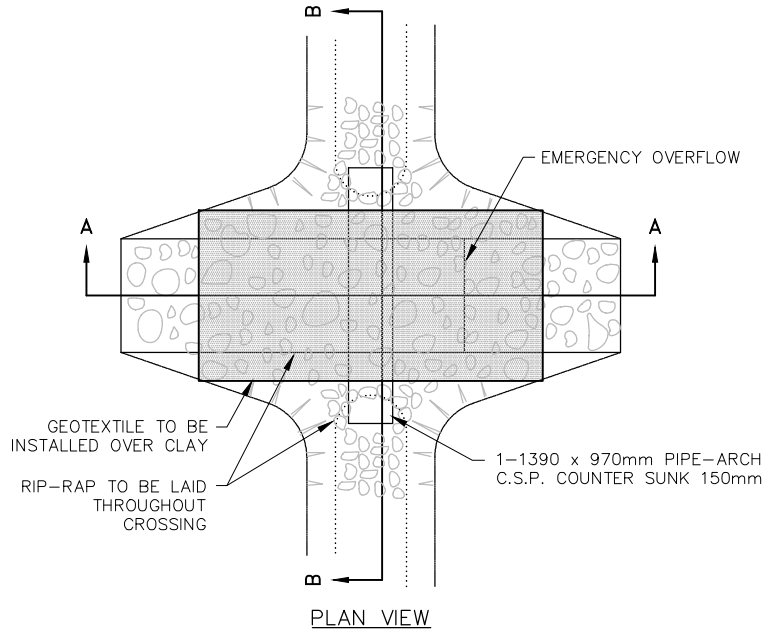


### LOW LEVEL X-ING WITH CULVERT

Approved:

Figure **G-53**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

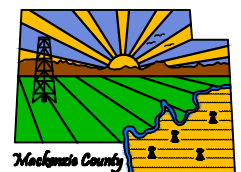


NOTES:

1. GEOTEXTILE OVERLAPS TO BE A MIN. OF 300mm.
2. ROCK LINED CROSSING: USE 150mm - 200mm ROCK, MAT THICKNESS 300mm.
3. EXTEND TO FULL WIDTH, LENGTH & SIDESLOPE OF CROSSING AS WELL AS UPSTREAM & DOWNSTREAM AND OVERFLOW CHANNEL.
4. SPRAY SLURRY CONCRETE (5MPa) TO FILL VOIDS (TOP ONLY).
5. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



### LOW LEVEL X-ING WITH CULVERT

Approved:

Figure

G-54

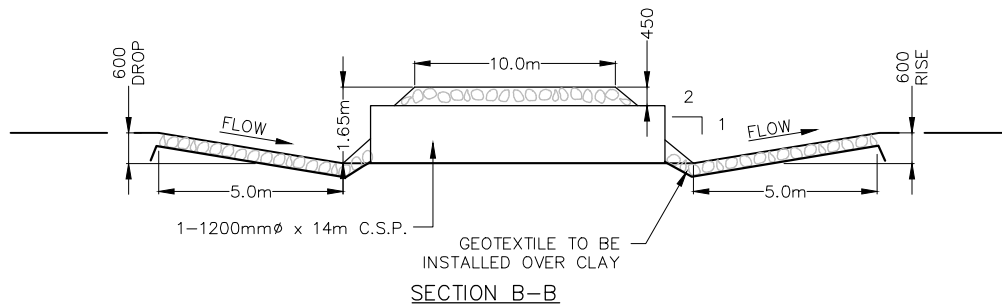
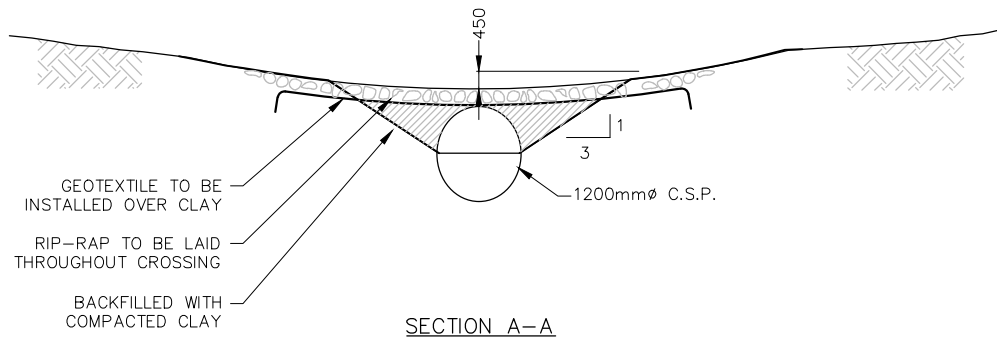
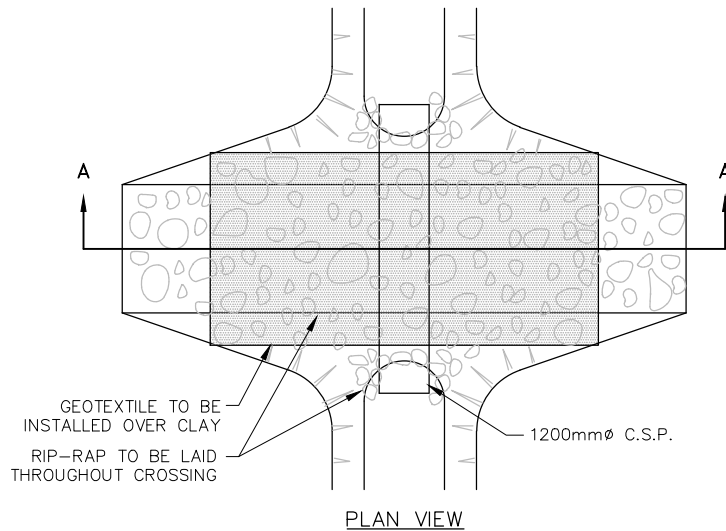
Rev.	
Rev.	
Rev.	
Rev.	2021-FEB-15
Date:	2010-AUG-31

File No.: GP60.33682

Design:

Scale: N.T.S

Drawn: K.P.L

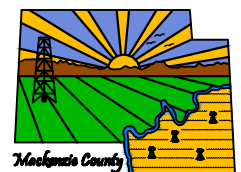


NOTES:

1. GEOTEXTILE OVERLAPS TO BE A MIN, OF 300mm.
2. ROCK LINED CROSSING: USE 150mm - 200mm ROCK, MAT THICKNESS 300mm.
3. EXTEND TO FULL WIDTH, LENGTH & SIDESLOPE OF CROSSING AS WELL AS UPSTREAM & DOWNSTREAM. SPRAY SLURRY MIX CONCRETE (5MPa) TO FILL VOIDS (TOP ONLY).
4. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



### LOW LEVEL X-ING WITH CULVERT

Approved:

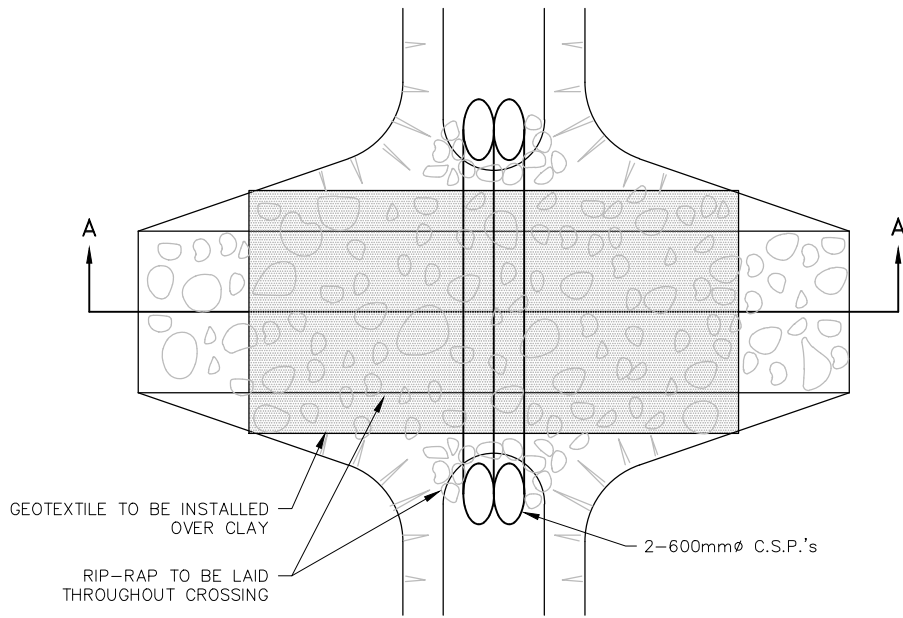
Figure

G-55

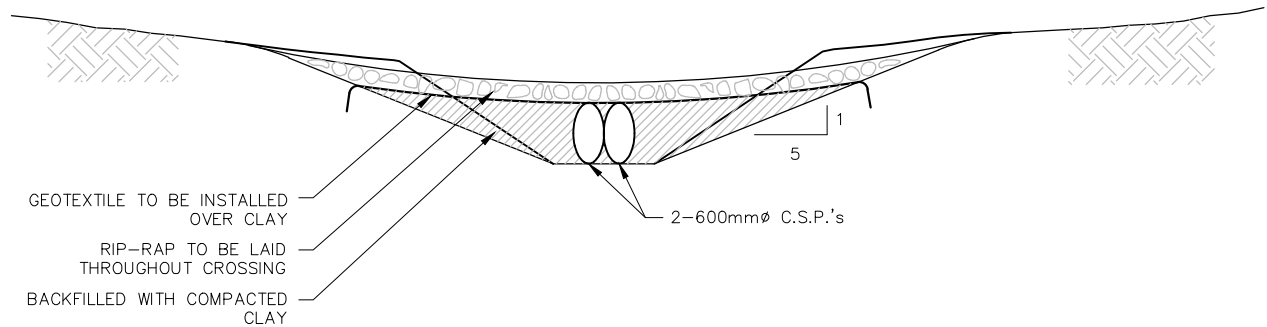
Rev.	
Rev.	
Rev.	
Rev.	2021-FEB-15
Date:	2010-AUG-31

File No.: GP60.33682  
Drawn: K.P.L

Design:  
Scale: N.T.S



PLAN VIEW



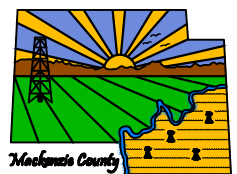
SECTION A-A

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



### LOW LEVEL X-ING WITH CULVERT

Approved:

Figure **G-56**

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

## SECTION H LANDSCAPING

### H.1 LANDSCAPING

#### H.1.1 Scope

- i. The Developer shall prepare and submit to the Municipality for review and approval the Landscaping Plan of the proposed subdivision.
- ii. Work under landscaping shall include, but is not necessarily limited to, the following:
  - a. site preparation,
  - b. seeding and/or sodding,
  - c. planting.

#### H.1.2 Landscaping Plans

- i. The Developer shall submit the Landscaping Plan detailing the proposed improvements, such as areas to be seeded or sodded, locations and names of all trees and shrubs, locations of planting beds, fencing and any park furniture or playground equipment proposed for installation. The Landscaping Plan shall utilize the overall road, sidewalk, and walkway plans as a base template drawing. The underground utilities shall be also shown on the Landscaping Plan.
- ii. The Developer shall submit detailed drawings of proposed park furniture and playground equipment for approval by the Municipality.
- iii. No landscaping work shall commence until the Landscaping Plan has been approved by the Municipality.

#### H.1.3 Landscape Design Requirements

- i. General requirements:
  - a. Landscape design to adhere to the latest edition of the Canadian Landscape Standard.
  - b. All landscaping materials and features shall be as shown on the Landscaping Plan approved by the Municipality.

### H.2 BOULEVARD GRASSING

#### H.2.1 Intent

The work shall include, but shall not be necessarily limited to, placing of topsoil, seeding, watering and at least two (2) successive cuttings of grassed areas as shown on the Contract Drawings.

**H.2.2 Materials**

- i. All materials shall be subject to inspection, testing and approval by the Municipality prior to placing.
- ii. Topsoil shall be of a natural, fertile agricultural soil of the "A" horizon layer, capable of sustaining plant growth. It shall be free of subsoil, clay lumps, stones, live plants or any other extraneous matter, whether organic or inorganic, which may be detrimental to the grass or any other plants. Topsoil shall contain no toxic materials and have a pH value of 6.0 - 7.5.
- iii. The seed mixture shall comply with Federal and Provincial seed Specifications and have a minimum germination of 75 % and a minimum purity of 97 %. Bags of the seed mixture shall be clearly tagged showing the name of the supplier and the contents. The seed mixture shall be No. 1 lawn seed mixture and shall consist of:
 

a. Kentucky Blue Grass-	50% by weight
b. Creeping Red Fescue (Festuea Rubra)	40% by weight
c. Red Top	10% by weight
- iv. Sod shall be No. 1 nursery-grown sod consisting of a uniform mixture of:
 

a. Kentucky Blue Grass-	60% by weight
b. Creeping Red Fescue (Festuea Rubra)-	40% by weight

Sod also shall be:

  - c. first cut and a minimum of 18 months old,
  - d. healthy with a thick growth and free of noxious weeds,
  - e. minimum 20 - 25 mm in thickness, and
  - f. sufficiently moist to prevent burning at the edges.
- v. Root fertilizer shall conform to the following:
  - a. granular water soluble fertilizer 10-6-4 Super phosphate,
  - b. granular water soluble fertilizer 5-20-10 or equivalent.
- vi. Supplementary fertilizer shall conform to the following:
  - a. organic fertilizer 14-7-6,
  - b. even 35 %.
- vii. Peat moss shall be mixed with topsoil and meet the following specifications:
  - a. have pH value of 5.0 - 7.0,
  - b. have a water holding capacity of 1,100 % by weight,
  - c. be free of toxic material, live plants, live roots or seeds, and

d. be delivered in a pulverized condition.

### H.2.3 Construction

- i. The Contractor shall be responsible for the control of weed growth until the final acceptance of the work.
- ii. All rocks larger than 50 mm in diameter, roots and other foreign matter shall be removed. The subsoil shall be mechanically loosened to a depth of not less than 50 mm immediately prior to placing the topsoil.
- iii. The topsoil shall be uniformly spread on the prepared areas to a minimum compacted depth of 150 mm measured after the area is readied with the soil seed equipment. If organic material is required to meet the specifications for topsoil, peat moss in pulverized condition shall be added in the field and mixed with cultivation equipment. The area shall then be disked, harrowed and floated thoroughly to a depth of 75 mm leaving the soil in a good viable condition and true to grade.
- iv. After the topsoil has been properly prepared, a uniform application of the fertilizer shall be done at the rate of 5 kg/100 m<sup>2</sup> using a mechanical spreader. The fertilizer shall be thoroughly and evenly mixed with the soil to a maximum depth of 75 mm. Approximately 6 weeks after germination, supplementary application of an organic fertilizer, such as 10-6-4 or equivalent, shall be done at a rate of 5 kg/100 m<sup>2</sup>.
- v. Grass seed shall be sown at a rate of 2.5 kg/100 m<sup>2</sup> by one or more of the following methods:
  - a. Hand application with a cyclone type seeder capable of distributing seed in two directions in equal amounts. Hand application shall require a 6 mm top dressing or mulch of pulverized peat moss.
  - b. Mechanical application with a calibrated grass seeder complete with compaction roller.
  - c. Hydro-seeding by applying of the approved turf-fiber at a rate of 0.135 kg/m<sup>2</sup>.
- vi. After seeding is finished, and to avoid damage as a result of washing, the area shall receive light watering with a fine spray to a penetration of not less than 25 mm. In areas where seed fails to germinate, the Contractor shall re-cultivate and re-seed such areas until germination occurs.
- vii. At the time of the supplementary fertilizing, the following repairs and maintenance shall be carried out by the Contractor:
  - a. Top dressing: repair ruts, unevenness and erosion problems,
  - b. Over-seeding: re-cultivate and re-seeded damaged areas,
  - c. Weed spraying: the approved weed killer shall be applied 1
  - d. week after the fertilizer had been applied.

- viii. Sodding shall be done on all areas where slopes are 2:1 or greater. Sod may be substituted for grass seeding on all other areas. The sod shall be closely butted together and placed evenly, in staggered rows, with all newly-laid sod matched to the existing grade of other landscaped or cultivated areas as specified. The sod shall be top dressed and rolled with a medium weight roller (90-120 kg) to a smooth and even surface. After placement, the sod shall be continuously watered for one (1) week or until significant root growth has occurred. Approximately four (4) weeks after placement, and following the initial cutting, an organic fertilizer shall be applied at the rate of 5 kg/100 m<sup>2</sup>.
- ix. The first and second grass cutting shall be done by the Contractor when the grass is approximately 100 mm in height. Cut height shall be 50 mm.
- x. Growing season:
  - a. Grass seeds shall not be planted before May 15 or after September 1.
  - b. Sod shall not be placed before May 15 or after September 1. Sod placing on slopes 3:1 or steeper shall not be done when the temperature is above 23°C.
  - c. Within one (1) year after the issuance of a Construction Completion Certificate for subdivision projects including paved roadways construction, the Developer shall sod and plant trees along all roadways boulevards. Deciduous trees shall be placed in a uniform lineal manner. The Developer shall be responsible for full maintenance and tree replacement for 1 calendar year after sodding and planting.

### **H.3 FENCING**

- H.3.1** The Landscaping Plan shall show the proposed fencing design details, including alignment, elevations, materials, foundations, coatings and construction details. Fencing shall comply with all setback and height requirements specified in the Municipality Land Use Bylaw.
- H.3.2** Wherever possible, proposed fencing shall be designed and installed to match or complement existing fencing on adjacent properties.
- H.3.3** Fencing shall be designed to be maintenance free for a minimum period of 15 years past the completion of construction.
- H.3.4** Fencing, including foundations, shall be located entirely within legal limits of the property it is proposed for.
- H.3.5** As required by the Municipality, the uniform fencing shall be constructed adjacent to, and at the following locations:
  - i. county property and arterial roadways,
  - ii. public parks, playgrounds, walkways and utility lots,
  - iii. schools and family sites,



iv. commercial and institutional sites.

**H.3.6** Wooden fencing shall be installed where residential property adjoins one of locations listed above. The Municipality may approve the use of chain link fencing where facilities such as playgrounds, parks or school sites are adjacent to arterial roadways. Wooden rail fencing may be required for selected park or walkway areas.

**H.3.7** Gates shall be installed as part of residential lot fencing where the properties back onto public parks. Gates shall be located at the mid-point of the property line and shall open inwards into the residential lot.

**H.3.8** The warranty period for the uniform fencing shall be two (2) years from the date of issuance of the Construction Completion Certificate.

#### **H.4 LANDSCAPE BERMS**

**H.4.1** The Landscaping Plan shall show the proposed berm design and construction details, including alignment, elevations, dimensions and slopes.

**H.4.2** Berms required for noise attenuation purposes shall be designed by a Professional Engineer or licensed Landscape Architect. The Developer shall provide design information including projected traffic volumes and noise exposure.

**H.4.3** Berm side slopes shall not be steeper than 4:1 to facilitate future maintenance. Minimum width of the flat top of the proposed berm shall be 1 m.

**H.4.4** All berms shall be top soiled and grass seeded or sodded as specified in these standards.

#### **H.5 COMMUNITY MAILBOXES**

**H.5.1** Mailboxes shall be located according to the following requirements wherever possible:

- i. on the side yard of the corner lot,
- ii. next to the community park or playground,
- iii. on the side of the street entering the proposed subdivision,
- iv. at a minimum of 10 m away from a fire hydrant, bus stop, streetlights, power poles and other permanent features, and as shown on the Contract Drawings,
- v. not directly above existing or proposed underground utilities and conforming to minimum site-specific requirements obtained from the utilities owners or operators,
- vi. not to obscure minimum specified safe sight distances for pedestrians and roadway users.

**H.5.2** The Developer shall submit a plan of the proposed subdivision to Canada Post requesting approval of mailbox locations. It is the Developer's responsibility to

ensure that the mailbox locations conform to the Postal Delivery Standards Manual, Planning for Postal Service.

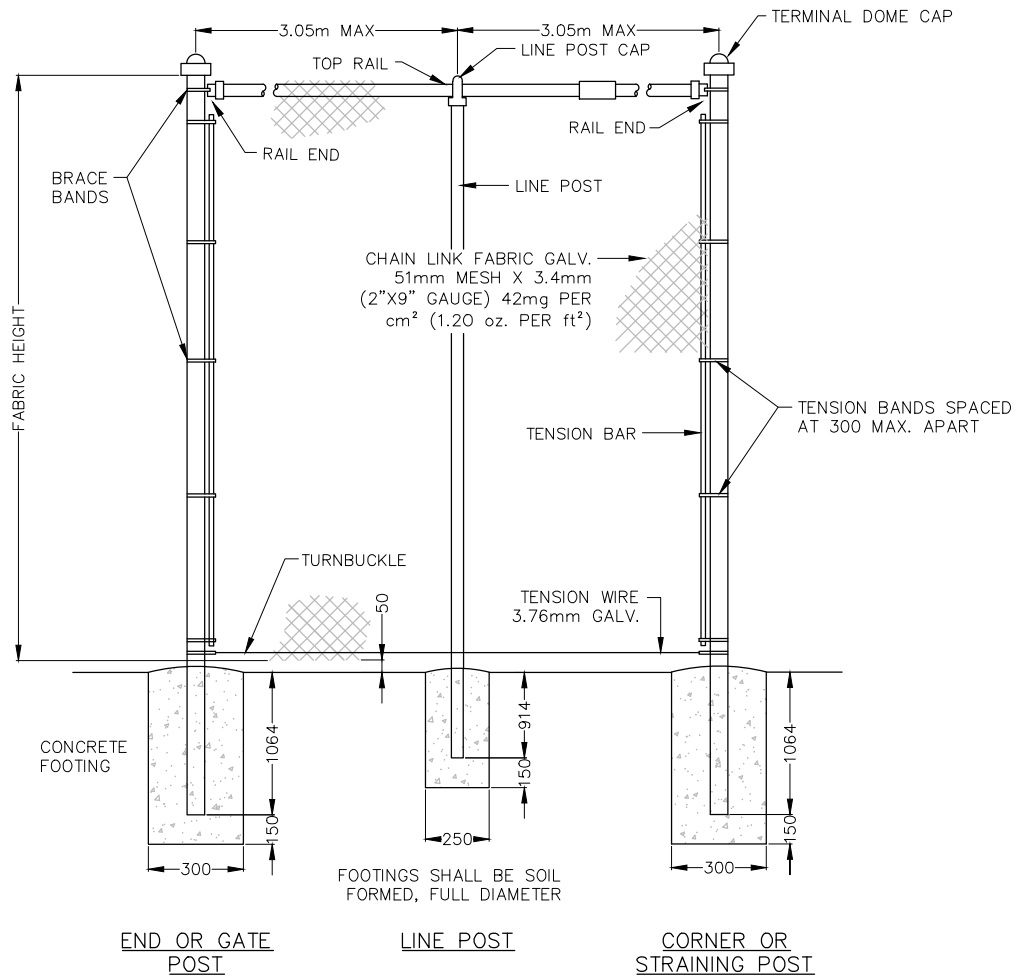
- H.5.3** Easements allowing encroachment onto private property shall be provided only if the mailbox pad extends beyond the right-of-way boundaries.

## **H.6 LIST OF DRAWINGS**

- H-01 Chain Link Fence Detail
- H-02 Chain Link Fence, Barbed Detail
- H-03 Chain Link Single Gate Detail
- H-04 Chain Link Double Gate Detail
- H-05 Noise Fence Detail
- H-06 Wood Screen Fence Detail
- H-07 Timber Fence for Open Space Areas
- H-08 Survey Monument Cover Detail
- H-09 Typical Lot Grading Plan
- H-10 Typical Lot Grading Plan
- H-11 Campground Layout Details
- H-12 Electrical Receptacle for R.V. Hook-Up
- H-13 Water Riser for R.V. Hook-Up
- H-14 R.V. Sani-Dump Station
- H-15 Single Vault Toilet

**END OF SECTION**



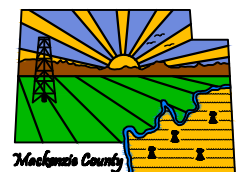


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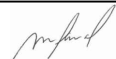
1. TOP RAIL: 33.4mm O.D. GALVANIZED STEEL. RAILS TO BE CONNECTED BY SLIP-ON SLEEVES.
2. LINE POSTS: 48.3mm O.D. GALVANIZED STEEL. SPACED 3.05m MAX. APART. STRAINING POSTS SHALL OCCUR AT MIN. 152m.
3. GATE POST: 88.9mm O.D. GALVANIZED STEEL FOR PANELS UP TO 3.05m (6.1m DOUBLE SWING GATE).
4. END OR CORNER POST: 88.9mm O.D. GALVANIZED STEEL.
5. CONCRETE: 30 MPa STRENGTH IN 28 DAYS.
6. TIE WIRE: 3.55mm (9 GAUGE) ALUMINUM WIRE EVERY 305mm FOR LINE POSTS, EVERY 457mm FOR TOP RAIL.
7. ALL PIPES TO BE SUFFICIENT STRENGTH TO SUPPORT FABRIC WEIGHT AND TENSION, AND TO SUPPORT WEIGHT OF GATE.
8. ALL FITTINGS TO BE DESIGNED AND MANUFACTURED OF MATERIALS HAVING SUFFICIENT STRENGTH TO PERFORM THE NECESSARY FUNCTIONS.
9. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
10. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

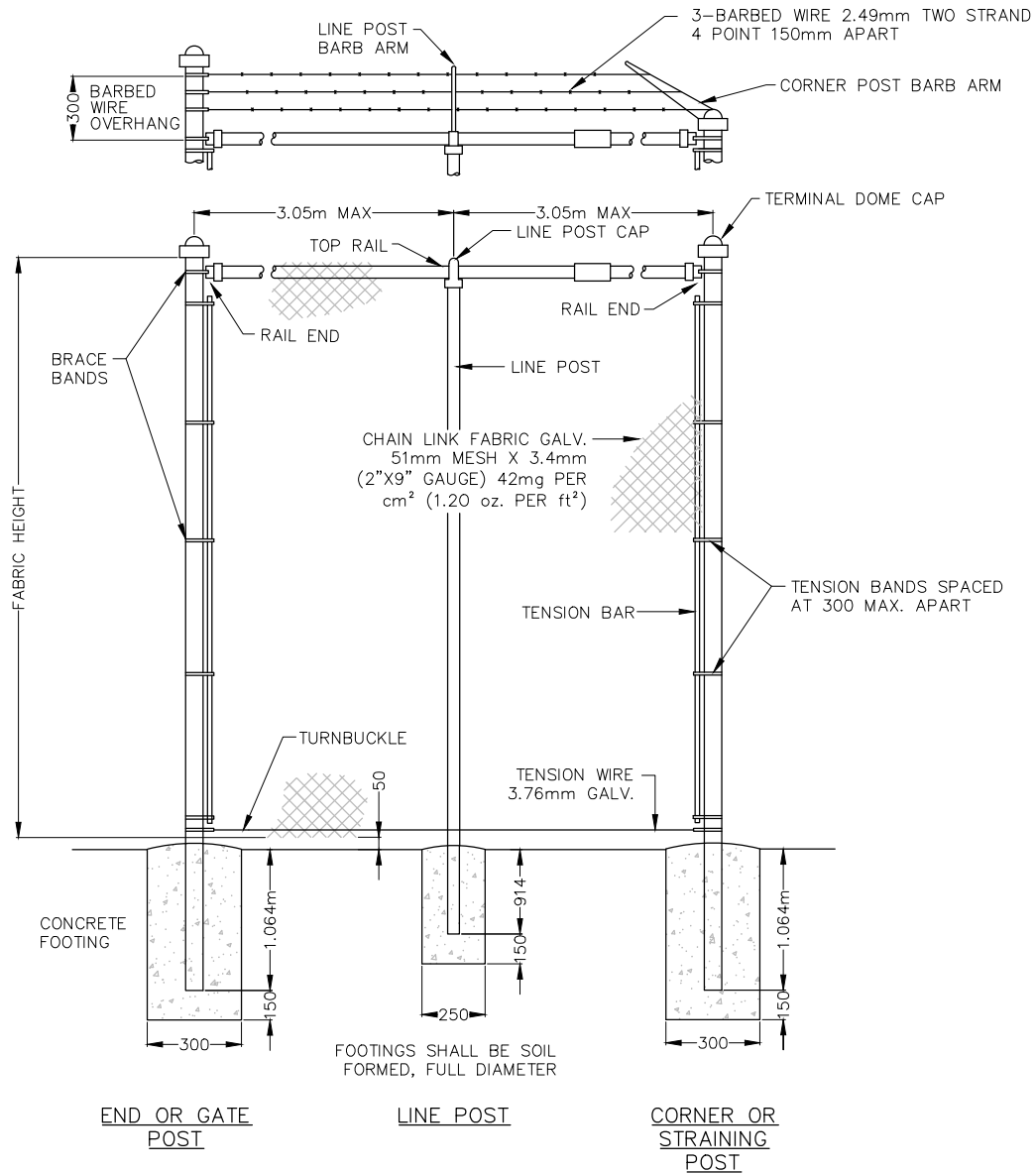
# MACKENZIE COUNTY

## General Municipal Improvements Standards



### CHAIN LINK FENCE DETAIL

Rev.				Approved: 	Figure H-01
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Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		

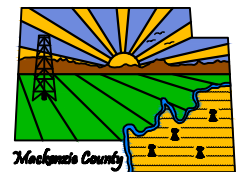


NOTES:

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# MACKENZIE COUNTY

## General Municipal Improvements Standards



### CHAIN LINK FENCE, BARBED DETAIL

Approved:

Figure

H-02

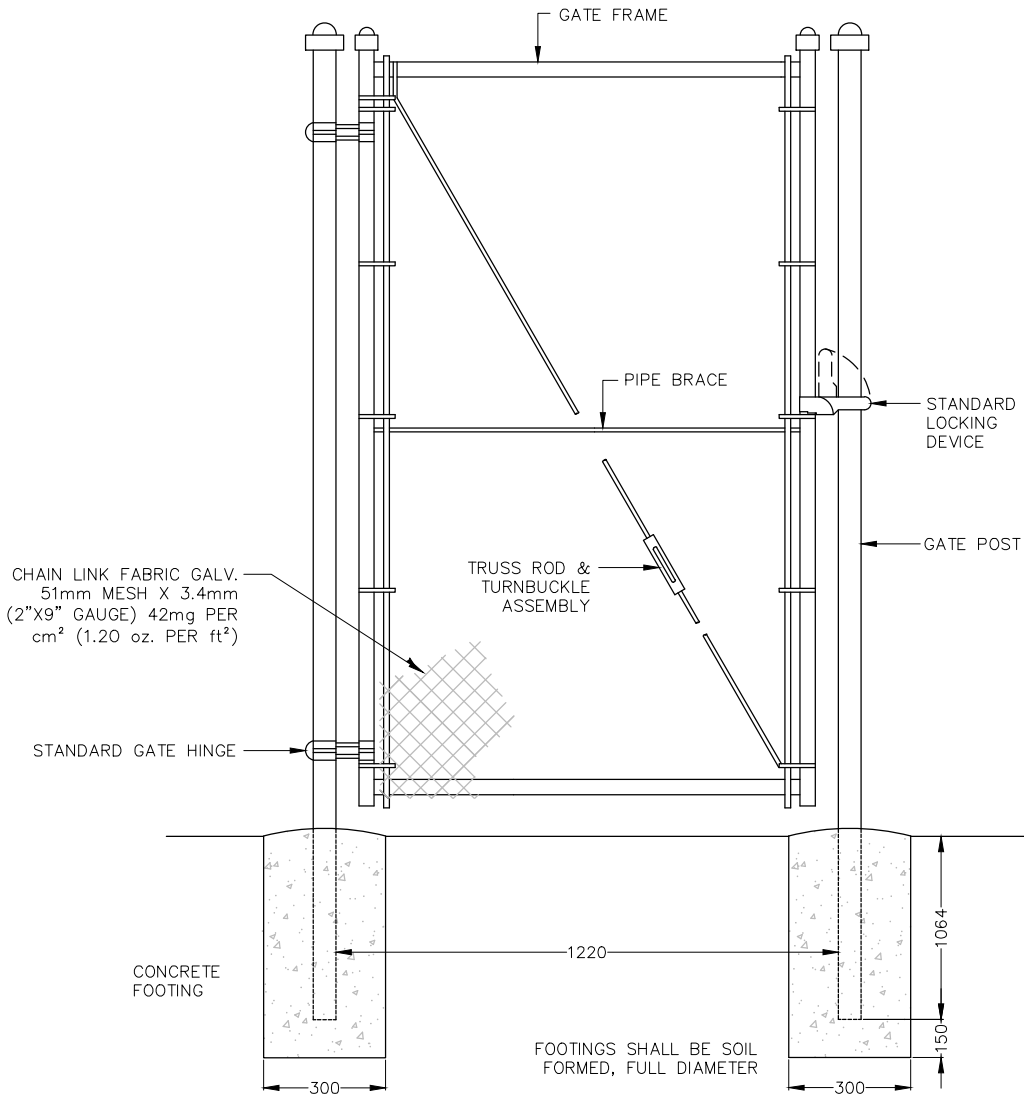
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Rev.	2021-FEB-15
Date:	2010-AUG-31

File No.: GP60.33682

Design:

Scale: N.T.S

Drawn: K.P.L

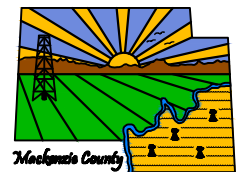


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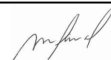
1. GATE POST: 88.9mm O.D. GALVANIZED STEEL FOR PANELS UP TO 3.05m (6.1m DOUBLE SWING GATE).
2. GATE FRAME: 41m O.D. GALVANIZED STEEL. WELDS TO BE ZINC PAINTED AFTER WELDING.
3. CONCRETE: 30 MPa STRENGTH IN 28 DAYS.
4. ALL PIPES TO BE SUFFICIENT STRENGTH TO SUPPORT FABRIC WEIGHT AND TENSION, AND TO SUPPORT WEIGHT OF GATE.
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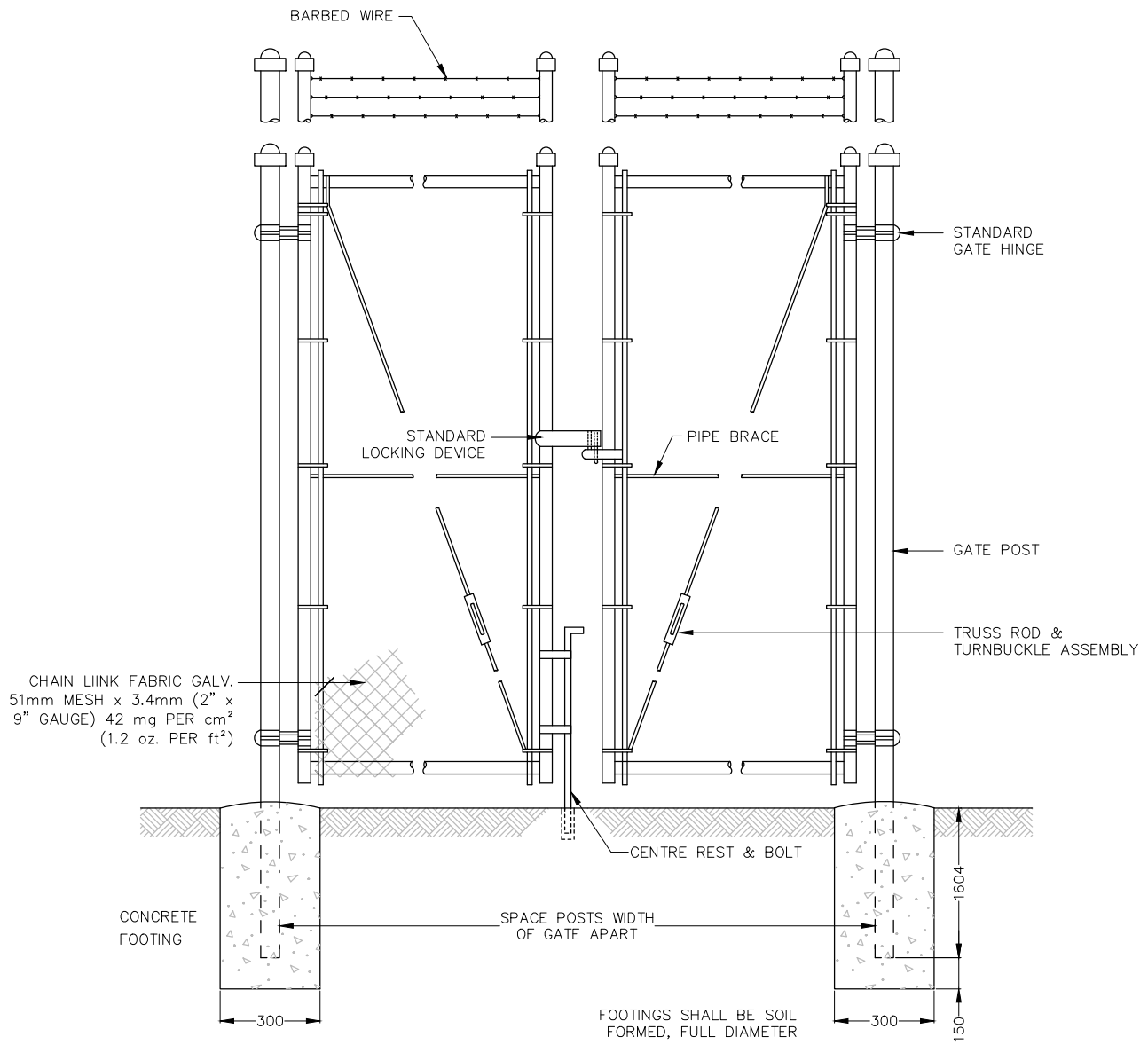
# MACKENZIE COUNTY

## General Municipal Improvements Standards



### CHAIN LINK SINGLE GATE DETAIL

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Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		

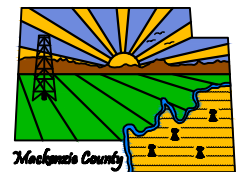


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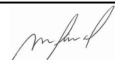
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# MACKENZIE COUNTY

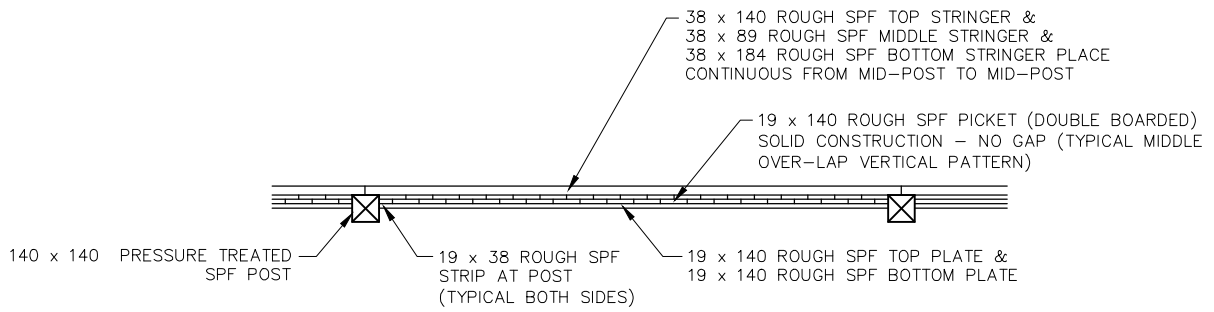
## General Municipal Improvements Standards



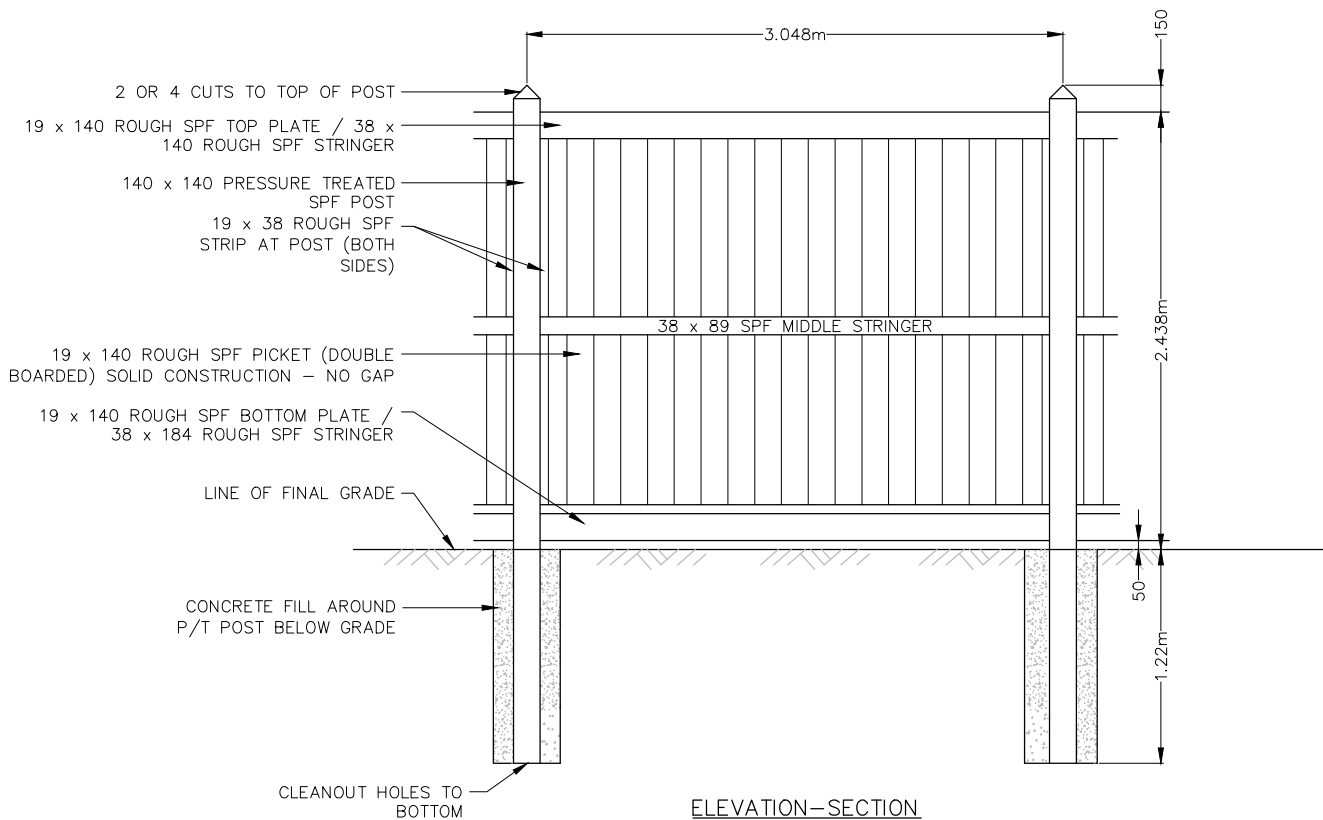
### CHAIN LINK DOUBLE GATE DETAIL

Rev.				Approved: 	Figure H-04
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Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		





PLAN VIEW



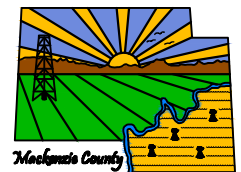
ELEVATION-SECTION


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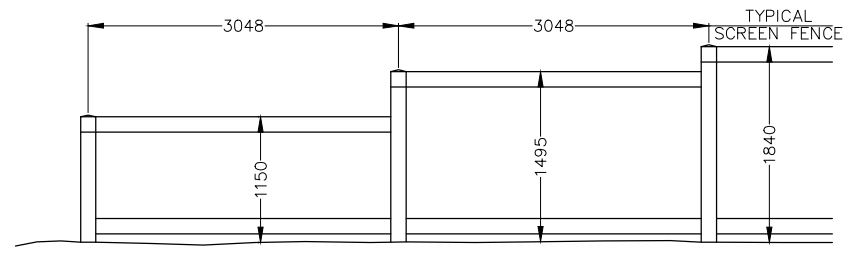
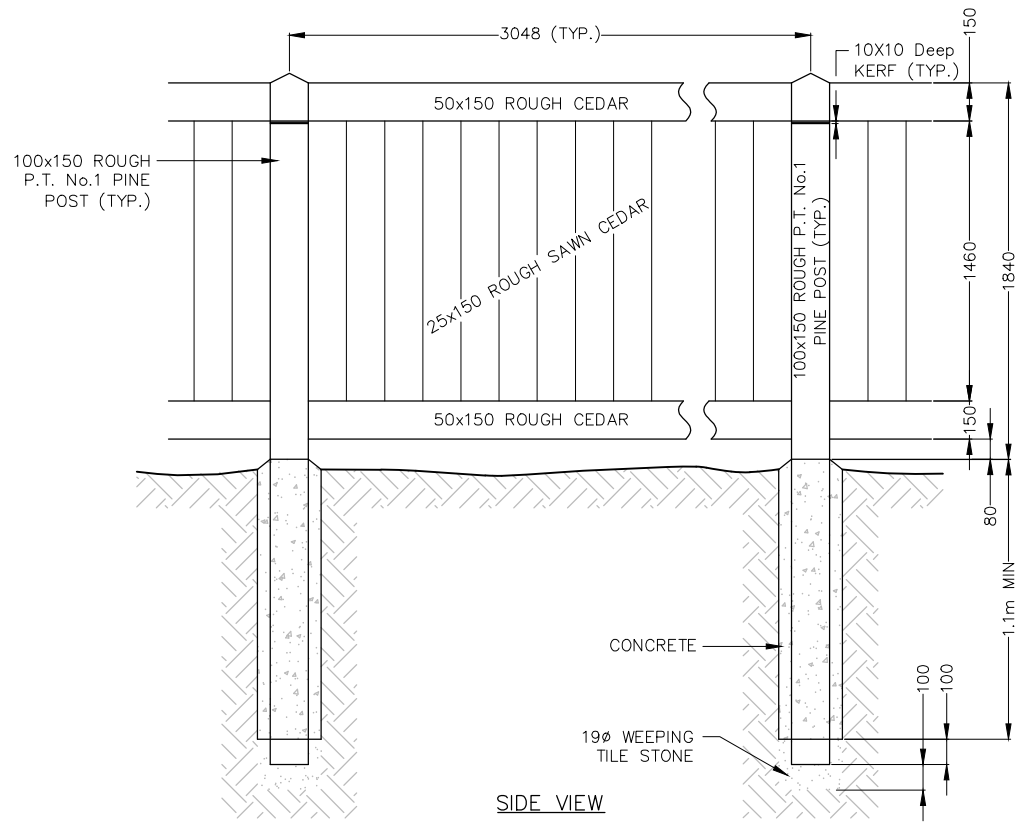
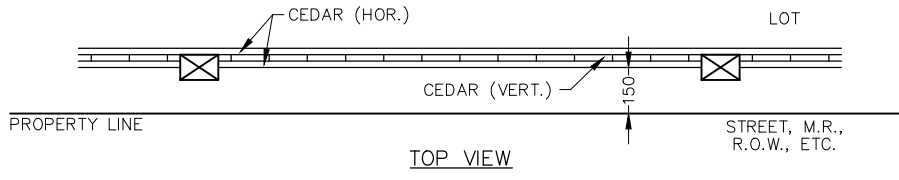
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
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# MACKENZIE COUNTY

## General Municipal Improvements Standards



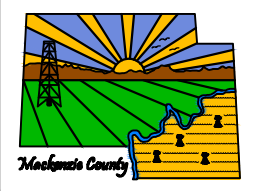
Rev.				NOISE FENCE DETAIL	Approved: 	Figure <b>H-05</b>
Rev.						
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Rev.	2021-FEB-15	File No.: GP60.33682	Design:			
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			





- NOTES:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
  2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

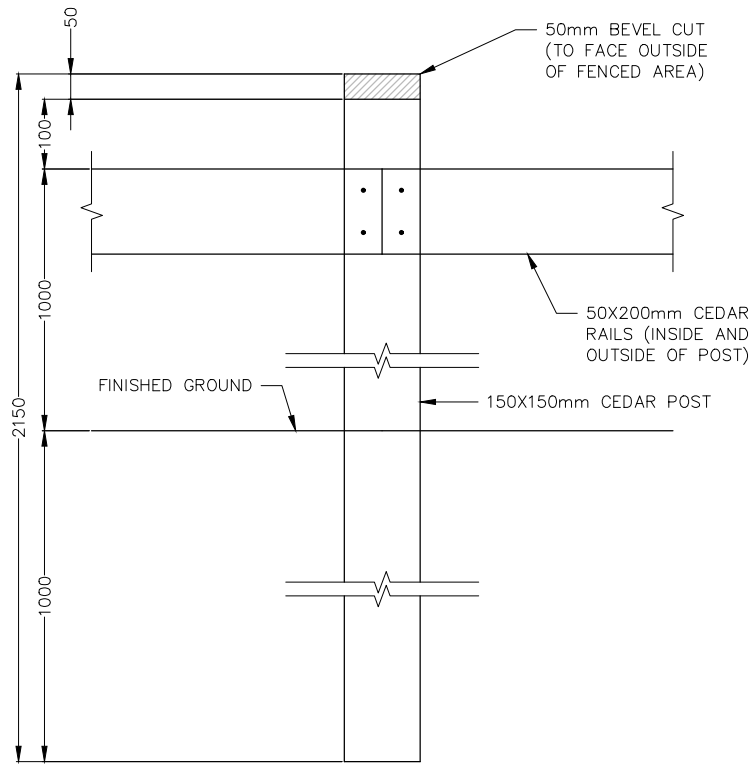
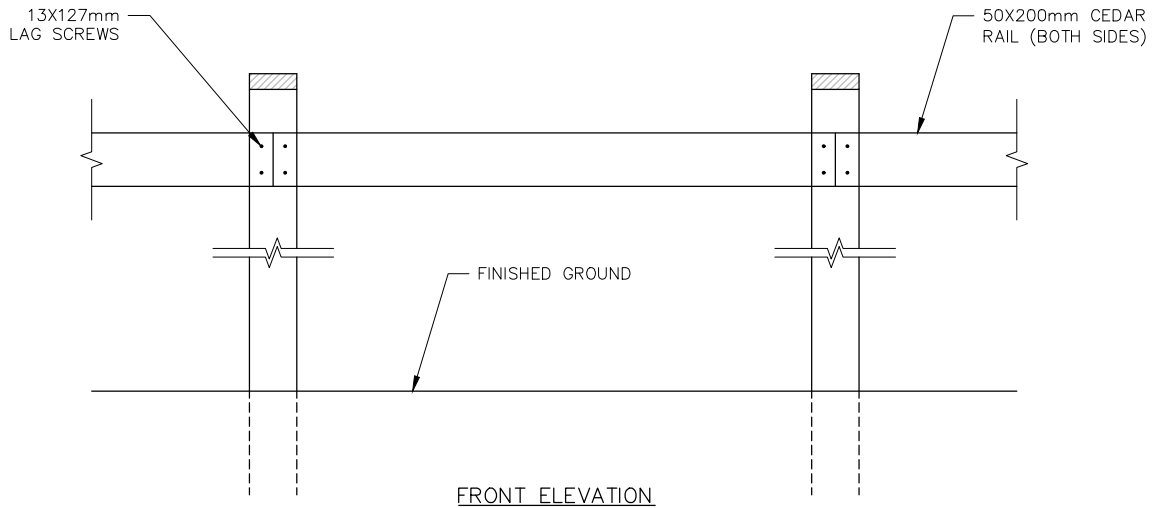
# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				Approved: 	Figure H-06
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Rev.	2021-FEB-15	File No.: GP60.33682	Design:	Approved: 	Figure H-06
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		

### WOOD SCREEN FENCE DETAIL

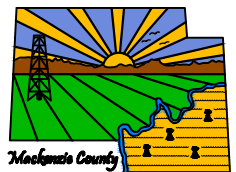


NOTES:

1. ALL LUMBER TO BE C.C.A. PRESSURE TREATED.
2. WHEN FENCE LINE CURVES, POSTS SHALL BE DOTTED SUCH THAT 50X200mm RAILS LAY FLUSH TO POSTS.
3. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



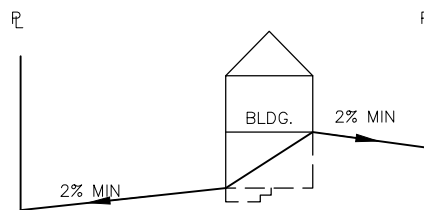
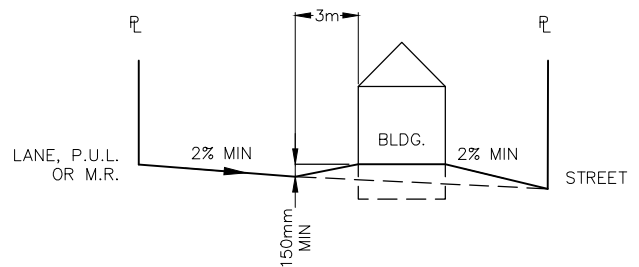
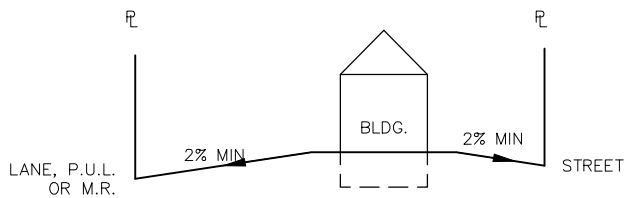
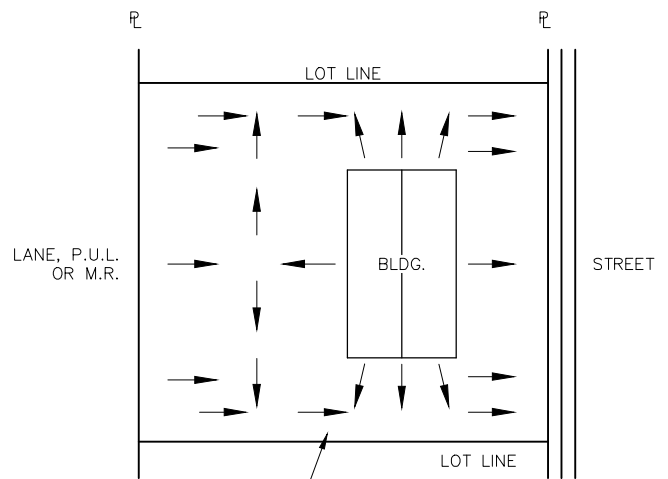
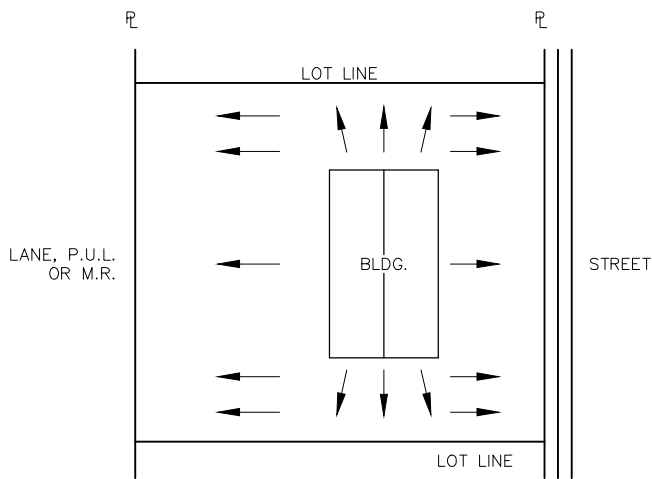
### TIMBER FENCE FOR OPEN SPACE AREAS

Approved:

Figure **H-07**

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Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

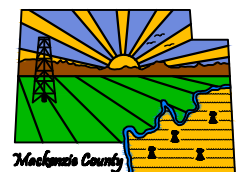




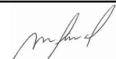
NOTE:  
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

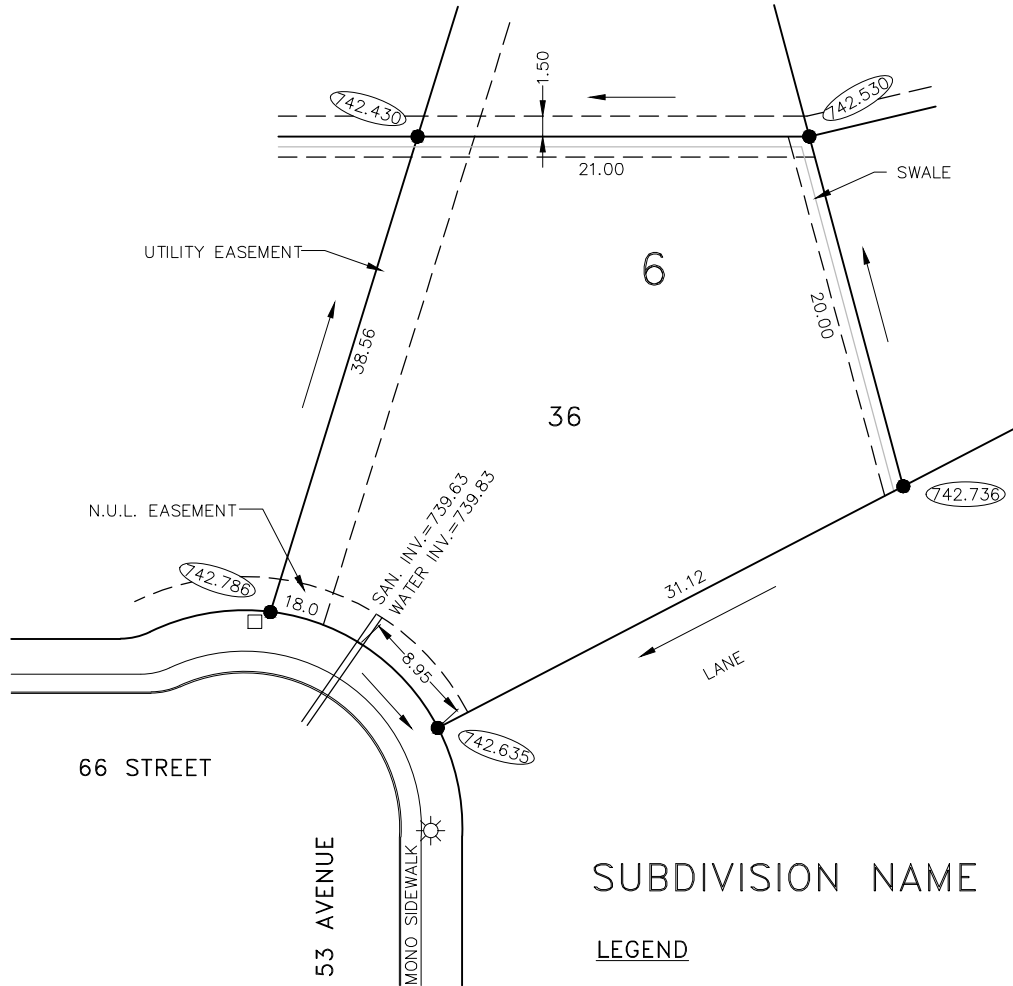
## General Municipal Improvements Standards



### TYPICAL LOT GRADING

Rev.				Approved: 	Figure H-09
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		

LOT 36  
 BLOCK 6  
 PLAN 832-2553  
 EASEMENT PLAN 832-2554



SUBDIVISION NAME

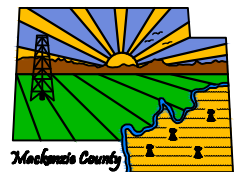
LEGEND

- 742.736 DESIGN LOT CORNER ELEVATIONS
- IRON PINS
- DIRECTION OF DRAINAGE
- FIRE HYDRANT
- MAIL BOXES
- CATCHBASINS
- LIGHT STANDARD
- POWER

NOTE:  
 ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

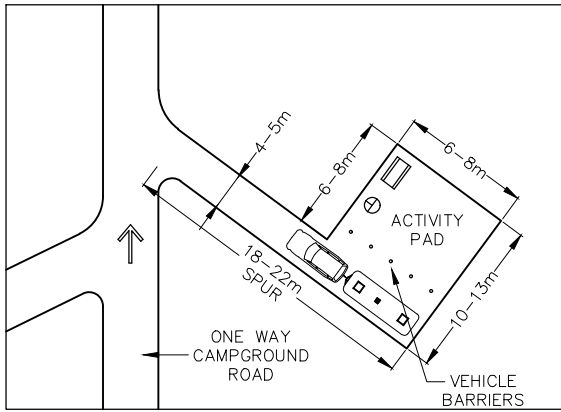
# MACKENZIE COUNTY

## General Municipal Improvements Standards

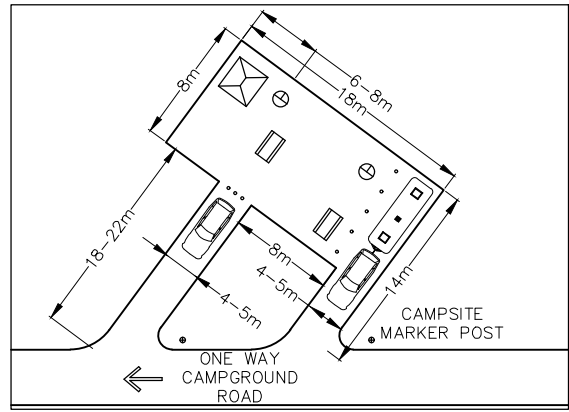


### TYPICAL LOT GRADING PLAN

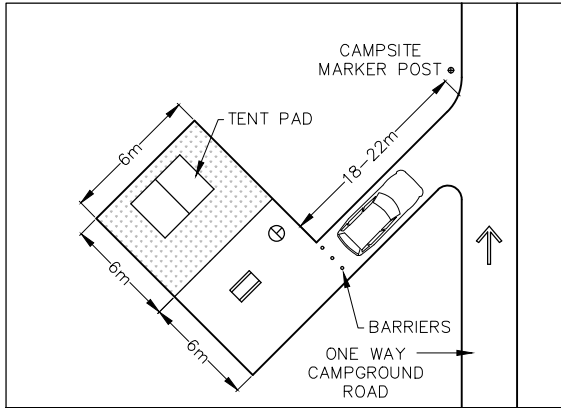
Rev.				Approved:	Figure H-10
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		



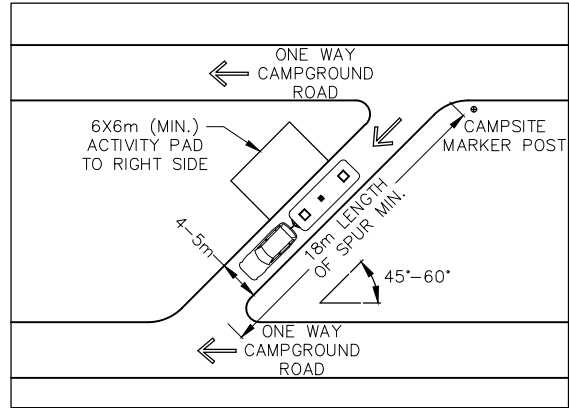
SINGLE BACK-IN CAMPSITE DESIGN



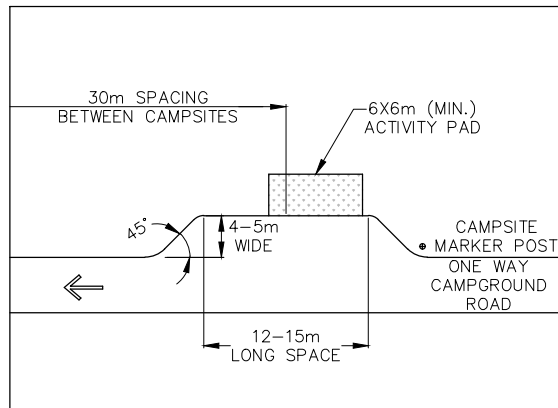
DIMENSIONS OF A DOUBLE BACK IN CAMPSITE



CAMPGROUND LOCATED AT REAR WITH TENT PAD PROVIDED



DIMENSIONS OF A PULL-THROUGH CAMPSITE

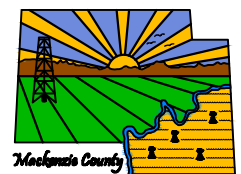


PULL-OVER CAMPSITE DESIGN

NOTE:  
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards

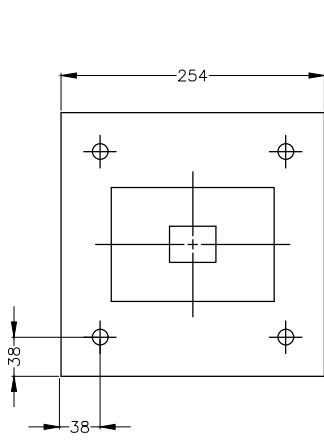


### CAMPGROUND LAYOUT DETAILS

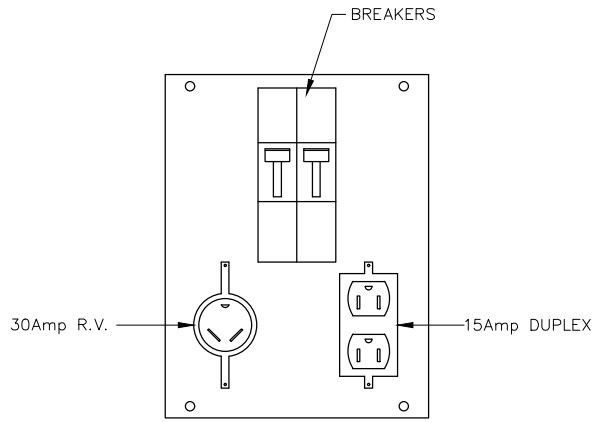
Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

Approved:

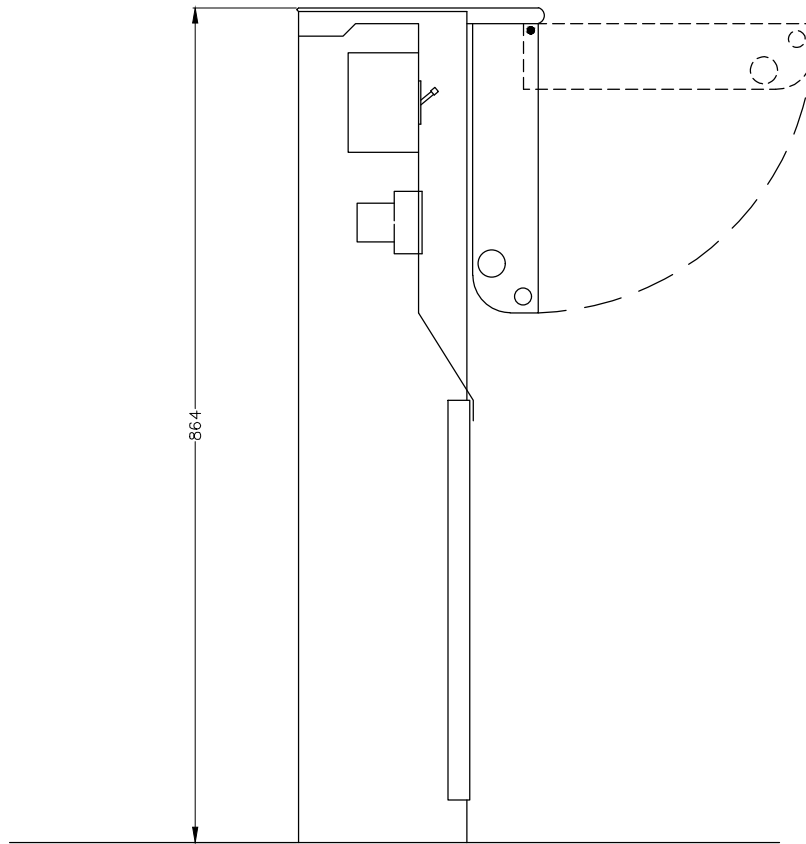
Figure H-11



TEMPLATE



APR-3 INSERT

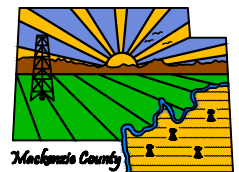


SIDE VIEW

NOTES:  
1. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



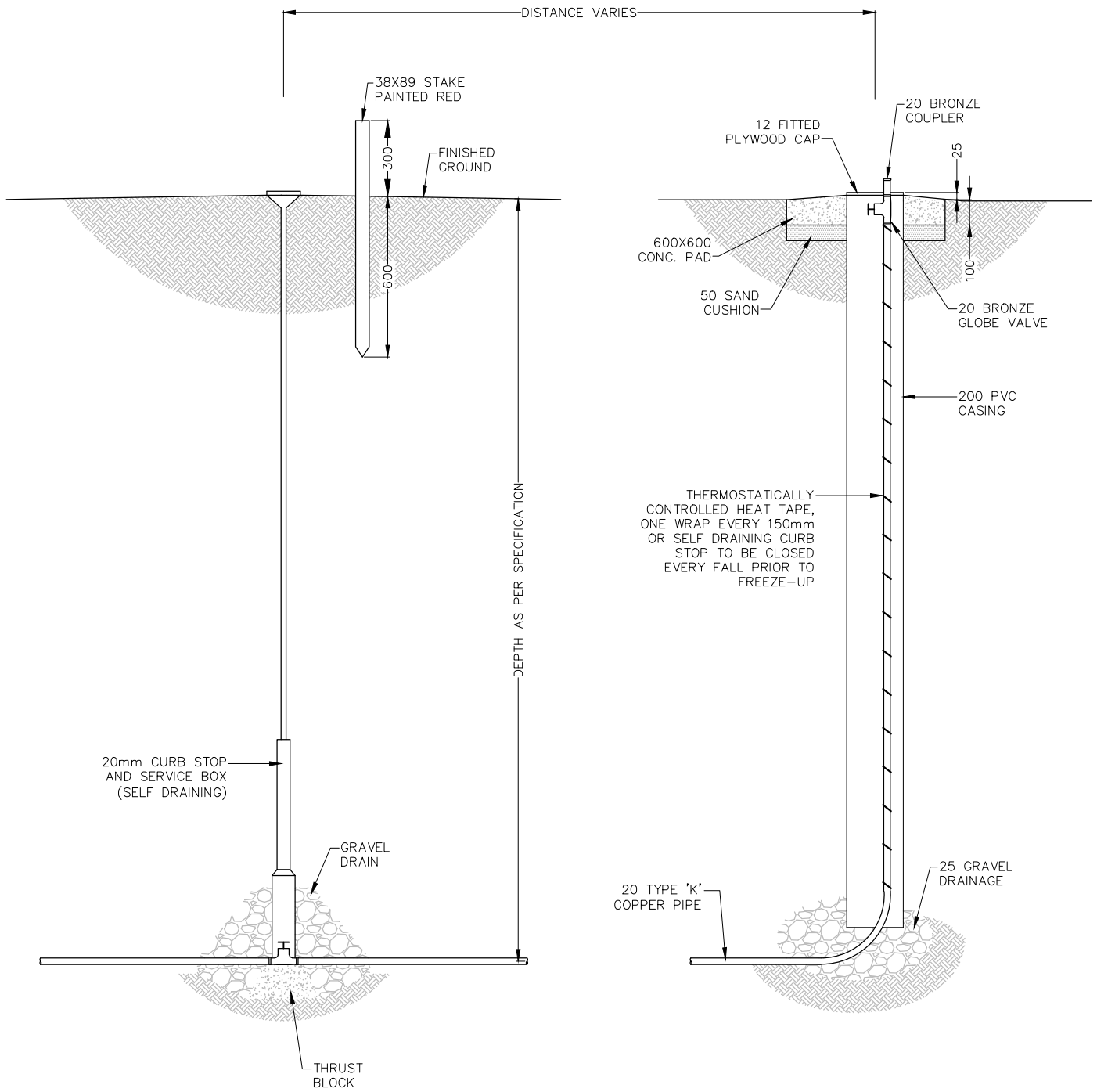
### ELECTRICAL RECEPTACLE FOR R.V. HOOK-UP

Approved:

Figure H-12

Rev.			
Rev.			
Rev.			
Rev.	2021-FEB-15	File No.: GP60.33682	Design:
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S

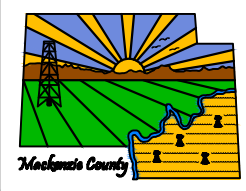




NOTE:  
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

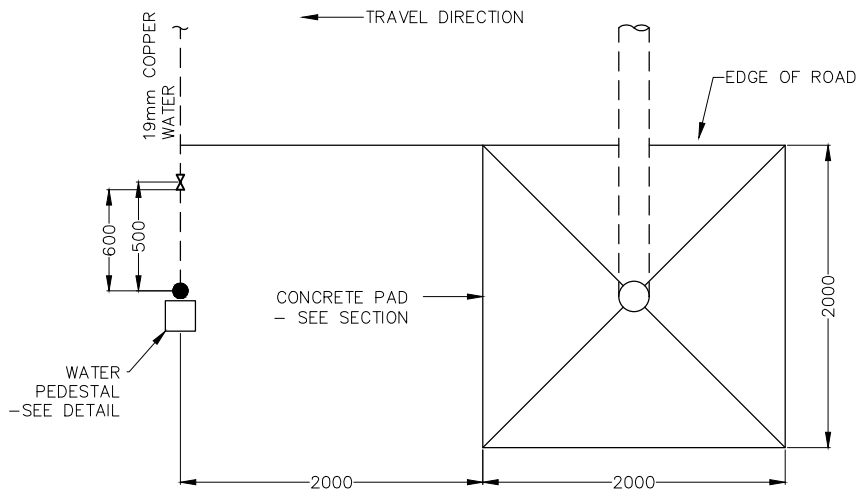
# MACKENZIE COUNTY

## General Municipal Improvements Standards

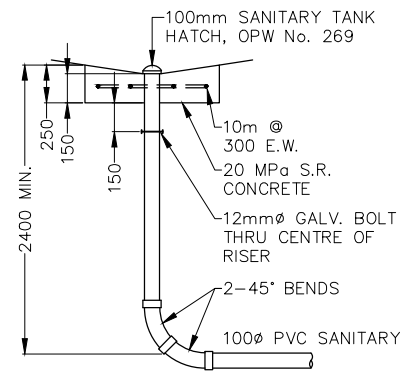


Rev.				Approved: 	Figure <b>H-13</b>
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:		
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		

WATER RISER FOR R.V. HOOK-UP

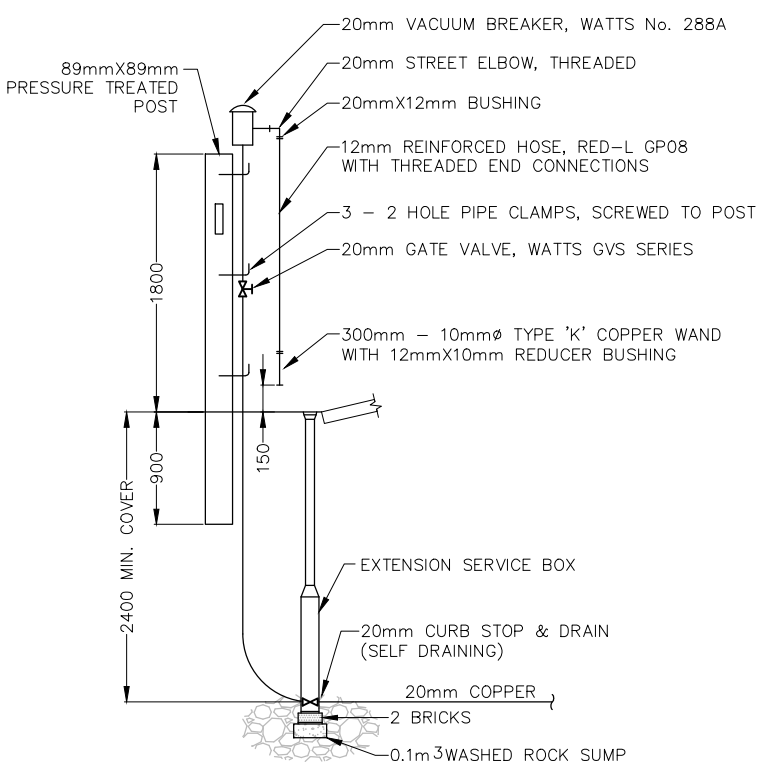


**SANI-DUMP SITE**

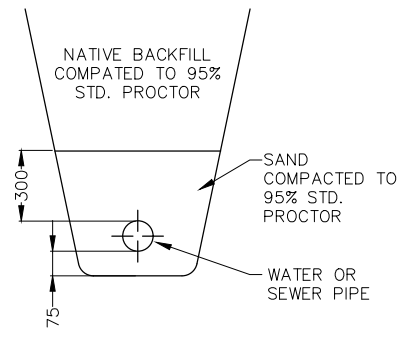


**SANITARY PAD SECTION**

\*NOTE: ALL BACKFILL 95% STD. PROCTOR



**WATER PEDESTAL DETAIL**

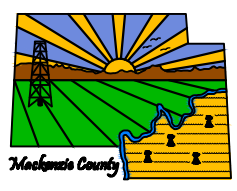


**TYPICAL TRENCH SECTION**

NOTE:  
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

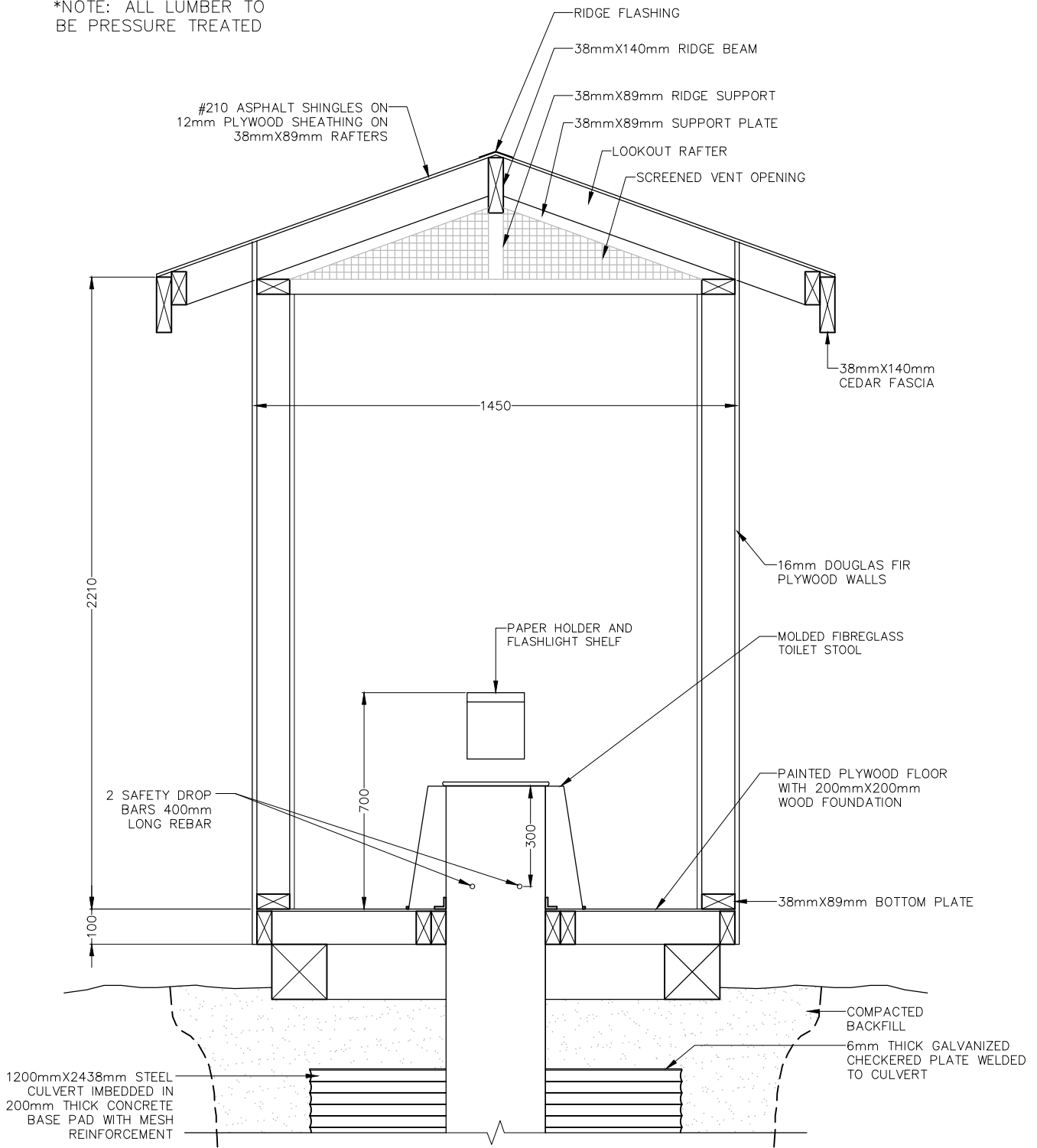
# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				R.V. SANI-DUMP STATION	Figure H-14
Rev.					
Rev.					
Rev.	2021-FEB-15	File No.: GP60.33682	Design:	Approved:	Figure H-14
Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S		

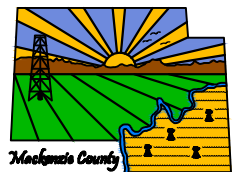
\*NOTE: ALL LUMBER TO BE PRESSURE TREATED




NOTE:  
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

# MACKENZIE COUNTY

## General Municipal Improvements Standards



Rev.				SINGLE VAULT TOILET	Approved: 	Figure <b>H-15</b>
Rev.						
Rev.						
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Date:	2010-AUG-31	Drawn: K.P.L	Scale: N.T.S			



## SECTION I REFERENCES

The following reference materials were predominantly used in the preparation of these Servicing Standards:

- “The City of Edmonton Design and Construction Standards”, June 2017–August 2020.
- “Standard Specifications for Highway Construction” Alberta Transportation, Edition 16, 2020
- “2018 Section 100 – Rural Servicing Design and Construction Manuals”, Aquatera 2018

Additionally, the following reference materials were used in the preparation of these standards:

- “American Association of State Highway Officials (AASHO)”
- “Design and Construction Standards”, Strathcona County, 2011.
- “Municipal District of Northern Lights Land Use Bylaw”
- “2021 Design Manual”, City of Grand Prairie, 2021
- “Rural Servicing Standards for Subdivisions and Road Construction”, County of Grande Prairie No.1, June 2000.
- “Procedures and Design Standards for Development”, Town of Calmar, 2020.
- “Municipal Engineering Standards”, City of St. Albert, May 2013.
- “Procedures and Design Standards for Development”, Town of Westlock, Oct. 2009.
- “Marine Guide to Small Boat Launches” Fisheries and Oceans Canada, March 2001
- “Fish Habitat & Building Materials” Fisheries and Oceans Canada, October 2003
- “Best Management Practices for Boat Launch Construction & Maintenance on Lakes”, Government of British Columbia, Ministry of Water, Land & Air Protection, July 2006
- “Standards and Guidelines for Municipal Waterworks”, Wastewater and Storm Drainage System, 2006
- “Canada-Wide Strategy for Management of Municipal Wastewater Effluent”, The Canadian Council of Ministers of the Environment, 2008
- “Big Eddy Sewerage Planning Study”, City of Revelstoke, 2007
- “General Municipal Servicing Standards”, Sturgeon County, 2009
- “General Municipal Servicing Standards”, Thorhild County, 2007
- “Guidelines for Canadian Drinking Water Quality”, Federal-Provincial-Territorial Committee on Drinking Water, 2020
- “Geometric Design Guide for Canadian Roads”, Transportation Association of Canada, 2020