

POLICY # PD 014		POLICY TITLE: GENERAL MUNICIPAL SERVICING STANDARDS (GMSS)	
APPROVAL DATE AND MOTION:	September 11, 2012 (10-09-12)	CROSS-REFERENCE:	Land Use Bylaw Municipal Development Plan
RESPONSIBILITY:	All Departments		APPENDICES:
APPROVER:	All Directors	EFFECTIVE DATE:	September 11, 2012
REVISION DATE(s)/ MOTION #:	January 10, 2023 (2023-01-19)	NEXT REVIEW DATE:	November 2027

1. POLICY STATEMENT

The County of Vermilion River recognizes the need to establish a minimum construction standard within the municipality and has assembled the General Municipal Servicing Standards (GMSS or Municipal Standards) that is intended to offer identifiable guidelines to assist the County and Developers.

2. OBJECTIVE

The GMSS has been created with two (2) objectives in mind:

2.a. – The GMSS safeguards the County with a quality product that will meet an adequate enduring product while preserving cost efficiency and practicality so as not to prohibit land development.

2.b. – To decrease the repairs to infrastructure associated with land development

3. GUIDING PRINCIPLES

The Municipal Standards presented in Schedule "A" should only be considered as a minimum requirement. The developer remains fully accountable 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. More rigid requirements may be needed on a site-by-site basis.

The most up-to-date referenced legislation or document within the GMSS should be used for the design or construction of any project in the County.



2023

GENERAL MUNICIPAL SERVICING STANDARDS



General Municipal Servicing Standards

Prepared 2023

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1 INTENT

1.1 The General Municipal Servicing Standards (GMSS) are intended to provide specific guidelines to assist the County and Developer in the design, preparation and submission of plans and specifications for construction of municipal improvements and systems (roads, water distribution systems, low-pressure/gravity sewer systems, storm water management facilities) that will meet the servicing requirements for commercial, industrial and residential subdivision development within the County of Vermilion River.

1.2 The GMSS have been developed with two goals in mind:

- to ensure that the County 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
- to minimize the maintenance requirements associated with land development.

1.3 The GMSS presented in this document should only be considered as minimum requirements. The Developer remains 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 more stringent standards.

1.4 The GMSS, as well as the latest editions of any referenced legislation or document, form part of the requirements for the design and construction of any project within the County of Vermilion River.

2 DEFINITIONS

Adjacent refers to those lands next to the development or subdivision area and includes those lands severed by a road, utility right-of-way, railroad, river, stream, reserve lands or other means of natural barrier.

Building Code refers to version of *The National Building Code* that is currently in force within the province of Alberta. It establishes design and construction standards, including

barrier-free access in new buildings and energy efficiency for housing and small buildings. It also applies to the alteration, change of use and demolition of existing buildings. The National Energy Code of Canada for Buildings 2017 or Current Edition is also adopted in Alberta and applies to new building construction other than housing and small buildings regulated under NBC(AE) Part 9.

Consulting Engineers shall mean the consulting professional engineer(s) retained by the Developer.

County shall mean the County of Vermilion River.

County Property shall mean:

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

CAO shall mean the Chief Administrative Officer, or designate, of the County of Vermilion River.

Council shall mean persons duly elected to the Council of the County of Vermilion River.

The **Developer** shall mean the proponent of a land development proposal, or the Owner as defined in the Development Agreement.

The **Developer's Engineer** shall mean the professional engineer(s) and/or firm retained by the Developer for the preparation of design, reports, studies, engineering drawings,

specifications and all other documents associated with the design and construction of the municipal improvements.

Development means 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.

The **Development Agreement** shall mean documents specifying the terms and conditions for the construction of municipal improvements necessary to service the approved subdivision.

Development Area shall mean the lands as described in schedule A and as shown in Schedule A-1 of the Development Agreement.

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

Endeavour to Assist means the assistance provided by the County, on behalf of the Developer, to try to recover from future developers and portion of excess costs respecting various municipal improvements paid for by the Developer.

External Road means any public road which is not an internal road or provincial highway.

External Local Improvements shall mean all the Local Improvements or the portions thereof to be constructed by the Developer outside of the Subdivision as described in Schedule D of the Development Agreement.

Final Acceptance Certificate (FAC) shall mean a certificate issued pursuant to the Development Agreement being used. The certificate shall be authenticated by the Developers Engineer that certifies that the construction and installation of identified local improvements have been completed in accordance with the GMSS and plans and specifications approved by the County and that all deficiencies have been resolved to the satisfaction of the County.

Geotechnical Report means a document prepared by a Professional Engineer, Geologist or Geophysicist licensed to practice in the Province of Alberta. The document must

contain the seals or stamps signed and dated by the professional in accordance with the enactments that govern their profession.

Grading means to level or grade the development area to a desired vertical and horizontal gradient.

Internal Road means a public road, 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 developments in which case the internal roads are privately owned.

Internal Local Improvements shall mean all the Local Improvements or the portions thereof to be constructed by the Developer within the Subdivision as described in Schedule D of the Development Agreement (Specifically includes lighting).

Land Use Bylaw refers to the latest version of the County of Vermilion River Land Use Bylaw (LUB) and is the day to day regulatory document that governs and controls the use and development of land in the County. This document outlines the various zoning districts and those activities that are permitted. Further, the LUB outlines setbacks, spacing, permit requirements etc.

Maintenance shall mean the Developer shall only be responsible for defects and deficiencies in materials or workmanship and any failure of the Local Improvements to comply with the General Municipal Servicing Standards and the Plans and Specifications. The County of Vermilion River shall provide the subdivision with such municipal services during the Warranty Period for the Internal Local Improvements and the External Local Improvements as are normally available to the other residence of the County of Vermilion River.

The **Municipal or Local Improvements** shall mean the installation of municipal services including, but not limited to, roads, water and sewer systems, storm sewer, and stormwater management systems, landscaping, street lighting, power, gas and telecommunication as required and specified in the Development Agreement.

The **Municipal Engineer** shall mean the professional engineer(s) and/or firm employed by the County to review, inspect and recommend approval or rejection of the work proposed or performed by the Developer under the terms of the Development Agreement.

Off Site Levies means 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 development will utilize.

Order means 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.

The **Permit, Building** means a certificate or document permitting the construction or alteration of a building or structure, which constitutes part, or all of the specified development. The permit issuance is in accordance with the minimum requirements of the *Alberta Building Code*.

The **Development Permit** means a certificate or document permitting a specified 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.

Person means one or more individuals, partnerships, corporate bodies, unincorporated organizations, government body, trustees, executors, administrators or legal representative other than the County of Vermilion River or its legal counsel.

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

Private Sewage Disposal System means a system for the on-site treatment and/or disposal of sewage and includes all components downstream of a point starting 1.8 m or less, upstream of any septic tank, packaged sewage treatment plant, sewage holding tank or the berm of a sewage lagoon but does not include a building drain leaving the building, as defined in the current edition of Alberta Private Sewage Systems Standard of Practice in place by the Province or Safety Codes Council.

Private Property means land owned by a person, group, corporation or entity that is not a government body.

Property means 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 County of Vermilion River.

Road Base Sieve Size means the aggregates specifications as determined by the Public Works Department or the County of Vermillion River's Municipal Engineer.

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

Unauthorized Use means the use of County property either by constructing, storing, landscaping, erecting, placement or removal of any structure, item or thing on, over or in County property without written authorization from the County;

- the placement of surface structures such as a driveway, parking area, walkway, patio, deck, stairs or retaining wall;
- permanent buildings, relocatable structures or accessory structures such as a detached garage, barn, shed, greenhouse, lean-to composter;
- Landscaping including fencing, fire pits or fire wood storage, the addition or removal of vegetation or a use that interferes with the growth of vegetation;
- Installation of utilities, antenna, satellite receiving dish or other telecommunication facilities;
- Storage of vehicle(s) or trailer(s) or off-road equipment, building material, rubble, stockpiles, debris or chattel;
- 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,
- Digging, cutting excavating or filling.

Units of Measurement the standard unit of measurement is metric and any reference to imperial measurement units is for convenience purposes only.

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, broadband internet or cable television.

Warranty Commencement Certificate (WCC) shall mean a certificate issued pursuant to the Development Agreement being used. The certificate shall be authenticated by the Developers Engineer that certifies that the construction and installation of identified local improvements have been completed in accordance with the GMSS and plans and specifications approved by the County and that all deficiencies have been resolved to the satisfaction of the County. The date of issuance on this certificate shall be considered the commencement of the warranty period.

Warranty Period shall mean the period as defined in the Development Agreement and will be for a term of 3 years from the date of issuance of the WCC. The Development Agreement will allow the County to extend this warranty period to a term of 5 years if issues arise during the period where the County believes an extended warranty would be of benefit to protect the interest of the County.

3 DEVELOPER'S RESPONSIBILITY

3.1 The Developer shall at their own cost and expense, provide the following:

- 3.1.1** Design and construction of the required municipal improvements including necessary off-site upgrades and utility over sizing associated with the Development.
- 3.1.2** Quality control and materials testing by an independent qualified Professional Engineer, during utility installation and roadway construction. Certification by the Professional Engineer that the construction has been completed in accordance with the approved drawings and specifications will be required.
- 3.1.3** Legal and all other costs incurred by the County for the preparation and execution of the Development Agreement.
- 3.1.4** The engineering and inspection costs incurred by the Municipal Engineer, for the review and approval of the design and construction of the required municipal improvements.

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- 3.1.5** Acquisition of additional land for road widening and municipal services as required.
- 3.1.6** Registration with Alberta Land Titles of all easements including plans and documents for the construction of municipal improvements outside of the municipal right-of-way.
- 3.1.7** A Plan of the Subdivision in accordance with the Plan approved by the County's Subdivision Approving Authority shall be registered at the Land Titles Office.
- 3.1.8** The Developer will supply both digital and hard copy of the Plan of Subdivision drawings and as-built drawings for the Development or subdivision infrastructure to the County.
- 3.2** The Developer shall be responsible for satisfying all statutory requirements governing such works and obtaining approvals for compliance with those requirements from the authorities having jurisdiction. Where conflicts or inconsistencies with the GMSS and referenced documents arise due to compliance with or amendment of statutory requirements, the Developer shall be responsible for satisfying the more stringent requirement.
- 3.3** It is the Developer's responsibility to satisfy the requirements established in the GMSS unless stated otherwise, all design criteria, materials, installation and testing shall be in accordance with the most recent editions of the referenced documents:
- Public Lands Act,*
Municipal Government Act,
Water Act,
Environmental Protection & Enhancement Act,
Canadian Environmental Assessment Act,
Fisheries Act,
Species at Risk Act,
Navigable Water Protection Act,
Safety Codes Act,
Rural Utilities Act,
Provincial Offences Procedures Act,
Plumbing Code,
Alberta Private Sewage Standards of Practice

*Alberta Building Code,
Provincial Wetlands Policy,
Alberta Environment, Standards and Guidelines for Municipal Waterworks,
Wastewater and Storm Drainage Systems
County of Vermilion River General Municipal Servicing Standards
Alberta Highway Design Guide
Transportation Association of Canada (TAC) Geometric Design Guidelines
TAC Uniform Traffic Control Devices for Canadian Roads
TAC Highway Lighting Design Guide
Municipal Bylaws, other
Provincial/Federal Government Authorities*

Or other such documents that may be applicable.

- 3.4** It is the Developer's or their consultant's responsibility to obtain, at their own cost copies of the referenced documents from the applicable authority.
- 3.5** The compiled list of referenced documents is not meant to be all inclusive, addition standards and documents may be listed in specific Sections of the GMSS for reference. The Developer and Developer's Engineer remain responsible for the design and construction of their development according to accepted engineering practices.

4 **DEVELOPMENT AGREEMENT**

- 4.1** Developer shall enter into a Development Agreement with the County prior to the construction and installation of municipal improvements. There shall be no Building Permit issued for any construction on a particular lot within the subdivision until all municipal improvements are in place and accepted by the County and endorsement of the subdivision plans and registration at Alberta Land Titles is completed.


5 **CHANGES IN DESIGN STANDARDS**


- 5.1** It is the Developer's responsibility to ensure that the design and construction is in compliance with the latest edition of the GMSS including any revisions thereto up to the date of acceptance of the detailed design.


6 INSPECTIONS AND FINAL ACCEPTANCE

- 6.1** Upon completion of all municipal improvements, the Developer shall give notice to the County and arrange for inspections. Upon the receipt of a Warranty Commencement Certificate (WCC) from the Developer, the Municipal Engineer, on behalf of the County, shall inspect the municipal improvements, prepare a deficiency list, and forward it to the Developer through the County.
- 6.2** All deficiencies shall be rectified to the satisfaction of the Municipal Engineer prior to the acceptance and approval of the WCC by the County and the Municipal Engineer.
- 6.3** The warranty period shall commence upon acceptance and approval of the WCC. During this period, the Developer shall repair any defect in material or workmanship.
- 6.4** Prior to the expiry of the warranty period, the developer shall notify the County and arrange for an inspection. Upon the correction of all deficiencies satisfactory to the Municipal Engineer, the Developer's Engineer shall issue a request for the Final Acceptance Certificate (FAC) for municipal improvements.

Examples of WCC and FAC

	<p>County of Vermilion River 4912 - 50 Avenue Kitscoty, AB T0B 2P0</p>	<p>WARRANTY COMMENCEMENT CERTIFICATE</p> <p>Form A1-1 Page 1 of 2</p>		
<p>Development Application No.: _____</p> <p>Developer: _____</p> <p>Contractor: _____</p> <p>Municipal Improvement: _____</p> <p>Location of Municipal Improvement: _____</p> <p>Date of Application for Construction Completion: _____</p>				
<p>PURSUANT TO THE DEVELOPMENT AGREEMENT, I _____ OF THE FIRM _____ ("CONSULTING ENGINEERS"), HEREBY CERTIFY COMPLIANCE WITH THE SERVICING STANDARDS AS SET OUT IN THE DEVELOPMENT AGREEMENT, AND RECOMMEND APPROVAL FOR CONSTRUCTION COMPLETION OF THE MUNICIPAL IMPROVEMENT.</p>				
<p>_____ Project Engineer (Consulting Engineering Firm)</p>		<p>_____ Date</p>		
<p>_____ Signing Officer (Consulting Engineering Firm)</p>		<p>_____ Date</p>		
<p>_____ Authorized by County of Vermilion River's Representative</p>		<p>_____ Date</p>		
<p>_____ Director of Public Works & Engineering Date</p>				
<table style="width: 100%; border: none;"> <tr> <td style="width: 40%; border: none;"> <input type="checkbox"/> Approved <input type="checkbox"/> Conditionally Approved <i>(See Attached Deficiency List)</i> <input type="checkbox"/> Rejected <i>(See Attached Deficiency List)</i> </td> <td style="width: 60%; border: none; background-color: #f0f0f0;"> <p>For Internal Use Only</p> <p>Total Amount of Letter of Credit: _____</p> <p>Amount Retained for Deficiencies: _____</p> <p>Amount Retained for Maintenance: _____</p> <p>Amount Released with CCC: _____</p> </td> </tr> </table>			<input type="checkbox"/> Approved <input type="checkbox"/> Conditionally Approved <i>(See Attached Deficiency List)</i> <input type="checkbox"/> Rejected <i>(See Attached Deficiency List)</i>	<p>For Internal Use Only</p> <p>Total Amount of Letter of Credit: _____</p> <p>Amount Retained for Deficiencies: _____</p> <p>Amount Retained for Maintenance: _____</p> <p>Amount Released with CCC: _____</p>
<input type="checkbox"/> Approved <input type="checkbox"/> Conditionally Approved <i>(See Attached Deficiency List)</i> <input type="checkbox"/> Rejected <i>(See Attached Deficiency List)</i>	<p>For Internal Use Only</p> <p>Total Amount of Letter of Credit: _____</p> <p>Amount Retained for Deficiencies: _____</p> <p>Amount Retained for Maintenance: _____</p> <p>Amount Released with CCC: _____</p>			
<p>I HEREBY CERTIFY THAT THE ITEMS LISTED AS REASONS FOR CONDITIONAL APPROVAL / REJECTION HAVE BEEN CORRECTED AS INDICATED ON THE ATTACHED DEFICIENCY LIST.</p>				
<p>_____ Project Engineer (Consulting Engineering Firm)</p>		<p>_____ Date</p>		
<p>Approved: _____</p>				
<p>_____ Director of Public Works & Engineering</p>		<p>_____ Date</p>		
<p>Date Maintenance / Warranty Period to Start: _____</p> <p>Scheduled Maintenance / Warranty Expiry Date: _____</p>				
<p>(OVER →)</p>				

	<p>County of Vermilion River 4912 - 50 Avenue Kitscoty, AB T0B 2P0</p>	<p>FINAL ACCEPTANCE CERTIFICATE Form A1-2 Page 1 of 2</p>
<p>Development Application No.: _____</p>		
<p>Developer: _____</p>		
<p>Contractor: _____</p>		
<p>Municipal Improvement: _____</p>		
<p>Location of Municipal Improvement: _____</p>		
<p>Date of Application for Final Acceptance: _____</p>		
<p>Scheduled Maintenance / Warranty Expiry Date: _____</p>		
<p>PURSUANT TO THE DEVELOPMENT AGREEMENT, I _____ OF THE FIRM _____ ("CONSULTING ENGINEERS"), HEREBY CERTIFY THAT AS OF THE ABOVE DATE, THE SAID MUNICIPAL IMPROVEMENT MEETS ALL OF THE REQUIREMENTS FOR FINAL ACCEPTANCE AS SPECIFIED BY THE DEVELOPMENT AGREEMENT, AND RECOMMEND THE MUNICIPAL IMPROVEMENT FOR FINAL ACCEPTANCE.</p>		
<p>Project Engineer (Consulting Engineering Firm) _____</p>		<p>_____ Date</p>
<p>Signing Officer (Consulting Engineering Firm) _____</p>		<p>_____ Date</p>
<p>Authorized by County of Vermilion River's Representative _____</p>		<p>_____ Date</p>
<p>Director of Public Works & Engineering _____</p>		<p>_____ Date</p>
<p><input type="checkbox"/> Approved <input type="checkbox"/> Rejected <i>(See Attached Outstanding Deficiency List)</i></p>		<p>For Internal Use Only LOC Amount Remaining from CCC: _____ Amount Retained for Deficiencies: _____ Amount Retained for Maintenance: _____ Amount Released with FAC: _____</p>
<p>I HEREBY CERTIFY THAT THE ITEMS LISTED AS REASONS FOR REJECTION HAVE BEEN CORRECTED.</p>		
<p>Project Engineer (Consulting Engineering Firm) _____</p>		<p>_____ Date</p>
<p>Approved: _____</p>		
<p>Director of Public Works & Engineering _____</p>		<p>_____ Date</p>
<p>Date Maintenance / Warranty to Expire: _____</p>		
<p>(OVER →)</p>		

	<p>County of Vermilion River 4912 - 50 Avenue Kitscoty, AB T0B 2P0</p>	<p>FINAL ACCEPTANCE CERTIFICATE Form A1-2 Page 2 of 2</p>			
Outstanding Deficiency List					
Item No.	Deficiency Description	Amount of LOC Retained for Deficiency	Re-Inspection Date	Noted Complete	
				Consultant's Initials	M.D. Rep's Initials
Additional Comments					

7 **WARRANTY PERIOD**

- 7.1** In an effort to be both fair and consistent when dealing with large development projects, the County has created a policy to outline the requirements associated transparency to both the County ratepayers and those in the development field.
- 7.2** The County of Vermilion River will adhere to the guidelines outlined within this policy when dealing with development agreements for multi-lot subdivision developments within the County. This policy will clearly outline the following items:
- how the County will determine Security for the development,
 - the form of the security accepted by the County,
 - the amount of security to be taken,
 - the warranty timelines and
 - the triggering events that will allow the County to release portions of security.
- 7.3** The County of Vermilion River (County) will require Stamped Engineer Drawings and Cost Estimates for all Municipal Infrastructure associated with the proposed development. These estimated figures will be verified by County Engineers and inserted into the 'Security' Schedule of the Development Agreement.
- 7.3.1** The County will require 125% of the total costs outlined within the 'Security' Schedule of the Development Agreement, either in the form of a certified bank draft or a self-renewing irrevocable letter of credit **PRIOR TO ENDORSEMENT** of the subdivision outlined within the agreement, for Security purposes.
- 7.3.2** The security will be held in its entirety until a Construction Completion Certificate (CCC) is issued by the County. Verification that the built infrastructure meets County standards will require the submission of engineering tests and reports to the satisfaction of the County. Additionally, if the Developer is able to provide the County with the servicing agreements and payment receipts for 'Shallow Buried Utilities' (Gas, Power, Telephone Etc.), as shown within the Development Agreement, these costs will not be included in the Security.

- 7.3.3** Upon issuance of a CCC, the County will, in accordance with the following: a percentage of the TOTAL costs for the infrastructure, subject to the terms of the Developer Agreement:
- 7.3.3.1** Developer – single development
- Release one hundred percent (100%) within thirty (30) days and upon the issuance of an FAC.
- 7.3.3.2** Developer – multi-lot / corporate / business / industrial development
- Release thirty-five percent (35%) and CCC issued for start of Warranty Period.
- 7.3.4** The remaining sixty-five percent (65%) will be retained by the County for warranty purposes. The warranty period will be defined in the Development Agreement and will be for a term of three (3) years from the date of issuance of the CCC. The development agreement will allow the County to extend this warranty period to a term of five (5) years if issues arise during the period where the County believes an extended warranty would be of benefit to protect the County interest.
- 7.3.5** Following the warranty period, the County will be in a position to issue a Final Acceptance Certificate (FAC) for the development. Prior to the end of the warranty period, the County will review the warranty and infrastructure along with any deficiencies. Subject to the satisfaction of the County, the FAC will be issued for the specific infrastructure and the County will release the remainder of the security.
- 7.3.6** Failure to complete the obligations listed in the Developer Agreement(s) in the time frame specified, will result in the County retaining the complete one hundred twenty-five percent (125%) and use that security to complete the construction.
- 7.4** Where there is a delay in the application of the final layer of asphalt on the internal roads and approaches, the warranty period for the internal roads and approaches shall be extended for a period of twelve (12) months from the date of acceptance of the WAC by the County for the final layer of asphalt.

7.5 The Developer shall provide, for the duration of the warranty period, an irrevocable Letter of Credit as required by the County.

8 UTILITY, PIPELINE AND RAILWAY CROSSINGS

8.1 The Developer shall be responsible for obtaining the Crossing Agreement where a crossing of utility, roadway, pipeline or railway is required for the installation of the municipal improvements.

8.2 The Developer shall comply with all terms and conditions of the Crossing Agreement and make application to transfer the Agreement to the County’s name prior to the application for a WCC.

8.3 Refer to Section G – Transportation for additional information regarding crossings for utilities, pipelines and railways.

8.4 For crossings of provincial highways. A permit from Alberta Transportation is required to install utility lines within the permit area of a provincial highway. The highway permit area for utility line installation varies depending on the highway classification.

Highway classification Permit area

Freeways	115 m from the centreline or 30 metres beyond the limit of the freeway, whichever is greater
Multi-lane highways and major 2-lane highways	60 m from the centreline or 30 m beyond the limit of the highway, whichever is greater
Minor 2-lane highway	50 metres from the centreline or 30 m beyond the limit of the highway, whichever is greater

Construction cannot take place without a valid permit.

9 FRANCHISE UTILITIES

The developer shall be responsible for all coordination with franchise utilities including design and installation. The Developer shall be responsible for any deficiencies noted as a result of installation such as curb damage, trench settlement or final boulevard grading.

10 **EASEMENT AND RIGHT OF WAY**

The Developer shall be responsible for obtaining all easements and right of ways for the installation of municipal improvements located outside of the normal right-of-way or utility lot. All permanent easements, including plans and documents, shall be registered at the Land Titles Office naming the County as the Grantor prior to application for a WCC.

11 **PERMITS AND LICENSES**

The Developer shall be responsible for obtaining all permits and licenses in compliance with the Provincial and Federal statutory requirements.

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1 **SUBMISSION REQUIREMENTS FOR LOT/SITE GRADING PERMIT**

- 1.1** Pursuant to Land Use Bylaw, “Development: Permits, Rules and Procedures” as may from time to time be amended, the following technical information is required to be submitted in support of a Development Permit application to begin site stripping, stockpiling of topsoil and cut and fill operations only:
- 1.1.1** For multi-lot subdivision development the subdivision application must be approved by the County’s Subdivision Authority prior to the submission of engineering drawings for review and approval.
 - 1.1.2** For large-scale industrial/commercial development where site grading may be desirable in advance of all other approvals at the discretion of the County of Vermilion River Development Authority may issue a development permit for site grading.
 - 1.1.3** For excavations other than for construction or building purposes, including, but not limited to, sand and gravel, topsoil stripping, peat moss, and construction of artificial bodies of water.
 - 1.1.4** Pursuant Section 3 of the Soil Conservation Act S-15 RSA 2000 as amended appropriate measure shall be implemented to prevent soil loss or deterioration from taking place or to stop soil loss and deterioration from continuing.
- 1.2** Development permit submission requirements are:
- 1.2.1** Provide a general site plan illustrating existing contours at 0.5 m intervals preferred not to exceed 1.0 m maximum. Elevations will be relative to geodetic datum. Reference benchmarks are to be detailed on the plan.
 - 1.2.2** Provide 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 development or subdivision area including road rights-of-way, laneways, drainage/utility easements, municipal reserve and all lots. Indicate on the plans the benchmark used in the control of

construction for the project. Other information to be shown includes stock piling and windrow placements.

- 1.2.3** The results of a Geotechnical/Hydrogeological Investigation completed by a qualified geotechnical engineering firm to a level that will allow the engineer to generally assess the site geotechnical/hydrogeological conditions and their effect on the development or subdivision. The report should outline any findings of contamination that may exist and any general recommendations.
- 1.2.4** For subdivision lots or development sites that require 1.0 m or more fill a geotechnical evaluation and engineering requirements for each lot/site is to be submitted to support the development of each lot/site. Identify each lot on the conceptual subdivision plan. The developer is responsible for the supply, placement and compaction of necessary fill for rough grading. The rough grades should ensure that the overall drainage plan is satisfied. No standing water or areas where water may pool or pond will be permitted.
- 1.2.5** At the discretion of the Development Approving Authority, a Phase I Environmental Site Assessment (ESA) of the subdivision or development area completed in accordance with Canada Standards Association (CSA) standard CSA Z768-01 may be required. A Phase II ESA conforming to CSA Z769-00 shall be required if recommended in the Phase I report.
- 1.2.6** If a creek, river or other major watercourse crosses the site, a plan of the floodplain and a letter outlining the recommended measures to ensure that the development would not be exposed to flooding is required.
- 1.2.7** Overall conceptual plans and description for the proposed subdivision or development area are required for review and approval; road layouts, water and sanitary sewer servicing and storm water management plan. The stormwater management plan is to address the capacity of existing systems and the requirements to accommodate the new flows is required to be completed with supporting calculations submitted for review.

- 1.2.8** Any subdivision or development involving pipeline and or power line transmissions and or public utility right-of-way shall be sited to comply with all relevant Federal and Provincial legislation. Setbacks from pipelines and other 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 are to be provided with the application.
- 1.3** The standard drawing size of 841 mm by 594 mm (or other standard sheet size) shall be used for all plan submissions with a scale of 1:1000 (index plan may be a reduction of the standard scale to allow the plan to fit the standard size sheet).
- 1.4** The County may require other non-technical submissions as part of the application.
- 1.5** The County shall/may require the Developer to submit a Historical Resource Report to identify any significant historical resources within the boundaries of the proposed development including a review for archaeological and palaeontological resources, in consultation with Alberta Community Development.
- 2** **PREREQUISITES TO REVIEW OF ENGINEERING DRAWINGS**
- 2.1** The subdivision plan must be approved by the County prior to the submission of engineering drawings for review and approval.
- 2.2** The Engineering Drawings must be prepared, signed and sealed by a Professional Engineer registered in the Province of Alberta and shall be signed and stamped with a Permit to Practice seal.
- 2.2.1** The standard drawing size of 841 mm by 594 mm (or other standard sheet size) shall be used for all plan submissions with a scale of 1:1000 (index plan may be a reduction of the standard scale to allow the plan to fit the standard size sheet).
- 2.3** The submission of drawings shall be accompanied by all supporting documents, reports, studies, calculations or any other information as required by the County.
- 2.3.1** The County may require other non-technical submissions as part of the application.

- 2.3.2** The County may require the Developer to submit a Historical Resource Report to identify any significant historical resources within the boundaries of the proposed development including a review for archaeological and palaeontological resources, in consultation with Alberta Community Development.

3 ENGINEERING DRAWINGS SUBMISSION & APPROVAL PROCEDURE

- 3.1** The Developer shall submit complete engineering drawings at least eight weeks prior to the start-up of construction. The County or its designated Engineer is not responsible for any delay of approval if submissions are incomplete or found to contain excessive errors or omissions.
- 3.2** Initially, the Developer shall submit, by mail or dropped off one (1) complete drawing set and specifications to the County together with all supporting documents and reports. The Developer shall also email one (1) PDF copy of drawings, specifications, documents and reports to the County.
- 3.3** The County shall respond to the Developer's initial submissions within four weeks and return one set of drawings and specifications to the Developer with comments for revision.
- 3.4** The Developer shall promptly revise the engineering drawings to the satisfaction of the Municipal Engineer and re-submit one (1) complete set of revised drawings and specifications, email PDF copies of the revised drawings and specifications and one (1) digital copy AutoCAD MapCAD 2012 GIS 10 or later (.DWG format) to the County for approval, together with any additional information as required by the Municipal Engineer.
- 3.5** Upon receipt of revised drawings, satisfactory to the Municipal Engineer, the County shall return one complete set of drawings to the Developer with an Approval letter for Construction.
- 3.6** The Developer shall not proceed with construction until the engineering drawings have been approved for construction. All engineering drawings will be reviewed to confirm the minimum standards are being met as outlined in this GMSS.

- 3.7** The County's Approval for Construction does not relieve the Developer or its Engineer's responsibility for the adequacy of the designs or the liability arising thereof.

4 GENERAL REQUIREMENTS FOR ENGINEERING DRAWINGS

- 4.1** Each drawing shall include the following:

- 4.1.1** a suitable title block, identifying:

- Name of the project,
- County File No.
- Draft or Revision No.,
- Revision Date,
- and Date of drawings issued;

- 4.1.2** the scale of the drawing;

- 4.1.3** a north direction indicator;

- 4.1.4** an appropriate space for the Professional Seal and Permit to Practice

- 4.2.** All dimensions and measurements shown in the engineering drawings shall be in metric units. All elevations shown in the engineering drawings shall be referenced to geodetic datum and shall be noted as such. Furthermore, the reference point shall be located within or near the proposed development and shall be easily accessible by the County.

- 4.3** Geodetic Datum, surveys and plans are to be prepared utilizing UTM Zone 12 North American Datum NAD83 (adopted) ground level coordinates.

- 4.4** All elevations must be relative to geodetic datum.

- 4.5** The standard drawing size of 841 mm by 594 mm shall be used.

- 4.6** All lettering must be a minimum of 2 mm (0.08") high.

- 4.7** It is suggested that abbreviations and drawing symbols used in the engineering drawings be consistent with industry standards.

4.8 The engineering drawings are to provide a complete description of all existing and proposed municipal improvements, including any provisions for future extensions of utilities and systems.

4.9 The engineering drawings shall include:

4.9.1 **Cover sheet** of standard size, indicating the names of the subdivision development, the Developer and the Consultant, and the legal location or address of the subdivision.

Site Plan

This drawing shall include, but not limited to, the following existing and proposed information:

- Property lines;
- Street names, lot and block numbers;
- All easements and right of ways;
- Water, sanitary, storm information (pipes, valves, hydrants, catch basins, manholes, etc.);
- Curb lines, sidewalks, trails;
- Drawing number references to plan/profile and plan details sheets;
- Community mailboxes.

This drawing can be made into two (2) separate drawings, one containing all underground information and the other all surface related information.

A minimum of two (2) survey reference points complete with location and elevation information as per the County of Vermilion River coordinate system must also be shown on this plan.

4.9.2 **Index plan** of standard size, scale 1:1000 or a reduction thereof, duplicating the legal plan, indicating drawing sheet number and related title.

- 4.9.3** Topography and Land Use Plan, scale 1:1000, indicating the existing contours at 0.5 m intervals and the proposed land uses.
- 4.9.4** Lot Grading Plan, scale 1:1000, that indicates the proposed lot corner elevations, the proposed finished grades at the buildings and the direction of surface drainage on the lots, streets and swales. Proposed building elevations and sewer service invert elevations should be shown. All lots on fill, disturbed or unsuitable soil must be identified on the lot-grading plan. The plan should indicate minimum rough grading requirements to be completed by the Developer. Rough grades shall ensure that the overall drainage concept is satisfied. No standing water or areas where water may pool or pond will be permitted at the rough grading stage.
- 4.9.5** Roadway Overall Plan, scale 1:1000, indicating all walks, lanes, roadway widths and alignments.
- 4.9.6** Drainage Basin, an overall drainage basin plan is required adjacent to all roadways, showing 1.0 m contours, existing overland drainage routes, and flood plains/ponding areas.
- 4.9.7** Pavement Marking and Signage Plan, scale 1:1000, indicating pavement marking and proposed signage locations and specifications.
- 4.9.8** Sanitary, Storm and Water Main Overall Plan, scale 1:1000, indicating the alignments and sizes of sanitary sewers, storm sewers and water mains and services, locations of manholes, catch basins, valves, hydrants and other proposed underground utilities.
- 4.9.9** Gas, Power and Telecommunication Overall Plan(s), scale 1:1000 indicating alignment of gas, power, telephone, underground cables, and utility easements if applicable. *
- 4.9.10** Landscaping Plan, scale 1:1000 identifying street names and landscape amenities including fencing, signage, screening berms, Canada Post mailboxes and pads, entrance features, entrance sign location and specifications and name and location of all trees and shrubs. The plan shall include up to three alternative names for each street. Street naming approval will be completed by County Council. The County

* Power: REA and Fortis ATCO Electric; Gas: ATCO Gas, County and Coops. (Maps in Appendix)

reserves the right to select or reject proposed names (See Section H for more detail).

4.9.11 Detailed Plans & Profiles for Roadways, scale 1:500 horizontal and 1:50 vertical, showing:

- 4.9.11.1** Road right-of-way width, roadway width offset from property line and horizontal curve data.
- 4.9.11.2** Original ground profiles & chainages.
- 4.9.11.3** Proposed centreline profiles & chainages.
- 4.9.11.4** Proposed top of curb elevations.
- 4.9.11.5** Proposed catch basin locations and inlet elevations.
- 4.9.11.6** Vertical curve data.
- 4.9.11.7** Elevations of shallow utilities at road crossings.
- 4.9.11.8** Pavement structure.

4.9.12 Detailed Plans & Profiles for Water, Sanitary and Storm Sewers, scale 1:500 horizontal and 1:50 vertical showing:

- 4.9.12.1** Horizontal alignment and separation distances between each utility.
- 4.9.12.2** Water main plan showing pipe sizes, location of hydrants, valves and fittings.
- 4.9.12.3** Water main profiles showing grades, cover, pipe sizes, pipe materials and class of pipe bedding.
- 4.9.12.4** Storm and sanitary sewer plan showing pipe sizes and manhole locations.
- 4.9.12.5** Storm and sanitary sewer profiles showing pipe sizes and materials, manhole invert elevations, length of pipe, grades between manholes and class of bedding.

4.9.12.6 Location of services and invert elevations at property line.

4.9.12.7 Elevations of oil and gas pipeline crossings.

5 **REPORTS AND STUDIES**

The Developer shall provide all relevant reports and studies in the submission of engineering drawings (if not previously provided) including:

- 5.1** Geotechnical/hydrogeological report to identify;
 - 5.1.1** Existing soil and sub-soil conditions, groundwater tables, limits of any site contamination, top of bank setbacks adjacent creeks or ravines with stability problems.
 - 5.1.2** Recommended pavement structure construction based on insitu conditions and projected traffic volume. A 20-year structure recommended by the Geotechnical Consultant is required; however, minimum pavement structure thickness as illustrated on the cross-sectional standard drawings must be maintained.
 - 5.1.3** Construction methods and procedures for trenching and backfill requirements for buried infrastructure, storm drainage facilities and service requirements for proposed private servicing requirements and building foundation requirements.
- 5.2** A Stormwater Management Plan outlining the proposed drainage concept including calculation of pre and post-development run-off rates and the proposed method of stormwater control. The plan should outline both on-site and off-site drainage patterns as well as the ability of existing municipal infrastructure to accommodate the run-off from the development.
- 5.3** Engineering design brief including design calculations and analysis of the proposed municipal improvements.
- 5.4** Environmental impact assessment may be required for any development depending on the circumstances.

AS-CONSTRUCTED RECORD DRAWINGS

- 6.1** Within six (6) weeks following the issuance of the Warranty Commencement Certificate (WCC), the Developer shall submit to the County a set of as-constructed record drawings in a digital format CAD or GIS of the latest version together with three sets of blueprints.

- 6.2** All drawings must indicate As-Built or As-Constructed and shall be stamped, signed, sealed and dated by a registered Professional Engineer.

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1 INTENT

- 1.1** This section is intended to assist the County and/or Developer with a general guideline outlining the level of service for a particular development based on the land use district. The Developer may use this section to determine the most appropriate servicing standards presented in the following sections.
- 1.2** The level of service applicable to any particular development is subject to review by the County. The County reserves the right to require a higher level of service for any particular development.
- 1.3** The guidelines and standards presented in this document should only be considered as minimum requirements. The Developer remains 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 that standards that are more stringent be met.
- 1.4** It is the Developer's responsibility to satisfy, in addition to these requirements, all regulations and conditions required by referenced legislation or document, Municipal By-Laws and Provincial/Federal Government Authorities.
- 1.5** 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 Municipal Engineer for review. The request will be reviewed, and a written reply returned with the final decision.

2 LAND USE DISTRICTS

- 2.1** Refer to the latest version of the Land Use Bylaw for a list of the land use districts in place and the levels of service.

3 LAND USE DISTRICTS AND LEVEL OF SERVICE

The intent is to assist the County of Vermilion River and/or Developer with a general guideline outlining the level of service for a particular development based on the land use

district. The Developer may use this section to determine the most appropriate servicing standards presented in the following sections.

The level of service applicable to any particular development is subject to review by the County of Vermilion River. The County of Vermilion River reserves the right to a higher level of service for any particular development.

It is the Developer's responsibility to satisfy, in addition to these requirements, all regulations and conditions required by referenced legislation or document, Municipal By-laws and Provincial/Federal Government Authorities.

Cold mix asphalt may be used in certain areas. The Developer must receive approval from the County prior to use.

3.1 Agricultural (A) District

- 3.1.1** 8 m min. finished roadway width
- 3.1.2** Gravel base course
- 3.1.3** Roadway surfacing requirements may be subject to review on a project specific basis
- 3.1.4** Private Water and Sewer Systems
- 3.1.5** Private On-site Stormwater Management System
- 3.1.6** Min area: as per current Land Use Bylaw

3.2 Highway Development (HD) District

- 3.2.1** 10.0 m min. finished roadway width
- 3.2.2** Asphalt with stabilized base course
- 3.2.3** Roadway surfacing requirements may be subject to review on a project specific basis
- 3.2.4** Private Water and Sewer Systems
- 3.2.5** Private Onsite Stormwater Management System

3.2.6 Min Lot area: as per current Land Use Bylaw

3.3 Collector Road (SR) District

3.3.1 10.0 m min. finished roadway width

3.3.2 Asphalt with stabilized base course

3.3.3 Roadway surfacing requirements may be subject to review on a project specific basis

3.3.4 Private Water and Sewer Systems

3.3.5 Overland Stormwater Management System

3.3.6 Min. lot area: as per the current Land Use Bylaw

3.4 Controlled Urban Development (CUD) District

3.4.1 10.0 m min. finished roadway width

3.4.2 Asphalt with stabilized base course

3.4.3 Roadway surfacing requirements may be subject to review on a project specific basis

3.4.4 Private Water and Sewer Systems

3.4.5 Overland Stormwater Management System

3.4.6 Min. lot area: as per the current Land Use Bylaw

3.5 Urban General (UG) District

3.5.1 9.0 m min. finished roadway width

3.5.2 Asphalt Concrete Pavement

3.5.3 Roadway surfacing requirements may be subject to review on a project specific basis

-
- 3.5.4 Sidewalk and curb & gutter requirements shall be determined on an individual basis
 - 3.5.5 Sidewalks shall generally be required for subdivisions with four or more lots constructed adjacent to developments with established sidewalks
 - 3.5.6 Serviced Lots – piped water at normal operating pressure, sanitary sewer, and fire protection services may be required
 - 3.5.7 Overland Stormwater Management System
 - 3.5.8 Min. lot area: as per the current Land Use Bylaw
- 3.6 Large Lot Residential (R) District**
- 3.6.1 9.0 m min. finished roadway width
 - 3.6.2 Asphalt Concrete Pavement with curb and gutter
 - 3.6.3 Roadway surfacing requirements may be subject to review on a project specific basis
 - 3.6.4 Sidewalk requirements shall be determined on an individual basis
 - 3.6.5 Sidewalks shall generally be required for subdivisions with four or more lots constructed adjacent to developments with established sidewalks
 - 3.6.6 Serviced Lots – piped water at normal operating pressure, sanitary sewer and fire protection services may be required
 - 3.6.7 Overland Stormwater Management System
 - 3.6.8 Min. lot area: 550 sq. m
- 3.7 Urban Residential (R2) District**
- 3.7.1 9.0 m min. finished roadway width
 - 3.7.2 Asphalt Concrete Pavement with curb and gutter

-
- 3.7.3** Roadway surfacing requirements may be subject to review on a project specific basis
- 3.7.4** Sidewalk requirements shall be determined on an individual basis
- 3.7.5** Sidewalks shall generally be required for subdivisions with four or more lots constructed adjacent to developments with established sidewalks
- 3.7.6** Serviced Lots – piped water at normal operating pressure, sanitary sewer and fire protection services may be required
- 3.7.7** Overland Stormwater Management System
- 3.7.8** Min. lot area: One Family Dwelling (372 sq. m), Duplexes (325 sq. m) and One Family (Type B) Dwellings (372 sq. m)
- 3.8 Hamlet Residential (R2) District**
- 3.8.1** 9.0 m min. finished roadway width
- 3.8.2** Asphalt Concrete Pavement with curb & gutter
- 3.8.3** Roadway surfacing requirements may be subject to review on a project specific basis
- 3.8.4** Sidewalk requirements shall be determined on an individual basis
- 3.8.5** Sidewalks shall generally be required for subdivisions with four or more lots constructed adjacent to developments with established sidewalks
- 3.8.6** Serviced Lots – piped water at normal operating pressure, sanitary sewer and fire protection services may be required
- 3.8.7** Overland Stormwater Management System
- 3.8.8** Min. lot area: Same as R1, except fourplexes lot size to be min. 740 sq. m
- 3.9 Country Residential One (CR1) District**
- 3.9.1** 9.0 m min. finished roadway width

-
- 3.9.2 Asphalt Pavement
 - 3.9.3 Roadway surfacing requirements may be subject to review on a project specific basis
 - 3.9.4 Sidewalks shall generally be required for subdivisions with four or more lots constructed
 - 3.9.5 Private Water and Sewer Systems
 - 3.9.6 Overland Stormwater Management System
 - 3.9.7 Min. Lot size 1.0 acre
 - 3.10 Country Residential Two (CR2) District**
 - 3.10.1 9.0 m min. finished roadway width
 - 3.10.2 Asphalt Pavement
 - 3.10.3 Roadway surfacing requirements may be subject to review on a project specific basis
 - 3.10.4 Private Water and Sewer Systems
 - 3.10.5 Protection services may be required
 - 3.10.6 Overland Stormwater Management System
 - 3.10.7 Min. Lot size 5.0 acres
 - 3.11 Manufactured Home Park (MHP) District**
 - 3.11.1 The County shall determine roadway standards on a project specific basis
 - 3.11.2 Private Water and Sewer Systems
 - 3.11.3 Private On-site Stormwater Management
 - 3.11.4 Min. lot area: 5 ac.
-

3.12 Business (B) District, Lloydminster Flinge Business (B2) District, Commercial (C1) District, Industrial Development (M) District, Light Industrial (M1) District and Heavy Industrial (MH) District

3.12.1 10.0 m min. finished roadway width

3.12.2 Asphalt Concrete Pavement

3.12.3 Roadway surfacing requirements may be subject to review on a project specific basis

3.12.4 Municipal water and Sewer may be available, and each project would be reviewed on an individual basis

3.12.5 Rated Fire Flows may be required

3.12.6 Overland Stormwater Management System/Private On-site Stormwater Management

3.12.7 Min Lots sizing: B – as per the current Land Use Bylaw

B2 – 14.8 ac.

C1 – as per the current Land Use Bylaw

M – as per the discretion of the Development Authority

M1 – 4000 sq. m

MH – 4000 sq. m

3.13 Urban Expansion (DE) District

3.13.1 The County shall determine applicable roadway standards on an individual project basis

3.13.2 Private Water and Sewer Systems

3.13.3 Municipal water and Sewer may be available, and each project would be reviewed on an individual basis

3.13.4 Rated Fire flows may be required

3.13.5 Overland Stormwater Management System/Private On-site Stormwater Management

3.13.6 Min lot area: as per the current Land Use Bylaw, Inter-municipal Development Plan and corresponding Area Structure Plans

3.14 Landfill and Composting (LC) District

3.14.1 The County shall determine and review each project on individual basis

3.14.2 Min. lot area: as per the current Land Use Bylaw

3.15 Parks and Recreation (PR) District

3.15.1 The County shall determine and review each project on individual basis

3.15.2 Min. lot area: 371 m²

4 PUBLIC WORKS

4.1 Roadways

4.1.1 The Developer's Engineer shall be responsible for determining an estimated Annual Average Daily Traffic (AADT) generated by the development in order to determine the required cross-sectional elements and pavement structure. Developer is responsible to determine daily traffic volumes generated for development. Section G provides a geometric design table and cross sections for the various roadway classifications.

4.1.2 The Standard roadway Classifications included:

- Arterial Road
- Connector Road
- Local Road
- Subdivision Road
- Hamlet Road
- Undeveloped Road:
 - Seasonal Access Road (Back Road)

Unimproved
Undeveloped

4.2 Water Systems

Developments may require one of the following types of water distribution systems:

4.2.1 Private Water Systems

4.2.1.1 Private water systems consist of individual wells or water cisterns. Systems must be designed and installed according to the Canadian Plumbing Code and applicable Provincial Regulations.

4.2.1.2 The County of Vermilion River will review the construction of communal water systems, which are designed to incorporate a water supply from an on-site well or public infrastructure.

4.2.2 Piped Water Distribution Systems

4.2.2.1 Piped water systems may consist of a piped network at normal operating pressure or a trickle system that delivers water at a lower than normal operating pressure. The type of system will depend on the layout, size and type of development as well as the existing infrastructure in the area.

4.2.2.2 All piped systems must be designed and installed according to provincial standards, AWWA standards, Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems and the Fire underwriters, and any applicable National Fire Protection Association Standards.

4.2.3 Communal Water Systems

4.2.3.1 Piped water collection systems may consist of either normal pressure or a trickle system that delivers water at a lower

than normal operating pressure. The specific type of system will depend on the layout, size and type of development as well as the existing infrastructure in the area. All communal water systems including municipal and co-op systems, must be designed and installed according to the minimum standards. Applicable standards include the County of Vermilion River's Bylaws, the *Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems and Rural Utilities Act*.

4.3 Sanitary Sewer Systems

Developments may require one of the following types of sanitary sewer systems:

4.3.1 Private Sewage System on Residential Development

4.3.1.1 Private Sewage systems may consist of any sewage collection or treatment system which is installed and managed entirely within private property boundaries. Systems may consist of septic tanks or holding tanks, disposal fields, treatment mounds, sewage lagoons, mechanical treatment units and related piping. All private sewage systems must be designed and installed in accordance with provincial Sewage Standards, regulations and Canadian Plumbing Code.

4.3.2 Non-Residential

4.3.2.1 A private sewage system that is designed to receive more than 5.68 m³ of sewage per day must be designed for the specific site by a qualified professional engineer or an individual who holds a certificate of competency acceptable to the Administrator as appointed pursuant to the Safety Codes Act.

4.3.3 Piped Sewage System

4.3.3.1 Piped sewage collection systems may involve either gravity lines or low-pressure lines. Dependant on layout, size and type of development proposed as well as any existing infrastructure within the area. All systems must be designed and installed according to Provincial Codes, Regulations, Guidelines (AENV Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage systems and Rural Utilities Act), Federal Codes, Regulation and Guidelines.

4.3.4 Communal Sewage System

4.3.4.1 Piped sewage collection systems may consist of either gravity lines or low-pressure lines. The specific type of system will depend on the layout, size and type of development as well as the existing infrastructure in the area. All communal sewage systems including municipal and co-op systems, must be designed and installed according to the minimum standards. Applicable standards include the County of Vermilion River's Bylaws, the *Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems and Rural Utilities Act*.

4.4 Stormwater Management Systems

4.4.1 Stormwater management systems shall be determined on an individual project basis. All systems must comply with provincial and in certain cases federal Codes, Regulations, and Guidelines. The type of stormwater management system will largely be dictated by the roadway standards. All urban cross sections with curb and gutter may use overland or piped storm sewer system. Rural Cross sections will employ an overland drainage system consisting of ditches and swales.

4.4.2 The Developer is responsible to provide compensation for downstream easements, and improvements to downstream water channels. The

developer may also be responsible to contribute to improvements for the downstream channel from the proposed development.

- 4.4.3** The property(s) should be graded, regardless of development stage, to direct and manage flows at rates that would not allow erosion or flooding to occur to other properties.

5 **ROAD CATEGORIES**

5.1 Arterial Road

- 5.1.1** An arterial road is a high-capacity road designed to deliver traffic from collector roads to primary and secondary highways at the highest level of service possible. As such, arterials have limited access and features as they must allow greater traffic flow over longer distances and minimal interruptions. For Arterial Road design requirements refer to Section G 5.0 Design Designations

5.2 Connector Road

- 5.2.1** A connector road is a moderate capacity road which serves to move traffic from local roads to arterial roads or primary and secondary highways. Unlike arterial roads, connector roads may be required to provide access to residential properties. For Connector Road design requirements refer to Section G 5.0 Design Designations

5.3 Local Road

- 5.3.1** A local road provides access to adjacent properties carrying traffic from higher order roads to individual land parcels. Local roads are typically low speed and low volume roadways. For Local Road design requirements refer to Section G 5.0 Design Designations

5.4 Subdivision Road

- 5.4.1** A subdivision road provides access to adjacent properties carrying traffic from higher order roads to individual industrial or residential lots within a designated subdivision. For Subdivision Road design requirements refer to Section G 5.0 Design Designations

5.5 Hamlet Road

5.5.1 A hamlet road provides access to properties within a designated hamlet carrying traffic from higher order roads to individual residential lots or conveying traffic within the hamlet. For Hamlet Road design requirements refer to Section G 5.0 Design Designations

5.6 Undeveloped Road

5.6.1 An undeveloped road does not warrant a specific design designation. Undeveloped roads typically provide access to one individual property/land parcel or agricultural access to an individual land parcel. For Undeveloped Road design requirements refer to Section G 5.0 Design Designations

5.6.2 Undeveloped roads are defined as a Seasonal Access Road (Back Road), Unimproved or Developed

6 UNAUTHORIZED DEVELOPMENT

6.1 County of Vermilion River as the stewards of all County property must ensure that the use and enjoyment of public lands is a benefit to all residents and is not interfered with by those few property owners who deliberately or inadvertently encroach onto public lands.

6.2 Unauthorized use is when a property owner accesses public land with encroachments, construction, storage, landscaping, or removal of anything on, over or in County property without written approval of the County.

6.2.1 Unauthorized use or encroachment can create public safety issues, limit public access or use of public lands, prevent County maintenance or operation from occurring and damage the natural environment.

6.3 The County will regulate the use of all County property to ensure the public safety and enjoyment and to protect natural areas and ecosystems.

6.3.1 The County will notify and work with the property owners with contravening unauthorized uses on a case by case issue providing an

explanation of the encroachment or unauthorized use and detail what corrective measures must be completed.

- 6.3.2** Non-compliance with County direction may result in legal enforcement.

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1 GENERAL

This section provides the design criteria employed in the analysis of water distribution systems to be provided in all developments.

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 standards 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.

All materials used in the development shall be new and in compliance with the most recent version of the standards listed below.

1.1 Organizations issuing standards:

- ASTM – American Society for Testing and Materials
- AWWA – American Water Works Association
- CSA – Canadian Standards Association
- ABC – Alberta Building Code (firewater requirements for new construction)
- AFC – Alberta Fire Code (firewater requirements for new construction)
- NFPA – National Fire Protection Association
- Fire Underwriter's Survey
- Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems

2 DESIGN CRITERIA

2.1 The water distribution system shall be designed as part of the overall or ultimate distribution system to meet maximum daily consumption plus fire flow or peak hour flows, whichever is greater. A design report shall be submitted to the County with all the design information and calculations for review.

2.2 Flow Requirements:

Average Daily Demand	-	350 L/person/day
Population Density (residential)	-	3.0 persons/residence
Maximum Daily Demand	-	2 x Average Demand
Peak Hourly Demand	-	3 x Average Demand
Minimum Residual Water Pressure During Peak Hour Flow	-	280 kPa
Minimum Residual Water Pressure During Maximum Day + Fire Flow	-	140 kPa
Minimum Residual Water Pressure During Maximum Day Flow (for operation of residential fire sprinklers)	-	350 kPa

For non-residential developments, the minimum water consumption rate shall be equal to zero point one five litres (0.15) per second per hectare. The applied peaking factor shall be $Pf = 10 * Q^{-0.45}$ to a maximum of 25 and a minimum of 2.5, Q being in litres per second. Where possible, water demand shall be based upon site specific requirements for identified uses. Fire flow requirements are to be included in all calculations.

2.3 Fire Flow: The County 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, that the municipality will not provide infrastructure necessary to deliver water flows required for fire protection in non-hamlet areas. Existing residential or industrial developments outside of the hamlet areas that have fire flow rates are to have fire flow rates maintained.

2.3.1 Fire flow requirements will be required in the Hamlet areas but not areas outside of the Hamlets. Fire flow requirements shall be in accordance with the Fire Underwriter’s Survey publication entitled “Water Supply for Public Fire Protection – a Guide to Recommended Practice”, or the latest version thereof. The minimum fire flow used for single family residential subdivision shall be 4,500 l/min or 1,000 igpm.

The minimum fire flow used for developments larger than a single family (e.g. commercial, apartment) should also be in accordance with the fire flow requirements set out by the architect.

Any development(s) requiring sprinkler systems need to be discussed with the County.

Minimum residual line pressure under maximum day plus fire flow conditions shall be 150 kPa at ground level of any point in the system. Minimum residual line pressure under peak hour flow conditions shall be 300 kPa at ground level of any point in the system. Minor pressure losses through valves and fittings must be accounted for.

Main line flow velocities should not exceed 1.5 m/s during peak hour flow conditions and 2.5 m/s during maximum day demand plus fire flow conditions.

The design must address low demand conditions, even if they will be temporary, which could affect chlorine residuals in the system.

2.3.2 Developers will be required to size any piped water distribution system such that the system can accommodate fire flow volumes if required off-site infrastructure is developed in the future.

2.4 If municipal fire protection is required in the development agreement, piped systems shall be designed to meet the fire flow requirements published by the Fire Underwriters Survey for the anticipated type of occupancy. Off-site improvements required by the Developer will be assessed on a case-by-case basis.

2.5 Automatic sprinkler protection conforming to the latest version of NFPA 13 standards may be required for all developments if the minimum flow and residual pressure requirements can be met.

2.6 Where required by the *Alberta Building Code*, the Developer and the Developer's Engineer will design dedicated self-contained fire water storage and delivery systems in accordance with the latest version of the Code and NFPA 1142 Standards for the building type and occupancy.

3 STORAGE REQUIREMENTS

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

3.2 When fire storage is required, potable water reservoirs shall be sized to accommodate the larger of:

3.2.1 $S = (A + B + C);$

where S = Total storage requirement (m^3)
 A = Fire storage (m^3)
 B = Equalization storage
= 25% of maximum daily demand (m^3)
 C = Emergency storage
= min. 15% of average daily demand (m^3)

3.2.2 Disinfection contact time storage required to meet Alberta Environment and Water CT requirements; or

3.2.3 2 times Maximum Day Demand

3.3 All municipal water storage facilities shall be designed with security features acceptable to the County. All fences, doorways and hatches shall be secured. Access shall be restricted to authorized personnel.

4 PIPE SIZING

4.1 Sizing of watermains shall be determined by hydraulic network analysis. Results shall be submitted to the Municipal Engineer for approval.

4.2 The minimum size for a distribution main shall be 150 mm for residential areas and 200 mm for commercial and industrial areas. Lines must be sized to accommodate the anticipated land use.

4.3 Where mains run for 200 m or over without ties to other mains, the minimum pipe size shall be 200 mm.

- 4.4 For lengths of pipe containing two or more hydrant connections without ties to other mains, the minimum pipe size shall be 200 mm.
- 4.5 The maximum velocity under normal operating conditions shall not exceed 3.0 m/s.
- 4.6 Hazen-Williams “C” value shall be 150 for PVC & HDPE pipe.

5 WATERMAIN ALIGNMENT AND LOCATION

- 5.1 Watermains shall be located within the road right-of-way and outside the carriageway in accordance with the typical roadway cross section (Section G).
- 5.2 Watermains shall be located a minimum of 3.0 m o/c from any sanitary and storm sewers, 1.5 m 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 a minimum distance of 1.0 m from any valve, hydrant or curb stop.
- 5.3 Public Utility Lot (PUL) widths shall be at least 6.0 m for a single utility.
- 5.4 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 the line is no longer than 120 m. Hydrant or Flush point are to be located near or at dead end.

6 REQUIRED DEPTH FOR WATERMAINS

- 6.1 The watermain shall be installed, in roads, to provide a minimum cover of 3.0 m from top of curb grade to the top of the pipe, or in lanes, 2.7 m from the horizontal centerline of the lane to top of pipe.
- 6.2 The watermain shall have enough depth of cover to provide complete frost protection. Where existing conditions dictate that the depth of cover be less than 2.7 m, the main/service must be insulated, and the design must be approved by an Engineer and the County.
- 6.3 The bottom of hydrant flanges shall be located 50 mm above finished grade. Invert depths at hydrant locations shall be 2.7 m below the top of curb.

- 6.4** Under preferred conditions, watermains shall cross above the sewer with sufficient clearance to allow for proper bedding and structural support of the pipes. Pipe clearance when passing over any sewer shall be a minimum of 300 mm separation between the top of the sewer pipe and the bottom of the watermain.
- 6.5** 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. Efforts shall be made to pass over the sewer when possible.

7 VALVES

7.1 Location and Spacing

- 7.1.1** The location and spacing of valves should be such that when the system is in operation:
- 7.1.1.1** No more than one hydrant will be put out of service by a watermain shutdown.
 - 7.1.1.2** No more than three valves are required to affect a shutdown with two valves at a tee and three at a cross.
 - 7.1.1.3** No more than 20 lots are out of service due to a watermain shutdown.
- 7.1.2** Valves should be no greater than 800 m apart on lines 450 mm and larger.
- 7.1.3** Valves shall be located on the projection of the property lines or at the BC of curb returns at intersections.
- 7.1.4** Valves shall be located at both ends of a main passing through a utility lot or easement and shall be placed 500 mm from the property line.
- 7.1.5** Flush point valves (min. 50 mm) must be installed at the end of all dead-end lines.

7.1.6 Pressure reducing valves shall be required at locations as determined by hydraulic modeling and shall be designed to a standard acceptable to the County of Vermilion River.

7.2 Material

7.2.1 Valves – General

7.2.1.1 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.

7.2.1.2 All valves shall have a working pressure of 1034 kPa.

7.2.1.3 Valves shall have non-rising stem with O-ring seals.

7.2.1.4 Valves shall 50 mm square operating nut.

7.2.1.5 Valves to open counter-clockwise.

7.2.1.6 All exterior bolts and nuts must be T304 stainless steel.

7.2.1.7 Exterior and interior factor applied epoxy coating conforming to AWWA C550. Corrosion protection to be provided by installation of a zinc sacrificial anode.

7.2.2 Gate Valves for Buried Service (100 mm – 300 mm)

7.2.2.1 Gate valves shall conform to AWWA C500 for bronze mounted solid wedge valves or C509 for resilient seated valves.

7.2.2.2 Valves shall be cast iron body, double disc or solid wedge with full 360E rubber to cast iron resilient seat.

7.2.2.3 Resilient seat to be bonded or mechanically attached to gate and valve body.

7.2.2.4 For blow offs, valves to be flanged to AWWA C207, Class D.

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- 7.2.3** Butterfly Valves in Chambers
- 7.2.3.1** All butterfly valves shall be rubber seat valves and conform to AWWA C504.
- 7.2.3.2** Valves shall be side-mounted, travelling nut on non-rising stem for direct bury operation.
- 7.2.3.3** Butterfly valves only to be used on 350 mm and larger diameter mains when specified by the Municipal Engineer.
- 7.2.4** Pressure Reducing Valves
- 7.2.4.1** Valves 200 mm and smaller shall be of single diaphragm type. Valves 250 mm and larger shall be double diaphragm type.
- 7.2.4.2** 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.
- 7.2.5** Flow Control Valves
- 7.2.5.1** Valves shall be diaphragm type, globe or angle style with cast iron body and bronze trim.
- 7.2.5.2** Provide an “O” ring seat seal on main valve and strainer and needle valve on pilot inlet lines.
- 7.2.6** Air Valves
- 7.2.6.1** All air valves shall conform to AWWA C512 with cast iron body and stainless steel float.
- 7.2.7** Valve Boxes
- 7.2.7.1** Type “B” valve is preferred; Type “A” is optional.
- 7.2.7.2** For Type “B”, all connections shall be thread fitting (screw down).

7.2.7.3 For Type “A”, the cap shall be thread fit with the top and extension parts being slip fit.

7.2.7.4 All parts shall be grey cast iron to ASTM A48, Class 20 excepting Type “A” which may use a Schedule 40 PVC pipe (or equivalent) for the extension and bottom sections.

7.3 Installation

7.3.1 Valves, valve casings and fittings shall be installed in accordance with the manufacturer’s specifications.

7.3.2 Valves shall be the same size as the corresponding main and all valves shall be installed with a concrete thrust block.

7.3.3 Valve casings shall be between 5 – 15 mm below grade for unpaved areas and at grade for paved surfaces and sidewalks.

7.3.4 Valve boxes complete with operating stem and rock disk are required on all valves. Valve boxes shall be a two section, bituminous coated, Type A, cast iron adjustable type with a cast iron lid. Valve boxes shall be sufficient length to provide for adjustments of 300 mm in up and down directions. The rock disk shall be no more than 0.3 m below finished surface grade. In landscaped areas valve boxes shall extend 300 mm above the finished grade.

7.3.5 Each valve box shall be marked by a vertical, nominal size of 38 mm x 89 mm timber, set one metre into the ground adjacent to the valve box and extending one metre above the top of the surrounding ground. The top 300 mm of the exposed portion of this marker post shall be painted blue.

7.3.6 Upon completion, all valve casings must be checked to ensure that they are plumb and that the operating nut can be turned properly.

8 **HYDRANTS****8.1** **Location and Spacing**

- 8.1.1** The maximum spacing between hydrants, as measured along the centre line of the right of way, shall be 150 m in residential areas and 120 m in multiple family residential, school and industrial/commercial areas. The distance from the primary entrance of any building to a hydrant shall not be greater than 90 m. Hydrant spacing in rural areas or on regional lines will be subject to approval of the County.
- 8.1.2** Hydrants shall be located within all cul-de-sacs which are 90 m or less in length on the intersection street at or near the intersection with the cul-de-sac. For cul-de-sacs less than 75 m in length, the hydrant shall be located at or near the intersection.
- 8.1.3** 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 monolithic curb and gutter sidewalk exists.
- 8.1.4** Each hydrant shall be connected to the main with a 150 mm PVC branch controlled by an independent 150 mm gate valve complete with a valve box located at least 1.0 m from the hydrant.
- 8.1.5** Hydrants within commercial or industrial developments shall be protected by steel bollards. The County may require bollards to protect hydrants within residential subdivisions that may be placed such that they are at risk of damage from vehicles.
- 8.1.6** Hydrants shall be located at the beginning of the curve of the curb return at the corner of an intersection. The front of the hydrant shall face the primary roadway.
- 8.1.7** Hydrants to be shown on site plans, submitted with subdivision application.

8.2 **Material**

- 8.2.1** All compression type hydrants shall be supplied conforming to the latest version of AWWA C502 and approved by the County. All hydrants

shall be designed for 1035 kPa working pressure and must be approved by the Municipal Engineer.

- 8.2.2** All hydrants shall be certified to NSF Standard 61 – Drinking Water System Components: Health Effects and Standard 14 – Plastics and Plumbing System Components.
- 8.2.3** Hydrants shall be self-draining and a gravel drainage pit shall be provided on each hydrant lead. Where the hydrant lead is located below the water table, the hydrant drain port shall be plugged. The County shall be notified of any hydrants with plugged drain ports prior to construction. The record drawings shall clearly indicate each plugged hydrant.
- 8.2.4** Hydrants shall have one pumper connection, 146 mm outside diameter, and two hose connections (63.5 mm) with Alberta Mutual Aid thread at least 415 mm above the ground flange. Nipples shall be provided with caps without chains or cables. The hose and pumper caps and hydrant valve shall open counter-clockwise.
- 8.2.5** Hydrants shall consist of a minimum 2.45 m barrel with 300 mm extension.
- 8.2.6** Hydrants shall have a 150 mm cast iron outside diameter inlet elbow with bell end and harnessing lugs. Elbow shall be flanged to the barrel.
- 8.2.7** Valve stem in hydrant head to have “O” ring seals.
- 8.2.8** Operating nut shall be three sided, each side being a 36.5 mm long arc.
- 8.2.9** Hydrants shall have stainless steel bolt assemblies throughout.
- 8.2.10** External paint shall conform to the latest version of AWWA C550 – corrosion resistant – red as approved by County of Vermilion River.

8.3 Installation

- 8.3.1** Hydrants shall be installed in accordance with the manufacturer’s specifications and AWWA M17.

- 8.3.2 All hydrants shall be installed with a concrete thrust block.
- 8.3.3 A gravel drain shall be provided at the base of the hydrant barrel consisting of a minimum of 1.0 m³ of washed rock.
- 8.3.4 Hydrant drain ports shall be left open except where the water table is above the hydrant drain. The County shall be notified of hydrants with plugged drain ports.
- 8.3.5 Upon completion, all hydrants must be checked to ensure that they are plumb and that the operating nut is functioning properly.

9 WATER SERVICES

9.1 General

- 9.1.1 Separate water service connections shall be provided for each separately titled lot.
- 9.1.2 Connections for all water services shall be installed at the time of initial subdivision development.
- 9.1.3 Minimum service size shall be 25 mm for main stops, piping and curb stops where the service length is 30 m or less. Where service lengths exceed 30 m, the minimum service size shall be 38 mm.
- 9.1.4 All water service lines shall be installed to provide a minimum depth of 2.7m of cover, including the “goose neck” or bend off the main. The end of the water service connection shall be adequately capped or crimped and sealed.
- 9.1.5 The minimum allowable distance between main stops shall be 600 mm and the minimum allowable distance between main stops and an adjacent collar or coupling shall be 300 mm. Each residential service connection shall incorporate a horizontal gooseneck and utilize a corporation main stop. Connections shall be staggered radially as required by the pipe manufacturers.

- 9.1.6** For residential services, the symbol **CS** shall be stamped in the sidewalk opposite the location of the curb stop.
- 9.1.7** Parks may require a water service. The size, type and requirement will be determined by the County Engineer.

9.2 Material

- 9.2.1** Water service pipe shall be Type K Copper conforming to AWWA C800, Blue Kitec Water Service Tubing (200 psi rating) conforming to CSA B137.1 or Series 160 Polyethylene tubing conforming to AWWA C901 and CSA B137.1.
- 9.2.2** For water services 100 mm and larger, match pipe, fittings and valves to main pipe materials.
- 9.2.3** Provide corporation main stops, service saddles, curb stops, service boxes and couplings according to the industry standard. Compression connections with stainless steel inserts are required for all materials.
- 9.2.4** All fittings shall be designed for an operating pressure of 1035 kPa.
- 9.2.5** 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.
- 9.2.6** Service saddles for use on polyethylene pipe shall be Romac type 101, 202, 305 or 306 series, Robar 2706 or approved equal for use on polyethylene pipe.
- 9.2.7** Operating rods shall be Type 304 stainless steel with brass cotter pins.

9.3 Installation

- 9.3.1** The pipe and gasket installation shall be conducted in compliance with the pipe manufacturer's specifications.
- 9.3.2** Installation of PVC pipe and fittings shall conform to AWWA M23.
- 9.3.3** Installation of cast iron fittings shall conform to AWWA C600.

- 9.3.4** Field welding procedures shall be in accordance with CSA Z662. Welders responsible for necessary welding shall be qualified as B pressure welders.
- 9.3.5** Align pipes carefully when jointing. Keep joints free of mud, gravel and foreign material and ensure that the joint is complete as outlined in the manufacturer's specifications. Complete each joint before laying the next length of pipe. Deflections shall not exceed those permitted by the manufacturer.
- 9.3.6** The pipe must be thoroughly flushed of all dirt, stones and pipe lubricant when complete.
- 9.3.7** 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 diameter.
- 9.3.8** The invert of the pipe shall not deviate from the design grade by more than 40 mm.

10 WATER PIPE MATERIALS

10.1 PVC

- 10.1.1** All pipe materials and fabrication shall conform to CAN3-B137.3 (AWWA C900 for 100 mm to 300 mm diameter pipe and AWWA C905 for 350 mm to 1,200 mm diameter pipe).
- 10.1.2** PVC watermain from 100 mm to 300 mm pipe sizes to be designated DR 18, pressure class 150.
- 10.1.3** PVC watermain 350 mm or greater pipe sizes to be designated DR 18, pressure class 235.
- 10.1.4** All pipes shall be sized to cast iron outside diameter (CI-OD) and coloured blue.

10.2 High Density Polyethylene (HDPE)

- 10.2.1** The use of polyethylene pipe requires prior approval by the Municipal Engineer.
- 10.2.2** High Density Polyethylene pressure pipe to AWWA C906, PE 3408 to be designated DR 11, pressure class 160 psi.
- 10.2.3** All pipes shall be sized to cast iron outside diameter (CI-OD). Pipe sizing shall be selected according to internal diameter.
- 10.2.4** During visual inspection of pipe upon delivery and a scratch is detected; if the scratch depth is 10% or greater than wall thickness either the pipe is not used, or the area of the scratch is removed (if less than half a pipe length) or repair per manufacturer's warranty.
- 10.2.5** Pipe shall be joined by thermal butt-fusion, flange assemblies, compression type fittings or electro-fused fittings.
- 10.2.6** HDPE pipe is the only pipe material to be used for trenchless installations.
- 10.2.7** 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.

11 FITTINGS

- 11.1** Polyvinyl chloride fittings to CAN 3-B.137.3, pressure class 150, with bell-end joints and gaskets conforming to AWWA C111. Fittings to be DR 18, size range up to 900 mm, conforming to AWWA C900, C905 and C907.
- 11.2** Ductile iron cast fittings to AWWA C110 with bell-end joints, with gaskets conforming to AWWA C111. Mechanical and flange joints as specified or approved by Engineer, with gaskets conforming to AWWA C111 and ANSI 303 stainless steel bolts, hex head nuts and washers conforming to ASTM A-3200.

- 11.3** Ductile iron cast couplings to be Robar 1506, epoxy coated couplings or approved equal, complete with T304 (ASTM A743) stainless steel nuts and bolts, compatible with outside diameters of pipes to be joined in locations approved or specified by Engineer.
- 11.4** HDPE fittings to AWWA C906, PE 4710 to be designated DR 11, pressure class 200 psi (alternate: PE 3408, pressure class 160 psi).
- 11.5** All fittings shall require installation of a zinc sacrificial anode.

12 **COUPLINGS AND ADAPTORS**

- 12.1** PVC couplings shall conform to AWWA C900, C906, or C907 as applicable.
- 12.2** Bolted sleeve couplings shall conform to AWWA C219 with ductile iron or 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.
- 12.3** Flange adaptors shall conform to AWWA C219 with ductile iron or 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 Linings shall be in accordance with AWWA C210, C213 or C550 and be suitable for use with potable water.
- 12.4** Couplings for grooved and shouldered joints shall conform to AWWA C606 and shall have operating pressures, coatings and linings as above.

13 **TAPPING SLEEVES**

- 13.1** Tapping sleeves shall conform to AWWA C207, Class D with carbon steel body with fusion bonded epoxy coating or Type 304 stainless steel.
- 13.2** 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.

14 PIPE CASING

- 14.1** Steel pipe casings to conform to AWWA C200, minimum tensile strength of 207 MPa.
- 14.2** Inside diameter of casing shall be at least 50 mm larger than the outside diameter of the carrier pipe bell and insulator runners.
- 14.3** Use plastic / polyethylene carrier pipe insulators.

15 METERS

- 15.1** The County utilizes Sensus meters. All water meters shall conform to AWWA C700, C701 and C710.
- 15.2** Meter chambers may be required at the property line for all properties with a building setback of 150 metres or greater at the county's discretion.
- 15.3** The meter box shall be from Badger Meter with an Itron reader unit or approved equal.
- 15.4** Chamber shall be 380 mm diameter PVC SDR 35 with a 3 metre bury.
- 15.5** 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 equal. The top shall be insulated with 100 mm factory supplied insulation.

16 CATHODIC PROTECTION

- 16.1** Cathodic protection shall be provided for all metallic main valves, fittings and hydrants.
 - 16.1.1** A 2.3 kg zinc sacrificial anode shall be connected to each valve, fitting, and coupling.
 - 16.1.2** A single 5.5 kg zinc sacrificial anode shall be connected to a hydrant.

17 TRENCHING, BEDDING AND BACKFILLING

- 17.1** All trenching and backfilling shall be completed in strict accordance with Occupational Health and Safety Regulations.
- 17.2** Prior to trenching and backfilling, the construction area must be stripped of all topsoil and/or organic materials. 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.
- 17.3** 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, shall extend up both sides to the trench wall and provide a minimum cover of 300 mm above the pipe. The Developer’s Engineer shall identify special pipe foundation measures for areas where unsuitable pipe foundation conditions exist.
- 17.4** The minimum trench width measured at the pipe springline shall be the pipe outside diameter plus 450 mm. Excavated material shall be stockpiled at a safe distance from the edge of the trench. Trench excavations shall be kept free of water.
- 17.5** The Developer’s Engineer shall identify areas where the trench excavation requires sheathing, shoring or bracing to protect workers, property or adjacent structures.
- 17.6** It is the Developer’s responsibility to ensure that the utility trenches are adequately compacted.
- 17.6.1** Native backfill under existing or proposed roads or laneways shall be compacted throughout the entire right-of-way width to minimum:
- 17.6.1.1** 98% standard proctor density from subgrade to 1.5 m below subgrade or original ground, whichever is lower;
- 17.6.1.2** 95% standard proctor density greater than 1.5 m from the subgrade or original ground, whichever is lower;

- 17.6.2** Granular backfill under existing or proposed roads or laneways shall be compacted to minimum 98% of standard proctor density throughout the entire trench depth below subgrade and the entire right-of-way width.
- 17.6.3** Backfill in all other areas shall be compacted to minimum 95% standard proctor density or as directed by the County.
- 17.6.4** Subgrade and base course compaction for roadway construction shall be as specified in Section G.
- 17.6.5** If the above standards cannot be achieved due to a large variation in soil types throughout the development, 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.
- 17.7** If the minimum compaction standards cannot be met due to abnormal weather or wet ground conditions, the Engineer may establish a more suitable standard on a site-specific basis provided adequate justification is presented by the Developer and approved by the County. One-mould proctor density testing will not be permitted as an alternate testing procedure due to wet soil conditions. The Developer's engineer will be required to suggest appropriate measures such as drying in-situ material or importing suitable material to meet the required Standard Proctor Densities.
- 17.8** All landscaping, pavement structures, sidewalks, curb and gutter damaged or removed during trenching shall be restored or replaced unless otherwise directed by the Municipal Engineer. All debris, surplus fill and unused materials must be removed from the site.

18 OPERATION OF BOUNDARY VALVES & EXISTING HYDRANTS

- 18.1** County representatives shall be notified at least 48 hours (two full business days) in advance of valve operation requirements. County personnel shall operate the boundary valves.

- 18.2** The Developer shall obtain permission for using a hydrant as a water source for construction. Arrangements for payment for water used may be required. County representatives may outline conditions of use depending on the circumstances.

19 SERVICE INSTALLATION

- 19.1** The water 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.

- 19.1.1** Residential water services shall be installed in common trench with sanitary sewer and sump pump discharge collection services as depicted on the Detailed Drawings. Class B bedding shall be used. Common trench installation is only permitted for sizes up to 50 mm.

- 19.2** The end of the pipe must be marked by a vertical, nominal size 38 mm x 89 mm timber, starting at the service pipe and extending one metre above the top surface of the surrounding ground. The top 300 mm of the exposed portion of the marker shall be painted blue.

- 19.3** Tapping for residential service connections shall be done with full operating pressure in the main. The tap shall be made within 30° of the pipe crown and goose-necked to service trench level. The service line shall be supported by sand bags until it reaches trench level.

- 19.4** A tapping valve and sleeve must be used for services 100 mm and larger.

- 19.5** Curb stops must be supported on concrete block and installed within 30cm of the property line such that they do not conflict with driveway locations and shall not be placed within concrete sidewalks or driveways.

- 19.5.1** A separate service line with metering chamber 1.5 m inside the property line may be required for each lot at the County's discretion. Refer to section 15.2.

- 19.6** Curb stops shall be marked with a red 50 mm by 50 mm by 1.50 m marker projecting 0.60 m above finished ground elevation. Curb stop boxes shall be installed in collapsed position unless directed otherwise by the Municipal

Engineer. Curb stops shall be placed 0.3 m from the property line within the public right of way.

19.7 Services crossing existing roadways and/or sidewalks shall be augured, bored or tunnelled unless otherwise approved by the Municipal Engineer.

19.8 When placing the hot water service, it will always be on the right of the sanitary service.

20 INSPECTION AND TESTING

20.1 Inspections

All water installations shall be subject to inspections by the Municipal Engineer prior to issuance of the Warranty Commencement Certificate (W.C.C.) and Final Acceptance Certificate (F.A.C.).

20.2 Compaction Testing

The developer's Engineer is required to submit all compaction test results to the County for review prior to the issuance of the Warranty Commencement Certificate (W.C.C.).

20.3 Pressure Testing

20.3.1 The entire system shall be subjected to a hydrostatic pressure test in the presence of the Municipal Engineer. The Developer is responsible for the supply of all necessary labour, materials and equipment to complete the testing. The Developer shall notify the County at least 48 hours (two full business days) in advance of the testing.

20.3.2 Select acceptable test sections in consultation with the County. The maximum length of distribution main test sections shall be 450 m. The maximum length of transmission main sections shall be 750 m.

20.3.3 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.

- 20.3.4 Ensure that all main valves and hydrant isolation valves in the test section are open and that the hydrants are close
- 20.3.5 Ensure that all air is expelled from the section using hydrants and service taps and high points and dead-ends and 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.
- 20.3.6 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 test.
- 20.3.7 Measure the water level at the end of the test and calculate the observed leakage. Compare against the allowable leakage, as defined in AWWA C600-82, calculated as follows:

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

- where
- L = allowable leakage, L/hr
 - N = total number of joints
 - D = nominal pipe diameter, mm
 - P = test pressure, kPa

20.4 High-density Polyethylene (HDPE) Pressure Testing

- 20.4.1 Before acceptance of any HDPE pipe water system, the entire system shall be subjected to hydrostatic pressure test in the presence of the Municipal Engineer. The Developer shall provide all the necessary labour, materials and equipment for the test including a suitable pump, measuring tank, pressure hoses, connection, plugs, caps, gauges and all other apparatus necessary for filling the main, pumping to the required test pressure and recording the pressure and expansion-leakage loss.
- 20.4.2 Expel air from collection system by slowly filling the main with water. High points must have automatic air/vacuum relief valves to vent air when filling and be closed when pressure is applied.

- 20.4.3 A hydrostatic test pressure of 1.5 times the rated pressure of the pipe at the lowest point in the system main shall be applied.
- 20.4.4 Pressurized pipe to require test pressure throughout a 3-hour period and hold required test pressure for an additional hour to allow for pipe expansion and stretching prior to the leakage test.
- 20.4.5 Test period shall be for a 2-hour duration. Amount of make up water (leakage) required to return the pipe to required test pressure shall not exceed the allowance given in the following table.

Field Testing of HDPE Waterline Systems:

Nominal Pipe Size (mm)	Allowance for Expansion 2-Hour Test (liters/100m of pipe)
50	1.6
75	1.9
100	3.1
150	7.5
200	12.5
250	16.2
300	28.7
350	33.7
400	41.1
450	53.6

- 20.4.6 Total time under test pressure must not exceed 8 hours. If test is not accepted due to leakage or equipment failure, test selection must be permitted to “relax” for 8-hour period prior to the next testing sequence.
- 20.4.7 Prior to the start pressure and leakage, chlorination and bacteria testing, the Developer’s Engineer will be required to provide a plan outlining how the testing is to be accomplished. The plan must include the sequence of valve turning, sections of water main to undergo pressure and leakage testing, how chlorination is being accomplished, and location when chlorine residual and bacteria tests are to be taken. Testing will not be allowed to proceed until the above is approved by the Municipal Engineer.

20.5 Flushing and Disinfection

- 20.5.1** Water mains are to be flushed and disinfected in accordance with AWWA C651 continuous feed method.
- 20.5.2** Chlorine residual tests shall be performed at the beginning and end of the disinfection and again after flushing the lines.
- 20.5.3** Approximately 16 hours after flushing the chlorine, one bacteriological sample for each 90 metres of main shall be taken and submitted for analysis unless otherwise approved by the Municipal Engineer. Where dead ends exist, samples shall be taken at the end of the line. Approved bacteriological sample bottles from the Provincial Laboratory of Public Health or the local Health Unit must be use
- 20.5.4** The mains shall not be commissioned and put into use until the bacteriological sample results are approved by the Municipal Engineer.
- 20.5.5** Under *Alberta Environment Protection Standards and Regulations*, super chlorinated water used for disinfection of the system cannot be directed into a ditch drainage system or open water body. De-chlorination will be required before being discharged into the environment.

20.6 Hydrants

- 20.6.1** At least one hydrant flow test shall be conducted by the Developer to ensure that the flows and pressures identified in the design calculations are being provided in the field. If discrepancies are found, all hydrants in the development shall be tested and the Developer's Engineer shall indicate the corrective action that the Developer must undertake to remedy the deficiency.

21 SUMMARY OF WATER DISTRIBUTION SYSTEM STANDARDS

The following is a list of standards applicable to water distribution system materials and construction. In all cases, it is intended that the latest version apply.

Standard	Title
CSA B137.1	Polyethylene Pipe, Tubing, and Fittings for Cold Water Pressure Services
CSA B137.2	PVC Injection-Moulded Gasketed Fittings for Pressure Applications
CSA B137.3	Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications
CSA A23.1 and A23.2	Concrete Specifications
AWWA C104	Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C111	Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C150	Standard for Thickness Design of Ductile-Iron Pipe
AWWA C151	Standard for Ductile-Iron Pipe, Centrifugally Cast for Water
AWWA C200	Steel Water Pipe – 6 In. (150 mm) and Larger
AWWA C205	Cement-Mortar Protective Lining and Coating for Steel Water Pipe – 4 In. (100 mm) and Larger – Shop Applied
AWWA 213	Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
AWWA C500	Metal-Seated Gate Valves for Water Supply Services
AWWA C502	Dry-Barrel Fire Hydrants
AWWA C504	Rubber-Seated Butterfly Valves
AWWA C509	Resilient-Seated Gate Valves for Water Supply Service
AWWA C550	Protective Epoxy Interior Coatings for Valves and Hydrants
AWWA C651	Disinfecting Water Mains
AWWA C800	Underground Service Line Valves and Fitting

AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. for Water Distribution
AWWA C905	Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 In. Through 36 In.
AWWA C907	Polyvinyl Chloride (PVC) Pressure Fittings for Water – 4 In. Through 8 In. (100 mm through 200 mm)
ASTM A48	Gray Iron Castings
ASTM D698	Moisture-Density Relation of Soils and Soil-Aggregate Mixtures Standard Proctor Maximum Density

22 COMMUNAL WATER SYSTEMS

This section provides additional design criteria employed in the analysis of communal water systems if approved for a development by the County.

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 standards serve 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.

The potable water system shall be of sufficient capacity to service the ultimate population projection of the development area. The flows and factors outlined in the following sections shall be used in the design of potable water systems.

The Developer and the Developer’s Engineer shall provide a proposal for sustainable, uninterrupted, safe and clean supply of drinking water for development. Alberta Environment and Parks and Alberta Health Services standards and guidelines shall be followed in accordance with the following;

Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems, Code of Practice for Waterworks Systems Using High Quality Groundwater, Code of Practice for Waterworks Systems Consisting Solely of a Distribution System, Water Act: Water Regulation and Environmental Public Health Field Manual for Private, Public and Communal Drinking Water Systems in Alberta.

All materials used in the development shall be new, not after market and in compliance with the most recent version of the standards listed below. The County of Vermilion River maintains its discretion to require a higher standard where specifically required.

A communal water system can be operated and maintained by a cooperative/homeowner's association/bare land condo. This system must follow all provincial and federal regulations, requirements and approvals.

The Developer or the Developers Engineer will need to provide approved easements for County access to all utilities and water systems prior to the F.A.C. being issued.

Organizations issuing standards:

- ASTM – American Society for Testing and Materials
- AWWA – American Water Works Association
- CSA – Canadian Standards Association
- ABC – Alberta Building Code (firewater requirements for new construction)
- AFC – Alberta Fire Code (firewater requirements for new construction)
- NFPA – National Fire Protection Association
- Fire Underwriter's Survey
- Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems
- Alberta Rural Utilities Act and Regulation

22.1 Design Criteria

System proposals must be in accordance with Alberta Environment regulations and guidelines. Plan-profile drawings, specifications and a letter report shall be prepared by a qualified Professional Engineer and be submitted to the County and Alberta Environment and Parks for review and approval prior to construction. The letter report shall include the design parameters and design calculations for sizing the lines based on:

1. Trickle Feed System: 2 L/Min/Unit restricted flow at minimum residual pressure of 70 kPa at ground level at a cistern (min 3,400 L capacity) on each lot.

The size of the cistern shall be based on the property need for an uninterrupted supply of water; one- or two-days' supply should be sufficient. A proper designed storage system (air gap with overflow) shall be used to provide protection against backflow.

2. or Low Pressure System: 350 l/person/day (3.0 persons/residence) at minimum residual line pressure under peak hour flow conditions shall be 280 kPa at ground level. The maximum daily flow rate shall be at least 2.0 times the average daily flow. Raw water supply and treatment equipment shall be designed for 110% of the peak daily flow. Harmon's peaking factor shall be used to determine the peak hourly flow rate for distribution but must be a minimum of two (2) times the maximum daily flow rate.

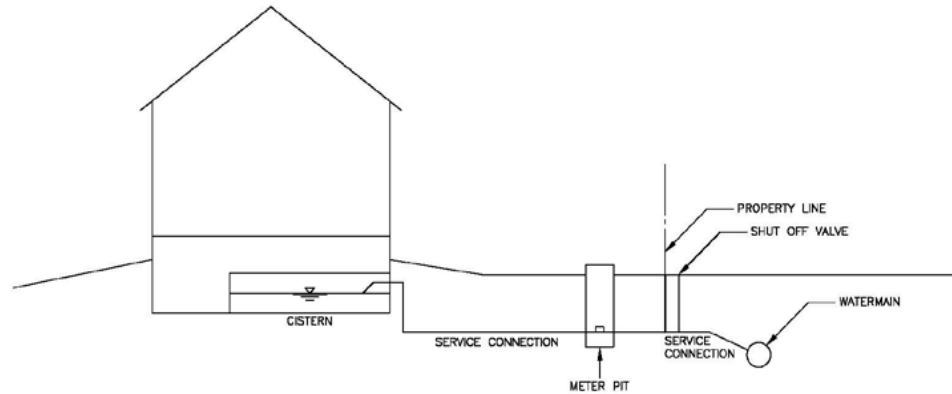
Fire Protection shall only be incorporated into a Rural Water System if accepted by the County, and if adequate flows are demonstrated for intended use

The letter report shall also include design parameters for raw water supply and metering, disinfection, residual chlorine monitoring, storage requirements and distribution pumping and metering requirements. System design should take into consideration the potential for future integration with a Regional Water System. Factors requiring consideration would include:

- a) Possible decommissioning of equipment made redundant by connection to Regional System.
- b) Suitable connection point for Regional supply.
- c) Decommissioning of wells that would cause "blended water" of well and regional supply.

22.2 On Site Requirements:

The Developer and the Developer's Engineer are responsible to ensure that a site will be properly designed and equipped with shut off valve, flow restrictor, cistern, float valve, power, water meter and pressure tank, see sample Schematic Diagram, cistern can be outside of house also.



Cross Connection Control Devices:

Cross connection control devices shall be installed at any location where a connection is made to an approved waterworks system for the purpose of serving a hamlet, municipal development, privately owned development or a truck fill station located outside the service boundary of the approved waterworks system. Cross connection control devices must be testable and of the Double Check Valve Assembly or Reduced Pressure type. Backflow preventers shall be installed in accordance with the latest edition of the Cross-Connection Control Manual, published by AWWA (Western Canada Section).

Sources:

1. Regional Treated Water Pipeline

This is the preferred method of providing treated water to rural subdivisions. System design should take into consideration the potential for future integration with a Regional Water System. Factors requiring consideration would include:

- Possible decommissioning of equipment made redundant by connection to Regional System.
- Suitable connection point for Regional supply

2. Groundwater

a) When establishing a location for a well, the following minimum setback shall be followed (based on Alberta Environment requirements):

- 100 m from above ground fertilizer and pesticide storage containers
- 100 m from livestock yards, animal barns or manure storage
- 100 m from any existing leaching cesspool
- 100 m from a watertight septic tank
- 100 m from a sub-surface weeping tile effluent disposal field or evaporation mound
- 100 m from sewage effluent discharge to the ground
- 100 m from a sewage lagoon
- 50 m from above-ground storage tanks
- 3.25 m from existing buildings
- 1.2 m from the wall of a ground water well pump house
- 2.0 m from overhead power lines if the line conductors are insulated or weatherproofed and the line is operated at 750 volts or less
- 6.0 m from overhead power lines if the well does not have a pipe and sucker rod pumping system
- Well casing sections no greater than 7.0 m in length
- 12.0 m from overhead power lines for all other well constructions
- 500 m from a sanitary landfill, modified sanitary landfill, or dry waste sit

b) Additionally, a ground water well shall have the following features:

- Well casing shall be at a minimum 30 cm above ground/floor with sloping away from well to prevent ponding around casing.
- A well will need to be installed at a depth as specified from a test hole report completed by an experienced drilling contractor.
- Have a PVC or non-conducting pipe pumping system
- If housed in a building, the building may only contain the well and its pump
- All wells shall be pitless.
- If well casing cap is not water-proof it shall be 60 cm above highest recorded flooding.
- All communal wells and cisterns to be on a PUL.

c) A drilled well is constructed when the aquifer is found to be deeper than 30 meters. The drilled well may be completed with surface casing with slotted or perforated liner, sand screen with continuous slot openings, single string slotted, or perforated casing. The casing size must have an inside diameter of at least 102 mm.

3. Surface Water

- a) For surface water supply, the raw water intake must be designed to account for seasonal variation in water level.
- b) Adequate raw water storage must be installed that compensates for reductions in water availability. Minimum storage will be two cells that can be independently operated, each capable of storing 75% of the average annual water demand.

Treatment:

The Developer shall refer to Alberta Environment's current *Codes of Practice and Design Guidelines* for proper establishment of water supply, treatment, and distribution guidelines and procedures. The system shall be designed to produce water that meets or exceeds the American Water Works Association drinking water quality standards and minimum performance requirements as outlined in Alberta Environment's *Water Performance Standards and Standards and Guidelines for Municipal Waterworks*.

1. Surface Water or Surface Water Influenced Groundwater Source Treatment:

- a) The minimum treatment for surface water and surface influenced groundwater sources shall be filtration and disinfection. Acceptable filtration methods are:
 - Chemically Assisted Rapid Sand Filtration - This is a multi-step treatment process that includes chemical mixing, coagulation and filtration. Filtration is usually preceded by flocculation and solids separation.
 - Slow Sand Filtration - This process operates at very low filtration rates and uses finer sand than is used for a rapid filter.
 - Cartridge Filtration - Cartridge filters use a fibrous medium to remove particles larger than one (1) micron. When used in surface water treatment, it is usually preceded by a sand filtration step.
 - Membrane Filtration - Membrane filters are non-fibrous materials that can remove particles larger than one (1) micron. Disinfection may be completed of entirely or partially of controlled chlorination addition into the system. Other additional methods of disinfection may include approved alternate chemicals such as fluoridation, chloramines, ozone, etc. and/or radiation such as ultra-violet radiation.

2. Groundwater Well Source Treatment

- a) The minimum level of treatment for ground water not classified as “ground water under the direct influence of surface water” should be continuous and effective chlorine disinfection.
- Treatment design shall be such that the residual disinfectant concentration in the distribution system, measured as total chlorine, free chlorine, or combined chlorine shall be a minimum of 0.1 mg/L throughout the system and 0.2 mg/L at the water treatment plant.
 - Developments that are less than 15 service connections or 3 km of total water distribution system fall under the jurisdiction of Alberta Health Services and are governed by the Environmental Public Health Field Manual. Developments that are 15 or more service connections, greater than 3 km of water distribution system or have a well that falls under ground water under the influence of surface water are under the jurisdiction of an Albert Environment Code of Practice.
- b) Naturally occurring fluoride up to a concentration of 2.4 mg/L is acceptable by Alberta Environment, raw water with a concentration greater than 2.4 mg/L shall be treated to reduce the level of 0.8 mg/L, which is the optimum level for the control of dental cavities. Note: the Guidelines for Canadian Drinking Water Quality maximum allowable concentration for fluoride is 1.5 mg/L, if levels are over this concentration and under 2.4 mg/L yearly analysis shall be performed.
- c) Reverse osmosis may be used as an additional treatment process to purify water and remove salts and other impurities in order to improve the color or taste of the treated water.
- d) If aesthetic objectives such as the reduction of Iron and Manganese are desired, the Guidelines for Canadian Drinking Water Quality (GCDWQ) shall be used.
- e) At a minimum trihalomethanes shall be monitored four times, once every 3 years (spring, summer, fall, winter) in the waterworks system

according to the requirements of Alberta Environment's Code of Practice for Waterworks Systems Using High Quality Groundwater.

Fire Protection:

If fire flow is to be provided by the treated water system, fire storage is determined as follows:

- a) Allow for a minimum two hours fire flow at a minimum rate of 4,500 L/minute
- b) Where developments contain buildings other than single family dwellings, use fire flow guidelines of the Fire Underwriters Survey.

Provide at least two (2) reservoir cells to allow flexibility in maintenance and storage retention depending on water demand.

An economical site selection will depend on the type of reservoir, but in general the major factors to consider are soils conditions, compatibility with future expansion requirements, and site access.

When planning the type of reservoir, the designer shall ensure that treated water is not stored or conveyed in a compartment adjacent to untreated water. The type of material to be used for the reservoir is to be reinforced concrete if the reservoir is located above ground and reinforced concrete or fiberglass if the reservoir is located below ground.

Elevated tanks and standpipes shall be insulated and hot water re-circulated, or heat traced, to prevent problems associated with ice formation. Generally, they should be maintained at a temperature of 4 Deg C or greater.

Where subsurface locations for storage tanks are proposed, these locations shall be free from sources of possible contamination, having drainage for overland and ground waters, chemical spills, overflows and flooding. Reservoirs shall be located on PULs.

Treated water storage reservoirs shall be disinfected and flushed before being put into service, in accordance with the current American Water Works Association Standard.

22.3 Watermain distribution

Alignment:

In country residential subdivisions the water main alignments shall be as approved by the County. The following alignment features are expected:

1. Looping: Looping of main flow is of particular importance in smaller developments, where potential exists for extended periods of low flow, especially in recreational developments in off-season. Dead-end lines should be avoided. Where dead-end lines are unavoidable, they should end at a hydrant or other means of flushing.
2. Water recirculation: for small systems, in addition to looping within the development, there must be a return flow line back to the water treatment plant, upstream of the chlorination point. The return line should be located so as to prevent short circuiting (see Figure G-1) and be provided with a flushing point at the downstream point.
3. A minimum distance of 3.0 m horizontal separation must be maintained between a water main and any sewer main unless otherwise approved by the County.
4. A minimum distance of 2.0 m horizontal separation must be maintained between a water main and any gas line.
5. Public Utility Lot (PUL) widths shall be a minimum of 6.0 m. A minimum 1.0 m easement is required on the lots on each side of a PUL.
6. A utility right-of-way is required to be registered on all lots.

Installation:

The following standards apply:

1. Mains shall be at a depth adequate to provide a minimum of 2.70 m depth of cover from finished grade to top of pipe.
2. Air release valves are required at high points in the line and blow offs at the ends of lines.

3. Steel (galvanized) marker posts, with sign, shall be installed perpendicular to all valve and appurtenances locations, adjacent to the property line. Warning signs and painted fence posts shall be installed at the edge of the road right-of-way where water mains cross roadways.
4. Mark locations of water valves and other underground appurtenances with a stake painted blue, 100 mm in diameter, 1.8 m long, driven 0.6 m into the ground.

Materials:

All system materials including fittings and valves shall be in accordance with the County Standards

In addition, the following standards apply:

1. High Density Polyethylene (HDPE) Pressure Pipe

- a) HDPE pipe suitable for potable water shall be conforming to CSA B137.1 and ASTM F714 Series 160 (DR 11) standard iron sized pipe.
- b) Pipe sizes 50 mm to 300 mm shall meet HDPE Grade PE 3408.
- c) Pipe age not to exceed two (2) years at time of installation.

2. Poly Vinyl Chloride (PVC) Pipe

- a) PVC pipe shall be DR 18, Class 150, and (1035 kPa) cast iron outside diameter, with bell and spigot ends.
- b) The pipe shall be supplied with integral wall thickened bell ends and continuous (joint-less) elastomeric gasket.
- c) Gaskets shall be of a pressure actuated seal design.
- d) PVC pipe shall be certified under CSA 137.3 – “Rigid Poly Vinyl Chloride Pipe for Pressure Applications”.
- e) The interior of the pipe shall be clean and no debris or PVC shavings shall be trapped inside the pipe.

- f) Pipe sizes 100 mm to 300 mm shall also conform to the AWWA C900 Standard.
- g) The pipe shall be manufactured from clean, 12454B PVC compound conforming to ASTM resin specification D1784.
- h) PVC pipe shall not be installed in areas contaminated or potentially contaminated with organic compounds (organic solvents or petroleum products), i.e. near buried petroleum fuel tanks, abandoned gas stations, petroleum storage areas or petroleum refinery sites.

Fittings:

1. High Density Polyethylene (HDPE), DR 11 conforming to ASTM F714 and CANB 137.1, shop molded fitting shall be used.
2. All HDPE molded fittings shall meet the requirements of ASTM D2683 for socket-type fittings, ASTM D3261 for butt-type fittings, or ASTM F1055 electro-fusion-type fittings.
3. Polyvinyl Chloride (PVC) injection-molded fittings Class 150 conforming to AWWA C907 shall be used. Fittings shall be supplied with continuous (joint-less) elastomeric gaskets. All gaskets for PVC fittings shall be of a pressure actuated seal design.
4. PVC tees, elbows, tapped (AWWA thread) couplings and reducers sizes 100 – 200 mm shall conform to CSA B137.2.
5. Cast iron fittings shall comply with AWWA Specification C-110, C-111 and be supplied with Tyton Joints and require a zinc sacrificial anode as per County requirements. The exterior of all fittings shall be coated with asphaltic coating or a fusion bonded epoxy coating conforming to AWWA C213.

Valves:

1. Valves shall be iron body; bronze mounted gate valves with a non-rising spindle, which open by turning in a counter clockwise direction. All valves shall conform to AWWA C500 for bronze mounted solid wedge gate valves or AWWA C509 for resilient seated gate valves.

2. Interior to be factory coated with epoxy coating conforming to AWWA C550. Exterior to be factory applied epoxy coated. Corrosion reduction to be provided by installation of a zinc sacrificial anode.
3. Valve ends compatible with pipe joint type (Cast Iron Outside Diameter)
4. Cast iron valve boxes conforming to ASTM A48, Class 25 of the screw or sliding type shall be required on all valves. Coating inside and outside shall be an asphaltic coating or fusion bonded epoxy conforming to AWWA C213. Set screws to be galvanized. Top of box to be marked "WATER".
5. Extension stem to be 25 mm square mild steel with 50 mm operating nut and flange suitable for 3.0 m bury. A rock disk nut is required on all valves.
6. All valves in roadways or sidewalks shall be Norwood Foundry Type B screw type valve boxes or an approved equal.
7. Schedule 40 PVC valve boxes for the bottom boot of Norwood Foundry Type 'A' siding type valve boxes or approved equal are permitted in areas not exposed to vehicle loading.

Service Connections:

1. Each lot unit must have a separate service.
2. Water service pipe shall be minimum 25 mm, Series 160 Municipal tubing certified potable water. Water service pipe shall conform to Series 160 Type "K" soft copper AWWA C800 c/w brass compression coupling, Kytex or approved equivalent.
3. Main connections shall be made by means of a tee saddle or tapping tee. All fittings and joints must be assembled by electro-fusion or butt-fusion for HDPE piping. Services to be in one piece, no mechanical connections permitted between main connection and meter chambers.
4. Curb stops shall be located such that they do not conflict with driveway locations.
5. Minimum depth of cover shall be 2.90 m from finished grade over a vertical gooseneck and to the top of pipe.

Pumping:

1. For a low-pressure system, pressures of at least 280 kPa must be provided throughout the system under peak flow conditions.
2. At least two (2) distribution pumps are required and the distribution system must be able to supply the maximum hourly flow rate at 280 kPa service pressure anywhere on the system, with the largest pump out of operation.
3. At least one (1) pump shall have variable speed drive to reduce pressure transients.
4. Provide back-up pumping in event of power failure, either by stand-by generation or gas or diesel engine-driven pump.

22.4 Instrumentation, Control, and Alarms

Small water systems will be expected to have sufficient instrumentation and controls to provide reliable water supply for extended periods unattended. Consult Section 2.3.6 of *Alberta Environment Standards and Guidelines* for further guidance.

As a minimum, the following features must be provided:

1. Remote monitoring for various treatment plant and water supply processes shall be supplied and installed as required by Alberta Environment or the County.
2. Any water treatment facility must include remote monitoring capabilities that allow County operators to operate and monitor the facility. Parameters to be monitored shall be determined by the Alberta Environment or Alberta Health Approval, and may any other parameter as required by the County.
3. Measurement Instrumentation:
 - a) Raw water supply flow rate
 - b) Treated water supply flow rate to distribution
 - c) Treated water supply pressure

- d) Chlorine flow rate
- e) Chlorine residual, shown as a daily minimum, maximum and average
- f) Ground water well level
- g) Treated water reservoir level

4. Alarms:

- a) Low well level
- b) Low reservoir level
- c) High reservoir level
- d) Low residual chlorine analysis
- e) Low distribution pressure
- f) Low building temperature
- g) Building smoke alarm

Depending on the complexity of the treatment system, other parameters (for example high water turbidity or high filter pressure) may be warranted. Use Alberta Environment Standards and Guidelines for guidance.

5. Data Storage:

- a) Raw water flow
- b) Treated water flow
- c) Chlorine residual, shown as a daily minimum, maximum and average

22.5 Pump Houses

The pump house design shall be submitted at the same time as the construction drawings and no work shall take place until approved by the County. The pump house shall incorporate the materials and design that will fit into the subdivision

aesthetics and generally shall have exterior materials with long life and low maintenance in mind. The pumphouse shall have an intrusion alarm. Brick exterior siding is preferred. The parking area around the pump house shall be paved to the same standard as the adjacent road. The tank site will be fenced with chain link, include a locking gate, leveled and landscaped to prevent weeds.

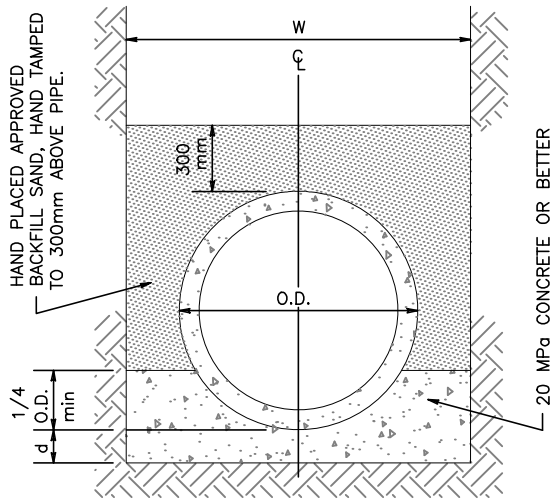
The developer or developer's consultant shall provide:

1. Water well drilling report
2. Complete water analysis by an accredited lab
3. Plan of record drawings of all water and wastewater
4. Standard Operating Procedures and Emergency Response Plan
5. Manufacturer specifications for maintenance

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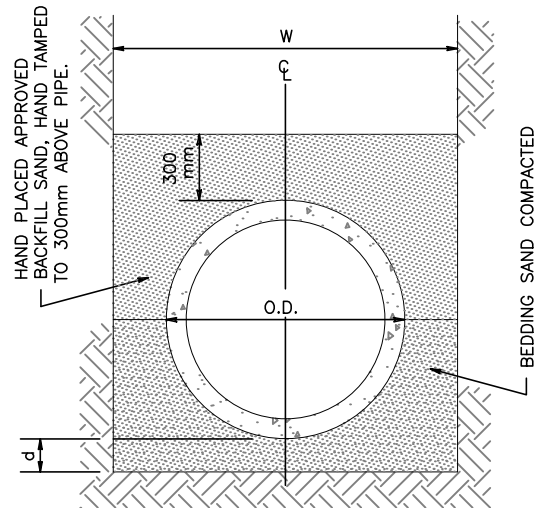
CLASS A BEDDING

$L_f = 2.8$



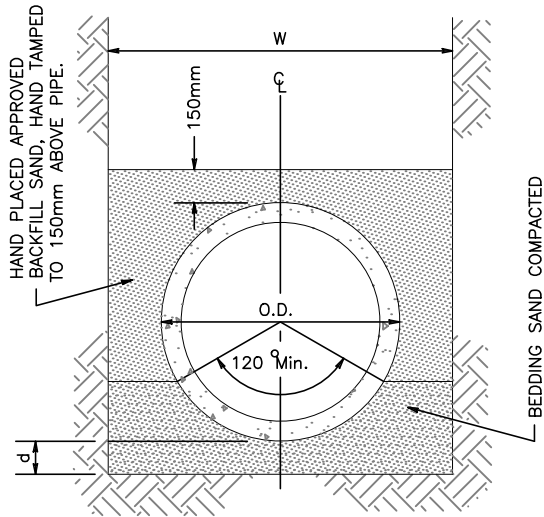
CLASS B BEDDING

$L_f = 1.9$



CLASS C BEDDING

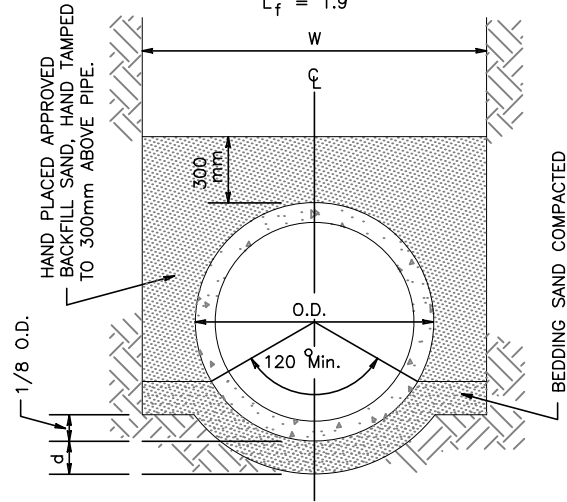
$L_f = 1.5$



CLASS B BEDDING

ALTERNATE - 375mm I.D. & UNDER

$L_f = 1.9$



NOTES:

- W = TRENCH WIDTH - O.D. + 450mm (MINIMUM)
 - 1000mm max. FOR PIPES UP TO AND INCLUDING 400mm DIAMETER
 - O.D. + 400mm max. (ON EITHER SIDE {800mm TOTAL}) FOR PIPE DIAMETERS 450mm AND ABOVE
- O.D.= OUTSIDE PIPE DIAMETER
- I.D. = INSIDE PIPE DIAMETER
- L_f = LOAD FACTOR
- d = DEPTH OF BEDDING BELOW PIPE
- I.D.= 675mm OR SMALLER - d min = 150mm
- I.D.= 750mm TO 1500mm - d min = 150mm
- I.D.= 1650mm AND LARGER - d min = 150mm

NOTE: all dimensions in millimeters unless noted otherwise



General Municipal Servicing Standards

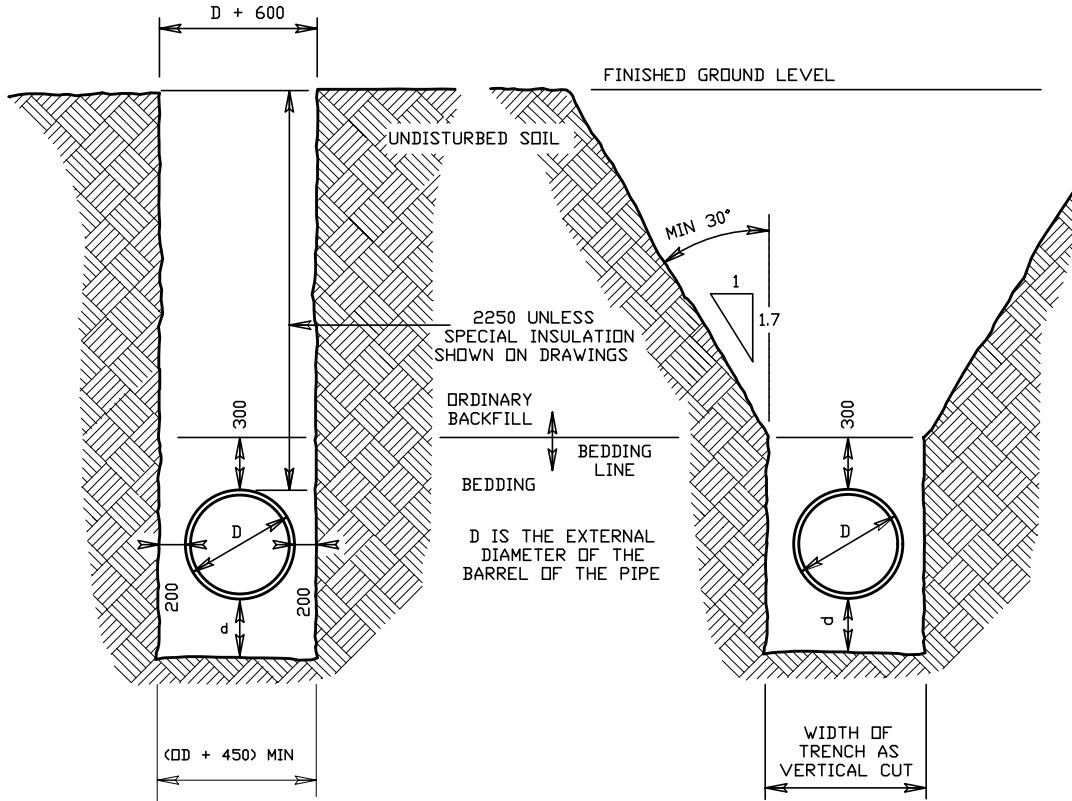


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Date:	FEBRUARY 2020
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Approved:

STANDARD TRENCH BEDDING FOR CIRCULAR PIPES

Drawing:
D-01



**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)

- EXTERNAL DIAMETER OF 700mm AND BELOW :75
- EXTERNAL DIAMETER GREATER THAN 700mm :100

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

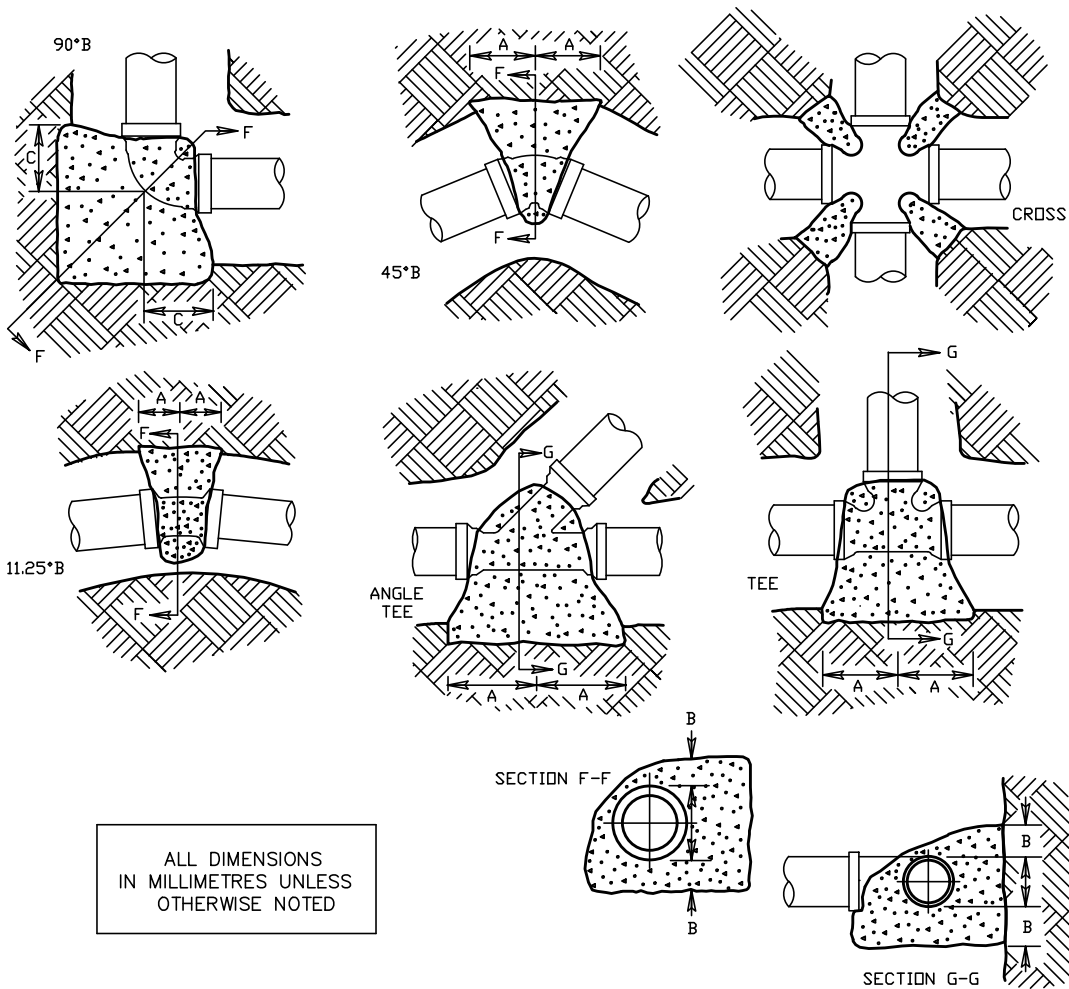


General Municipal Servicing Standards



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STANDARD TRENCH DIMENSIONS FOR CIRCULAR PIPE	
Approved:	Drawing: D-02



ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

REQUIRED BEARING AREA

	TEE BRANCH & DEAD END					22.5° & 11.25° BENDS					45° BENDS					90° BENDS				
	300	250	200	150	100	300	250	200	150	100	300	250	200	150	100	300	250	200	150	100
DIA (mm)	300	250	200	150	100	300	250	200	150	100	300	250	200	150	100	300	250	200	150	100
A (mm)	975	775	550	375	250	300	225	200	150	100	550	450	375	300	200					
B (mm)	75	75	75	75	75	150	125	100	75	75	150	125	100	75	75	525	350	300	200	150
C (mm)																450	400	350	300	200
AREA (m ²)	1.025	0.750	0.475	0.275	0.125	0.50	0.275	0.200	0.150	0.05	0.800	0.550	0.375	0.225	0.100	1.475	1.025	0.700	0.400	0.175

NOTES:

1. DESIGN BASIS:
 - a. HYDRAULIC PRESSURE 1035kPa (150 psi)
 - b. SOIL BEARING CAPACITY 72kPa (1500 lb/sq.ft) (MEDIUM SOFT CLAY)
2. TEMPORARY BLOCKING MUST BE APPROVED BY THE ENGINEER
3. CONCRETE STRENGTH SHALL BE 25MPa AT 28 DAYS
4. CONCRETE TO BE CLEAR OF BELLS AND PIPE AND UNDER ALL FITTINGS



General Municipal Servicing Standards

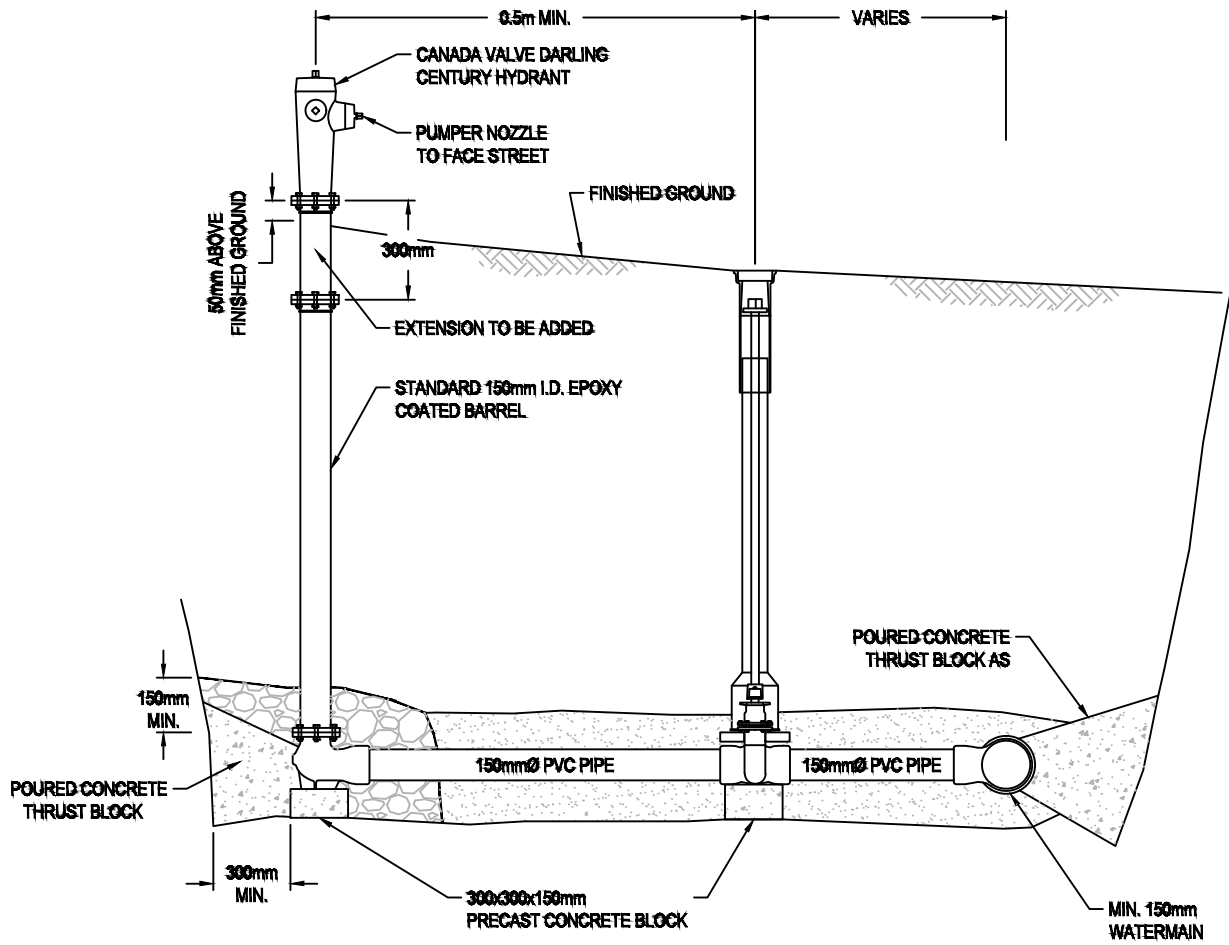


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HORIZONTAL CONCRETE THRUST
BLOCK DETAILS

Approved:

Drawing:
D-03



NOTES:

1. HYDRANT TO BE SET PLUMB WITH BARREL EXTENSIONS TO SUIT DEPTH OF HYDRANT LEAD. HYDRANT LEAD TO BE SET LEVEL WITH A MIN. OF 3.0m OF COVER ABOVE TOP OF PIPE. EXTENSION TO BE INSTALLED BETWEEN HYDRANT AND TOP OF BARREL.
2. ALL THRUST BLOCKING TO BE AGAINST UNDISTURBED TRENCH WALL WITH DRAIN HOLES CLEAR OF CONCRETE.
3. VALVE BOX TO BE INSTALLED IN VERTICAL POSITION WITH TOP FLUSH WITH FINISHED GRADE.
4. HYDRANT SHALL BE COMPRESSION TYPE AS SPECIFIED.
5. ALL CAST IRON VALVES AND FITTINGS SHALL BE CATHODICALLY PROTECTED BY SACRIFICIAL ANODES.
6. HYDRANT TO BE SUPPLIED WITH BREAKAWAY FLANGE.
7. CONCRETE TO BE 25MPa TYPE HS.



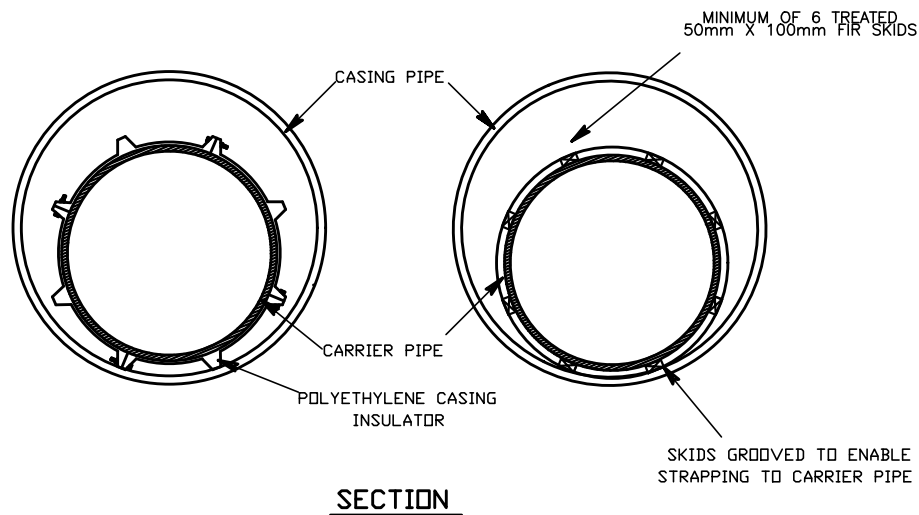
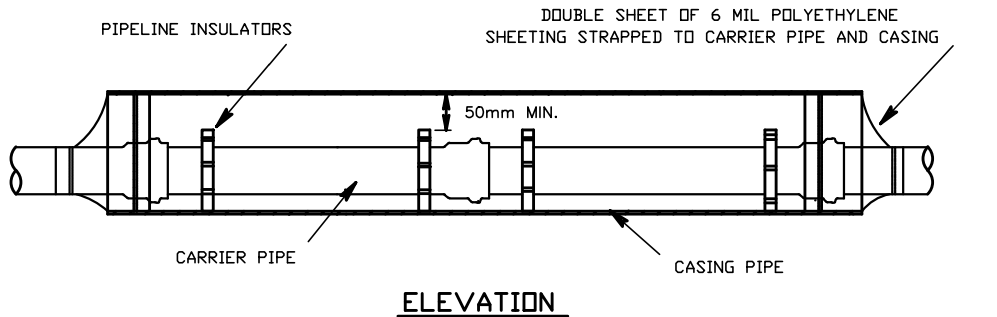
General Municipal Servicing Standards



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TYPICAL HYDRANT CONNECTION	
Approved:	

Drawing:	D-04
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ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

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.

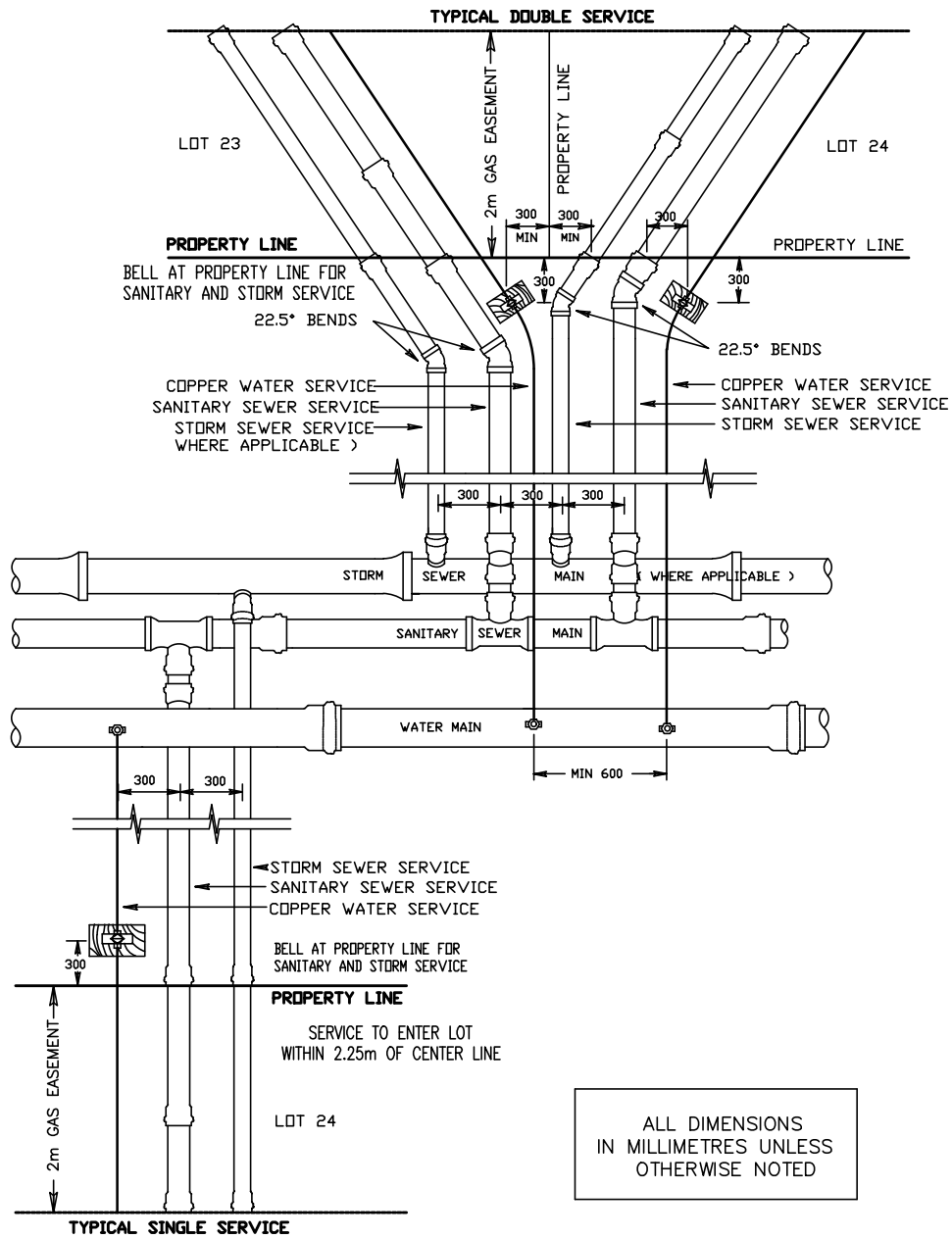


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TYPICAL CASING PIPE WITH INSULATOR	
Approved:	Drawing: D-05



NOTES:

1. WATER AND SEWER SERVICES MAY BE EXTENDED TO EDGE OF 2.0m GAS EASEMENT.
2. THE CITY 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. THE END OF COPPER WATER SERVICE PIPING SHOULD NOT BE CRIMPED CLOSED, PERMEABLE FILTER CLOTH MAY BE USED TO PREVENT INTRUSION OF DEBRIS AND TO ALLOW TESTING FLOW OF CURBSTOP.

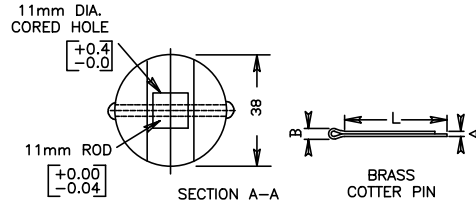
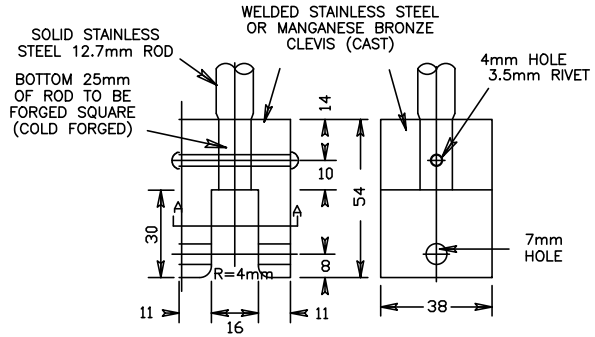
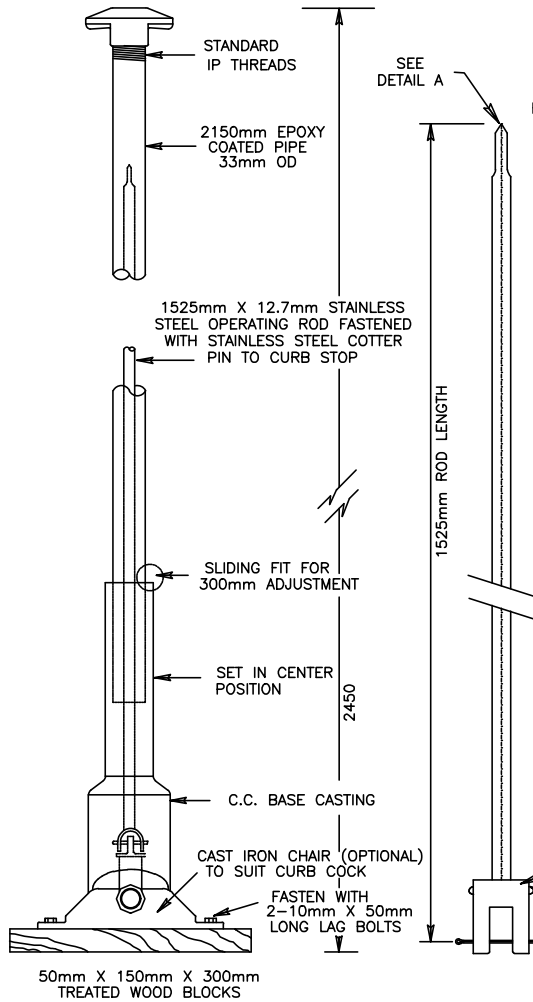
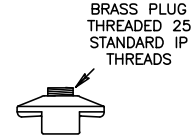
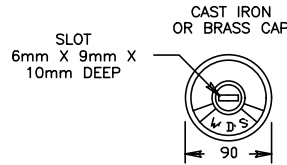
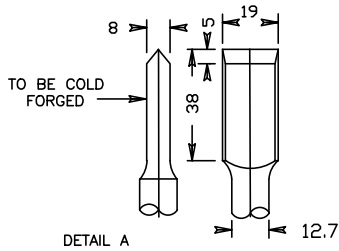


General Municipal Servicing Standards



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TYPICAL SERVICES (SINGLE AND DUAL)	
Approved:	Drawing: D-06



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

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

NOTES:

- OPERATING ROD SHALL BE SUPPLIED AS A SINGLE UNIT COMPRISED OF A SOLID STAINLESS STEEL ROD, ATTACHED TO A WELDED STAINLESS STEEL OR MANGANESE BRONZE CLEVIS WITH A STAINLESS STEEL RIVET.
- THE MANUFACTURER'S NAME SHALL BE EMBOSSED ONTO THE CLEVIS.



General Municipal Servicing Standards

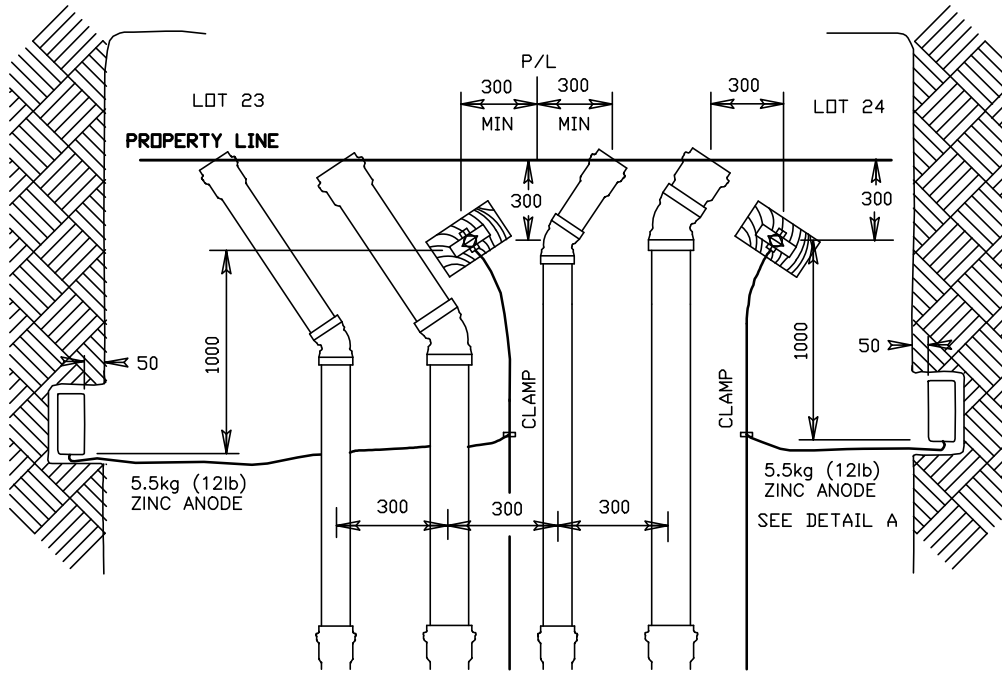


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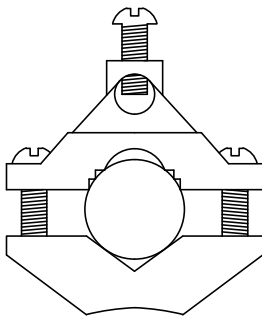
SERVICE BOX DETAIL FOR 50mm AND SMALLER WATER SERVICE

Approved:

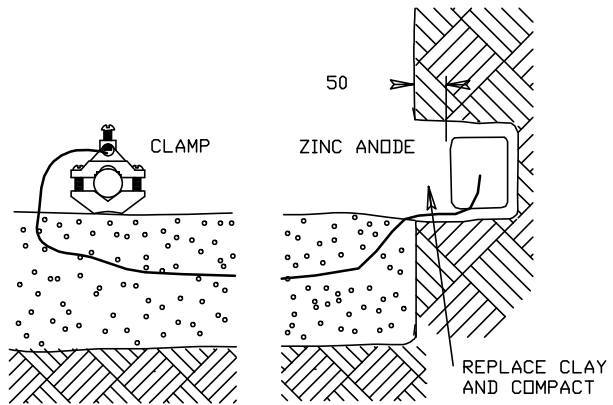
Drawing:
D-07



PLAN VIEW



TYPICAL PIPE CLAMP



DETAIL 'A' TYPICAL

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

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 AROUND ANODES.



General Municipal Servicing Standards

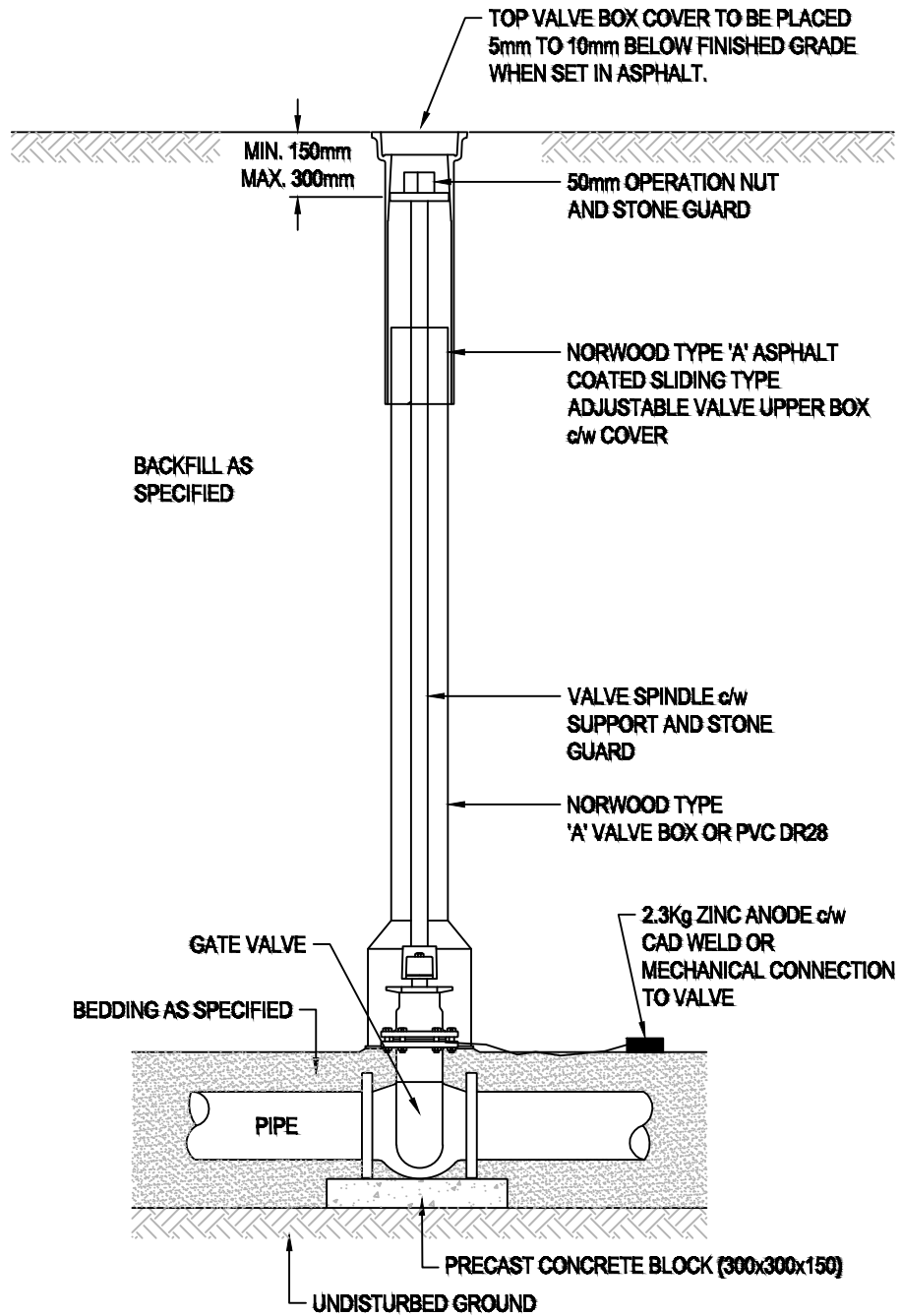


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Rev.	
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Scale:	N.T.S.

ANODE ON 50mm AND SMALLER COPPER WATER SERVICE

Approved:

Drawing:
D-08



NOTES:

1. VALVE BOX TOPS TO BE SET FLUSH WITH SURFACE IN BOULEVARDS, GREEN SPACES AND CONCRETE SIDEWALKS.

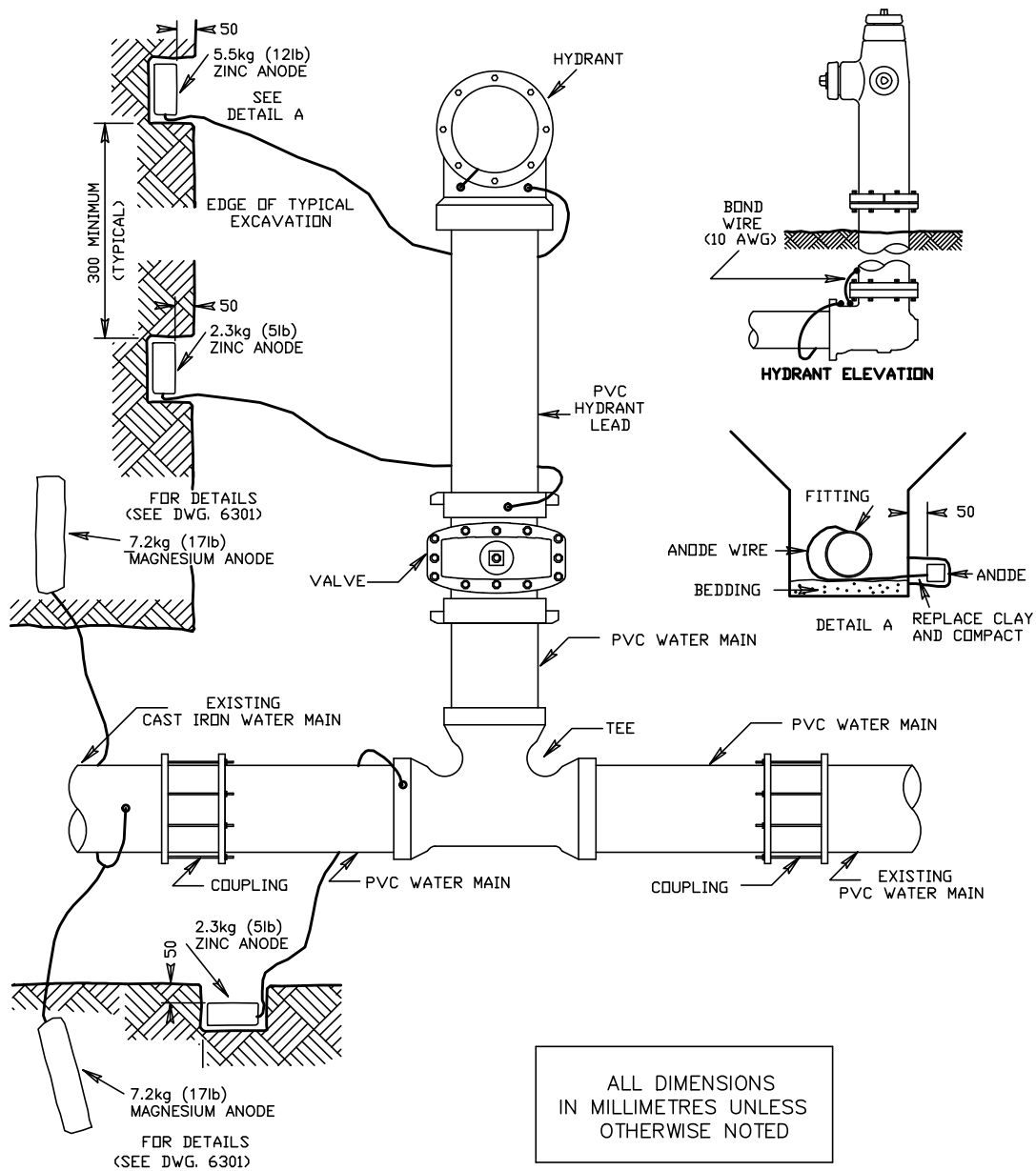


General Municipal Servicing Standards



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ANODE INSTALLATION FOR STEEL AND IRON WATER MAINS	
Approved:	Drawing: D-10



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.



General Municipal Servicing Standards

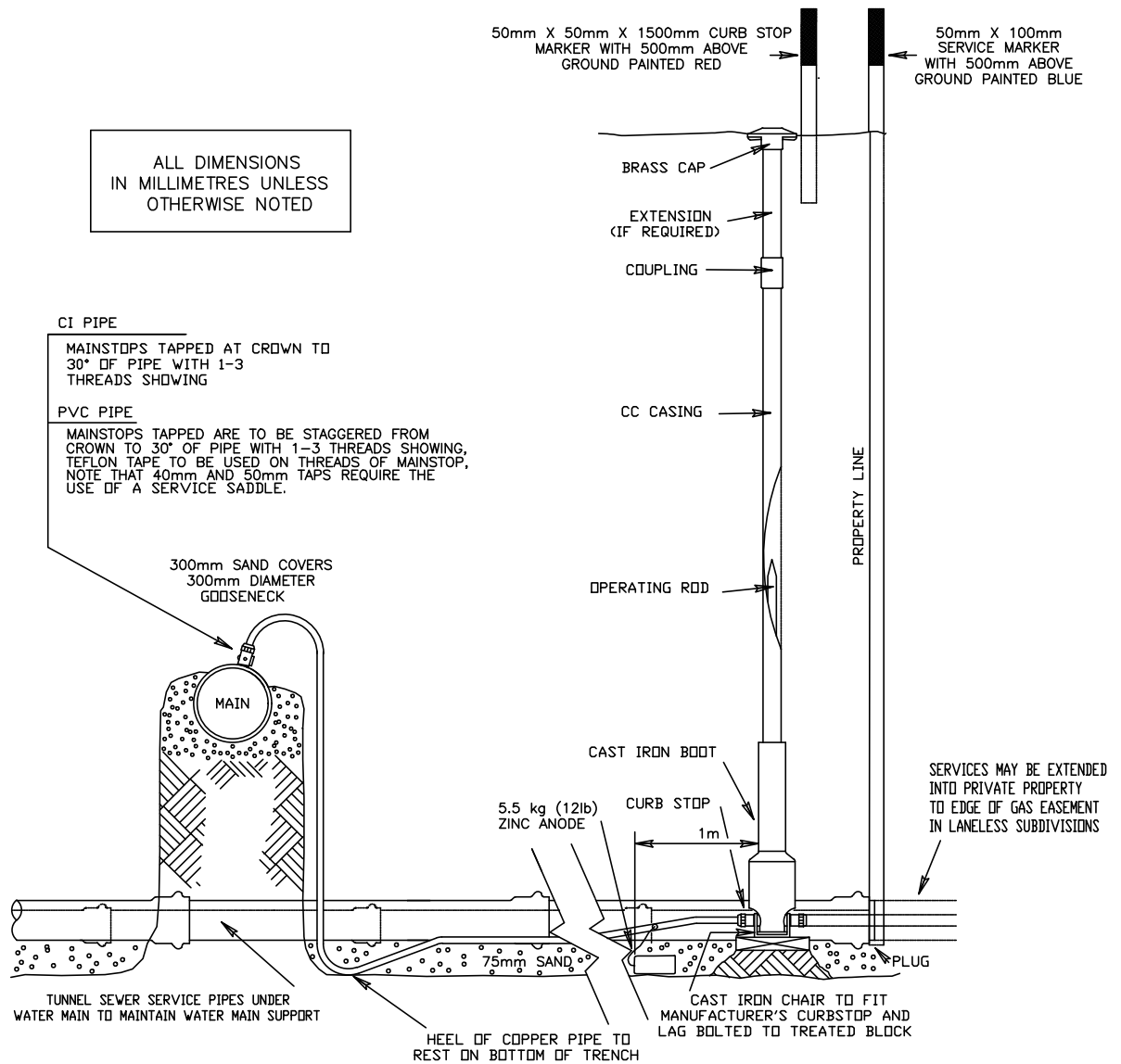


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Scale:	N.T.S.

Approved:

ANODE INSTALLATION AT HYDRANT

Drawing:
D-11



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. COPPER SERVICE PIPE SHALL BE ONE CONTINUOUS PIECE, SHOULD LENGTH EXCEED 20m, A DOUBLE UNION WILL BE ALLOWED. SIZE OF COPPER SERVICE MUST BE 25mm MIN. IF LENGTH OF SERVICE EXCEEDS 20m.
4. INVERT ELEV. OF WATER SERVICE PIPES AT P/L SHALL BE 2.59m BELOW ESTABLISHED FINISHED GRADE.
5. WHERE ENGINEER APPROVED COVER OVER WATER SERVICE TO BE LESS THAN 2.59m 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.

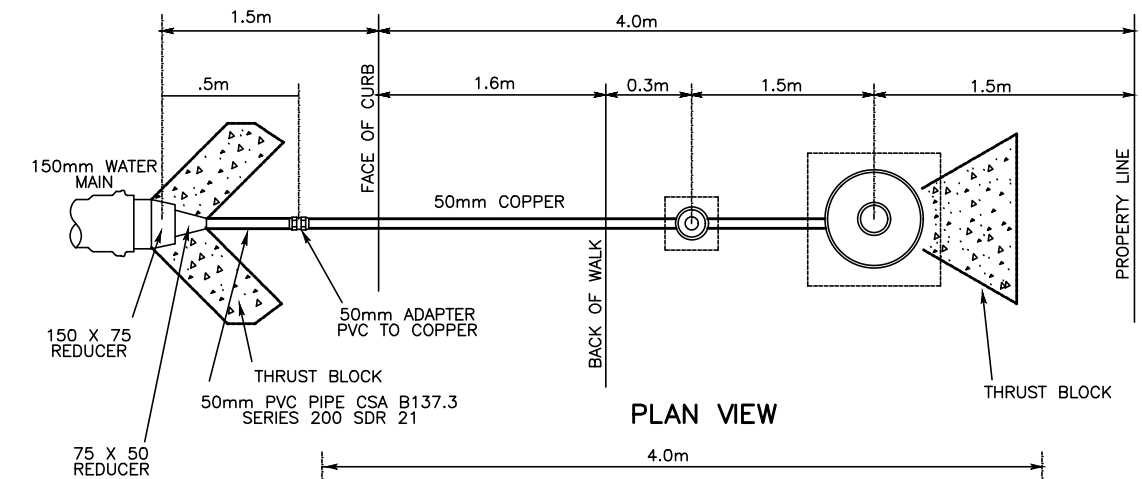


General Municipal Servicing Standards

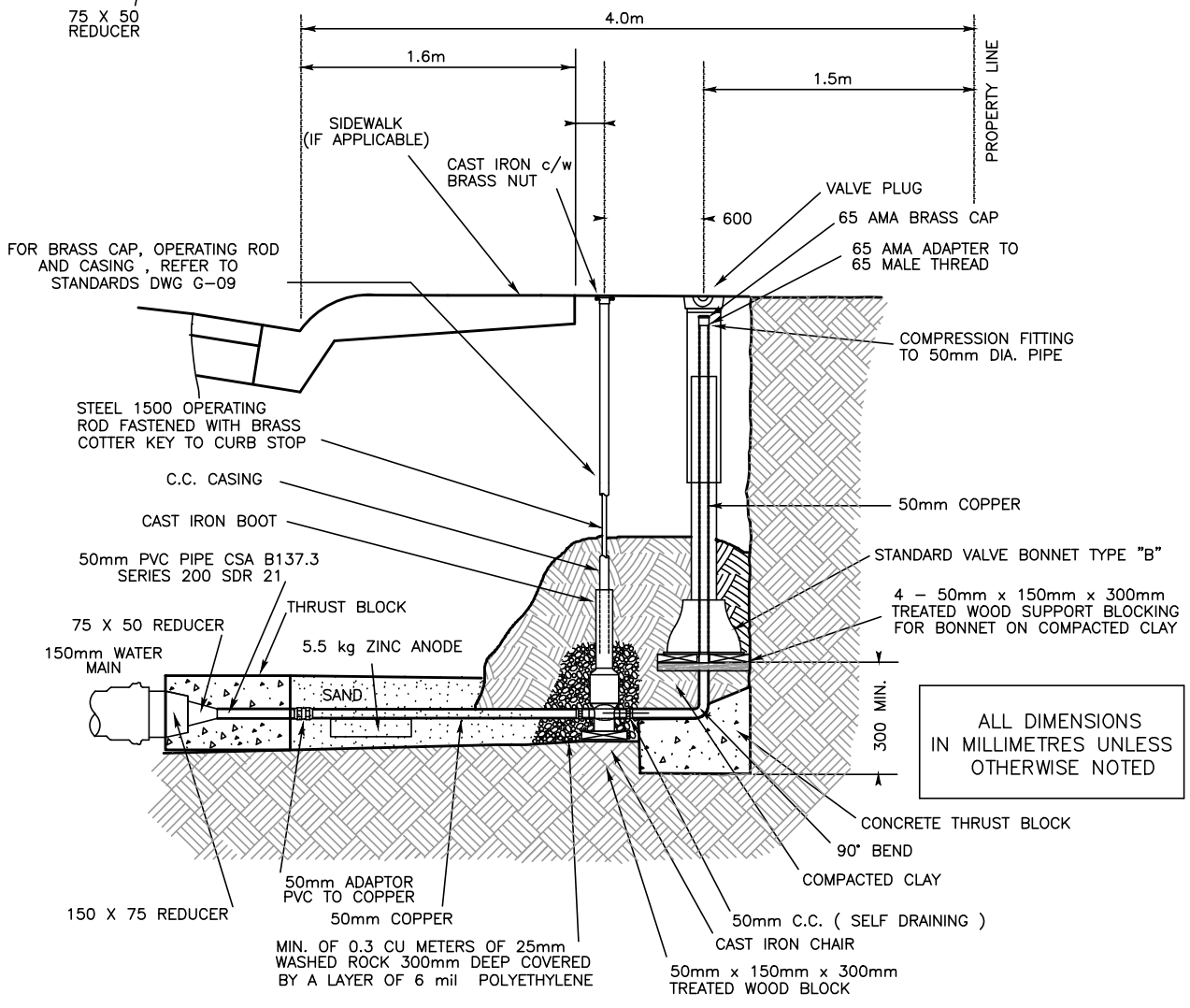


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TYPICAL 50mm & SMALLER WATER SERVICE FOR 300mm & SMALLER WATER MAINS	
Approved:	Drawing: D-12



PLAN VIEW



SECTION



General Municipal Servicing Standards

	Rev.	FLUSH POINT DETAIL	Approved:	Drawing: D-13
	Rev.			
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1 GENERAL

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 specification to be prepared by the Developer’s Engineer.

1.2 Organizations issuing standards:

- ASTM – American Society for Testing and Materials
- CSA – Canadian Standards Association
- Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems

2 FLOW GENERATION RATES

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

2.1.1	Average Sewage Flow	-	320 L/person/day (residential)
		-	6170 L/ha/day (non-residential, including infiltration)
2.1.2	Population Density	-	3.5persons/residence (residential)
2.1.3	Peak Sewage Flow	-	Average Flow x Peaking Factor
2.1.4	Peaking Factor	-	Residential (Harmon’s Formula) $1 + 14/(4+P^{1/2})$ where P = the contributing design population in thousands. If P<1, a peaking factor of 4.5 shall be used.
		-	Non-Residential - 3.0

2.1.5 Infiltration - 0.28 L/s/ha (residential)

2.1.6 Inflow at Sag Manholes - 0.4 L/s/manhole

For Preliminary Planning purposes 18.0 m³/ha/day may be used for Commercial Light Industrial.

2.2 The total design peak flow rates for the sanitary sewer shall be the sum of the peak flow rates plus all extraneous flow allowances.

3 GRAVITY SEWER PIPE SIZING

The following design factors shall be used in determining the sanitary sewer pipe sizes:

- 3.1 Minimum pipe size - 200 mm diameter (residential)
- 250 mm diameter (commercial/ industrial/institutional)
- 3.2 Manning’s Formula “n” - 0.013
- 3.3 Required sewer capacity - $\frac{\text{Estimated Peak Design Flow}}{0.86}$
- 3.4 Minimum flow velocity - 0.6 m/sec (during average flow)
- 3.5 Maximum flow velocity - 3.0 m/sec
- 3.6 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 and greater	0.10 %

3.7 Minimum slopes shall be increased by 50% on all curved sections.

- 3.8** The minimum grade of the first upstream leg shall not be less than 1.0%.
- 3.9** It is recommended that all sanitary sewers be designed with a slope of 0.4% or greater, wherever possible.
- 3.10** Weeping Tiles (Foundation Drains)
- 3.10.1** For any development (residential, commercial, industrial, etc.), weeping tiles, roof leaders (downspouts) and similar appurtenances that handle storm water or ground water are not permitted to discharge into sanitary sewers.
- 3.10.2** Weeping tiles must be connected to sumps with pumped discharge into a sump pump discharged collection service. The required general arrangement of the sump pump and discharge piping to the sump discharge collection services is depicted on the Typical Sump Pump Discharge Connection Detail Drawing E-10. The detailed arrangement must also comply with the Plumbing regulations.
- The surface discharge piping shown on the Detail must be installed to provide a flow if the storm drainage system cannot accommodate the flows due to capacity, freezing, or other problems. The storm sewer system shall be designed to handle weeping tile flow.
- 3.10.3** The Developer shall insure that the builders install sump pumps and make the required sump pump connections.

4 SANITARY SEWER ALIGNMENT AND LOCATION AND DEPTH

- 4.1** Sewer mains shall be located within the road right-of-way and in accordance with the typical roadway cross section.
- 4.2** Sanitary 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.
- 4.4** Public Utility Lot (PUL) widths shall be at least 6.0 m for a single sanitary line.
- 4.5** Curved sewers shall be permitted with the following restrictions:

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- 4.5.1** Curved sewers shall run parallel to the curb or road centreline
 - 4.5.2** Length of pipe shall be such that deflections at each joint are less than the maximum recommended by the manufacturer.
 - 4.5.3** Manholes shall be located at the beginning and end of the curve with the maximum interval between manholes no greater than 90 m along the curve.
 - 4.6** Under normal conditions, sewer mains shall cross below water mains with sufficient clearance to allow for proper bedding and structural support of the pipes. Pipe clearance when passing under any watermain shall be a minimum of 300 mm separation between the top of the sewer pipe and the bottom of the watermain.
 - 4.7** Where it is necessary for the water main to cross below the sewer, the water main shall be protected by providing:
 - 4.7.1** A vertical separation of at least 0.5 m from water main crown to sewer invert.
 - 4.7.2** Structural support of the sewer to prevent excessive joint deflection and settling.
 - 4.7.3** A centering of the length of water of water main at the point of crossing so that the joints are equidistant from the sewer.
 - 4.8** The main shall have a minimum depth of cover of 2.7 m measured from finished grade to invert. Where conditions dictate that the depth of bury be less than 2.7 m, the main/service is to be insulated.
 - 4.9** Gravity mains shall have sufficient depth to allow all buildings to drain by gravity to the sewer. Special consideration should be taken when building floor elevations are lower than the roadway. Service lines shall have a minimum cover of 2.7 m from the finished lot surface to the top of pipe at the property line.
 - 4.10** The maximum depth of cover shall not exceed 5.5 m in cases where sanitary service connections are to be installed. In situations where depth of cover exceeds 5.5 m, the sewer system must be redesigned and /or the site grading shall be adjusted to reduce the depth of cover to less than 5.5 m.

5 **SANITARY SEWER MATERIALS**

- 5.1** The Developer shall supply only new materials. All materials found to be defective or damaged shall be replaced at the cost of the Developer.
- 5.2** Where specific products are specified, it is intended that approved equals are also acceptable. Approval must be obtained from the Municipal Engineer prior to installation.
- 5.3** PVC pipe and fittings shall conform to the following:
- 5.3.1** CSA B182.1, CSA B182.2, ASTM D3034, and ASTM F679 standards with minimum stiffness of 320 kPa as measured in accordance with ASTM Standard D2412. Service lines shall a minimum stiffness of 625 kPa.
 - 5.3.2** Standard Dimension Ratio (SDR) 35 unless otherwise indicated on the drawing.
 - 5.3.3** Sealing gaskets shall meet requirements of CSA B182.2 and ASTM F477.
 - 5.3.4** 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.
 - 5.3.5** 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.
 - 5.3.6** Pipe and fittings shall be installed within two years from the production date indicated on the certification.
- 5.4** Concrete pipe and fittings shall conform to the following:
- 5.4.1** All concrete pipe shall be sulphate resistant (Type HS) pipe.
 - 5.4.2** Non-reinforced concrete pipe shall conform to CSA A257, minimum Class 3 and ASTM C14.
 - 5.4.3** Reinforced concrete pipe shall conform to CSA A257 and ASTM C76.

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- 5.4.4** Flexible rubber gasket joints shall conform to CSA 257 and ASTM C443M.
- 5.4.5** 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.
- 5.4.6** Each concrete pipe shall be marked with the manufacturer's name, date of casting and quality testing passing stamp.
- 5.5** Polyethylene pipe and fittings for low-pressure systems shall conform to the following:
- 5.5.1** Polyethylene pipe shall conform to CSA B137.1 and ASTM D3035, D3350
- 5.5.2** Minimum pressure rating of 690 kPa (Series 100)
- 5.5.3** Moulded fittings shall conform to ASTM D2683 or D3261
- 5.5.4** Fabricated fittings shall be manufactured from pipe of the same series as that used in the piping system.
- 5.5.5** Pipe shall be joined by thermal butt-fusion, flange assemblies or brass compression type fittings complete with stainless steel inserts.
- 5.5.6** Flanges shall be stainless steel or epoxy coated ductile iron conforming to ASTM A536-80 with stainless steel nuts, bolts and washers.
- 5.5.7** Compression couplings shall be used with stainless steel inserts.
- 5.5.8** 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.
- 5.5.9** 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.

6 SANITARY SEWER INSTALLATION

- 6.1 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.
- 6.2 Handle pipe by approved manufacturer's methods. For rigid pipe, do not use chains or cables passed through the pipe bore so that the weight of the pipe bears upon the pipes end.
- 6.3 Align pipes carefully when jointing. Keep joints free of mud, gravel and foreign material and apply sufficient pressure to ensure that the joint is complete as outlined in the manufacturer's specifications. Complete each joint before laying the next length of pipe. Deflections shall not exceed those permitted by the manufacturer. At rigid structures, install pipe joints no more than 1.2 m from side of structure.
- 6.4 The pipe must be thoroughly flushed of all dirt, stones and pipe lubricant when complete.
- 6.5 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 300 mm of diameter.
- 6.6 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.

7 SANITARY SERVICES

- 7.1 Separate sanitary sewer connections shall be provided for each separately titled lot.
- 7.2 The minimum size of a residential gravity sanitary sewer service from the main to the property line shall be 150 mm diameter. The County may approve 100 mm diameter services under special circumstances where the total service length from main to proposed building site is less than 30 m., and at a minimum 2.0% grade.
- 7.3 The minimum size of a residential low-pressure sanitary sewer service shall be 38 mm.

- 7.4 Non-residential service connections shall be sized according to anticipated user requirements.
- 7.5 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. Curb Stops shall not be stop and drain.
- 7.6 Connections for all proposed residential lots shall be installed at the time of initial subdivision development.
- 7.7 The minimum grade for a gravity sanitary sewer service line shall be 2.0% for 100 mm diameter lines and 1% for 150 mm diameter lines and larger.
- 7.8 Risers for service lines shall be required when sewer mains exceed 4 metres in depth.
- 7.9 Services shall be located such that they do not conflict with driveway locations.
- 7.10 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 service connections shall be extended to the edge of the easement furthest from the roadway.
- 7.11 Sanitary services shall always be installed to the left of the water service when facing the property line from the roadway.
- 7.12 Weeping tiles, roof leaders and other similar appurtenances handling storm or groundwater shall not be permitted to discharge into the sanitary sewer.

8 MANHOLES

8.1 Design and Location

- 8.1.1 Manholes shall be located at the end of each line, at all changes in pipe size, grade or alignment, at all junctions and at intervals not greater than 150 m along the length of the sewer.
- 8.1.2 All manholes shall be 1200 mm minimum inside diameter.

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- 8.1.3** Manholes shall be located at the extension of property lines whenever possible to avoid conflicts with driveways.
- 8.1.4** The drop across manholes should be of sufficient magnitude to account for any energy losses in the manhole.
- 8.1.4.1** pipe deflections of less than 45° require a drop of at least 30 mm
- 8.1.4.2** pipe deflections of 45° to 90° require a drop of at least 50 mm
- 8.1.4.3** pipe deflections shall not be greater than 90°
- 8.1.5** Invert drops for pipes larger than 600 mm or for high flow situations shall be assessed on an individual basis.
- 8.1.6** The obvert elevation of a sewer entering a manhole shall not be lower than the obvert elevation of the outlet pipe.
- 8.2 Materials**
- 8.2.1** Manholes shall be manufactured using Type 50 sulphate resistant cement with a 28-day strength of 25 MPa. The maximum allowable slump shall be 75mm.
- 8.2.2** Manhole sections shall be pre-cast reinforced concrete conforming to latest version of ASTM C478 and CSA A257.
- 8.2.3** 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 Engineer.
- 8.2.4** Manhole steps shall be standard safety type, hot dipped galvanized iron conforming to ASTM A615 and ASTM A123 or aluminium forged from 6061-T6, 6351-T6.
- 8.2.5** All pipe penetrations shall be sealed with rubber gaskets conforming to ASTM C443 and grouted with non-shrink grout.

- 8.2.6** Manhole frames and covers shall be cast iron conforming to Class 20 ASTM A48 and ASTM A536. Type NF80 covers shall be used for all streets and driveways, type NF90 covers with rubber gasket shall be used for manholes located in sags and low areas and type F39 covers shall be used for all other areas. Castings shall be marked with series designation, foundry identification and date of casting. Manhole covers with County of Vermilion River identification will be encouraged. Other municipal identification covers are not permitted.
- 8.2.7** Pre-benched manhole bases shall be used wherever possible with pre-cored connection holes and watertight Duraseal or G-Loc joints or approved equal.
- 8.2.8** Tee Riser manholes shall conform to CSA 257.2, ASTM C76 and CSA A257.4, ASTM C76.
- 8.2.9** Safety platforms are required for all manholes greater than 6.0 m in depth.
- 8.2.10** All pre-cast units shall be marked with manufacturer's identification, date of casting, type of cement and CSA standard.

8.3 Installation

- 8.3.1** Manholes, frames and covers shall be installed as depicted on the detail drawings and in accordance with manufacturer's recommendations.
- 8.3.2** Backfill around manholes shall be compacted to a minimum of 98% Standard Proctor Density.
- 8.3.3** Tee Riser manholes shall require Class A bedding to the elevation of the springline.
- 8.3.4** Pre-cast manhole bases shall be installed on a base of 100 mm to 300 mm washed gravel.
- 8.3.5** Cast in place manhole bases approved by the Engineer shall be placed directly on undisturbed ground.

- 8.3.6** 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 E-08 for details.

9 TRENCHING, BEDDING AND BACKFILLING

- 9.1** All trenching and backfilling shall be completed in strict accordance with Occupational Health and Safety Guidelines.
- 9.2** 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.
- 9.3** 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, shall extend up both sides to the trench wall and provide a minimum cover of 300 mm above the pipe. The Developer’s Engineer shall identify special pipe foundation measures for areas where unsuitable pipe foundation conditions exist.
- 9.4** The minimum trench width measured at the pipe springline shall be the pipe outside diameter plus 450 mm. The maximum trench measured at the pipe springline shall be the pipe outside diameter plus 600 mm. The Municipal Engineer must be notified if the trench must be excavated deeper or wider than specified.
- 9.5** Excavated material shall be stockpiled at a safe distance from the edge of the trench.
- 9.6** The Developer’s Engineer shall identify areas where the trench excavation requires sheathing, shoring or bracing to protect workers, property or adjacent structures.
- 9.7** Trench excavations shall be kept free of water.

- 9.8** It shall be the Developer's responsibility to ensure that the utility trenches are adequately compacted.
- 9.8.1** Native backfill under existing or proposed roads or laneways shall be compacted throughout the entire right-of-way width to minimum:
- 9.8.1.1** 98% standard proctor density from subgrade to 1.5 m below subgrade or original ground, whichever is lower;
- 9.8.1.2** 95% standard proctor density greater than 1.5 m from the subgrade or original ground, whichever is lower;
- 9.8.2** Granular backfill under existing or proposed roads or laneways shall be compacted to 98% of standard proctor density throughout the entire trench depth below subgrade and the entire right-of-way width.
- 9.8.3** Backfill in all other areas shall be compacted to minimum 95% standard proctor density or as directed by the County.
- 9.8.4** Subgrade and base course compaction for roadway construction shall be as specified in Section G.
- 9.8.5** If the above standards cannot be achieved due to a large variation in soil types throughout the development, 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.
- 9.9** If the minimum compaction standards cannot be met due to abnormal weather or wet ground conditions, the Engineer may establish a more suitable standard on a site specific basis provided adequate justification is presented by the Developer, and approved by the County. One-mould proctor density testing will not be permitted as an alternate testing procedure due to wet soil conditions. The Developer's engineer will be required to suggest appropriate measures such as drying in-situ material or importing suitable material to meet the required Standard Proctor Densities.

9.10 All landscaping, pavement structures, sidewalks, curb and gutter damaged or removed during trenching shall be restored or replaced unless otherwise directed by the Municipal Engineer.

9.11 All debris, surplus fill and unused materials must be removed from the site.

10 INSPECTION AND TESTING

10.1 All sewer installations shall be subject to inspections by the County prior to issuance of the Warranty Commencement Certificate (W.C.C.) and Final Acceptance Certificate (F.A.C.).

10.2 Video inspections by qualified personnel are required prior to W.C.C. Two written reports including still photographs and two (2) video tape recordings of the entire inspection shall be submitted to the County for review. The report shall indicate the location and severity of all leaks, cracks, breaks, collapses, deflections, sags, obstructions and any other defects affecting the performance of the line. Sections requiring repair will be subject to re-inspection when complete.

10.3 Re-inspection by camera may be required on suspect areas prior to F.A.C. at the discretion of the County. All video inspection costs shall be borne by the Developer.

10.4 All material testing (backfill densities and concrete testing) shall be performed by an accredited agency and certified by a Professional Engineer. All test results shall be submitted to the County with a report indicating any deficiencies and remediation.

10.5 An infiltration and/or exfiltration test may be required at the Municipal Engineer's sole discretion for any section showing deficiencies during the camera test.

10.5.1 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 as determined by the Engineer. The test duration shall be 2 hours. The water level should be measured at the beginning and end of the test to calculate the infiltration/exfiltration.

10.5.2 The allowable leakages are as follows:

10.5.2.1 Infiltration Test: Performed when the groundwater is above the pipe crown for the entire test length. Allowable infiltration is 5.0 L/day/mm dia./km for PVC pipe and 20.0 L/day/mm dia./km for concrete pipe.

10.5.2.2 Exfiltration Test: Performed when the groundwater is below the pipe invert for the entire test length. Allowable exfiltration is 5.0 L/day/mm dia./km and 20.0 L/day/mm dia./km for concrete pipe.

10.6 The maximum acceptable long-term deflection for any PVC or other flexible pipe is 7½ % of the normal internal diameter.

11 SANITARY WASTEWATER PUMPING SYSTEMS

11.1 General

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 subdivision design report taking the development plans for the surrounding area into account.

11.2 Standards and Approvals

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

11.3 Location

11.3.1 The pumping station shall be located in such a manner as to minimize the impact to adjacent development in terms of visibility, odour and noise.

11.3.2 Pumping stations shall not be located in areas subject to flooding during a major rainfall event.

11.3.3 Pumping stations shall always be accessible by road.

11.4 Configuration

11.4.1 A wet well configuration with submersible pump or above ground suction head pump is preferred.

11.4.2 A wet well / dry well configuration may be considered for larger facilities.

11.4.3 A building may be required for the wet well / dry well pumping stations.

11.4.4 A collection manhole shall intercept flow from all incoming sewers before discharge to the pumping station. The station shall receive flow from one inlet only.

11.4.5 Provision shall be made to shut off flow from the collection manhole if required.

11.4.6 Any stations without a building shall be fenced with a lockable gate to prevent unauthorized access.

11.4.7 The Developer shall be responsible for any 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 County.

11.5 Pumping Station Design

11.5.1 The pumps shall be sized to accommodate the maximum expected flow as determined by accepted engineering practice and according to the requirement specified in Section 2 Flow Generation Rates.

11.5.2 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.

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- 11.5.3** Pumps shall be provided by a well-recognized manufacturer with a local repair service depot.
- 11.5.4** Submersible pumps shall have a non-clog impeller design and/or flush valves.
- 11.5.5** Pump motors shall operate on 3-phase power wherever possible. This requirement may be relaxed by the County if 3-phase power cannot be supplied at a reasonable cost.
- 11.5.6** Dead storage shall be minimized while meeting minimum depth requirements specified by the pump manufacturer.
- 11.5.7** 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. The design shall meet pump manufacturer's specifications.
- 11.5.8** Wet wells shall be sized and equipped to accommodate operator access, maintenance and safety requirements.
- 11.6 Valves and Piping**
- 11.6.1** The minimum diameter for all pump suction and discharge piping shall be 100 mm.
- 11.6.2** Pipe sizing shall allow for minimum and maximum flow velocities of 0.75 m/s to 3.5 m/s respectively within the station.
- 11.6.3** The minimum pressure rating of piping within the station shall be determined based on calculated operating pressures but shall not be less than 900 kPa.
- 11.6.4** Pumps shall be connected in parallel to a common discharge header located within the station. Check valves and isolation valves shall be installed on the discharge line between each pump and the discharge header.
- 11.6.5** A forcemain isolation valve shall be installed on the main discharge pipe outside the wet well.

11.7 Water Supply

- 11.7.1** Water supply must be provided to the facility for washing/cleaning purposes.
- 11.7.2** 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 Alberta Environment and Water “Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems” for Water Supply and Wastewater Facilities.
- 11.7.3** Where a potable water supply is to be used for washing/cleaning purposes, a break tank, pressure pump and 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.

11.8 Alarms and Emergency Backup

- 11.8.1** The Developer shall make provisions to mitigate environmental or property damage caused by facility failure.
- 11.8.2** Stations shall be equipped with or provided with the feature for future connection of remote sensing and telemetry equipment enabling operators to monitor the alarms.
- 11.8.3** Power must be supplied from an independent source. 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 fuelled by natural gas unless a supply tank is provided on site.
- 11.8.4** Special consideration shall be made to control any possible overflow in a manner acceptable to the County and Alberta Environment and Water.

11.9 Access and Maintenance

- 11.9.1** Permanent hoist equipment and access hatches of sufficient size and capacity shall be provided for removal of station equipment.
- 11.9.2** All access points shall have locking devices.
- 11.9.3** Ladders shall be non-skid and shall comply with Occupational Health and Safety requirements.
- 11.9.4** Stations shall have adequate interior and exterior lighting.
- 11.9.5** 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 including control diagrams, schematics and manufacturer's operation, maintenance, service and repair specifications. The Developer shall submit five (5) copies to the County along with all commissioning and testing results prior to issuance of the WCC.

11.10 Heating and Ventilation

- 11.10.1** Forced mechanical ventilation is required for dry wells below ground level and for wet wells containing screens or mechanical equipment requiring maintenance or inspection.
- 11.10.2** Equipment shall be able to provide at least six air changes per hour. Provision shall be made for ventilation of the wells with portable equipment in case of system failure. Ventilation failure alarms are required.
- 11.10.3** There shall be no interconnection between wet well and dry well ventilation systems.
- 11.10.4** 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.

11.10.5 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.

11.10.6 Automatic heating and dehumidification equipment shall be provided in all dry wells.

11.11 Lift Station Requirements

11.11.1 Service area shall be of an adequate size to allow for the required access hatches, hoist equipment, ventilation and control equipment while allowing for an appropriate workspace for pump maintenance.

11.11.2 Access to the wet well shall be of adequate size.

11.11.3 Facility layout and access shall be designed to facilitate the removal of any equipment that may require off-site maintenance.

11.11.4 The design shall incorporate measures to reduce the noise and odour impact on the surrounding development.

11.11.5 Lift station area shall be designed to blend architecturally with the surrounding development.

11.11.8 Chain link fence 1.8 m (6 ft) in height to be constructed around lift station and work area or something similar.

11.12 Forcemains

11.12.1 System head curves shall be developed for each forcemain to be submitted to the Municipal Engineer upon request.

11.12.2 The minimum forcemain diameter shall be 100 mm.

11.12.3 The pressure rating of the pipe shall be twice the operating pressure or 690 kPa, whichever is greater.

11.12.4 The velocity shall be within 0.9 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 to stabilize the line shall be incorporated when design velocities exceed 3.0 m/sec.

- 11.12.5 The forcemain design pressure shall allow for the normal static and dynamic operating pressures including water hammer effects.
- 11.12.6 A series of 45° bends shall be used in lieu of 90° bends.
- 11.12.7 Air release valves shall be installed in concrete access chambers at all relative high points. Forcemain grades should be designed to minimize the requirement for an air release valve wherever possible.
- 11.12.8 Blow-off valves shall be provided at all low points.
- 11.12.9 Vacuum relief valves shall be installed wherever necessary in lines designed to drain by gravity between pumping cycles.
- 11.12.10 Provide stainless steel bolts on all valves.
- 11.12.11 Provide operating nuts located between 2.0 m and 3.0 m below ground surface without rock shields on all valves.
- 11.12.12 The forcemain 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.
- 11.12.13 When forcemain length exceeds 1000 metres, cleanouts should be installed in concrete access chambers complete with isolation valves and adaptor coupling for line flushing.
- 11.12.14 A 2-hour pressure test shall be conducted for all new forcemains in accordance with the specifications listed under Section D.27.1 Pressure Testing.

12 RURAL LOW-PRESSURE SANITARY SERVICING

12.1 General

The sanitary sewer system shall be of sufficient capacity to service the ultimate population projection of the development area. The flows and factors outlined in the following sections shall be used in the design of a low pressure sanitary sewer systems.

The Developer and the Developer's Consultant are responsible to ensure that the infrastructure is designed and constructed to achieve manufacturers' design life expectations consistent with good design and construction practice. System proposals must identify disposal means in accordance with Alberta Environment and Water Regulations and Guidelines. Plan-profile drawings, specifications and a letter report shall be prepared by a qualified Professional Engineer and be submitted to the County and Alberta Environmental Protection for review and approval prior to construction.

12.2 Estimating Average Sewage Flows

- 12.2.1 A sewage generation rate of 250 L/person/day for a low pressure sewer system with no infiltration rate shall be used, unless otherwise determined by the County. Any sewage generation rate than the above will be dependant upon the disposal system capacity.
- 12.2.2 In determining residential flows a minimum of 3.5 persons per household shall be used unless otherwise determined by County.
- 12.2.3 Recommended pump rate and head will need to be provided. This information will be included in any plumbing permit issued by the county and will endure that all residents are aware of this requirement.

12.3 Pipe Sizing

- 12.3.1 Minimum main pipe size - 50 mm diameter
- 12.3.2 Minimum service pipe size - 38 mm diameter
- 12.3.3 Minimum flow velocity - 0.6 m/sec
- 12.3.4 Hazen Williams flow coefficient (C) - 150
- 12.3.5 The low-pressure sewer main shall be sized according to the number of services. 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.
- 12.3.6 A two-compartment septic tank is required with a minimum total volume of 3000 litres for a single-family dwelling.

- 12.3.7** Pumps may either be submersible sewage pumps installed in the second chamber (liquid chamber) of the septic tank or a centrifugal pump installed in the basement with a suction line to the second chamber. The use of a single chamber tank with a grinder pump is not permitted. All pump connections shall incorporate double check valves downstream of the pump discharge to prevent backflow into the septic tank.
- 12.3.8** The maximum head for a low-pressure system is 24 metres (35 psi). Pumps with a higher discharge head shall only be permitted if all pumps and mains within the system have been designed to accommodate the higher pressure.
- 12.3.9** All pumps within the system should typically have the same maximum discharge head 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 to ensure proper system operation.
- 12.3.10** 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. (See Section 16, Rural Low-Pressure Sanitary Servicing).
- 12.3.11** A report from the Developer's Consultant must be prepared to ensure that pipe sizing is calculated in consideration with the topography of the serviced lands and the population projections.

12.4 System Materials and Installation

12.4.1 General

- 12.4.1.1** The Developer shall supply and install only new materials.
- 12.4.1.2** All such materials which are defective in manufacture, damaged in transit, or have been damaged after delivery shall be replaced by the Developer at his/her expense.

12.4.1.3 All standards referred to mean the latest edition of that Standard.

12.4.1.4 Where specific products are specified, it is intended that approved equals are also acceptable. Approval must be obtained from the County before using an equal product.

12.4.2 High Density Polyethylene (HDPE) Pipe

12.4.2.1 High Density Polyethylene pressure (HDPE) pipe shall be DR11 or DR13.5, PE 3408 iron pipe sized (IPS) and shall conform to CSA B137.1, ASTM F714 and ASTM D3350 Standards. Pipe sized from 13 mm through 76 mm shall conform to ANSI/AWWA C901-02 Standard. Pipe sized from 100 mm through 1575 mm shall conform to ANSI/AWWA C906-00 Standard.

12.4.2.2 Shop only moulded pipe fittings shall be used. If unavailable other alternatives must meet County approval first.

12.4.2.3 All joints are to be thermal heat fused. Mechanical service connections are not approved.

12.4.2.4 All components shall be made of corrosion resistant materials.

12.4.2.5 Pipe age not to exceed two years at time of installation.

12.4.3 Low Pressure Sewer Mains

12.4.3.1 In country residential subdivisions the sewer main alignments shall be as depicted on the Typical Country Residential Right-of-Way Roadway cross section drawing E-11.

12.4.3.2 Mains shall be at a depth adequate to provide a minimum of 2.7 m depth of cover from finished grade to top of pipe.

12.4.3.3 Auguring or directional drilling is required under all roads.

-
- 12.4.3.4** Compaction of any trenches and auger pits and repair of any settlements that occur within two years is required.
- 12.4.3.5** A separate service line with a curb stop, marked “sewer” at the property line is required for each lot.
- 12.4.3.6** Flushing pipes are required at the start each collection main to facilitate removal of main line blockage.
- 12.4.3.7** Manual air/vacuum relief valves are required at all high points for removal of hydrogen sulphide gases from anaerobic decomposition of organics.
- 12.4.3.8** Sanitary sewers shall be located a minimum of 2.5 m o/c from any watermain and 1.8 m o/c from any gas line or as required by the utility company.
- 12.4.3.9** Public Utility Lot (PUL) widths shall be at least 4.0 m for a single utility and 6.0 m for two utilities. A 1.0 m easement is required on the lots on each side of a PUL.
- 12.4.3.10** Tracer Wire of a gauge copper shall be installed simultaneously with the pipe on all mains and services. Splicing the tracer wire can be done by soldering, and mechanical connections, the following shall apply:
- Tracer wire shall not be connected to the steel pipe or transition couplings.
 - Tracer wire shall be brought flush to the ground at every valve box riser at every road crossing, at every facility location and at end of every plastic pipe section. It shall be brought flush to the ground inside a rigid PVC conduit and looped inside a PVC junction box, within a type A valve box marked “Sewer”. An electrical continuity test shall be performed prior to acceptance.
- 12.4.3.11** Marker posts shall be installed perpendicular to all valves, air release and flushing standpipe locations, adjacent to the

property line. Warning signs and painted fence posts shall be installed at the edge of the road right-of-way where low pressure sewers cross roadways.

12.4.3.12 Posts shall be GlasForms Inc., Fiberglass Composite Markers, Dual-Flex, Part number DF66-00 (1676 mm or 66 inches long in White) with Orange reflective stickers applied to both sides, or approved alternate.

- Posts shall include one composite post anchor and shall be installed 457 mm (18 inches) in depth, thereby leaving 1.2 m (4ft) visible above ground.
- Refer to drawing *B-12*.

12.4.4 Fittings

12.4.4.1 High Density Polyethylene (HDPE), DR11 conforming to ASTM FT714 and /CAN B137.1, shop molded fittings shall be used.

12.4.4.2 All HDPE molded fittings shall meet the requirements of ASTM D2683 for socket-type fittings, ASTM D3261 for butt-type fittings, or ASTM F1055 electrofusion-type fittings.

12.4.5 Valves

12.4.5.1 Gate valves for 75 mm and larger shall be iron body, bronze mounted gate valves with a non-rising spindle, which open by turning in counter clockwise direction. All valves shall conform to AWWA C500 for bronze mounted solid wedge gate valves or AWWA C509 for resilient seated gate valves. Interior to be factory coated with epoxy coating conforming to AWWA C550. Exterior to be factory applied epoxy coated. Corrosion reduction to be provided by installation of a zinc sacrificial anode. Valves to be flanged for polyethylene pipe.

- 12.4.5.2** Brass inverted key-type curb stops shall be used for valves 50 mm and smaller conforming to ASTM B62 compression type. Curb stops to have adjustable bituminous or epoxy coated cast iron service base with stem to suit 3.0 m depth of bury. Top of cast iron box to be marked "SEWER". All curb stops shall incorporate 75 mm long stainless steel sleeves for connections to polyethylene pipe.
- 12.4.5.3** Valve ends compatible with pipe joint type (Cast Iron Outside Diameter) to be used.
- 12.4.5.4** Cast iron valve boxes conforming to ASTM A48, Class 25 of the screw or sliding type shall be required on all valves. Coating inside and outside shall be an asphaltic coating or fusion bonded epoxy conforming to AWWA C213. Set screw to be galvanized. Top of box to be marked "SEWER".
- 12.4.5.5** Extension stem to be 25 mm square mild steel with 50 mm operating nut and flange suitable for 3.0 m bury. A rock disk nut is required on all valves.
- 12.4.5.6** Schedule 40 PVC valve boxes for the bottom boot of Norwood Foundry Type A siding type valve boxes or approved equal are permitted in areas not exposed to vehicle loading.

12.4.6 Service Connections

12.4.6.1 General

- Each lot must have a separate service.
- Curb stops marked "SEWER" shall be installed at the private property line, located within the 3.5 m utility easement.

12.4.6.2 Details

- Sanitary sewer service pipe shall be 40 mm, DR11 polyethylene pipe, Series 110 Municipal tubing.

- Main connections shall be made by means of fused in-line tees or saddles. All fittings and joints must be assembled by electro fusion or butt fusion for HDPE piping. Services to be in one piece, no mechanical connections are permitted between main connection and curb stop.
- Curb Stops shall be non-draining type located adjacent to driveway locations.
- Minimum depth of cover shall be 2.75 m from finished grade over top of pipe.

12.4.6.3 Septic Tank/Pump

- Use two-compartment tank or a single-compartment tank with a pump vault, sized and constructed in accordance with Alberta plumbing codes.
- Extend tank access risers at least 150 mm above finished ground surface, provide watertight manhole covers and divert surface runoff away from the manhole cover.
- Tank must be large enough to provide:
 - 450 mm for pump submergence, minimum,
 - Full day of emergency storage capacity above the high water alarm level, utilizing the septic tank freeboard capacity below ground and/or below building drain outlet invert,
 - Minimum 12-hour retention time below high water alarm level for proper treatment of the sewage flow,
 - Storage of sludge and scum accumulation,
 - Typically 3800 L (1000 gal) minimum total storage for an average 3 bedroom dwelling, and
 - Reference "Alberta Private Sewage System Standard of Practice 2015".

- Tank must be sealed watertight tank (fibreglass, or one-piece precast pump tank) or special provisions for assuring watertight tank.
- Anti-buoyancy provisions must be adequate.
- All pipe and wire conduits into tank must be through hubs or fittings made during the construction of the tank and installed in a watertight and gastight fashion.
- No drainage or any water other than sanitary wastewater shall be allowed to enter the tank.
- The effluent shall enter the pump compartment or pump vault from the clear zone of the tank between the scum and sludge layers.
- Pump must be:
 - Submersible,
 - Capable of 3 minute minimum pump run time 1L/s pumping rate, and
 - Must be a CSA approved effluent pump capable of delivering 0.3 L/s at 70 m of total dynamic head or at a pressure established by the County. Pump must be readily removable for the ground surface.
- Pump discharge pipe must be of DR11 HDPE or stronger and include a check valve, disconnect union and valve within the pump tank.
- The pump screens shall be no larger than 3 mm in size and occupy a surface area of 1.44 square metres or equivalent product approved by the County.
- Pumps must be activated by either mechanical level controllers or Mercury level control switches.

- When any pump is located at a higher than the elevation of the terminal end a siphon-break valve must be provided for that pump.
- Provision for ventilation should be provided.

12.4.6.4 System Installation

12.4.6.4.1 General

- The system installation standards are intended to address key points only and are not be considered as a suitable for a detail construction specification to be prepared by the Developer's Engineer.

12.4.6.4.2 Trenching, Bedding and Backfilling

- Refer to Section 9 Trenching, Bedding and Backfilling.

12.4.6.4.3 Augering of All Services Connection

- All service connections shall be installed by augering under proposed or existing streets except where augering is not feasible due to adverse soil conditions. Open trenching may be permitted subject to the Manager, Engineering and Environmental Planning department's acceptance of the need and acceptance of the backfill material.
- All auger pit excavations shall be backfill with granular bedding material and mechanically compacted, in lifts not to exceed 150 mm in depth, to a minimum of 98% Standard Proctor Density to 300 mm above the pipe.

- Backfill of auger pit excavation over 300 mm above the pipe shall be compacted in lifts not to exceed 150 mm in depth, to a minimum of 95% in the road ditch or ditch slope or a minimum of 98% if in the side slope of the road.

12.4.6.5 Inspection and Testing

12.4.6.5.1 Before acceptance of the work, the entire system shall be subjected to a hydrostatic pressure of the presence test in the presence of the County representative. The Developer shall provide all necessary labour. Materials and equipment for the test including a suitable pump, measuring tank, pressure hoses, connections, plug, caps, gauges and all other apparatus necessary for filling the main, pumping to the required test pressure and recording the pressure and expansion-leakage losses. The Developer shall provide evidence that the gauges used are accurate.

12.4.6.5.2 Expel air from collection system, slowly filling main with water. High points must have automatic air/vacuum relief valves to vent air when filling and be closed when pressure is applied.

12.4.6.5.3 A hydrostatic test pressure of 1.5 times the pipe at the lowest point in the system main shall be applied.

12.4.6.5.4 Pressurized pipe to require test pressure over a 3-hour period and hold requires test pressure for an additional hour to allow for pipe expansion and stretching prior to the leakage test.

12.4.6.5.5 Test period shall be for 2-hour duration. Amount of make-up water (leakage) required to return the pipe to required test pressure shall not exceed the allowance given in the following table.

Field Testing of Low Pressure Sewer Systems

Nominal Pipe Size mm	Allowance for Expansion (Leakage) (litres/100 m of pipe) 2 Hour Testing
50	1.6
75	1.9
100	3.1
150	7.5
200	12.5

Total time under test pressure must not exceed 8-hours. If test is not accepted due to leakage or equipment failure, test sections must be permitted to "relax" for 8-hour period prior to the next testing sequence.

13 SUMMARY OF SANITARY SEWER SYSTEMS STANDARDS

The following is a summary of the standards applicable to the sanitary sewer systems materials and construction. In all cases, it is intended that the latest apply.

ASTM

A48	Grey Iron Castings
C14	Concrete Sewer, Storm and Drain, and Culvert Pipe
C76	Reinforced Concrete Culver, Storm Drain, and Sewer Pipe
C443	Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
C478	Precast Reinforced Concrete Manhole Sections
D698	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures
D3034	Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

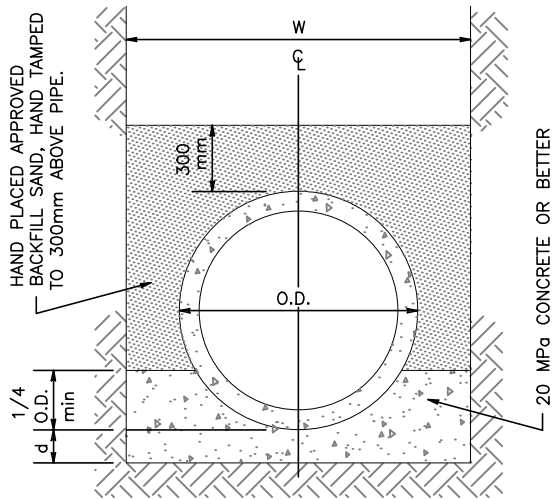
CSA

A5	Portland Cements
A23.1	Concrete Materials and Methods of Concrete Construction
A257 Series	Standards for Concrete Pipe
B182.1	Sewer Pipe Fittings
B182.2	PVC Sewer Pipe and Fittings (PSM Type)
B182.11	Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings
G30.12	Billet Steel Bars for Concrete Reinforcement

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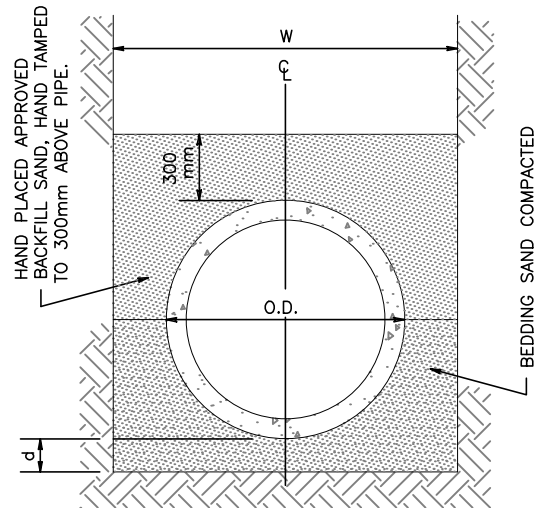
CLASS A BEDDING

$L_f = 2.8$



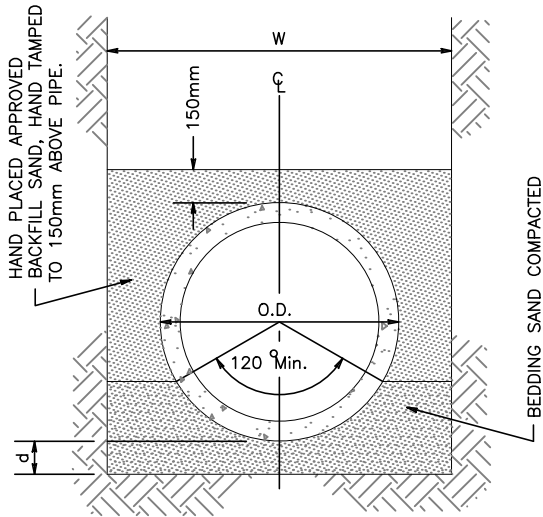
CLASS B BEDDING

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CLASS C BEDDING

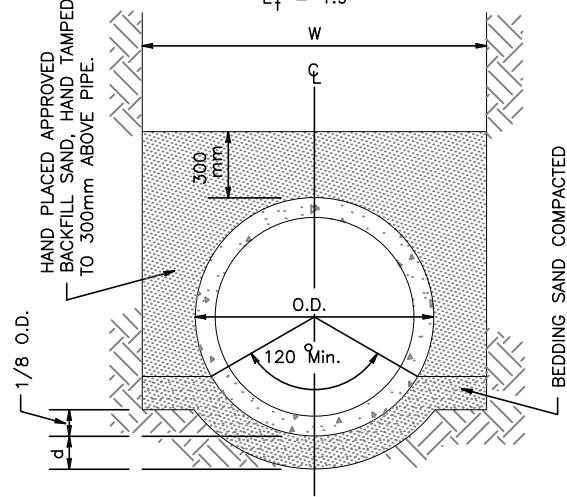
$L_f = 1.5$



CLASS B BEDDING

ALTERNATE - 375mm I.D. & UNDER

$L_f = 1.9$



NOTES:

- W = TRENCH WIDTH - O.D. + 450mm (MINIMUM)
 - 1000mm max. FOR PIPES UP TO AND INCLUDING 400mm DIAMETER
 - O.D. + 400mm max. (ON EITHER SIDE {800mm TOTAL}) FOR PIPE DIAMETERS 450mm AND ABOVE
- O.D.= OUTSIDE PIPE DIAMETER
- I.D. = INSIDE PIPE DIAMETER
- L_f = LOAD FACTOR
- d = DEPTH OF BEDDING BELOW PIPE
- I.D.= 675mm OR SMALLER - d min = 150mm
- I.D.= 750mm TO 1500mm - d min = 150mm
- I.D.= 1650mm AND LARGER - d min = 150mm

NOTE: all dimensions in millimeters unless noted otherwise



General Municipal Servicing Standards

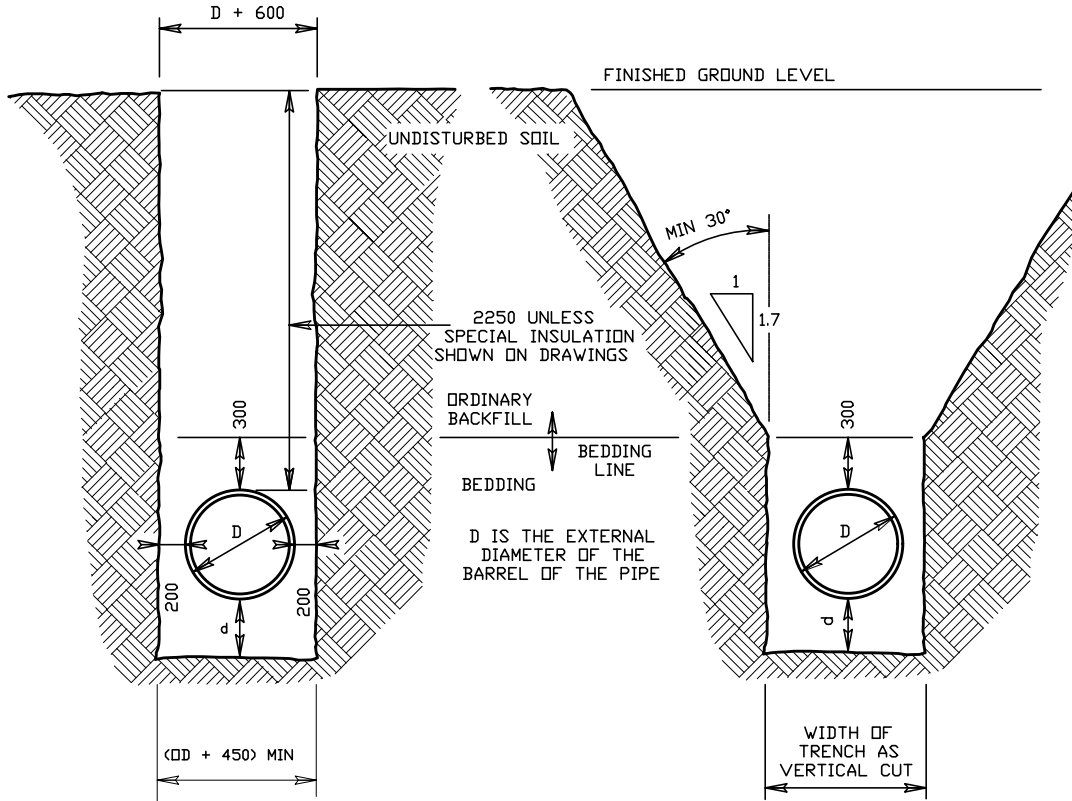


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Rev.
Rev.
Date: FEBRUARY 2020
Scale: N.T.S.

Approved:

STANDARD TRENCH BEDDING FOR CIRCULAR PIPES

Drawing:
E-01



**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)

- EXTERNAL DIAMETER OF 700mm AND BELOW :75
- EXTERNAL DIAMETER GREATER THAN 700mm :100

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

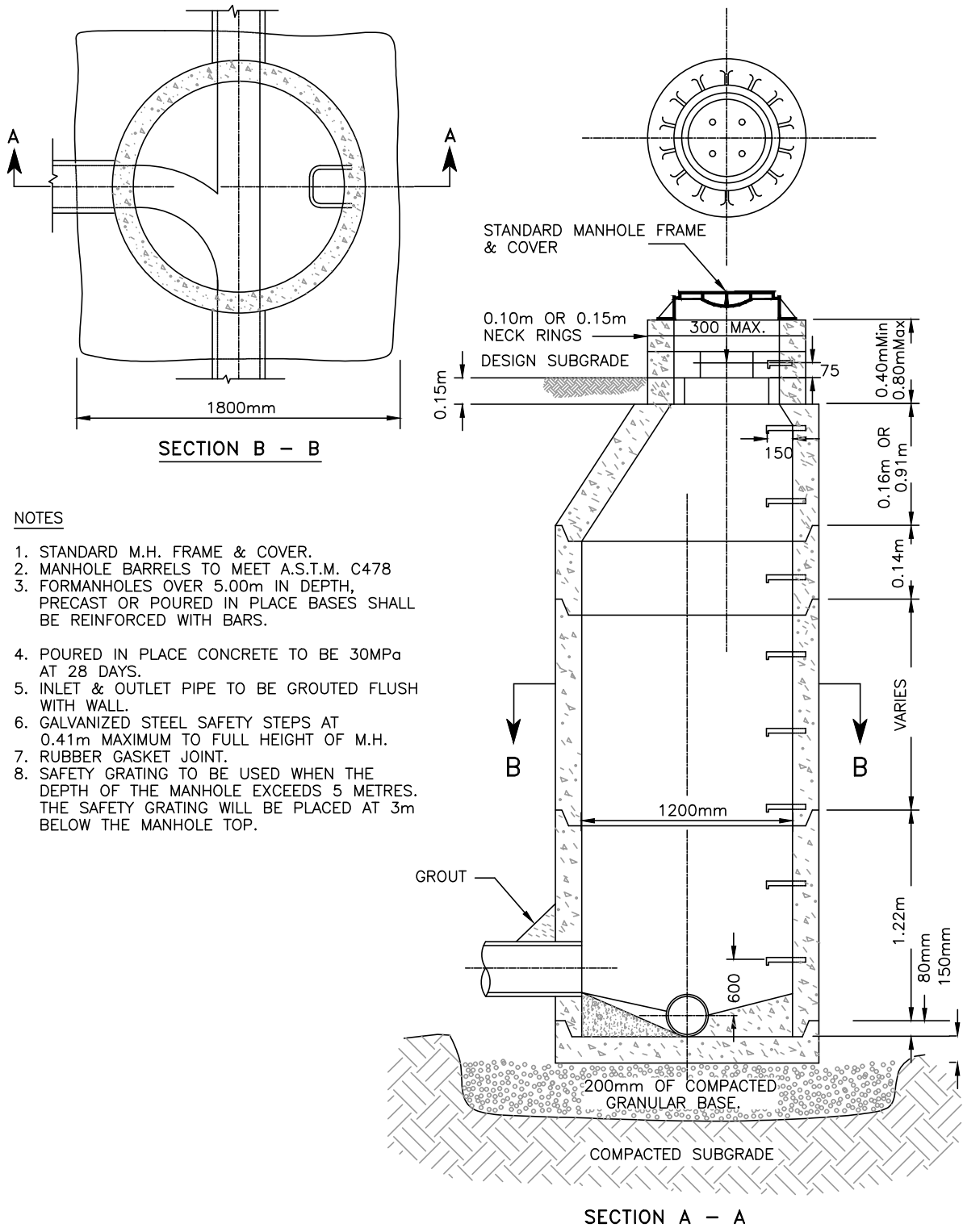


General Municipal Servicing Standards



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Rev.
Rev.
Date: FEBRUARY 2020
Scale: N.T.S.

STANDARD TRENCH DIMENSIONS FOR CIRCULAR PIPE	
Approved:	Drawing: E-02



NOTES

1. STANDARD M.H. FRAME & COVER.
2. MANHOLE BARRELS TO MEET A.S.T.M. C478
3. FORMANHOLES OVER 5.00m 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 JOINT.
8. SAFETY GRATING TO BE USED WHEN THE DEPTH OF THE MANHOLE EXCEEDS 5 METRES. THE SAFETY GRATING WILL BE PLACED AT 3m BELOW THE MANHOLE TOP.



General Municipal Servicing Standards

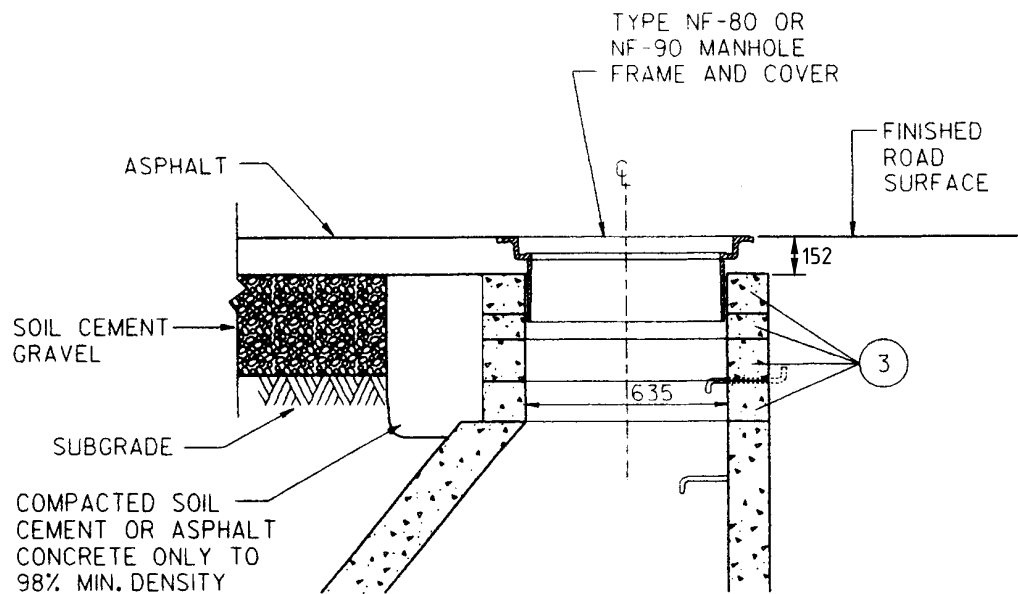
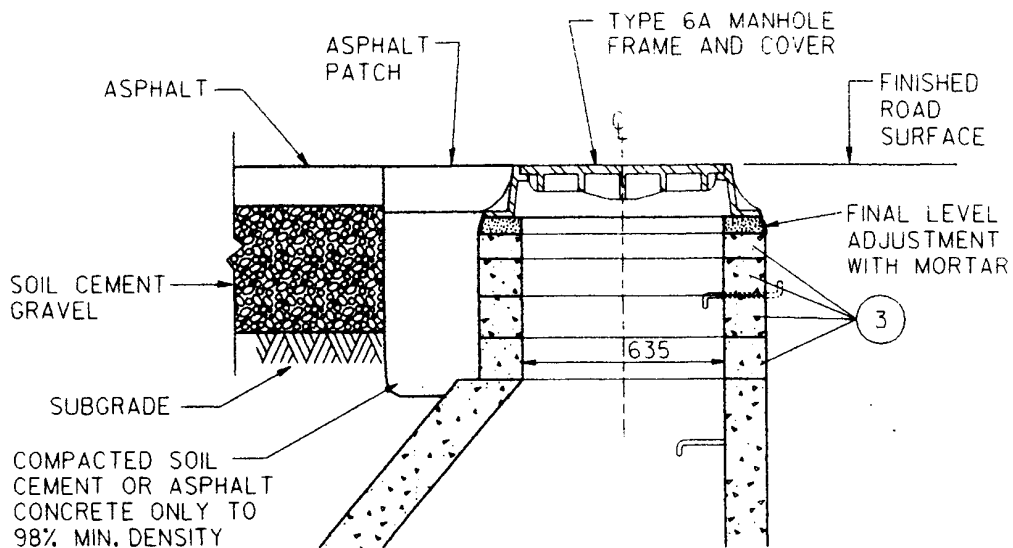


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Rev.	
Date:	FEBRUARY 2020
Scale:	N.T.S.

Approved:

STANDARD 1200mm MANHOLE

Drawing:
E-03



General Municipal Servicing Standards

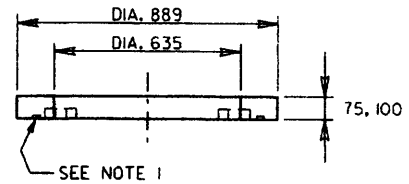
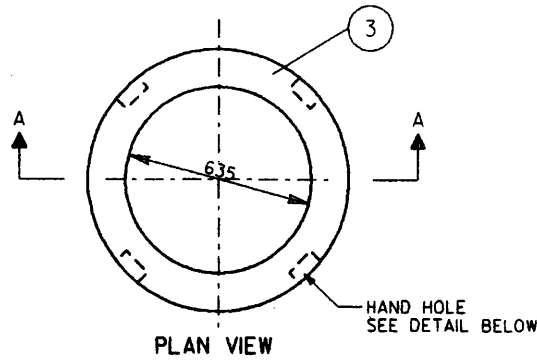


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Date:	FEBRUARY 2020
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NECK SECTION DETAILS FOR STANDARD
1200mm MANHOLE

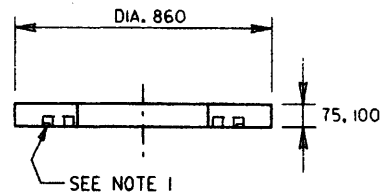
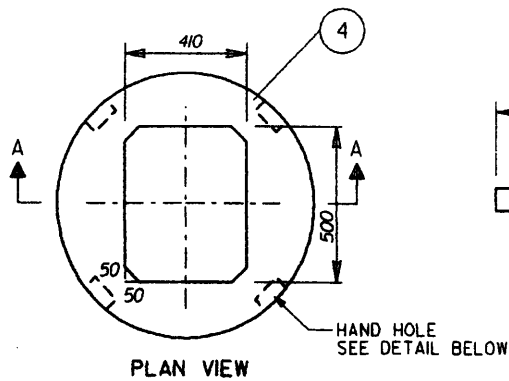
Approved:

Drawing:
E-04



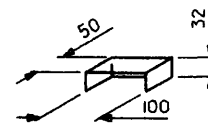
635 RING

(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-51
WITHOUT SIDE INLET FRAMES AND GRATINGS)



NOTES:

1. A CONCENTRIC GROOVE LOCATED AT MID CROSS SECTION, SUITABLE FOR SEALANT IS REQUIRED FOR NECK RINGS AND EXTENSION RINGS.



General Municipal Servicing Standards

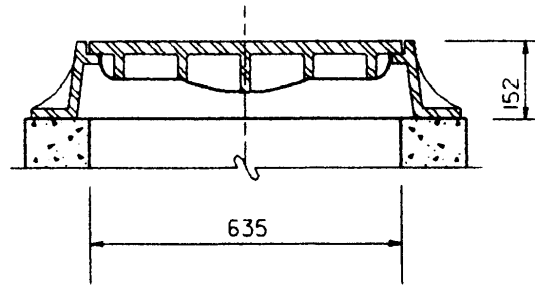
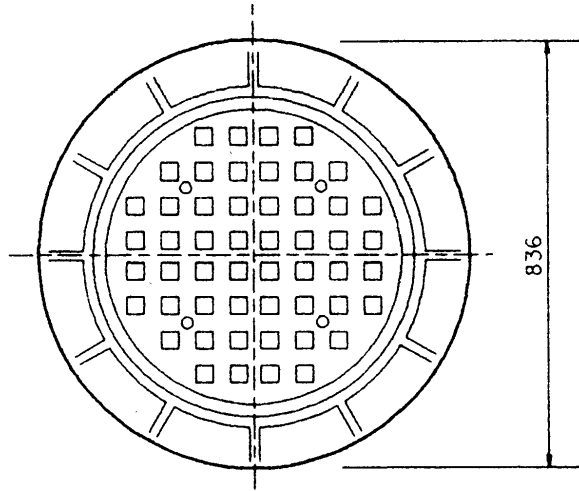


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Date:	FEBRUARY 2020
Scale:	N.T.S.

635 NECK RING

Approved:

Drawing:
E-05



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



General Municipal Servicing Standards

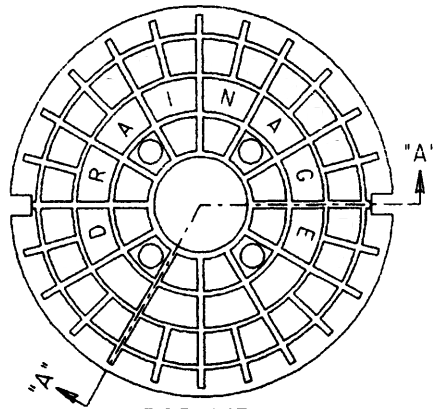


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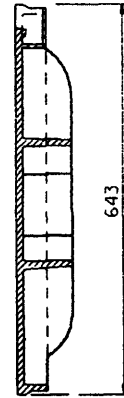
TYPE 6A COVER AND FRAME

Approved:

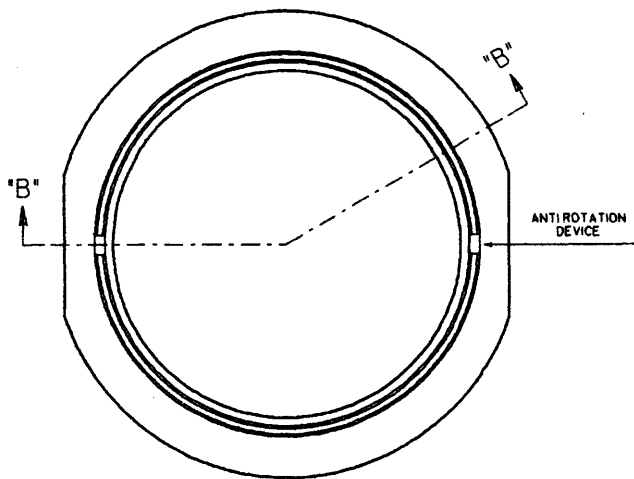
Drawing:
E-06



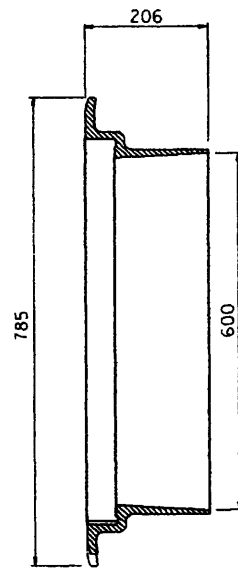
TOP VIEW
MANHOLE COVER
WITH 4 VENTHOLES



SECTION "A-A"



PLAN



SECTION "B-B"

TYPE NF-80 FLOATING MANHOLE FRAME

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



General Municipal Servicing Standards

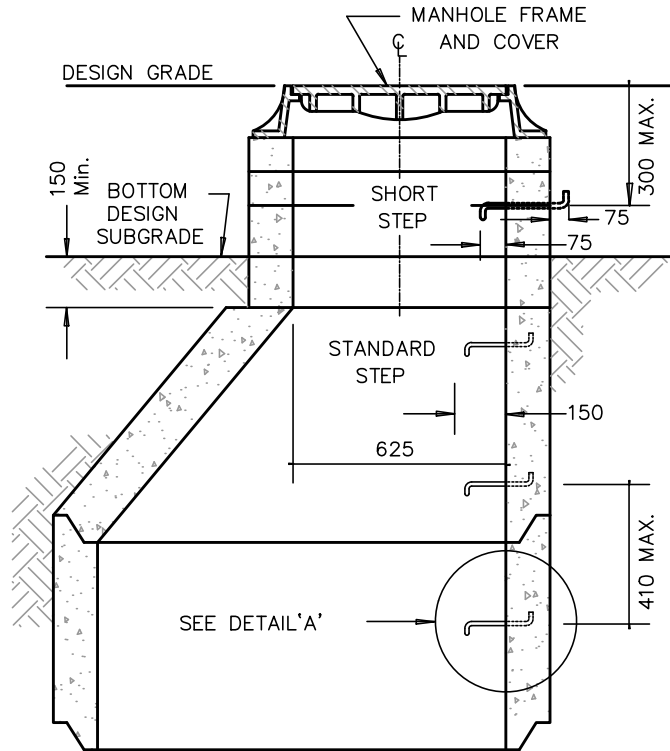


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Date:	FEBRUARY 2020
Scale:	N.T.S.

FLOATING MANHOLE FRAME AND COVER TYPE NF-80 AND NF-90	
Approved:	Drawing: E-07

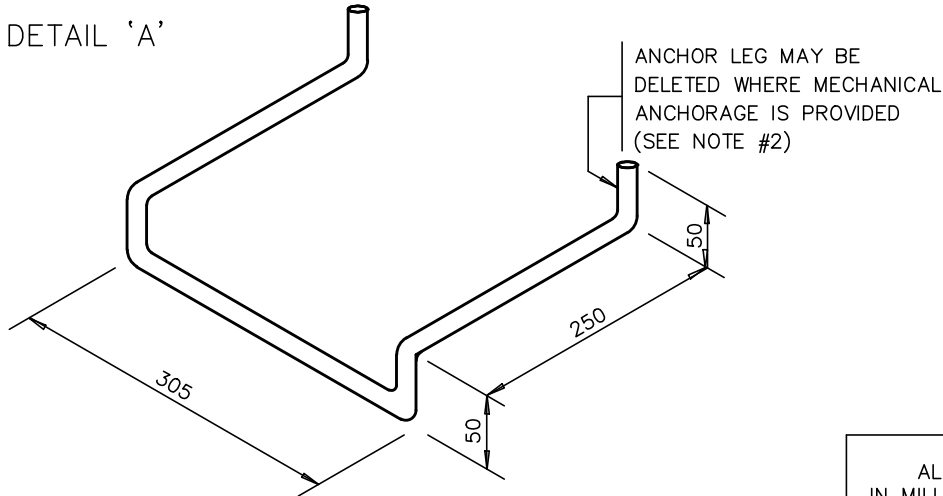
PLACEMENT:

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.



TYPICAL MANHOLE SECTION

DETAIL 'A'



ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED



General Municipal Servicing Standards

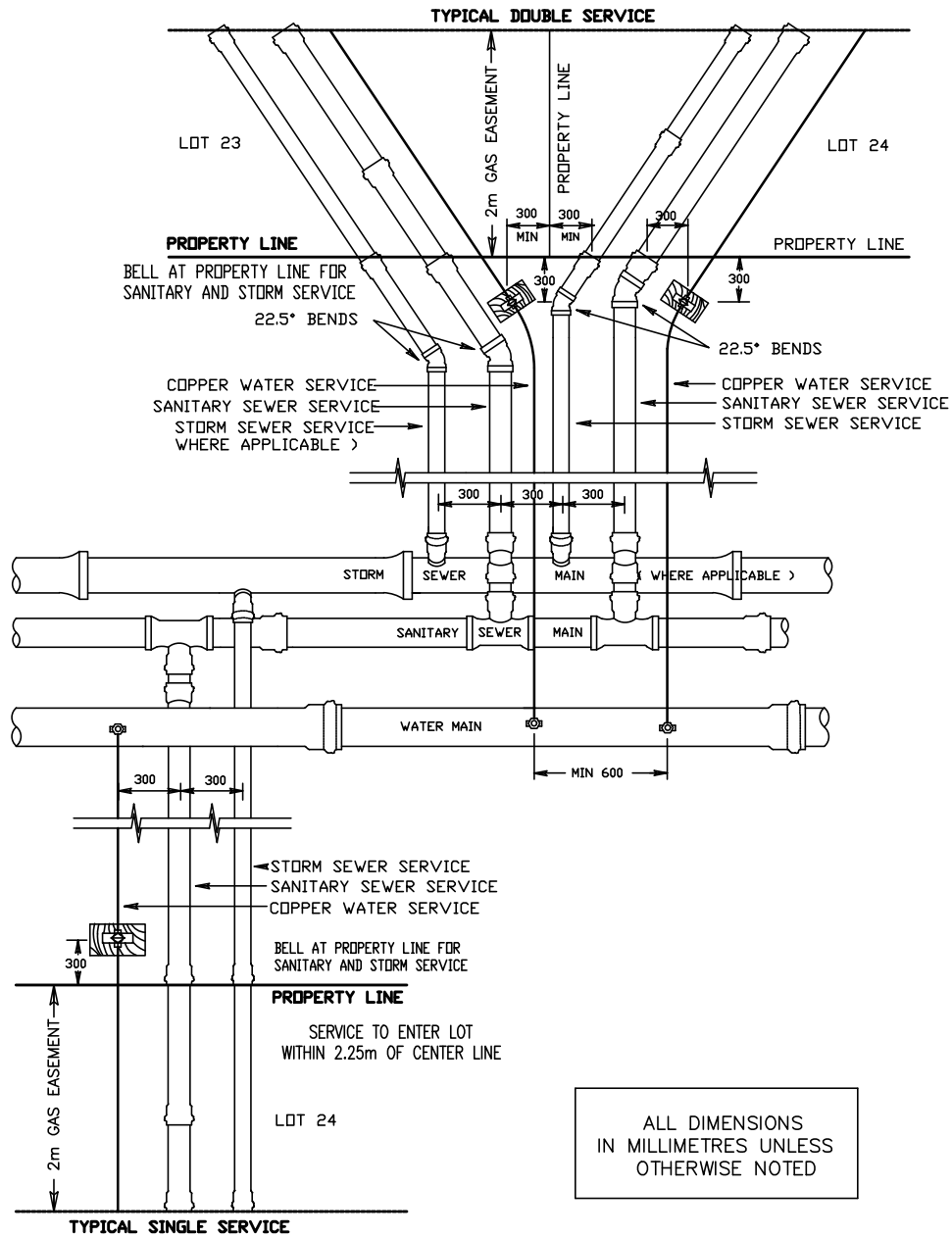


Rev.
Rev.
Rev.
Date: SEPTEMBER 2020
Scale: N.T.S.

Approved:

SAFETY STEPS FOR MANHOLES

Drawing:
E-08



NOTES:

1. WATER AND SEWER SERVICES MAY BE EXTENDED TO EDGE OF 2.0m GAS EASEMENT.
2. THE CITY 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. THE END OF COPPER WATER SERVICE PIPING SHOULD NOT BE CRIMPED CLOSED, PERMEABLE FILTER CLOTH MAY BE USED TO PREVENT INTRUSION OF DEBRIS AND TO ALLOW TESTING FLOW OF CURBSTOP.

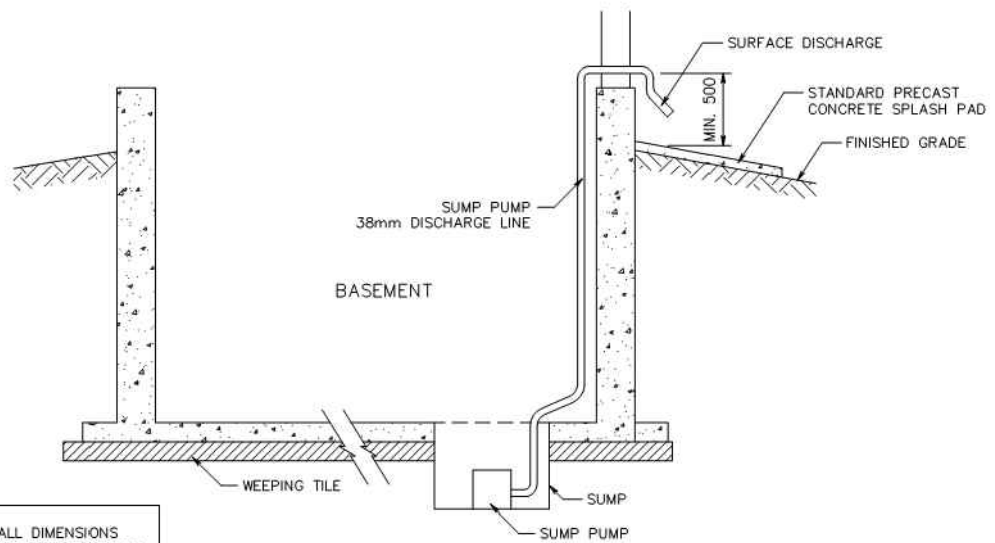


General Municipal Servicing Standards



Rev.
Rev.
Rev.
Date: FEBRUARY 2020
Scale: N.T.S.

TYPICAL SERVICES (SINGLE AND DUAL)	
Approved:	Drawing: E-09



ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

NOTES:

1. ROOF LEADERS (DOWNSPOUTS) OR ANY OTHER STORM WATER SOURCE MUST NOT BE CONNECTED TO THE SUMP DISCHARGE COLLECTION SERVICE LINE.
2. THE SURFACE DISCHARGE MUST BE INSTALLED TO PROVIDE AN OVERFLOW IN THE EVENT THAT THE STORM DRAINAGE SYSTEM CANNOT ACCOMMODATE FLOWS DUE TO CAPACITY, FREEZING OR OTHER PROBLEMS.



General Municipal Servicing Standards



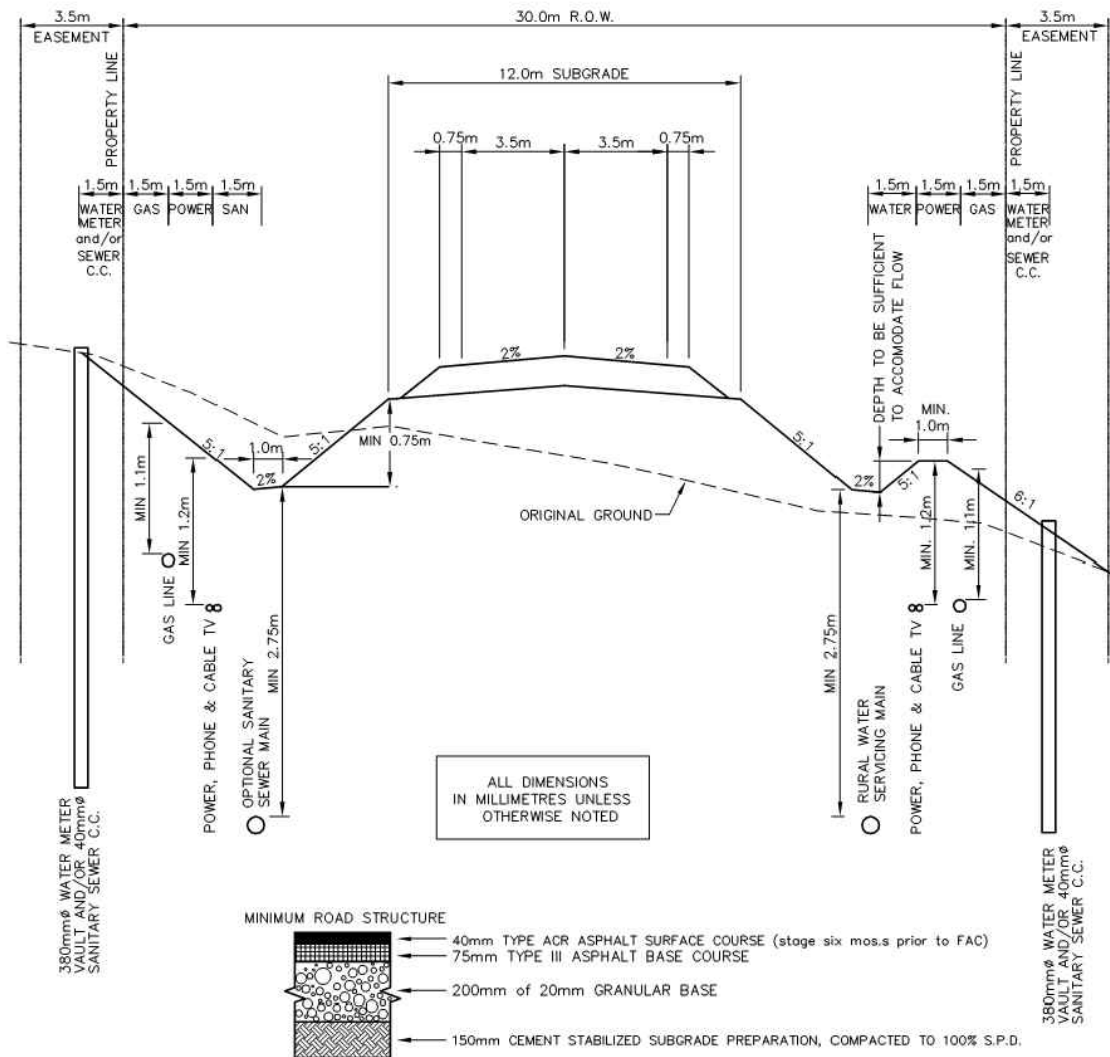
Rev.	
Rev.	
Rev.	
Date:	FEBRUARY 2020
Scale:	N.T.S.

TYPICAL SUMP PUMP
DISCHARGE CONNECTION

Approved:

Drawing:

E-10



- NOTES:
1. PROVISION FOR 7.5m FINISHED TOP AND 11.0m SUBGRADE ON CUL-DE-SAC ROADS PER LOT NUMBER AND SECOND ACCESS REQUIREMENTS.
 2. MINIMUM LONGITUDINAL GRADE FOR ROAD AND DITCH TO BE 0.6%.
 3. POSITIVE DRAINAGE IS TO BE MAINTAINED AT ALL LOCATIONS.
 4. DITCH DEPTH TO BE CONFIRMED BY GEOTECHNICAL REPORT.
 5. MINIMUM ROAD STRUCTURE SUBJECT TO REVISION BY GEOTECHNICAL REPORT RECOMMENDATIONS.
 6. ALL TRENCHES IN ROADS OR SIDESLOPE REQUIRE COMPACTION TO 98% STANDARD PROCTOR DENSITY.
 7. ALL TRENCHES IN DITCH BOTTOM OR BACKSLOPE TO 95% STANDARD PROCTOR DENSITY.



General Municipal Servicing Standards

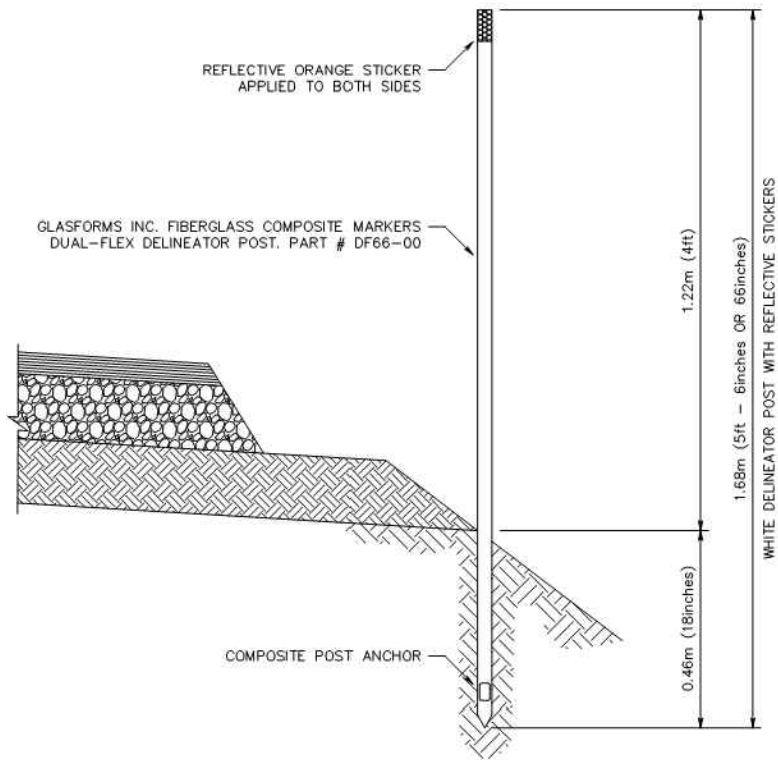


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Rev.
Rev.
Date: FEBRUARY 2020
Scale: N.T.S.

RESIDENTIAL SUBDIVISION ROAD 8.5m
FINISHED TOP ON 12.0m SUBGRADE

Approved:

Drawing:
E-11



NOTES:

1. POSTS TO BE INSTALLED AT EDGE OF SUBGRADE PREPARATION.
2. EACH POST TO INCLUDE ONE POST ANCHOR.
3. SIX POSTS REQUIRED PER SUBDIVISION ACCESS (EXCEPT ON CLASS I GRID ROADS).
4. TWO POSTS REQUIRED PER RESIDENTIAL ACCESS.



General Municipal Servicing Standards



Rev.	
Rev.	
Rev.	
Date:	FEBRUARY 2020
Scale:	N.T.S.

FLEXIBLE DELINEATOR POSTS

Approved:

Drawing:

E-12

1 GENERAL

- 1.1 The Developer and the Developer's Engineer are responsible to ensure that the storm 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 specification to be prepared by the Developer's Engineer. The proposed system must be integrated into latest approved County overall master stormwater plan.
- 1.2 The stormwater management system should be designed with major and minor drainage systems. In general, a **minor system** consists of piping, manholes, catch basins and outfall structures that have been designed in order to avoid property damage and flooding due to runoff generated by a 1 in 5 year rainfall event. A **major system** consists of the roads, gutters, lot drainage and detention facilities designed to direct runoff and minimize property damage by a 1 in 100 year rainfall event. When the capacity of the minor system is exceeded, the major system must provide a continuous overland flow route allowing the runoff to reach the designated ponding areas or receiving water body to minimize flooding and property damage.
- 1.3 Post development runoff rates shall not exceed the pre-development runoff rate for a given contributing area. The allowable discharge rate must be calculated by the Developer's Engineer and presented in a suitable Stormwater Management Plan. The proposed method of stormwater control must reduce the allowable discharge rate to a level that is acceptable to both the Municipality and the Province.
- 1.4 The design of both the major and minor systems must meet or exceed the requirements outlined in the Alberta Environment and Parks *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems*. Drainage diversions (pipes, ditches, berms, ditch checks, storm ponds, culverts, rip-rap) and other means of erosion control may require approval by the Ministry of Environment and Parks as applicable.
- 1.5 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 stormwater collection system and receiving water body.

- 1.6 Legislation, standards and guidelines that may affect the design and construction of stormwater management systems include (latest editions thereof):
- Alberta Environmental Protection and Enhancement Act (EPEA)
 - Alberta’s “Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems”
 - Alberta Public Lands Act
 - Stormwater Management Guidelines for the Province of Alberta
 - Alberta Wetland Restoration / Compensation Guide
 - Alberta Water Act
 - ASTM – American Society for Testing and Materials
 - County of Vermillion River Land Use Bylaw
 - County of Vermilion River Master Stormwater Management Plan
 - County of Vermilion River Master Stormwater Management Plan Technical Report Council Approved
 - County of Vermilion River Municipal Development Plan
 - County of Vermilion River and the City of Lloydminster Intermunicipal Development Plan
 - CSA – Canadian Standards Association
 - Federal Canadian Environmental Assessment Act (CEAA)
 - Federal Fisheries Act
 - Federal Navigable Waters Protection Act (NWPA)
 - Municipal Government Act
 - Municipal Policies and Procedures Manual

2 **MINOR SYSTEM****2.1** **Flow Rates**

- 2.1.1** The storm sewers shall be designed as a separate sewer system. Effluent from sanitary sewers or any potentially contaminated drainage shall not be discharged into the storm sewers.
- 2.1.2** The minor system shall be designed to accommodate the runoff generated from up to a 1:5 year 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.
- 2.1.3** Roof leaders should be discharged to the ground and drain away from the building, water supply well and septic bed. Provisions shall be made to prevent soil erosion. The municipal engineer may approve discharge of roof leaders to the storm sewer when conditions warrant in order to prevent erosion and/or property damage.
- 2.1.4** 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 five (5) metres from the building foundation and located to ensure that drainage flows away from the building.
- 2.1.5** For areas less than 65 hectares (ha) in size, computer modelling techniques are encouraged. However, the Rational Method may also be used in estimating flows for the design of the minor stormwater management system. For areas larger than 65 ha, computer modelling shall be used to determine the design flows. The Rational Method formula can be stated as follows:

$$Q = \frac{CiA}{360}$$

- Where
- Q = the design peak flow rate in cubic metres per second
 - C = the runoff coefficient (no units)
 - i = the intensity of rainfall corresponding to the time of concentration in millimetres per hour

A = the contributing area in hectares
1/360 = unit conversion factor.

2.1.6 Any rainfall intensity or other required Intensity-Duration-Frequency (IDF) data shall be taken from Intensity-Duration-Frequency Data as published by Atmospheric Environment Services, Environment Canada, 2014 edition or latest.

2.1.7 For minimum runoff coefficients refer to table 4.3 and Table 4.4 of the Storm Water Management Guidelines for the Province of Alberta, Alberta Environmental Protection, January 1999 edition or latest. The minimum runoff coefficients are summarized in the following table:

Land Use or Surface Characteristics	Storm Frequency	
	5 year	100 year
Residential	0.35	0.60
Apartments	0.70	0.80
Downtown Commercial	0.85	0.90
Neighborhood Commercial	0.65	0.80
Lawns, Parks, Playgrounds	0.20	0.30
Undeveloped Land (Farmland)	0.10	0.20
Paved Streets	0.90	0.95
Gravel Streets	0.25	0.65

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

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

- 2.1.9** The intensity for the rational formula is to be sought from Atmospheric Environment Services, Environment Canada. The Time of Concentration (T_c) is comprised of the sum of the inlet time and the 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.
- 2.1.10** For areas larger than 65 hectares, the Developer **must submit** acceptable computer modelling of the area for review.
- a) The selection of an appropriate computer model shall be based on an understanding of the principles, assumptions, and limitations in relation to the system being designed.
 - b) Wherever possible, the computer model shall be calibrated. In all analyses, the parameters used, the drainage boundaries, the pipe network, and its connectivity, shall be clearly identified on an overall drawing.
 - c) Computer printouts of the input and output files, and a design summary report describing the details of the modelling effort shall be provided.
 - d) Electronic input and output files will also be required for review and record keeping purposes.
- 2.1.11** Weeping tile flows must be presented in a detailed Geotechnical Hydrogeological Investigation prepared by a qualified geotechnical engineer or hydrogeologist. The report should outline expected weeping tile flows and any design and construction procedures required for foundation installation.

2.2 Pipe Sizing

The following design factors shall be used in determining the storm sewer pipe sizes:

Minimum pipe size for storm sewer main	-	300 mm
Minimum pipe size for foundation drains (main accommodating flow from weeping tiles ONLY)	-	150 mm
Minimum pipe size for catch basin leads	-	250 mm
Manning's Formula "n" (concrete and PVC pipe)	-	0.013
Manning's Formula "n" (CSP pipe)	-	0.024
Minimum flow velocity when flowing full	-	0.6 m/s
Preferred minimum flow velocity when flowing full	-	0.9 m/s
Maximum flow velocity	-	3.0 m/s
Minimum grade for catch basin leads	-	1.0%
The minimum grade of the first upstream leg	-	0.5%

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 %
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 %

Minimum slope on curved sections:

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

2.3 Storm Sewer Alignment, Separation, and Location

- 2.3.1** Storm sewer mains shall be located within the road right-of-way and outside the carriageway in accordance with the typical roadway cross section.
- 2.3.2** Storm sewers shall be separated at 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.
- 2.3.3** Public Utility Lot (PUL) widths shall be at least 6.0 m for a single storm line.
- 2.3.4** Curved sewers shall run parallel to the curb or road centreline.

2.4 Required Depth for Storm Sewers and Catch Basin Leads

Storm sewers shall be installed at a sufficient depth to meet the following requirements:

- 2.4.1** The main shall have a minimum depth of cover of 2.7 m measured from finished grade to the invert.
- 2.4.2** The storm sewer shall have sufficient depth of cover to provide complete frost protection.
- 2.4.3** Where existing conditions dictate that the depth of bury be less than 2.7 m, the main/service is to be insulated.
- 2.4.4** The main shall have enough depth to allow all required building foundations to drain by gravity to the sewer. Special consideration should be taken when building floor elevations are lower than the roadway. Service lines shall have a minimum cover of 2.0 m from the finished lot surface to the top of pipe at the property line.

- 2.4.5** The catch basin leads shall have a minimum of 1.5 metres of cover measured to the top of pipe.
- 2.4.6** Under normal conditions, storm sewer mains shall cross below water mains with enough clearance to allow for proper bedding and structural support of the pipes. Pipe clearance when passing under any watermain shall be a minimum of 300 mm separation between the top of the sewer pipe and the bottom of the watermain.
- 2.4.7** Pipe clearance when passing over any 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 when possible.

2.5 Manhole Design and Location

- 2.5.1** Manholes shall be located at the end of each line, at all changes in pipe size, at all junctions, at all changes in grade and alignment.
- 2.5.2** The maximum distance between manholes shall not exceed 150 m.
- 2.5.3** All manholes shall be a minimum 1200 mm minimum inside diameter.
- 2.5.4** Precast manhole vaults or an oversized manhole barrel shall be used on mains of 900 mm in diameter or greater.
- 2.5.5** Manholes shall be located at the extension of property lines whenever possible in order to avoid conflicts with driveways.
- 2.5.6** The drop across manholes should be of sufficient magnitude to account for any energy losses in the manhole.
- 2.5.6.1** pipe deflections of less than 45° require a drop of at least 30 mm
- 2.5.6.2** pipe deflections of 45° to 90° require a drop of at least 50 mm
- 2.5.7** Invert drops for pipes larger than 600 mm or for high flow situations shall be assessed on an individual basis.

2.5.8 The obvert elevation of a sewer entering a manhole shall not be lower than the obvert elevation of the outlet pipe.

2.5.9 Pipe deflections in manholes shall not be greater than 90°.

2.6 Storm Services and Foundation Drains

2.6.1 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 collection systems with surface discharge shall not be permitted in areas with urban road cross sections.

2.6.2 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.

2.6.3 When required, separate storm sewer or foundation drain service connections shall be provided for each separately titled lot.

2.6.4 The minimum size of a residential storm sewer or foundation drain service shall be 100 mm in diameter. Non-residential service connections shall be sized according to anticipated flow.

2.6.5 Connections for all proposed residential lots requiring storm sewer or foundation drain services shall be installed at the time of initial subdivision development.

2.6.6 The minimum grade for a storm sewer or foundation drain service line shall be 2.0%.

2.6.7 Services shall be located such that they do not conflict with driveway locations.

2.6.8 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 past the easement.

2.7 Catch Basins and Leads

- 2.7.1** The maximum surface/gutter flow distance shall be 150 m.
- 2.7.2** The catch basin grates, leads and spacing shall be designed such that there will be no ponding during a 1:5 year rainfall event.
- 2.7.3** At sag locations, the determination of the required capacity must account for flow that may bypass inlets at upstream gutter locations.
- 2.7.4** The minimum inside diameter for a pre-cast catch basin shall be 610 mm.
- 2.7.5** The minimum sump depth in catch basins shall be 600 mm.
- 2.7.6** Gutter flow shall be intercepted by a catch basin prior to crossing a walkway wherever possible.
- 2.7.7** The depth of flow in gutters should not exceed the top of curb at any point.
- 2.7.8** Catch basins shall be located at the BC or EC of any curb return.
- 2.7.9** The maximum length of a catch basin lead shall be 30 metres. If the length must exceed 30 metres, a catch basin manhole must be installed on the upstream end.
- 2.7.10** All leads shall be connected to a manhole or catch basin manhole at the downstream end.
- 2.7.11** Catch basins and leads shall not be placed beyond the public right-of-way. Lots must be filled and graded to ensure that all runoff drains to a public right-of-way.
- 2.7.12** The minimum size of catch basin leads shall be 250 mm in diameter with a minimum grade of 1%.
- 2.7.13** The lead from a catch basin manhole to a main line manhole shall be a 300 mm pipe with a minimum grade of 1%.
- 2.7.14** The minimum grade on a catch basin lead shall be 1. %.

2.7.15 Minimum depth of cover shall be 1.5 metres to top of pipe.

2.8 Storm Sewer Materials

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

2.8.2 Where specific products are specified, it is intended that approved equals are also acceptable. Approval must be obtained by the Municipal Engineer prior to installation.

2.8.3 PVC pipe and fittings shall conform to the following:

2.8.3.1 CSA B182.2, ASTM D3034, ASTM F679, NQ 3624-130 and NQ 3624-135 standards with minimum stiffness of 320 kPa. Service lines shall a minimum stiffness of 625 kPa.

2.8.3.2 Ultra Rib PVC or approved equal is acceptable from 250 to 600 mm. Pipe shall conform to CSA B182.2 and ASTM F794 with a minimum stiffness of 320 kPa.

2.8.3.3 Standard Dimension Ratio (SDR) 35 unless otherwise indicated on the drawing.

2.8.3.4 Sealing gaskets shall meet requirements of CSA B182.2 and ASTM F477.

2.8.3.5 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.

2.8.3.6 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.

2.8.3.7 Pipe and fittings shall be installed within two years from the production date indicated on the certification.

2.8.4 Concrete pipe and fittings shall conform to the following:

- 2.8.4.1** All concrete pipe shall be manufactured using Type V sulphate resistant cement CSA A3000.
- 2.8.4.2** Non- reinforced concrete pipe shall conform to CSA A257.1, minimum Class 3 and ASTM C14.
- 2.8.4.3** Reinforced concrete pipe shall conform to CSA A257.2 and ASTM C76.
- 2.8.4.4** Flexible rubber gasket joints shall conform to CSA 257.3 and ASTM C443.
- 2.8.4.5** 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.
- 2.8.4.6** Each concrete pipe shall be marked with the manufacturer's name, date of casting and quality testing passing stamp.

2.9 Manhole Materials

- 2.9.1** Manholes shall be manufactured using Type 50 sulphate resistant cement with a 28-day strength of 25 MPa. The maximum allowable slump shall be 75mm.
- 2.9.2** Manhole sections shall be pre-cast reinforced concrete conforming to ASTM C478 and CSA A257.
- 2.9.3** All manholes shall have an inside diameter of 1200 mm for pipe diameters less than 900 mm. For pipe exceeding 900 mm or manholes having multiple inlets, manhole sizing shall be subject to review by the Municipal Engineer.
- 2.9.4** Manhole steps shall be standard safety type, hot dipped galvanized iron conforming to ASTM A615 and ASTM A123 or aluminium forged from 6061-T6, 6351-T6.
- 2.9.5** All joints shall be sealed with rubber gaskets conforming to ASTM C443 and grouted with non-shrink grout.

- 2.9.6** Manhole frames and covers shall be cast iron conforming to Class 20 ASTM A48 and ASTM A536. Type NF80 covers shall be used for all streets and driveways, type NF90 covers with rubber gasket shall be used for manholes located in sags and low areas and type F39 covers shall be used for all other areas. Castings shall be marked with series designation, foundry identification and date of casting. Manhole covers with County of Vermilion River identification will be encouraged. Manhole covers with names of other municipality names are not permitted.
- 2.9.7** Pre-benched manhole bases shall be use wherever possible with pre-cored connection holes and watertight Duraseal or G-Loc joints or approved equal.
- 2.9.8** Tee Riser manholes shall conform to CSA 257.2, ASTM C76 and CSA A257.4, ASTM C76.
- 2.9.9** Safety platforms are required for all manholes greater than 7.0 m in depth.
- 2.9.10** All pre-cast units shall be marked with manufacturer's identification, date of casting, type of cement and CSA standard.
- 2.10 Catch Basin Materials**
- 2.10.1** Catch basin barrels shall be manufactured using sulphate resistant Type V cement.
- 2.10.2** Catch basin frames and grates shall be cast iron conforming to Class 20 ASTM A48 and ASTM A536. Type F38 or F39 grates shall be used for all round top inlet catch basins, type F51 or F36A grates shall be used for straight face curbs and type F33, K7 or DK7 shall be used for rolled face curb. Any other types must obtain approval by the Municipal Engineer. Castings shall be marked with series designation, foundry identification and date of casting.
- 2.10.3** If required, catch basin steps shall be standard safety type, hot dipped galvanized iron conforming to ASTM A615 and ASTM A123 or aluminium forged from 6061-T6, 6351-T6.

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

2.11 Trenching, Bedding and Backfilling

2.11.1 All trenching and backfilling shall be completed in strict accordance with Occupational Health and Safety Guidelines.

2.11.2 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.

2.11.3 Class "B" pipe bedding shall be used 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, shall extend up both sides to the trench wall and provide a minimum cover of 300 mm above the pipe. The Developer's Engineer shall identify special pipe foundation measures for areas where unsuitable pipe foundation conditions exist.

2.11.4 The minimum trench width measured at the pipe springline shall be the pipe outside diameter plus 450 mm. The maximum trench measured at the pipe springline shall be the pipe outside diameter plus 600 mm. The Municipal Engineer must be notified if the trench must be excavated deeper or wider than specified.

2.11.5 Excavated material shall be stockpiled at a safe distance from the edge of the trench.

2.11.6 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.

2.11.7 Trench excavations shall be kept free of water as required.

2.11.8 It shall be the Developer's responsibility to ensure that the utility trenches are adequately compacted.

- 2.11.8.1** Native backfill under existing or proposed roads or laneways shall be compacted throughout the entire right-of-way disturbed width to:
- 98% standard proctor density from subgrade to 1.5 m below subgrade or original ground, whichever is lower;
- 95% standard proctor density greater than 1.5 m from the subgrade or original ground, whichever is lower;
- 2.11.8.2** Granular backfill under existing or proposed roads or laneways shall be compacted to 98% of standard proctor density throughout the entire trench depth below subgrade and the entire right-of-way width.
- 2.11.8.3** Backfill in all other areas shall be compacted to 95% standard proctor density.
- 2.11.8.4** Subgrade and base course compaction for roadway construction shall be as specified in Section G.
- 2.11.8.5** If the above standards cannot be achieved due to a large variation in soil types throughout the development, the Municipal Engineer, at his or her sole discretion, may 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.
- 2.11.9** If the 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 will not be permitted as an alternate testing procedure due to wet soil conditions. The Developer's engineer will be required to suggest appropriate measures such as drying in-situ material or importing suitable material in order to meet the required Standard Proctor Densities.

2.11.10 All landscaping, pavement structures, sidewalks, curb and gutter damaged or removed during trenching shall be restored or replaced unless otherwise directed by the Municipal Engineer.

2.11.11 All debris, surplus fill and unused materials must be removed from the site.

2.12 Storm Sewer Installation

2.12.1 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.

2.12.2 Pipe installation shall start at the outlet and work upstream.

2.12.3 Align pipes carefully when jointing. Keep joints free of mud, gravel and foreign material and apply sufficient pressure to ensure that the joint is complete as outlined in the manufacturer's specifications. Complete each joint before laying the next length of pipe. Deflections shall not exceed those permitted by the manufacturer.

2.12.4 The pipe must be thoroughly flushed of all dirt, stones and pipe lubricant when complete.

2.12.5 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 diameter.

2.12.6 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.

2.13 Manhole Installation

2.13.1 Manholes shall be installed as depicted on the detail drawings and in accordance with manufacturer's recommendations.

2.13.2 Backfill around manholes shall be compacted to a minimum of 98% Standard Proctor Density.

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- 2.13.3** Tee Riser manholes shall require Class A bedding to the elevation of the springline.
- 2.13.4** Pre-cast manhole bases shall be installed on a base of 100 mm to 300 mm washed gravel.
- 2.13.5** Cast in place manhole bases approved by the Engineer shall be placed directly on undisturbed ground.
- 2.13.6** 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-03 for details.
- 2.13.7** The frame and cover shall be installed following manufacturer's recommendations.
- 2.14 Inspection and Testing**
- 2.14.1** All sewer installations shall be subject to inspections by the Municipal Engineer prior to issuance of the Warranty Commencement Certificate (W.C.C.) and Final Acceptance Certificate (F.A.C.).
- 2.14.2** Video inspections by qualified personnel are required prior to W.C.C. for all sewers less than 1200 mm in diameter. A walk-through inspection is permitted for any sewer 1200 mm and larger. A written report including still photographs and/or a video tape recording of the entire inspection shall be submitted to the Municipal Engineer for review. The report shall indicate the location and severity of all leaks, cracks, breaks, collapses, deflections, sags, obstructions and any other defects affecting the performance of the line. Sections requiring repair will be subject to re-inspection when complete.
- 2.14.3** Re-inspection by camera may be required on suspect areas prior to F.A.C. at the discretion of the Municipal Engineer. All video inspection costs shall be borne by the Developer.

2.14.4 All material testing (backfill densities) 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.

2.14.5 An infiltration and/or exfiltration test may be required at the Municipal Engineer's sole discretion for any section showing deficiencies during the camera test.

2.14.5.1 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.

2.14.5.2 The allowable leakages are as follows:

- Infiltration Test: Performed when the groundwater is above the pipe crown for the entire test length. Allowable infiltration is 5.0 L/day/mm dia./km for PVC pipe and 20.0 L/day/mm dia./km for concrete pipe.
- Exfiltration Test: Performed when the groundwater is below the pipe invert for the entire test length. Allowable exfiltration is 5.0 L/day/mm dia./km and 20.0 L/day/mm dia./km for concrete pipe.

3 MAJOR SYSTEM

3.1 General

3.1.1 The overall major drainage system for the Urban Services Areas must be designed to provide continuous overland flow routes with minimum depths of ponding in roadway sags and to provide overflow routes at all storm water management facilities. The development of the major drainage system framework shall be a key component of the Storm

Water Management Plan to be developed by the Developer's Engineering Consultant for new drainage basins (watersheds).

3.1.2 The major system shall accommodate a 1:100 year storm condition with maximum surcharging in the roadway gutter of 180 mm. If downstream constraints require a gutter flow in excess of 180 mm, special modelling and design calculations shall be submitted to the County for review. The County shall determine the extent, if any, of a relaxation of the maximum 180 mm gutter flow standard on an individual basis. The major drainage system shall be fully contained within the boundary of public property.

3.1.3 Arterial roads shall not be a part of the major overland flow system. Where the slope of the terrain makes it particularly difficult to prevent the major drainage from accessing an arterial right-of-way the County Engineer may grant the Developer permission to discharge primary drainage flow on to the arterial right-of-way subject to:

- 3.1.3.1** no adverse impact on the drainage on the arterial road, or
- 3.1.3.2** the opportunity for the provision of a depressed swale or pathway with sufficient flow and/or storage capacity to accommodate a 1:100 year storm event and carry the flow to the point of discharge into an off arterial overland flow route, and
- 3.1.3.3** the Developer's agreement to pay for the cost of such additional works or charges needed to accommodate the increased discharge.

3.1.4 Provisions must be taken to employ control/abatement measures so that construction material and debris does not enter any storm water management facility at any point during subdivision construction.

3.1.5 Grading

Carefully designed and controlled lot grading is an important component of the Major System. Lots shall be designed to drain from back except under extreme cases where the Developer can satisfy the

County Engineer that back to front drainage is not technically feasible. If an alternate system is required it must be designed so that surface water crosses the fewest lots possible in its path to the street. No more than 2 lots shall be crossed. In extreme cases the County Engineer may permit more than 2 lots to be crossed provide a concrete drainage swale and easements are established. The potential problem areas shall be identified in the storm water management plan.

3.2 Lot Grading

- 3.2.1** Proper lot grading is the first step towards a well-planned major drainage system. The goal of the lot grading shall be to ensure that water flows away from the building, water supply well, and septic bed, and in no case shall ponding levels come within 150 mm from the finished ground elevation at the building during a 1:100 year rainfall event. 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 development and existing topography.
- 3.2.2** 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 right-of-ways are in place to accommodate drainage directly from the lot without crossing adjacent lots. The Developer will be required to submit a building grade certificate for each lot showing all relevant features including, but not limited to, elevations, grades, property lines, shallow and deep utility locations, and all other features.
- 3.2.3** The slope shall be at a minimum grade of 2.0% on all sides away from the building to the property boundary. Larger slopes are desirable if topography allows up to a maximum of 10%. If the backyard slopes towards the building, provisions must be made to keep stormwater runoff at least 3 m from the building and runoff must be directed away for subsequent collection.
- 3.2.4** Reserves, and public lands shall be graded to drain towards developed streets, lanes, and/or the storm drainage system.

3.3 Swales

- 3.3.1** Drainage swales on municipal or private property shall be constructed prior to any development of subdivision lots. Complete swale construction shall be a prerequisite to the issuance of the Warranty Commencement Certificate.
- 3.3.2** Drainage swales located on private property shall be covered by an easement in favour of the County. A minimum clearance of 200 mm should be provided between the edge of the swale and the property line. Major rainfall event flows shall be contained within the easement.
- 3.3.3** Drainage swales crossing several properties for the collection of runoff shall not be permitted unless special circumstances warrant.
- 3.3.4** Concrete swales shall be required when accommodating flow from more than three adjacent lots.
- 3.3.5** Earthen swales shall be protected from erosion by grass cover, appropriate ground cover or geotextile fabric.
- 3.3.6** The minimum design slope for concrete swales on private property is 0.75%.
- 3.3.7** The minimum design slope for concrete swales on public property is 0.5% or as required to provide adequate hydraulic capacity.
- 3.3.8** The minimum design slope for swales without a concrete gutter is 1.5%.

3.4 Roadways

Grading of streets comprising the major drainage system shall follow the guidelines listed below:

- 3.4.1** Continuity of overland flow routes between adjacent developments shall be maintained.
- 3.4.2** Collectors shall have at least one lane that is not inundated.

3.4.3 Local roads should not have a depth of water more than 50 mm above the crown of the road.

3.4.4 The depth of water at the curb shall be less than 300 mm for all roadways.

3.5 Stormwater Storage Facilities

3.5.1 General

3.5.1.1 This section identifies the general design parameters for the planning and design of stormwater storage facilities.

3.5.1.2 A storm water management plan must be prepared by the Developer providing a detailed description of the development area including overland flow, catchment areas, natural storage and planned storage.

3.5.1.3 Several different storage methods may be employed for a stormwater storage facility such as:

3.5.1.3.1 Retention Storage (wet ponds) – collects and stores runoff for a period of time and releases it after the inflow has ceased. Retention storage also includes constructed wetlands.

3.5.1.3.2 Detention storage (dry ponds) – 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.

3.5.1.3.3 Channel Storage – channels constructed with wide bottoms and small grades will provide a type of storage as the channel fills with water. The Municipality will not permit roadside ditches to be used as channel storage.

- 3.5.1.4** The design of the storage facility shall be based on a 1:100 year return period 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.
- 3.5.1.5** These minimum standards are not intended to restrict Developers from formulating innovative stormwater management processes intended to protect the environment and improve the stormwater quality prior to release. All stormwater management plans must be submitted to the County for review and approval.
- 3.5.1.6** The developer and his Engineering consultant must address the guidelines presented in the latest edition of the Government of Alberta publication "Stormwater Management Guidelines for the Province of Alberta"
- 3.5.1.7** Storm water quality best management practices shall be an objective in the design of storm water management facilities.

3.5.2 Design Standards for Lakes and Wet Ponds

- 3.5.2.1** 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).
- 3.5.2.2** Private property subject to potential flooding shall be covered by an easement in the favour of the County.
- 3.5.2.3** A restrictive covenant shall be placed on the lots abutting the facility as required to control development that will restrict the capacity.

- 3.5.2.4** The design shall incorporate a semi-annual turnover at average annual precipitation.
- 3.5.2.5** The high water level (HWL) shall be at least 300 mm below the lowest building opening on adjacent lots.
- 3.5.2.6** The minimum surface area at normal water level shall be 2 ha in order to discourage a large number of small facilities.
- 3.5.2.7** The lake (pond) shall have maximum (i.e. steepest) side slopes of 3H : 1V from the lake bottom to 1 m below the NWL. Slopes above this level shall have a maximum (i.e. steepest) slope of 7H : 1V. These slopes may be revised in confined spaces or areas with extreme topography at the discretion of the Municipal Engineer.
- 3.5.2.8** The maximum water level fluctuation (active storage) for wet ponds during the 1:100 year storm event shall be 1.5 m measured from the NWL to the HWL.
- 3.5.2.9** A minimum freeboard of 0.3 m (300 mm) above the HWL must be provided.
- 3.5.2.10** The minimum depth from the NWL to the lake (pond) bottom shall be 2.5 m to discourage growth of vegetation.
- 3.5.2.11** Where the ground water level is below the NWL, the lake (pond) bottom shall be of impervious material. Where the ground water level is near or above the NWL, the lake (pond) bottom may be made of a pervious material based on geotechnical investigation.
- 3.5.2.12** Inlets and outlets are to be placed to maximize detention time and water circulation thereby avoiding hydraulic “short-circuiting” and dead storage areas.
- 3.5.2.13** Sediment traps, pre-treatment sumps, or sedimentation forebays shall be provided at each inlet.

- 3.5.2.14** Inlet and outlet pipes are to be fully submerged and at least 200 mm above the lake (pond) bottom and 1.0 m below the NWL.
- 3.5.2.15** The inlet manhole invert shall be at or above the NWL to avoid sedimentation.
- 3.5.2.16** Provision shall be made to drain the lake (pond) completely by gravity or portable pump system.
- 3.5.2.17** An overflow channel and overland drainage route (emergency overflow spillway) must be provided at the high water level (HWL).
- 3.5.2.18** Edge treatment is required for erosion protection due to wave action from 0.3 m (300 mm) below the NWL to 0.3 m (300 mm) above the NWL.
- 3.5.2.19** All weather vehicle access must be provided to all control works. Access to the lake for launching boats shall also be available.
- 3.5.2.20** Approved fencing and signage shall be installed where necessary for safety purposes.
- 3.5.2.21** The shoreline treatment between the high water level (HWL) and the normal water level (NWL) shall be chosen to ensure that erosion does not occur and natural wetland vegetation develops.

3.5.3 Design Standards for Dry Ponds

- 3.5.3.1** 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).
- 3.5.3.2** Private property subject to potential flooding shall be covered by an easement in the favour of the County.

- 3.5.3.3** A restrictive covenant shall be placed on the lots abutting the facility as required to control development that will restrict the capacity.
- 3.5.3.4** All 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.
- 3.5.3.5** The maximum storage depth shall be 1.5 m measured from the invert of the outlet pipe.
- 3.5.3.6** The pond shall be designed to drain completely after excess flow has dissipated. The pond bottom shall have a minimum slope of 1.0% towards the outlet.
- 3.5.3.7** Side slopes shall have a maximum slope of 7H:1V within private property and 5H:1V within public property.
- 3.5.3.8** A minimum freeboard of 0.3 m (300 mm) above the HWL must be provided.
- 3.5.3.9** Grass cover shall be established after completion of construction.
- 3.5.3.10** Where possible, dry ponds should be aesthetically contoured and landscaped to provide an attractive feature for the subdivision. Alternate uses for dry ponds, commensurate with the municipal reserve land use designation, should be explored (sport fields, passive park uses, etc.) at the discretion of the Director of Planning and Development.
- 3.5.3.11** All inlets and outlets shall have grates with a maximum bar spacing of 150 mm over their openings in order to prevent unauthorized access. The possibility of plugging shall be considered in the sizing of the outlet pipe. Maximum flow through the grating shall be 1.0 m/sec.

3.5.4 Inlets, Outlets and Outfall Structures

- 3.5.4.1** Obverts of outfall pipes shall be above the 1:5 year flood level of the receiving drainage course.
- 3.5.4.2** Inverts shall be above the winter ice level or completely submerged with obverts 1.0 m below NWL.
- 3.5.4.3** Drop structures, energy dissipaters, riprap and filter fabric shall be used where necessary to prevent erosion.
- 3.5.4.4** Removable grates shall be installed on openings to discourage unauthorized access.
- 3.5.4.5** All piped inlets and outlets for stormwater storage facilities shall be capped with compacted clay or other impervious material at the pond inverts in order to prevent water from washing out the granular bedding material.
- 3.5.4.6** A silt trap shall be provided at the inlets of each pond (sedimentation forebay).
- 3.5.4.7** A defined path via publicly owned land or established drainage courses shall be identified and designed to carry flows when the design storage is exceeded.
- 3.5.4.8** The lake (pond) and perimeter area design must allow for vehicle access to inlets, outlets, and other facilities requiring maintenance.

3.6 Erosion and Sediment Control (ESC) Plan

- 3.6.1** For any land disturbing construction project, the proponent shall prepare a project specific Erosion and Sediment Control (ESC) Plan outlining appropriate preventive measures against potential erosion and sedimentation. An ESC plan shall comprise of a report and a detailed drawing illustrating structural and vegetative erosion and sediment control measures for the specific project.

- 3.6.2** Latest versions of Alberta Transportation Design Guidelines for Erosion and Sediment Control for Highways, City of Lloydminster Erosion and Sedimentation Control Guidelines and/or other industry standard guidelines may be utilized in preparing the ESC plan.
- 3.6.3** The ESC plan report should include as a minimum the following:
- Project description including proposed construction activities and the area to be disturbed.
 - Existing site conditions including soil, topography, vegetation and drainage.
 - Adjacent features such as stream, lakes, residential areas, road, environmental reserves, etc., which may be affected by the land disturbance.
 - An assessment of potential erosion and sedimentation.
 - Any temporary and permanent structural and/or non-structural erosion and sediment control practices including specifications.
 - Inspection and maintenance schedule of ESC structures.
- 3.6.4** The ESC plan drawing should include as a minimum the following:
- Site plan with contours.
 - Limits of clearing and grading.
 - Drainage patterns
 - Existing vegetation - Show the existing tree lines, grassed areas, or unique vegetation.
 - Critical erosion areas with potentially serious erosion problems.
 - Location of temporary and permanent ESC structures and vegetations
 - Appropriate details, notes and specifications of the ESC practices for proper installation, maintenance and inspection.
- 3.6.5** The ESC plan shall be certified by a Professional Engineer or a Certified Professional in Erosion and Sediment Control (CPESC) and to be

submitted as a separate package along with other design drawings/documents. The ESC plan drawing and report should bind into one document.

- 3.6.6** The proponent shall notify the County and submit an updated ESC plan should the original plan changes.

4 WETLANDS

4.1 Constructed Wetlands

Constructed wetlands are preferred over wet ponds. Constructed wetlands consist of a forebay and a shallow environment suitable for the growth of aquatic and semi-aquatic plants. They may be used to provide an enhanced level of water treatment via sedimentation, filtration, and biological uptake. Constructed wetlands may be built in conjunction with downstream wet ponds and/or wetlands.

In order to assist developers and designers in understanding design requirements for constructed wetlands, a basic set of regulatory standards, supporting documents, and guidelines which may be referenced for the design and installation of wetlands include the following:

- Alberta Wetland Policy
- Alberta Guide to Wetland Construction in Stormwater Management Facilities
- Alberta Wetland Assessment and Impact Report Directive
- Alberta Wetland Classification System
- Alberta Wetland Identification and Delineation Directive
- Alberta Wetland Mitigation Directive
- Alberta Wetland Rapid Evaluation Tool-Actual (ABWRET-A) Guide
- Alberta Wetland Restoration Directive
- Directive for Permittee-Responsible Wetland Construction in Alberta

- Guide to the Alberta Wetland Rapid Evaluation Tool-Actual (ABWRET-A) for the Boreal and Foothills Natural Regions

Additional information may be found in the following publications:

- The Canadian Wetland Classification System
- City of Edmonton Wetland Strategy 2012
- Draft Guidelines for Constructed Stormwater Wetlands – City of Edmonton
- Integrating Natural Wetlands and Improving Design of Naturalized Storm Water Management Facilities in the City of Edmonton.
- Wetland Conservation Plan – City of Calgary
- Wetland Design Guidelines – City of Saskatoon
- Wetland Evaluation Guide. North American Wetlands Conservation Council (Canada).

4.1.1 Overall Configuration

- Where possible, a wetland should be limited to 1 inlet and 1 outlet.
- Minimum side slope is 7:1.
- Active storage fluctuation depth should be limited to 1.8 m.
- Minimum 1.0 m of freeboard is required.
- The Government of Alberta has indicated (1999, 2006, 2013) that, as a general rule, the constructed wetland size should be approximately 5% of the watershed area it services, with a minimum tributary drainage area of 5 ha.

4.1.2 Inlet Pipe Configuration

- Inlets should be located with the longest flow path possible between inlet and outlet to minimize short circuiting.

- Submerged inlets are preferable, where the crown of the inlet pipe requires a minimum of 0.8 m below NWL, and the invert a minimum of 100 mm from the wetland floor.
- Unsubmerged inlets can be used provided the pipe invert is set at the HWL, and the inlet has a grating.
- If pre-treatment of flow through a forebay vortex separator is not possible, a skimming type manhole on the first manhole upstream of the inlet is recommended to prevent floatables from entering the wetlands.
- Inlet velocities should be limited to 1.5m/s where possible to minimize erosion or scour.
- Erosion control measures must be provided at the bottom of the inlet structure to control erosion and scour.

4.1.3 Sediment Forebay

- Sediment forebays should be designed to Alberta Environment Standards.
- Forebay area is not to exceed one-third of the permanent pool surface area.
- Forebays are typically separated from the wetland by gabions, rip-rapped berm, or by an earthen berm with a controlled overflow with erosion protection. The height of the gabions or berm can be from 0.15m to 0.3 m below the NWL.
- Minimum length to width ratio of the forebay is 2:1.
- Flow baffles or other means of lengthening the flow path could be considered if minimum length to width ratio cannot be maintained.
- Forebay depth range is from 1-3 m.

4.1.4 Permanent Pool Configuration

- Minimum side slope below NWL is 5:1.
- Permanent pool depths typically range from 150 mm – 300 mm.
- Deep zones with a minimum depth of 1 m should be introduced to redistribute flow across the wetland to encourage sheet flow.

Any interior berms used for flow attenuation will have a minimum side slope of 5:1 below NWL, and 3.5:1 above. Width of the top of the berm will be a minimum of 1 m for foot traffic, and 3 m for vehicle traffic.

4.1.5 Wetland Outlet Configuration

- There are two main outlet flow structure configurations: reverse sloped outlet pipe and a perforated riser outlet pipe. The precise details of the outlet structure will be evaluated on a case-by-case basis.
- It is preferable that all outlet pipes be fully submerged with the crown of the pipe a minimum of 0.8 m below discharging wetland NWL, and a minimum of 100 mm above wetland floor.
- Outlet control structures should be designed so that water level depth can be controlled in the wetland, including complete draining of the wetland.

4.1.6 Vegetation Establishment

- After excavation, grading, and 75 mm to 150 mm of top soil placement, if manually planting emergent vegetation such as bare root, plugs, or potted material, the wetland should be kept flooded (saturated) until planting. At least 48 hours prior to planting, the wetland should be drained. After planting the soil must be kept saturated with minimal standing water of 100 – 200 mm until the plants are well established and have a growth to more than 0.5 m height. The wetlands can then return to normal functionality.

- Maximum drain time after a rain event should be kept to 48 hours to protect the viability of young plants.
- Experience suggests that from the time of germination to the time when the wetland can be brought up to the NWL is about 6-8 weeks.
- Maintaining saturated conditions can be done by pumping water into the wetland if dry conditions are present. This is particularly important if using wetland soils containing viable rhizomes/roots. If the wetland is being constructed with non-wetland soils, the wetland can remain dry until about one week before planting.
- When establishing or restoring vegetation, inspection every 2 weeks of vegetation health, density, and diversity should be performed.
- If the earthworks can be completed in the summer/fall period, the wetland can be seeded in the fall.
- If the wetland bottom elevation will not change and the existing soils are tight enough that the hydraulic conductivity is similar to that of clay compacted to 95-98% proctor, consideration can be given to retaining the wetland soil undisturbed in the areas that are at the correct bottom elevation.
- Seeds and plants supplied must come from the same climatic zone as the County of Vermilion River and preferably be species tolerant to the general climate within the County.

5 SUMMARY OF STORMWATER MANAGEMENT SYSTEM STANDARDS

The following is a summary of the standards applicable to the storm sewer systems materials and construction. In all cases, it is intended that the latest apply.

ASTM

A48	Grey Iron Castings
C14	Concrete Sewer, Storm and Drain, and Culvert Pipe
C76	Reinforced Concrete Culver, Storm Drain, and Sewer Pipe
C443	Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
C478	Precast Reinforced Concrete Manhole Sections
D698	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures
D3034	Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

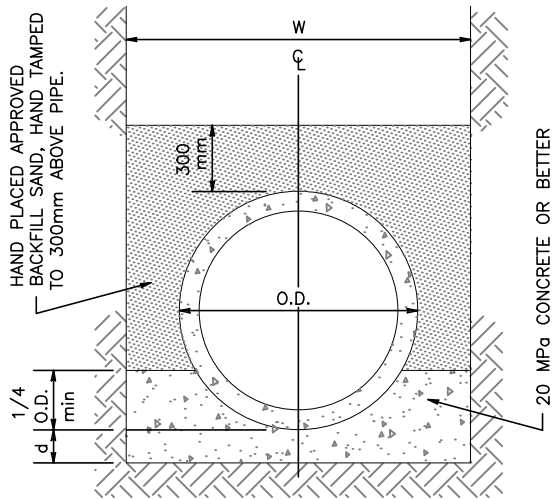
CSA

A5	Portland Cements
A23.1	Concrete Materials and Methods of Concrete Construction
A257 Series	Standards for Concrete Pipe
B182.1	Sewer Pipe Fittings
B182.2	PVC Sewer Pipe and Fittings (PSM Type)
B182.11	Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings
G30.12	Billet Steel Bars for Concrete Reinforcement

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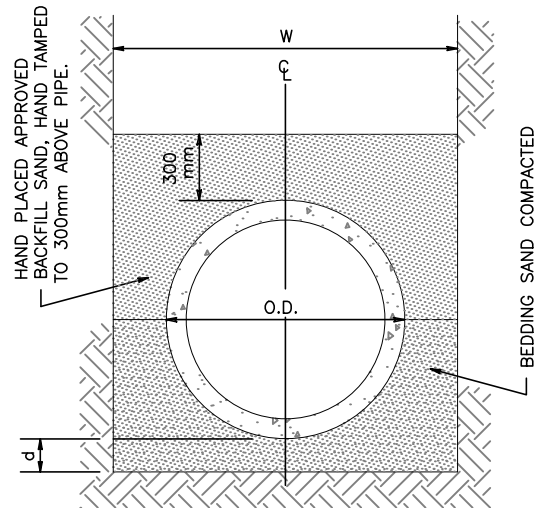
CLASS A BEDDING

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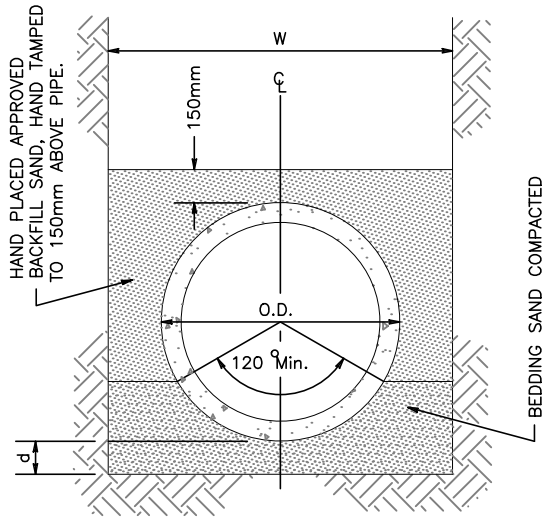
CLASS B BEDDING

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CLASS C BEDDING

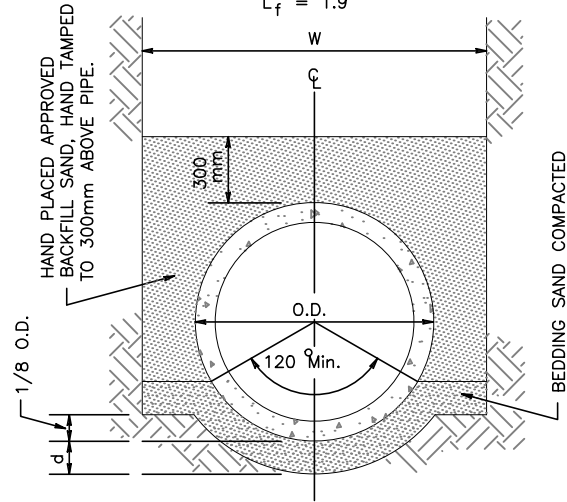
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CLASS B BEDDING

ALTERNATE - 375mm I.D. & UNDER

$L_f = 1.9$



NOTES:

- W = TRENCH WIDTH - O.D. + 450mm (MINIMUM)
- 1000mm max. FOR PIPES UP TO AND INCLUDING 400mm DIAMETER
- O.D. + 400mm max. (ON EITHER SIDE {800mm TOTAL}) FOR PIPE DIAMETERS 450mm AND ABOVE
- O.D.= OUTSIDE PIPE DIAMETER
- I.D. = INSIDE PIPE DIAMETER
- L_f = LOAD FACTOR
- d = DEPTH OF BEDDING BELOW PIPE
- I.D.= 675mm OR SMALLER - d min = 150mm
- I.D.= 750mm TO 1500mm - d min = 150mm
- I.D.= 1650mm AND LARGER - d min = 150mm

NOTE: all dimensions in millimeters unless noted otherwise



General Municipal Servicing Standards

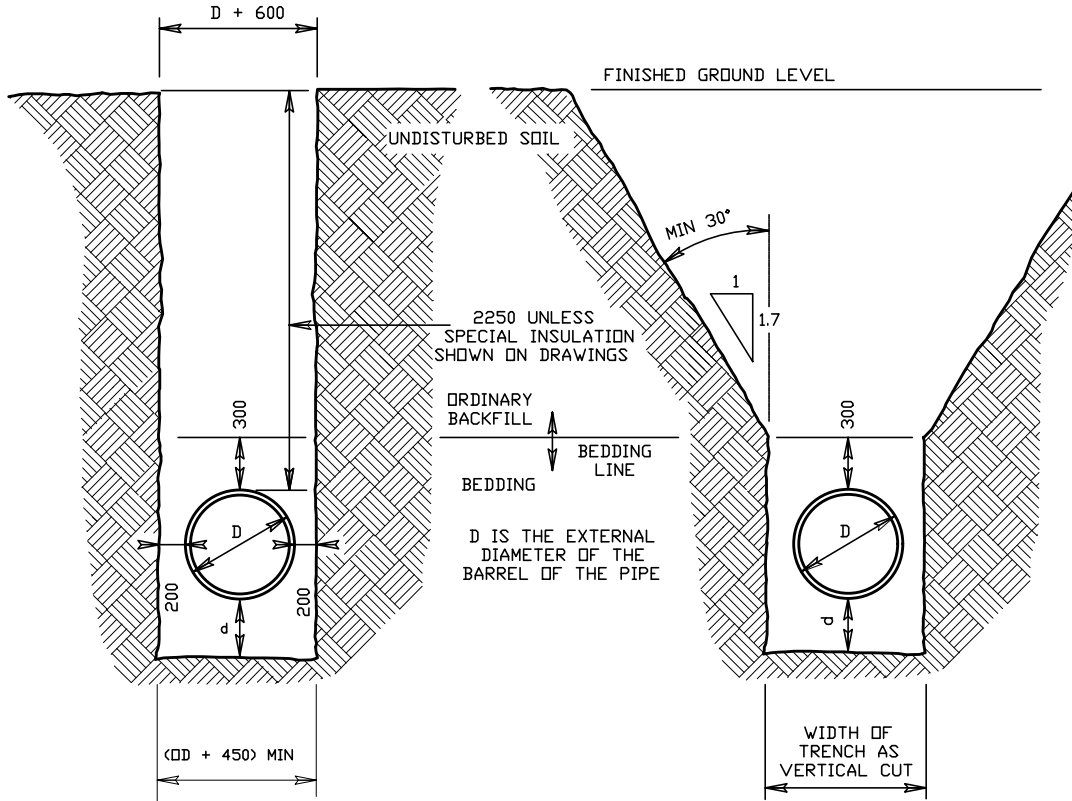


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Date:	FEBRUARY 2020
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Approved:

STANDARD TRENCH BEDDING FOR CIRCULAR PIPES

Drawing:
F-01



**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)

- EXTERNAL DIAMETER OF 700mm AND BELOW :75
- EXTERNAL DIAMETER GREATER THAN 700mm :100

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

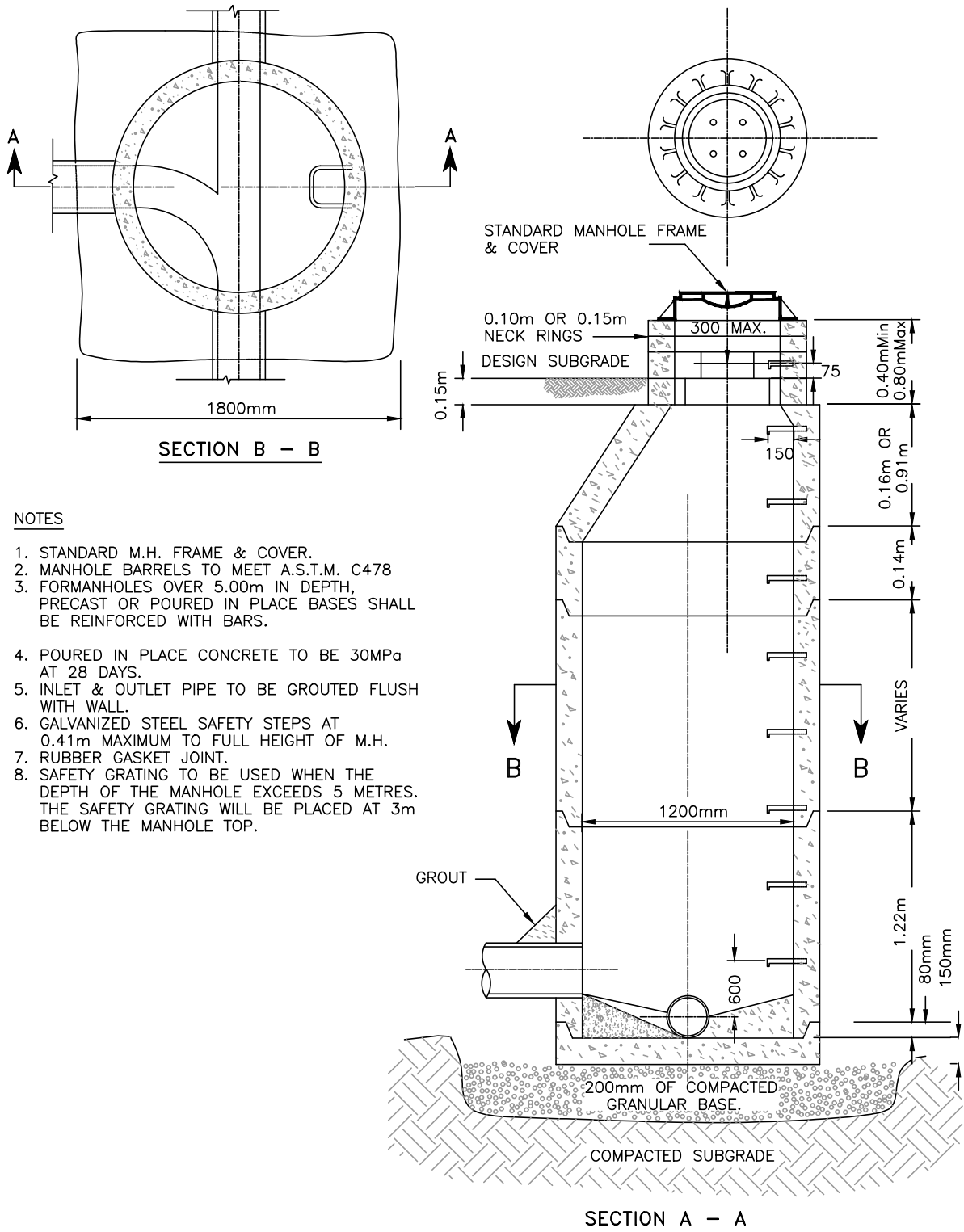


General Municipal Servicing Standards



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STANDARD TRENCH DIMENSIONS FOR CIRCULAR PIPE	
Approved:	Drawing: F-02



NOTES

1. STANDARD M.H. FRAME & COVER.
2. MANHOLE BARRELS TO MEET A.S.T.M. C478
3. FORMANHOLES OVER 5.00m 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 JOINT.
8. SAFETY GRATING TO BE USED WHEN THE DEPTH OF THE MANHOLE EXCEEDS 5 METRES. THE SAFETY GRATING WILL BE PLACED AT 3m BELOW THE MANHOLE TOP.



General Municipal Servicing Standards

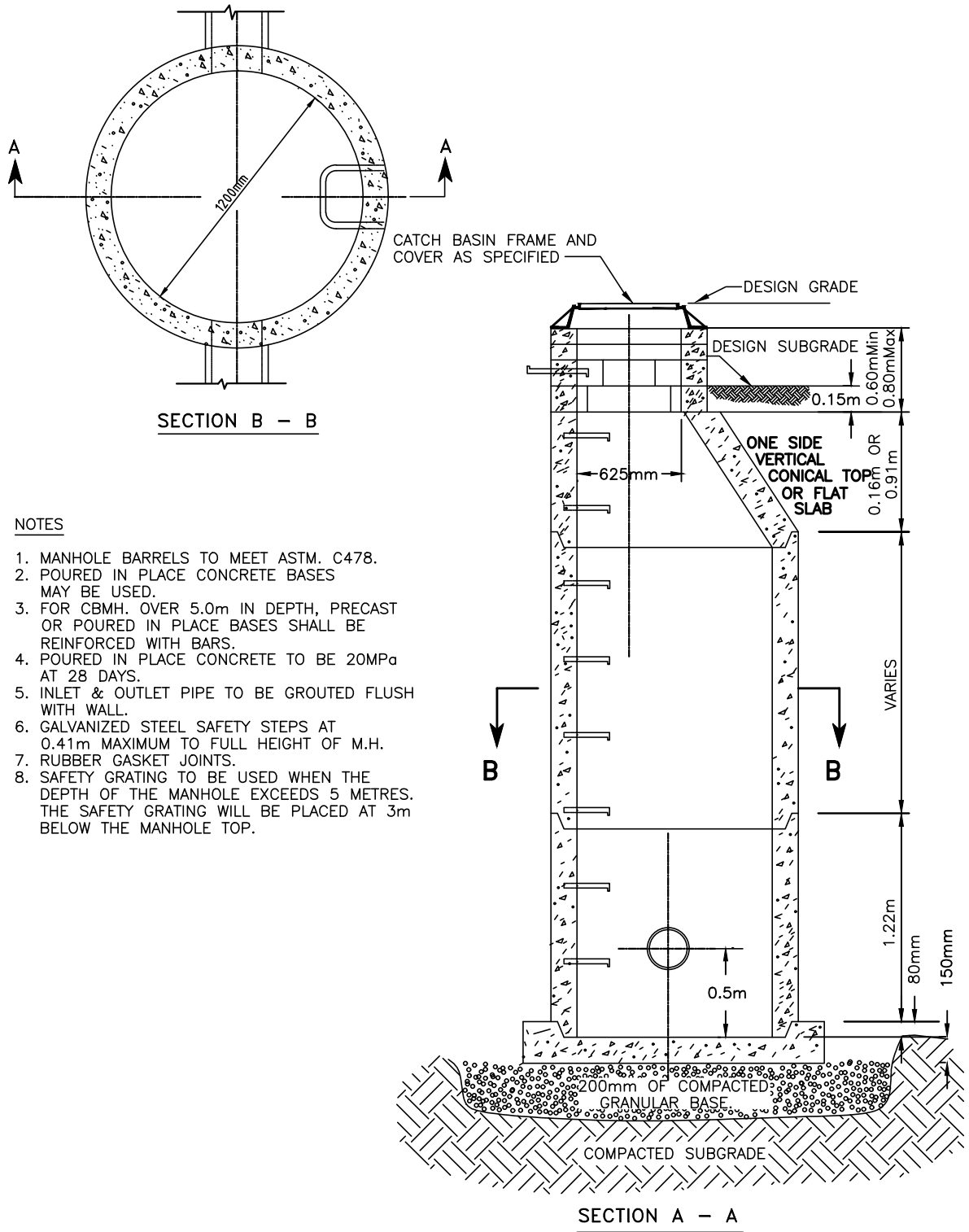


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Approved:

STANDARD 1200mm MANHOLE

Drawing:
F-03



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 20MPa 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 GRATING TO BE USED WHEN THE DEPTH OF THE MANHOLE EXCEEDS 5 METRES. THE SAFETY GRATING WILL BE PLACED AT 3m BELOW THE MANHOLE TOP.



General Municipal Servicing Standards

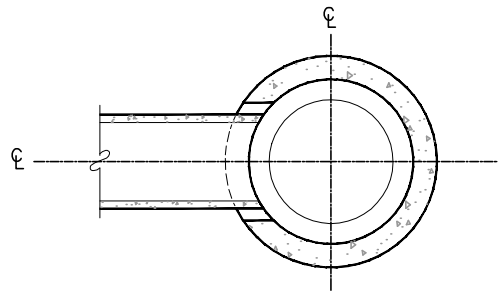


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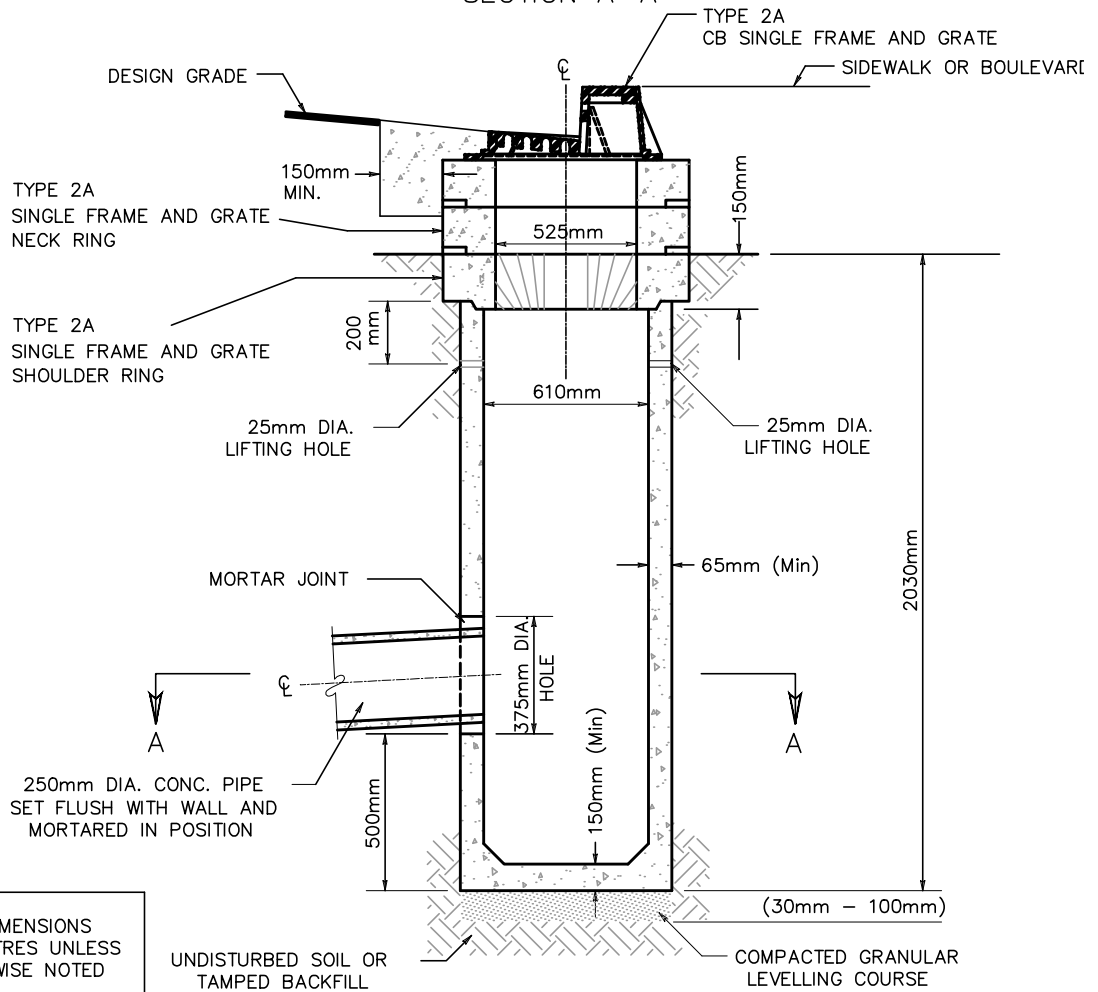
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STANDARD 1200mm
CATCH BASIN MANHOLE

Drawing:
F-04



SECTION A-A



ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

NOTES:

1. RUBBER GASKET, KENT SEAL OR EQUIVALENT TO BE INSTALLED BETWEEN BARREL, ALL SHOULDER AND NECK RINGS AND CATCH BASIN FRAME.
2. ALL ROUGH JOINTS SHALL BE POINTED WITH MORTAR TO ENSURE SMOOTHNESS.
3. ALL CATCH BASIN COMPONENTS TO BE IN ACCORDANCE WITH ASTM C478.



General Municipal Servicing Standards

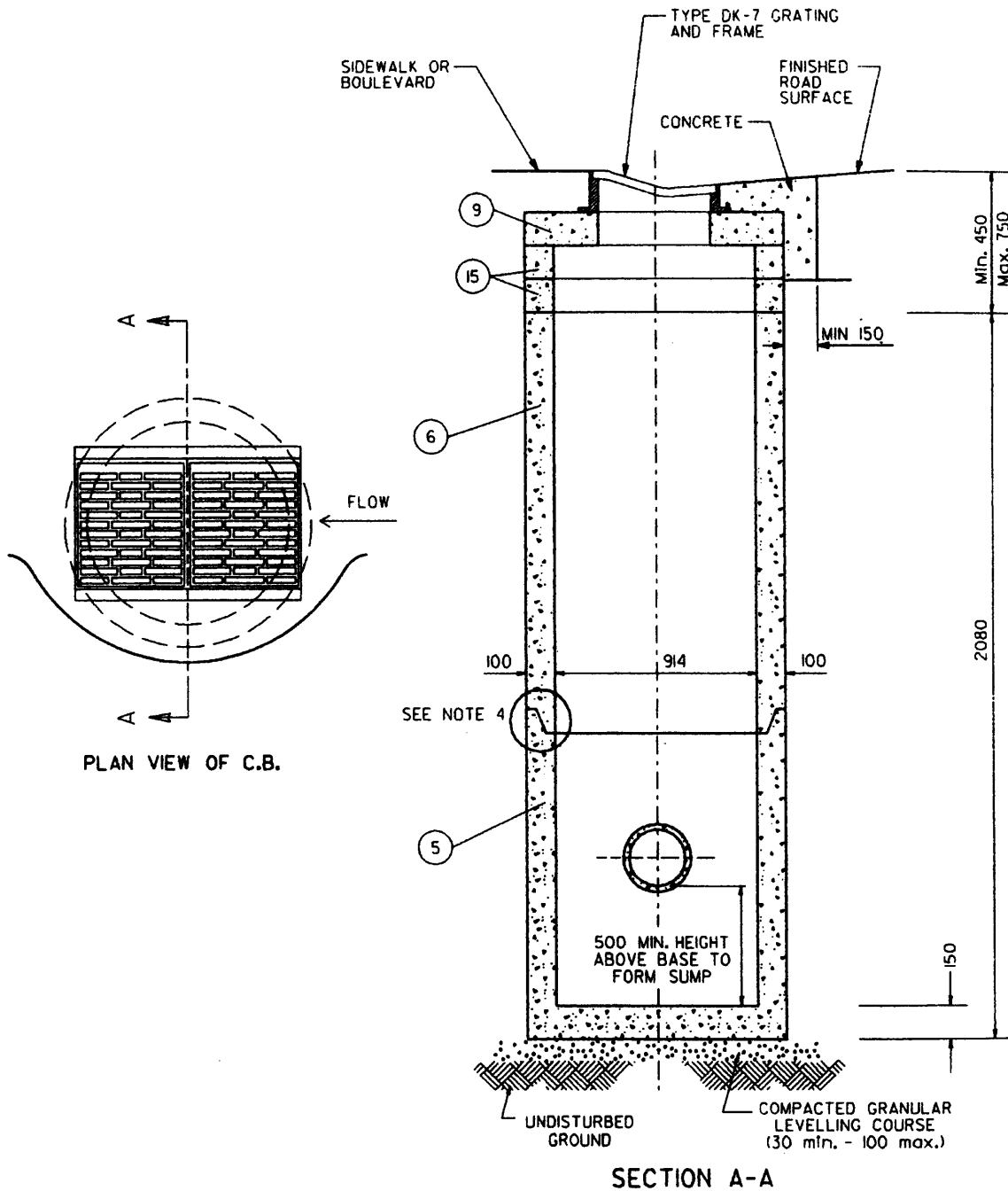


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PRECAST 610 CATCH BASIN

Approved:

Drawing:
F-05



PLAN VIEW OF C.B.

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.



General Municipal Servicing Standards

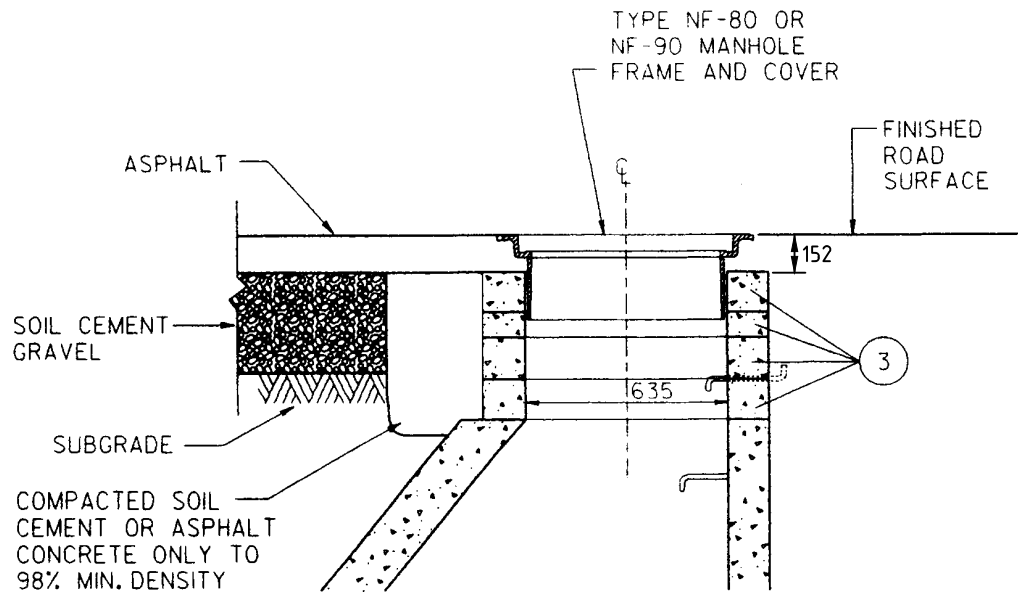
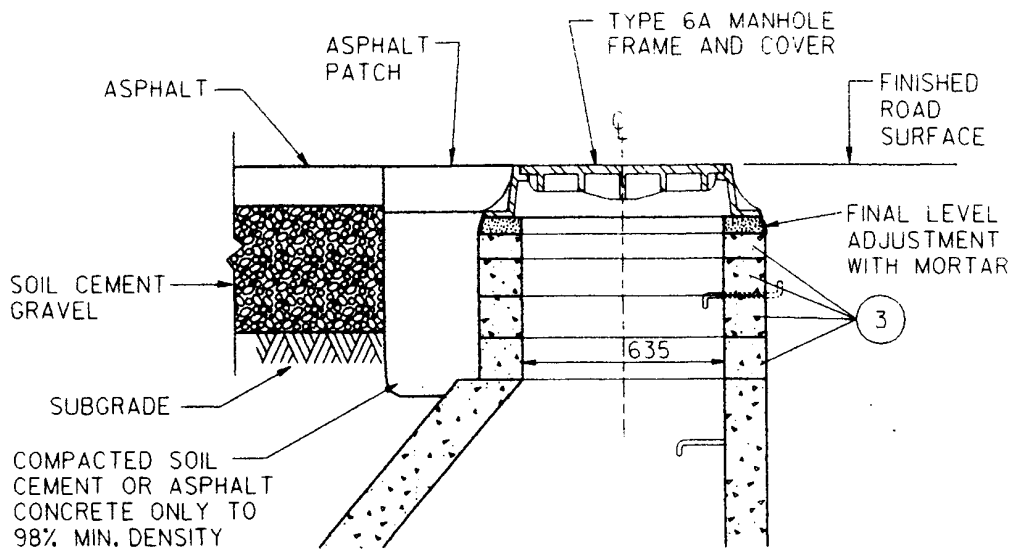


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STANDARD 900 CATCH BASIN WITH TYPE DK-7 GRATING AND FRAME

Approved:

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F-06



General Municipal Servicing Standards

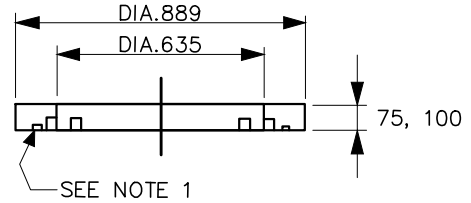
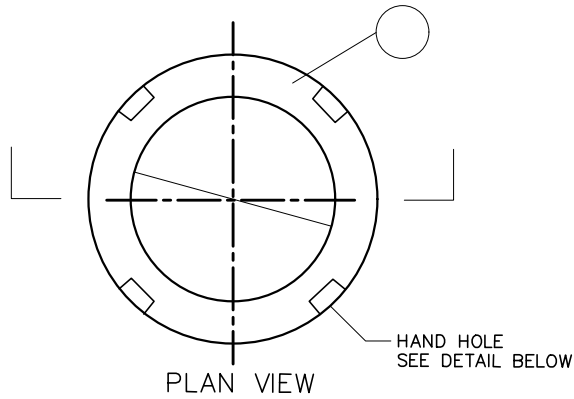


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Date:	FEBRUARY 2020
Scale:	N.T.S.

NECK SECTION DETAILS FOR STANDARD
1200mm MANHOLE

Approved:

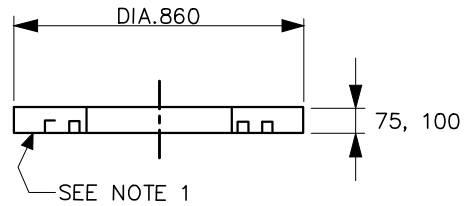
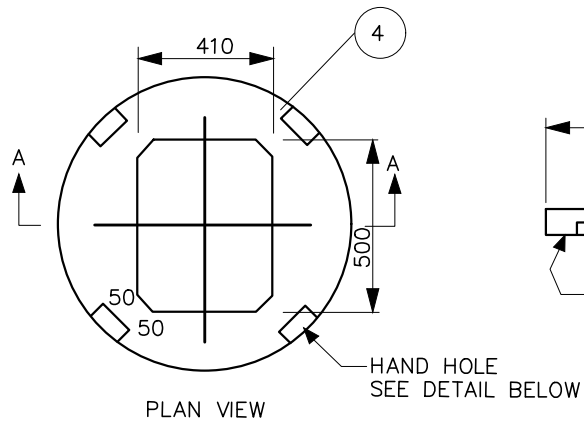
Drawing:
F-07



SECTION A-A

635 RING

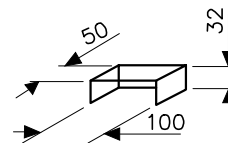
(NECK RING FOR USE WITH TYPES 4A, 6, 6A, 8, NF-80, NF-90
FRAMES AND CPVERS/GRATINGS)



SECTION A-A

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.



General Municipal Servicing Standards

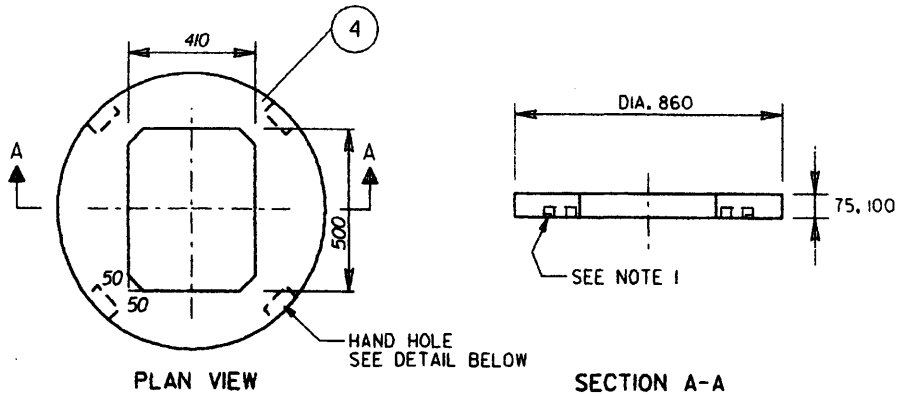


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Date:	FEBRUARY 2020
Scale:	N.T.S.

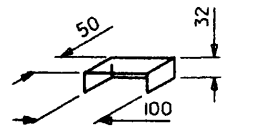
NECK RINGS

Approved:

Drawing:
F-08



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



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 mm UNLESS OTHERWISE NOTED.



General Municipal Servicing Standards

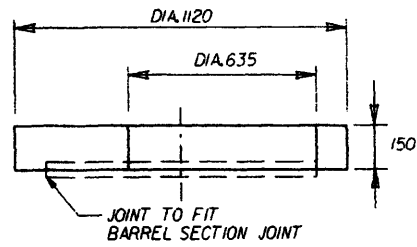
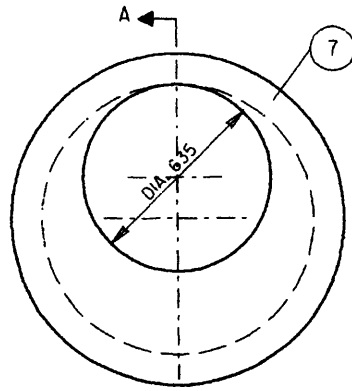


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Date:	FEBRUARY 2020
Scale:	N.T.S.

K-7 NECK RING

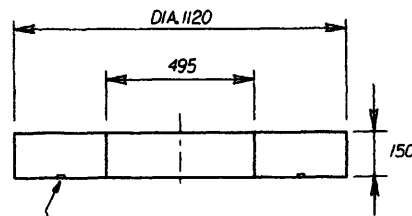
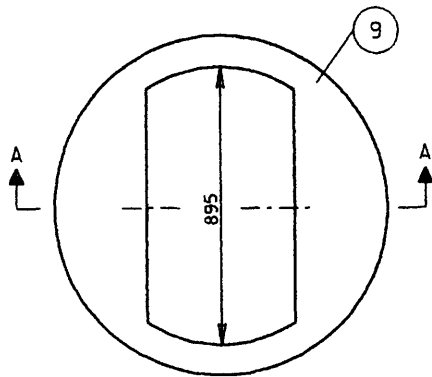
Approved:

Drawing:
F-09



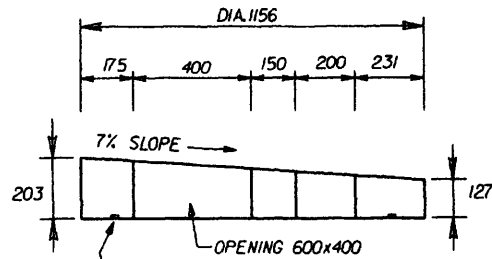
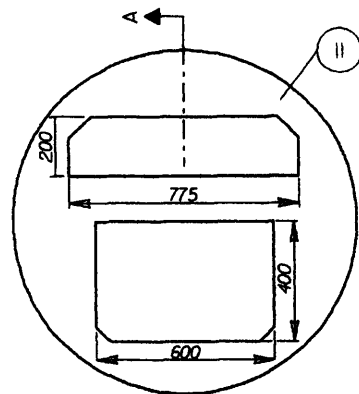
SECTION A-A

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)

ALL DIMENSIONS IN mm UNLESS OTHERWISE NOTED

NOTES:

- 1. A CONCENTRIC GROOVE LOCATED AT MID CROSS SECTION, SUITABLE FOR SEALANT IS REQUIRED FOR NECK RINGS AND EXTENSION RINGS.



General Municipal Servicing Standards

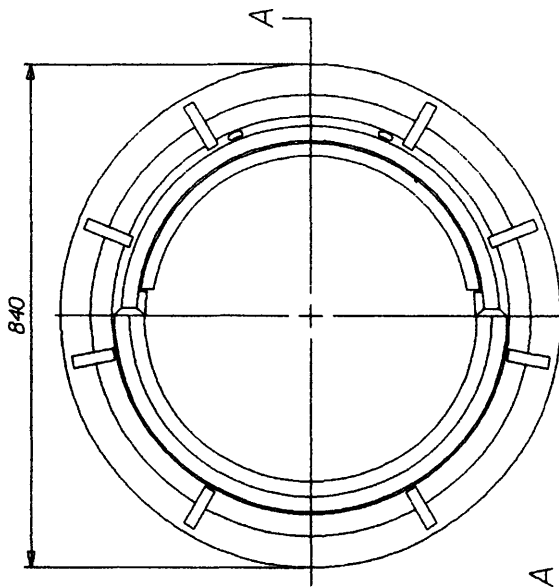


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Date:	FEBRUARY 2020
Scale:	N.T.S.

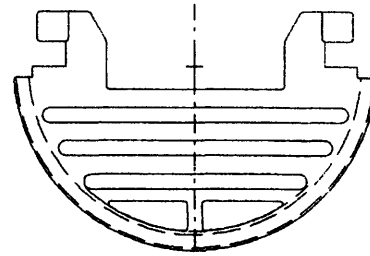
Approved:

SLAB TOPS FOR STANDARD
900 CATCH BASIN

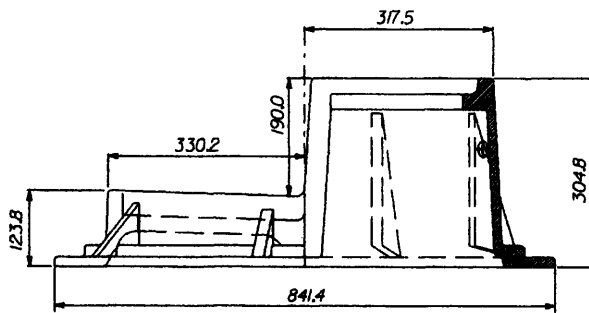
Drawing:
F-10



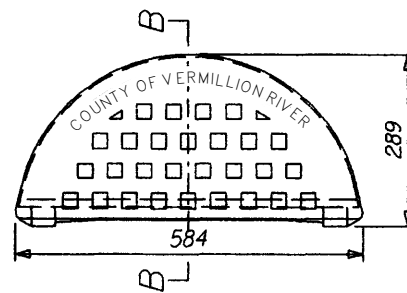
TOP VIEW (FRAME)



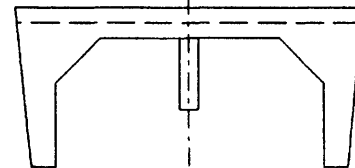
TOP VIEW - COVER (Part A)



SECTION A - A



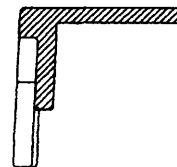
TOP VIEW - COVER (Part B)



FRONT VIEW COVER (PART B)

ALL DIMENSIONS IN mm UNLESS OTHERWISE NOTED

MATERIAL:
 FRAME: GRAY IRON CLASS 20B
 COVER: PART A IRON CLASS 20B
 PART B DUCTILE IRON GRADE 65-45-12



SECTION B-B



General Municipal Servicing Standards

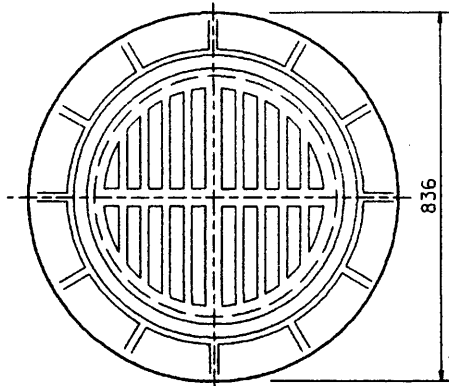


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Date:	FEBRUARY 2020
Scale:	N.T.S.

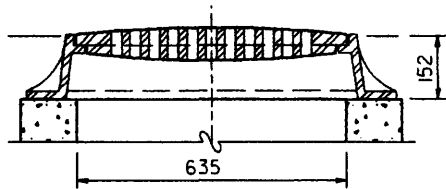
Approved:

TWO PIECE TYPE 4A
 GRATING AND FRAME

Drawing:
 F-11

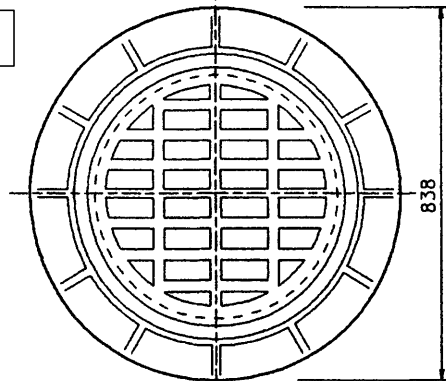


MATERIAL: GRAY IRON
 FRAME: CLASS 20B
 COVER: CLASS 20B

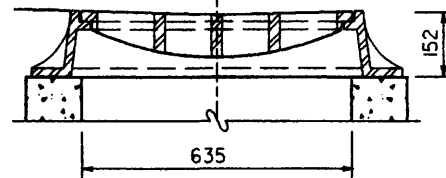


No. 6 ROUND TOP CATCHBASIN
 OR MH FRAME & COVER

ALL DIMENSIONS IN mm UNLESS
 OTHERWISE NOTED



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



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



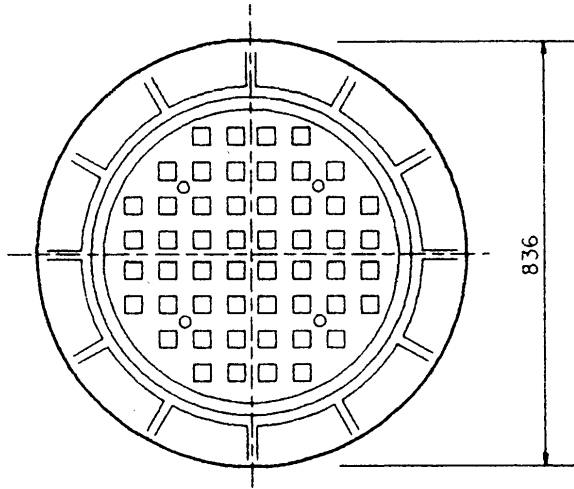
General Municipal Servicing Standards



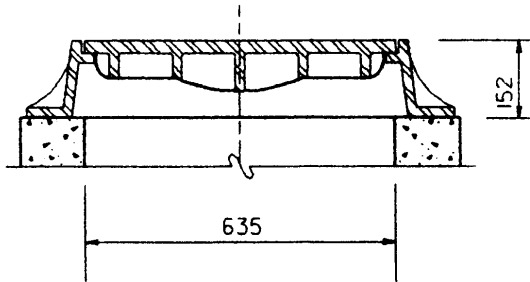
Rev.	
Rev.	
Rev.	
Date:	FEBRUARY 2020
Scale:	N.T.S.

FRAME AND GRATING TYPE 6 AND 8	
Approved:	

Drawing:	F-12
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ALL DIMENSIONS IN mm UNLESS OTHERWISE NOTED



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



General Municipal Servicing Standards

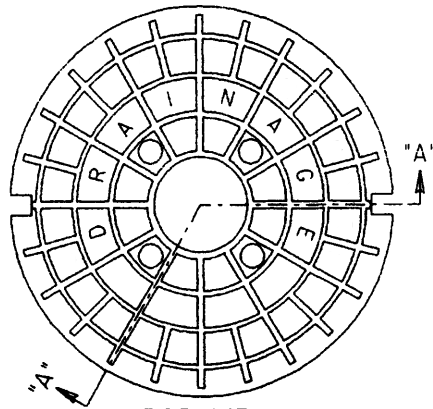


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Date:	FEBRUARY 2020
Scale:	N.T.S.

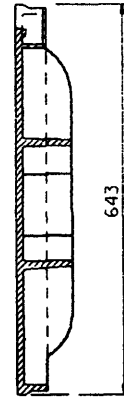
TYPE 6A COVER AND FRAME

Approved:

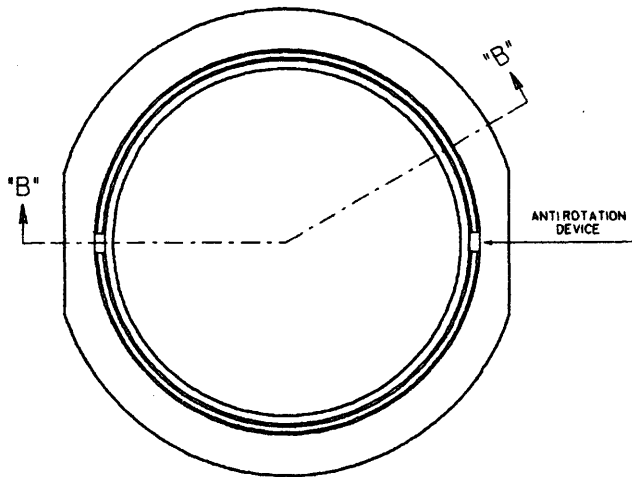
Drawing:
F-13



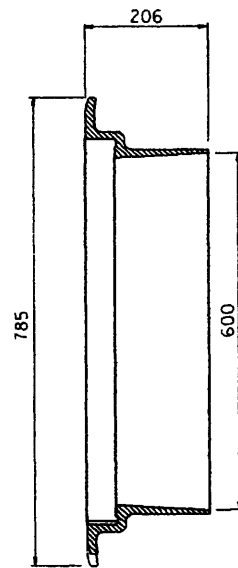
TOP VIEW
MANHOLE COVER
WITH 4 VENTHOLES



SECTION "A-A"



PLAN



SECTION "B-B"

TYPE NF-80 FLOATING MANHOLE FRAME

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

ALL DIMENSIONS IN mm UNLESS
OTHERWISE NOTED

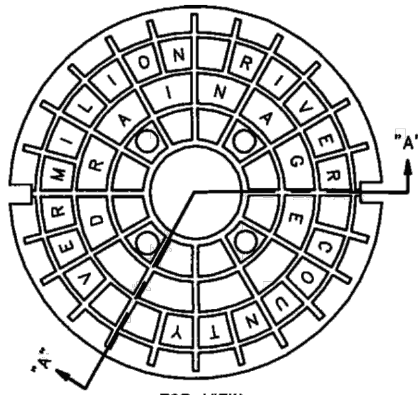


General Municipal Servicing Standards

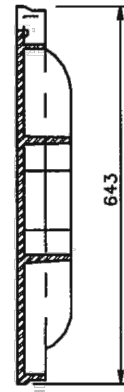


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Rev.	
Date:	FEBRUARY 2020
Scale:	N.T.S.

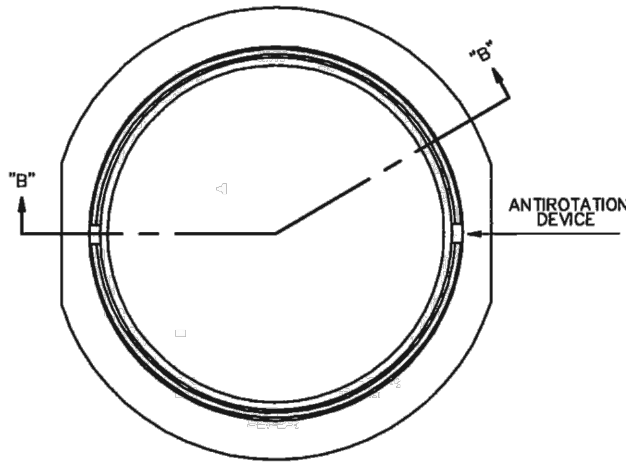
FLOATING MANHOLE FRAME AND COVER TYPE NF-80 AND NF-90	
Approved:	Drawing: F-14



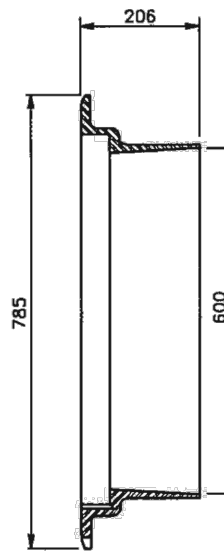
TOP VIEW
MANHOLE COVER
WITH 4 VENTHOLES



SECTION "A-A"



PLAN



SECTION "B-B"

ALL DIMENSIONS IN mm
UNLESS OTHERWISE NOTED

TYPE NF-80 FLOATING MANHOLE FRAME

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



General Municipal Servicing Standards

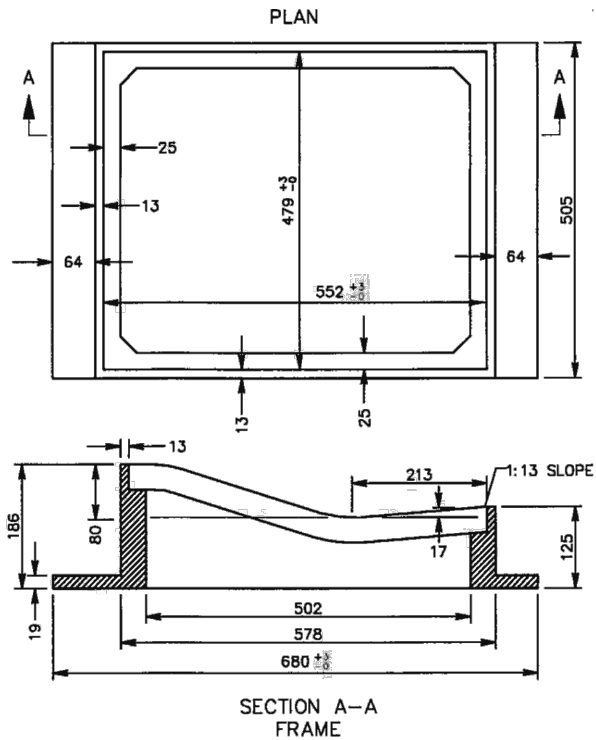
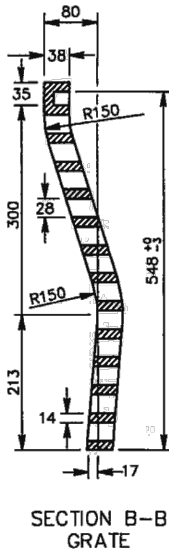
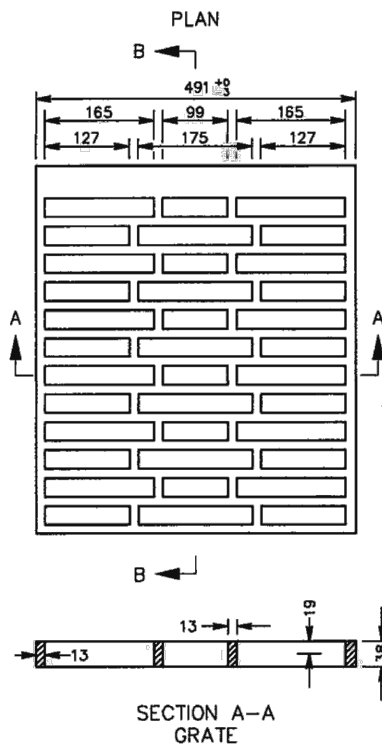


Rev.	
Rev.	
Rev.	
Date:	FEBRUARY 2020
Scale:	N.T.S.

TYPE NF-80 AND NF-90

Approved:

Drawing:
F-14



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



General Municipal Servicing Standards



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Date:	FEBRUARY 2020
Scale:	N.T.S.

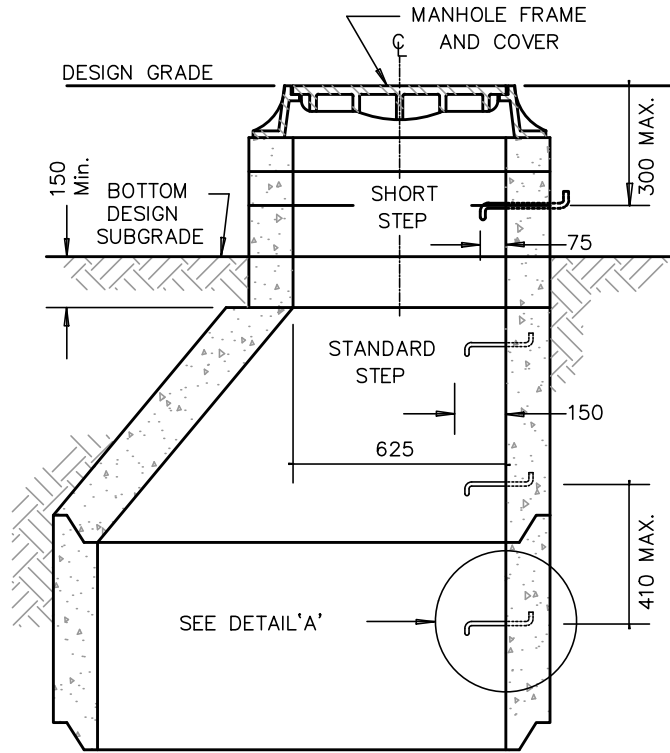
FRAME AND GRATING TYPE K-7

Approved:

Drawing:
F-15

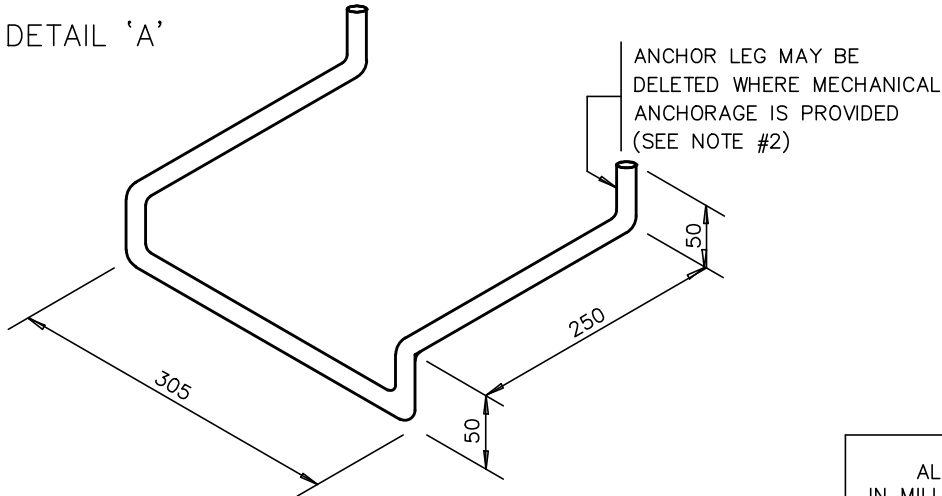
PLACEMENT:

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.



TYPICAL MANHOLE SECTION

DETAIL 'A'



ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED



General Municipal Servicing Standards

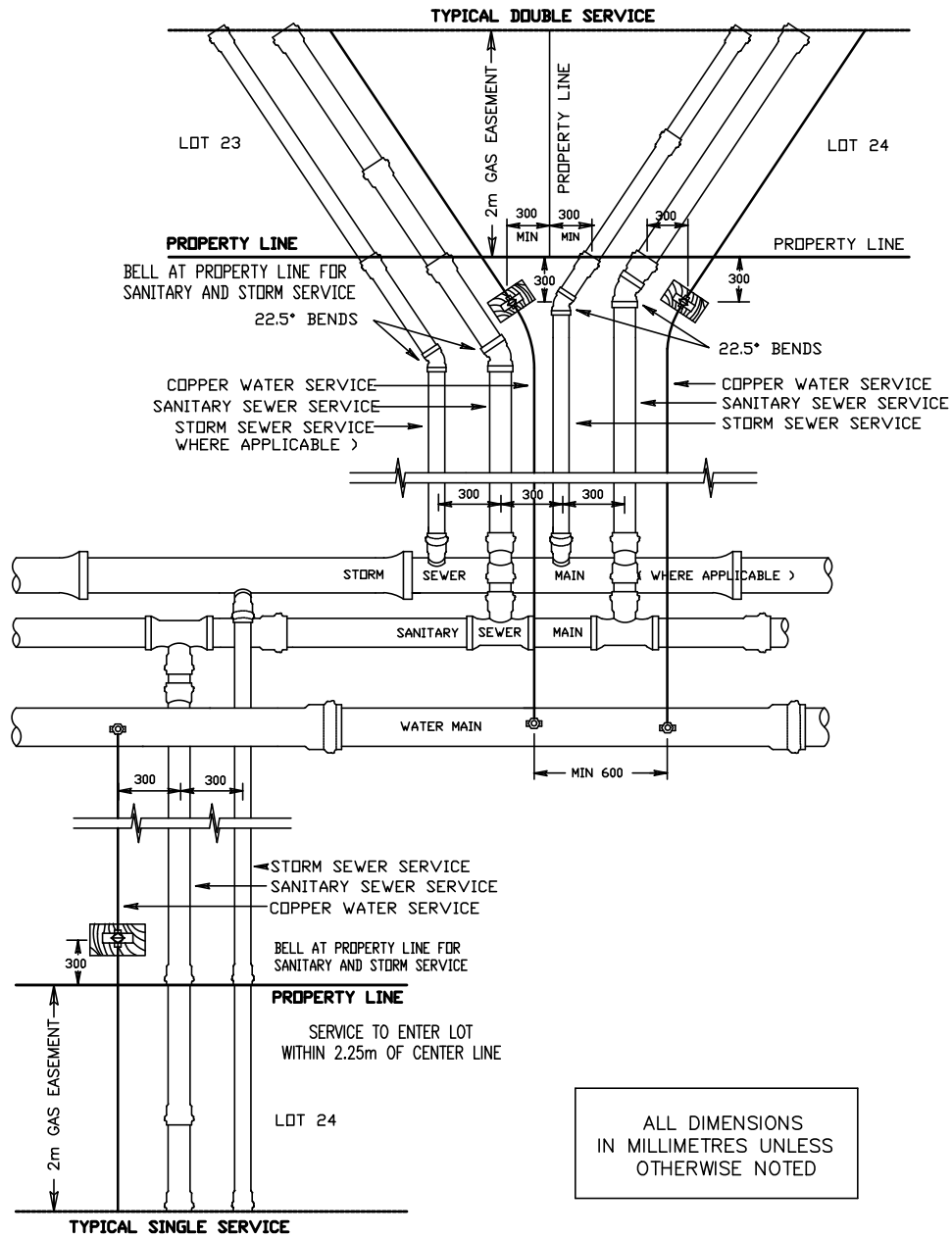


Rev.
Rev.
Rev.
Date: FEBRUARY 2020
Scale: N.T.S.

Approved:

SAFETY STEPS FOR MANHOLES

Drawing:
F-16



NOTES:

1. WATER AND SEWER SERVICES MAY BE EXTENDED TO EDGE OF 2.0m GAS EASEMENT.
2. THE CITY 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. THE END OF COPPER WATER SERVICE PIPING SHOULD NOT BE CRIMPED CLOSED, PERMEABLE FILTER CLOTH MAY BE USED TO PREVENT INTRUSION OF DEBRIS AND TO ALLOW TESTING FLOW OF CURBSTOP.



General Municipal Servicing Standards

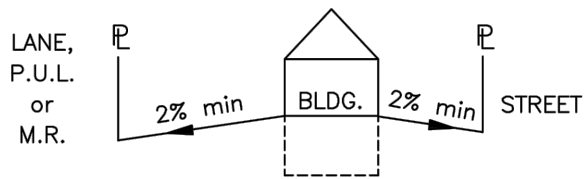
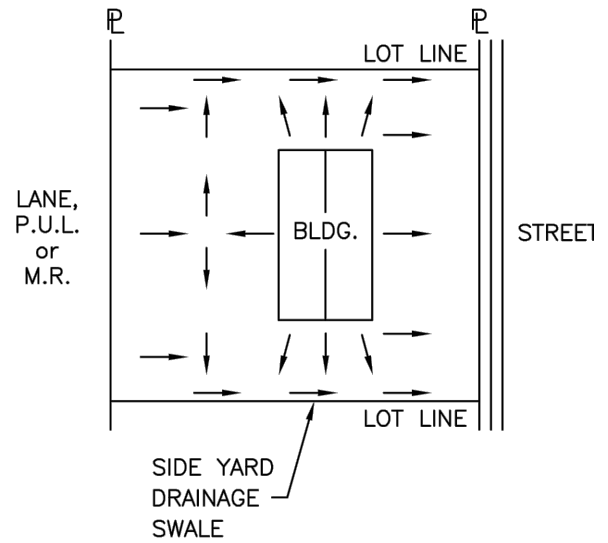
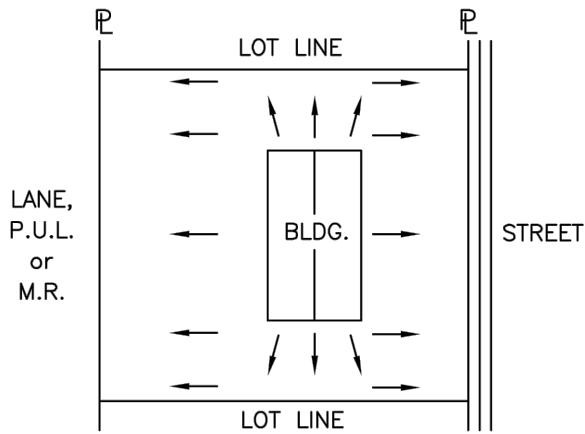


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Rev.	
Date:	FEBRUARY 2020
Scale:	N.T.S.

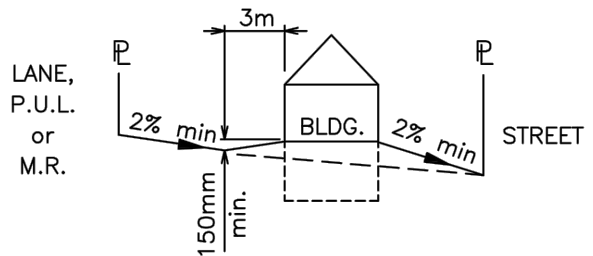
TYPICAL SERVICES (SINGLE AND DUAL)

Approved:

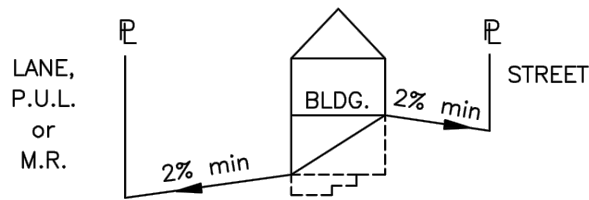
Drawing:
F-17



SPLIT DRAINAGE



BACK TO FRONT DRAINAGE



REARYARD BASEMENT WALKOUT SPLIT DRAINAGE



General Municipal Servicing Standards



Rev.
Rev.
Rev.
Date: APRIL 2021
Scale: N.T.S.

TYPICAL LOT GRADING

Approved:

Drawing:
F-18

1 **INTENT**

1.1 This section is intended to provide guidelines to assist the Developer in the design of road, sidewalk and trail improvements that will meet the servicing requirements for commercial, industrial and residential development within The County of Vermilion River. The County of Vermilion River may consider alternative road design variations, approved by the Municipal Engineer, provided that public safety and the County are not at risk.

1.2 The servicing standards have been developed with goals in mind:

1.2.1 To ensure that the County 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.

1.2.2 To minimize the maintenance requirements associated with roads and subdivisions.

1.3 The guidelines and standards presented in this section should only be considered as minimum requirements. The Developer remains 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 more stringent standards are met.

1.4 It is the Developer's responsibility to satisfy, in addition to these requirements, all regulations and conditions required by the following:

Public Lands Act,

Municipal Government Act,

Water Act,

Environment & Enhancement Act,

Provincial Wetlands Policy,

Alberta Environment, Standards and Guidelines for Municipal Waterworks,

Wastewater and Storm Drainage Systems

County of Vermilion River General Municipal Servicing Standards

Alberta Highway Design Guide

Transportation Association of Canada (TAC) Geometric Design Guidelines

TAC Uniform Traffic Control Devices for Canadian Roads

*TAC Highway Lighting Design Guide
Municipal Bylaws
Fisheries Act,
Species at Risk Act,
Navigable Water Protection Act, other
Provincial/Federal Government Authorities*

2 **LEVEL OF SERVICE ROADWAYS**

- 2.1** When required, the Developer's Engineer shall be responsible for determining an estimated annual average daily traffic (AADT) generated by the development in order to determine the required cross sectional elements and pavement structure.
- 2.2** Generally local roads with an AADT of 100 or less are built as if the gravel surface is the final surface finish, The County of Vermilion River may require a provision for wider subgrade to allow for future base paving. For multi-lot residential subdivision's (more than 4 lots), the minimum road standard shall be:
- 2.2.1** pavement or alternative form of hard surfacing at the discretion of the Municipal Engineer within 800 meters from a surface treated road. Areas beyond this shall be at the discretion of the Municipal Engineer.

3 **GENERAL**

- 3.1** For each new development, the appropriate roadway classifications and design designation shall be determined during the planning stages in consultation with County officials. Refer to the Land Use Bylaw for a general guideline identifying the minimum applicable roadway designation for each type of Land Use Districts.
- 3.2** Where conflicts or inconsistencies with the General Municipal Servicing Standards arise due to adoption of other transportation planning documents, the Developer shall be responsible for satisfying the more stringent requirement.
- 3.3** Should the need arise that any of the standards cannot be met; a written request outlining the variance is to be forwarded to the Municipal Engineer. The request will be reviewed, and a written response will be returned.

- 3.4 The Developer shall be responsible for quality control testing related to the roadway construction including but not necessarily limited to sieve analysis, densities, mix design, 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.

4 DESIGN CRITERIA

- 4.1 It is the Developer's responsibility to assess the traffic impacts associated with a proposed land development. This assessment must include a projection of the average annual daily traffic (AADT) over a 20-year design life for the internal subdivision roads as well as any adjacent provincial highways or municipal roadways.
- 4.2 All off-site road improvements required as a result of land development must be identified in the design stage by the Developer. An off-site levy may be assessed and charged to the developer.
- 4.3 The trip generation rate for single detached housing in The County of Vermilion River shall be 9 one-way trips per household. Trip generation rates for other types of development shall be justified by the Developer or the Developer's Engineer and approved by the Municipal Engineer.

5 DESIGN DESIGNATIONS

- 5.1 The County of Vermilion River uses the following design designations for rural and urban roads. The cross section elements for each of these design designations are shown in drawings **G-01** to **G-012** at the back of this section.

Arterial Road – An arterial road is a high-capacity road designed to deliver traffic from collector roads to primary and secondary highways at the highest level of service possible. As such, arterials have limited access and features as they must allow greater traffic flow over longer distances and minimal interruptions. **Refer to drawing G-01**

Connector Road – A connector road is a moderate capacity road which serves to move traffic from local roads to arterial roads or primary and secondary highways. Unlike arterial roads, connector roads may be

required to provide access to residential properties. **Refer to drawing G-02 & 03**

Local Road – A local road provides access to adjacent properties carrying traffic from higher order roads to individual land parcels. Local roads are typically low speed and low volume roadways. **Refer to drawing G-04 & 05**

Subdivision Road – A subdivision road provides access to adjacent properties carrying traffic from higher order roads to individual industrial or residential lots within a designated subdivision. **Refer to drawing G-06, 07, 08 & 09**

Hamlet Road – A hamlet road provides access to properties within a designated hamlet carrying traffic from higher order roads to individual residential lots or conveying traffic within the hamlet. **Refer to drawing G-10, 11 & 12**

Undeveloped Road – An undeveloped road does not warrant a specific design designation. Undeveloped roads typically provide access to one individual property/land parcel or agricultural access to an individual land parcel. Undeveloped roads shall be defined by the following 3 categories:

- Seasonal Access Road (Back Road)
 - Access to agricultural properties, no residential development
 - 20 m right-of-way
 - Minimal road grade and ditches
 - Dirt trail, may have reject gravel surface
 - No winter maintenance

- Unimproved
 - Driveway or Agriculture (farm access) only
 - 20 m right-of-way
 - Dirt trail, may have reject gravel surface
 - Maintenance by adjacent landowner or license holder

- Undeveloped
 - Agriculture only
 - 20 m right-of-way
 - Dirt or grass trail
 - Road allowance not maintained by County

For any development being accessed from an undeveloped road, does not constitute the undeveloped road being developed by the County of Vermilion River. The developer, pending decision by Council, may be responsible for the road development.

- 5.2** For the purpose of these servicing standards, all roadways (including undeveloped roads) within the County of Vermilion River other than primary and secondary highways and some major grid roads will be considered local roads. Although some may perform minor collector and arterial functions, the above design designations should apply to most roadways.
- 5.3** The roadway design shall be prepared considering the future requirements, economic factors, safety considerations, staging, and other road users not associated with the development.
- 5.4** The design speed selected should relate to the expected operating speed on the road after improvement. It should reflect public expectations and include an allowance for safety. The design speed is typically 10 km/hr higher than the anticipated posted speed limit.

Table 1.1 – Geometric Design Requirements

Description	Arterial	Connector		Local Road		Subdivision				Hamlet		
	A1 (ACP)	C1 (ACP)	C2 (Gravel)	L1 (ACP)	L2 (Gravel)	S1 (Industrial ACP)	S2 (Industrial Gravel)	S3 (Residential Hard Surface)	S4 (Residential Gravel)	H1 (Urban ACP - Curb & Gutter)	H2 (Rural Hard Surface)	H3 (Rural Gravel)
Drawing Reference	G-01	G-02	G-03	G-04	G-05	G-06	G-07	G-08	G-09	G-10	G-11	G-12
Top Width	10.4	9	9	8-9	8	9	9	8	8	12	9	9
AADT	>1000	<1000	>200	<200	<100	>200	<200	>200	<200	<1000	>200	<200
Truck Traffic	Signif.	Signif.	Signif.	Min.	Min.	Signif.	Signif.	Min.	Min.	Min.	Min.	Min.
Minimum ROW (m)	40	30	30	20	20	20	20	20	20	20	20	20
Desirable ROW (m)	40	40	40	30	30	30	30	30	30	30	30	30
Design Speed (km/h)	110	110	90	90	90	60	60	60	60	60	60	60
Sideslope H:V	4:1	4:1	4:1	3:1	3:1	3:1	3:1	3:1	3:1	NA	3:1	3:1
Max. Gradient (%)	6	6	6	9	9	6	6	9	9	NA	NA	NA
SSD (m)	235	235	170	170	170	85	85	85	85	85	85	85
Crest K	100	100	55	55	55	15	15	15	15	15	15	15
Sag K	60	60	40	40	40	20	20	20	20	20	20	20
Min. Horiz. Radius (m)	440	440	300	300	300	120	120	120	120	200	120	120

- AADT = Average Annual Daily Traffic
- ROW = Right-of-Way
- SSD = Stopping Sight Distance
- Crest K = Minimum “K” value Crest Curve
- Sag K = Minimum “K” value Sag Curve Headlight Control

Note: The recommended design speeds are for internal roadway systems only. Geometric standards are from Alberta Transportation’s Highway Geometric Design Guide. It has been assumed that the maximum superelevation rate will be 0.08 m/m for gravel surfaced roads and 0.06 m/m for asphalt surfaced roads.

6 **STRIPPING TOPSOIL**

6.1 Topsoil shall be stripped from road right-of-way and trenching areas to its full depth. Topsoil from these areas shall be used on Public Lands or boulevards as required. Any remaining topsoil shall be stockpiled at approved locations and shall become the property of the County. The topsoil, when used as fill shall be placed such as to add to existing topsoil, thereby utilizing it for landscaping purposes. Surplus topsoil is to be stockpiled for use in final grading of parks, boulevards, buffer strips, and developed lots.

7 **PAVEMENT STRUCTURE**

7.1 Roadway subgrade and pavement structures 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. The pavement structures indicated on the cross sections are intended as minimum standards only. It is the Developer's responsibility to design the roadways to meet or exceed these standards in accordance with good engineering practices and specific site conditions.

8 **SUBGRADE PREPARATION**

8.1 The subgrade shall be prepared by compacting the soil below the design subgrade elevation to an average of 100% Standard Proctor Density, with no test result being less than 98% Standard Proctor Density. The moisture content for compaction shall be within a range of 2% above to 2% below optimum moisture. The soil below the design subgrade elevation shall be compacted in layers not exceeding 150 mm. Each compacted layer shall be accurately shaped and graded parallel to the design grades and cross-sections. If density cannot be met then the subgrade is to receive cement stabilization treatment or an alternate approved product as determined by a qualified geotechnical engineer.

8.2 During compaction, the soil shall be at its optimum moisture content as determined by a qualified geotechnical engineer. When a deficiency in moisture content exists, the soil shall be watered and thoroughly mixed until optimum moisture content is uniformly attained. When there is an excess of moisture the soil shall be worked and aerated until the optimum moisture content is reached.

One-mould proctor density testing will not be permitted as an alternate testing procedure due to wet soil conditions. The Developer's Engineer will be required to suggest appropriate measures such as drying on-site material or importing suitable material in order to meet the required Standard Proctor Densities.

9 PIT-RUN MATERIAL

- 9.1** Pit-run shall be used to stabilize the sub-base in areas where silty in-situ materials exist. If the area is not being paved, the minimum depth of pit-run shall be 1.0 m or as determined by the Municipal Engineer. Filter cloth or geogrid or proven engineered method can be utilized as alternative to pit run.
- 9.2** After over-excavation of any unsuitable sub-base material, pit-run shall be placed in the excavation and compacted to the satisfaction of the Municipal Engineer. Additional layers of pit-run required to bring the sub-base elevation to the bottom of the base course shall be placed in layers not exceeding 150 mm in depth and compacted to the satisfaction of the Municipal Engineer. The optimum moisture content for the mixture shall be determined by a qualified geotechnical engineer or firm. If necessary, water shall be added or applied to the material during compaction to maintain the required uniform moisture content.

10 Base Course

- 10.1** Each lift shall be compacted to 100% Standard Proctor Density. Water shall be applied and mixed uniformly with the crushed gravel until the final moisture content is at least the optimum moisture for the mixture, and preferably from 2% above optimum moisture. The optimum moisture content for the mixture shall be determined by a qualified geotechnical engineer or firm. If necessary, water shall be added or applied to the material during compaction to maintain the required uniform moisture content.
- 10.2** Base course material shall be laid and compacted in a single layer when the compacted thickness specified does not exceed 150 mm. When a thickness in excess of 150 mm is specified the material shall be laid and compacted in layers not exceeding 150 mm.

11 CUL-DE-SACS

- 11.1** The maximum length for any cul-de-sac without a Public Utility Lot (PUL) is 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 5.5 m wide PUL allowing emergency vehicle access and watermain looping. See drawing **G-13** at the back of this section.
- 11.2** PUL's provided to allow for emergency access shall not be utilized for stormwater storage. The PUL shall be properly graded to ensure positive drainage toward the road and seeded or sodded to prevent erosion.
- 11.3** Cul-de-sacs should be graded to drain towards the intersection unless a PUL is provided to allow drainage to escape.
- 11.4** The minimum cul-de-sac bulb radius for residential areas is 18 m measured to the face of curb or shoulder. Industrial radius for bulbs is minimum 24 m.

12 INTERSECTIONS

- 12.1** Intersections shall be designed at 90° wherever possible. The minimum angle of intersection for two roadways shall be 75° unless otherwise approved by the Municipal Engineer.
- 12.2** Intersection design shall incorporate accepted sight distances based on the roadway classification and good engineering practice.
- 12.4** Refer to the Land Use Bylaw for minimum intersection spacing measured from centreline to centreline.
- 12.5** Intersection treatments shall be designed based on estimated 20-year traffic volumes. All necessary widenings of existing right-of-ways shall be provided by the Developer. Sight distance shall be minimum 300 m both directions.

13 CONCRETE CURB AND GUTTER

- 13.1** Concrete curb and gutter shall be constructed on all urban cross sections according to the typical cross sections shown in drawings **G-10**.

- 13.2** The vertical face curb and gutter cross section shall be used on all roads fronting public lands such as parks and public utility lots. 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.
- 13.4** Curb returns on all residential street intersections shall have a minimum radius of 9.0 m.
- 13.5** Curb returns on all commercial/industrial intersections shall have a minimum radius of 15.0 m and shall be designed to accommodate truck turning movements.
- 13.6** The minimum gutter grade shall be 0.5% except for cul-de-sac bulbs, curb returns and catch basin approaches, which shall be 0.8%. The 0.5% minimum grade shall be maintained throughout sag vertical curves to avoid the short length at near horizontal grade.
- 13.7** Curbs shall be constructed using Portland Cement to CSA A3000-13. Materials, production, delivery, placement and finishing shall conform to CSA A23.1-14.
- 13.8** The minimum 28 day compressive strength of concrete shall be 30 MPa. Air entrainment shall be within 5 – 8 % by volume. Concrete testing is required for every 50 m³ of cast in place concrete or 1 test per day of placing. Testing shall be at the developers cost.
- 13.9** Curbs shall be constructed on prepared subgrade, cement stabilized subgrade, granular base course, soil cement or asphalt concrete.
- 13.10** For all urban cross sections, wick drains shall be placed below the curb, between the subgrade and granular base course. The wick drain shall be connected to the nearest catch basin.
- 13.11** Curbs must be backfilled with suitable clay prior to placement of the roadway structure. Backfill of materials along green concrete shall be no sooner than 7 days after placement. The clay material shall be backfilled to within 100 mm of the top of curb to allow for the placement of topsoil material.
- 13.12** The use of swale gutters shall be limited to minor and residential streets. Swale gutter cross section shall be a minimum of 1.0 m wide and 200 mm thick with steel reinforcing.

13.13 All driveways crossing a swale shall be reinforced with a minimum of two No. 4 rebars.

14 **SIDEWALKS AND PAVED STRUCTURES**

14.1 Sidewalks shall be accessible to all persons as well as being safe, functional and aesthetically pleasing.

14.2 Sidewalks installed for new subdivisions shall integrate with the existing walkway system on intersecting roadways.

14.3 Separate sidewalks shall be a minimum of 1.5 m wide.

14.4 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.

14.5 Curb ramps shall be used at all curbed intersections.

14.6 All sidewalks shall be imprinted with the Contractor's stamp indicating year of construction every 200 m.

14.7 Sidewalks shall be imprinted with a "CC" at all curb locations.

14.8 Minimum 28-day compressive strength shall be 30 MPa. Air entrainment shall be within 6 – 8%. All sidewalks are to be adequately reinforced as per drawing **G-19**.

14.9 The granular base course shall consist of 150 mm compacted thickness. The subgrade and gravel base course under the sidewalk shall be compacted to 100% Standard Proctor Density.

14.10 Horizontal sidewalk alignment for separate sidewalks shall be at a constant offset from the adjacent roadway centreline.

14.11 Sidewalks shall be graded to facilitate positive drainage flow. The minimum grade is 0.5%. Wick drains shall be provided under monolithic sidewalk, curb and gutter structures.

- 14.12** Cold weather concrete pouring below 5 degrees Celsius shall require prior approval by the Municipal Engineer and shall be placed according to CSA A23.1-14.

15 GRANULAR WALKWAYS AND WOOD MULCH HIKING TRAILS

- 15.1** The Developer shall be responsible for the design and construction of walkways or trails as required by the Development agreement. Rest areas are to be incorporated into the right-of-way width every 800 m.
- 15.2** Where a walkway/trail is required to be incorporated into a development the alignments and locations within the development must allow for adequate public access to parks, recreational areas and environmental and municipal reserves.
- 15.3** Top of bank walkways/trails shall be designed and constructed so as not to impede natural and post development drainage down the embankment. Grading is to ensure that concentrated overland flows are not generated any where along the bank unless an engineered outlet structures are present.
- 15.4** Where walkways/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 will require approval by Alberta Environment and applicable Federal Agencies. Design of footbridges will be in accordance with Part 4 of the Alberta Building Code.
- 15.5** Wherever possible, walkways/trails should be centred within the right-of-way. Walkways/trails may be offset from the centreline in situations where this will prevent conflicts with utilities sharing the same right-of-way.
- 15.6** Walkway/trail grading shall ensure positive drainage with a minimum grade of 2.0%. Grading shall be designed in order to incorporate the overall drainage pattern of the development.
- 15.7** Where the walkway/trail is located within an existing utility right-of-way, the Developer shall be responsible for obtaining necessary agreements from the proper authority.

- 15.8** Where the walkway/trail right-of-way is not shared with other utilities, it shall be a minimum of 6 m wide with a minimum clearance of 2 m from the edge of the walkway/trail to the property line.
- 15.9** The subgrade must be compacted to a minimum 98% Standard Proctor Density (SPD) for a depth of 150 mm.
- 15.10** 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 is to be anchored 0.06 m below excavation depth. The granular material shall be spread uniformly and compacted to 95% Standard Proctor Density.
- 15.11** 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/cross fall and roller compacted in-place ensuring a uniform depth and surface appearance.
- 15.12** Where walkways/trails are planned through wooded areas the minimum width is to be 1.5 m or as specified by the Development Authority. The minimum headroom clearance at the center line of the walkway/trail is to be 3.0 m. Vegetation is to be cleared a minimum of 0.6 m from the edge of the walkway/trail edge.
- 15.13** Surfacing material must be approved by the County prior to installation. Materials shall be selected to minimize the maintenance and replacement costs.
- 15.14** Rest areas are to incorporate a bench and waste receptacle as approved by the County.

16 APPROACHES

- 16.1** Approaches shall be situated such that they do not access directly onto a roadway with an estimated AADT of greater than 1000.
- 16.2** Approaches shall have a minimum clearance of 1.5 m from any surface feature such as hydrants, power poles, and curb cocks. In rural areas, the minimum clearance shall be 5.0 m.

- 16.3** Approaches shall not be situated on a curb return.
- 16.4** For corner lots, the approaches should access the road with a lesser traffic volume wherever possible. Refer to the Land Use Bylaw, Designated Setbacks from Roadways for the location of new and replaced approaches.
- 16.5** 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.
- 16.6** Residential approaches shall be a minimum of 7.5 m in width. Industrial approaches shall be a minimum of 10.0 m in width subject to review for specific vehicle movements anticipated with the development.
- 16.7** All approaches shall have the same structure as the adjoining roadway and be constructed up to the property line.
- 16.8** Ingress to or egress from County Roadways shall be a minimum of 150 m from existing approaches on the same side of the road.

17 SIGNAGE

- 17.1** The supply and installation of a traffic control and street identification signs as per Drawings **G-30** & **G-31** is the responsibility of the Developer.
- 17.2** Traffic control signs shall be manufactured and installed in accordance with the latest edition of “Uniform Traffic Control Devices for Canada”.
- 17.3** Street addressing signs shall be located within 10.0 m of the intersection in the direction of the near-side approaching traffic. Signs shall be offset at least 1.0 m from the edge of the road and mounted 3.0 m to 3.5 m above the finished road surface. Street addressing 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 address does not fit on the maximum size, two signs may be joined with an end bracket and H-clip. Signs shall have silver lettering with a blue background. Street name sign locations shall be approved by the County of Vermilion River.

Except in urban areas, a clearly visible panel containing the proper number of the parcel of land accompanied by the proper road number or number which complies with the following specifications; numbers and letters are not to be less than 10 cm (4 inches) in height, light reflective, white in color, mounted on a light reflective green panel, and the sign is to be posted 1.8 m (6 feet) to the left of the access/entrance of the parcel of land, and 0.3 m (1 foot) inside the property line and a minimum of 1.22 m (4 feet) above the natural ground level so as to be clearly visible from the road.

In urban areas, the proper number for the parcel of land such numbers being not less than 10 cm (4 inches) in height.

- 17.4** Street names shall be approved by the County of Vermilion River and included in the Development Agreement. Reference to Section H-3.1
- 17.5** All signs shall be placed so as not to obstruct the view of oncoming vehicles.
- 17.6** Permanent subdivision identification signs located at the entrance shall:
- 17.6.1** be designed to be maintenance free for a minimum of 15 years;
 - 17.6.2** be constructed and installed to hold signs rigidly in their proper and permanent position;
 - 17.6.3** be constructed of concrete, masonry, stone, non-ferrous metal or a combination thereof. No permanent wood signage will be permitted.
 - 17.6.4** be maintained by the Developer to the end of the maintenance period
- 17.7** Material for temporary signs, such as subdivision layout signs, shall be approved by the County prior to installation. Removal of temporary signs shall be the responsibility of the Developer prior to the end of the maintenance period.
- 17.8** The Developer shall install a County prepared Municipal Address Sign within the road right-of-way, adjacent to the first lot on the right hand side at the main subdivision entrance. The sign design and location shall be submitted to the County for approval. The developer will be responsible for supply of the post and sign installation. The Municipal Address Sign shall be in compliance with Bylaw 06-023, or as amended and/or replaced from time to time.

- 17.9** All parcels of land in the County of Vermilion River fronting upon a road, which are occupied by a household, shall be assigned a municipal address by the County of Vermilion River.

18 **DRAINAGE AND CULVERTS**

- 18.1** It is the Developers responsibility to construct a drainage system that will meet the flow requirements outlined in Section F for both rural and urban cross sections.
- 18.2** Ditches for rural roadways shall have backslopes no steeper than 2H:1V.
- 18.3** Ditch grades shall match the road grades wherever possible.
- 18.4** 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.
- 18.5** Drainage channels shall be provided with ditch checks and/or other means of erosion control as necessary. All drainages shall be seeded. See Section H for seed mixture.
- 18.6** Ditches shall have a flat bottom, width as per applicable design standard.
- 18.7** Culvert sizing is 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 height of the subgrade.
- 18.8** 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.
- 18.9** Minimum pipe sizes for various uses are as follows:

Residential Approach Culvert	500 mm diameter
Industrial Approach Culvert	600 mm diameter
Roadway Centreline Culverts	800 mm diameter*

*Or as determined by the Municipal Engineer

- 18.10** All culverts shall have appropriate sloped end and rip rap treatments depending on application. Inverts shall be extended to the toe of the side slope.

18.11 The culvert grade shall not be less than the ditch grades at the inlet and outlet.

18.12 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.

19 **ROAD GRAVELLING (RURAL ROADS)**

19.1 The roadway gravelling application rate shall be determined by the municipal engineer based on the roadway use and soil conditions.

19.2 All rural residential driveways shall be gravelled at a minimum rate of 5 cubic metres per approach, from the roadway shoulder to the property line.

19.3 Gradation of surface gravel shall be approved by the Municipal Engineer.

20 **PAVEMENT PAYMENT PENALTIES**

20.1 If the average core thickness is deficient relative to the overall pavement design thickness, the area of asphalt pavement will be assessed a pay factor as outlined below. The Pay factor will be applied to the unit price for the supply and placement of asphalt pavement in the mat area, irrespective if the asphalt surfacing is staged over an identified period or completed immediately following the placement of the initial lift or lifts. In the case of staged paving, the pay factor will be assessed against the final lift.

Thickness Deficiency (mm)	Pay Factor (%)
6.0	100.00
7.0	97.0
8.0	93.7
10.0	85.5
11.0	80.5
12.0	Grind & Re-surface

There shall be no adjustment in the unit price to asphalt pavement that exceeds the specified thickness, and no claim from the Developer and/or Contractor for extra payment will be accepted. The application of an adjusted unit price for

deficient thickness does not relieve the Developer and/or Contractor from their obligations and responsibilities for the maintenance and warranty requirements.

- 20.2** If the average core density for each lift is below the specified density, the represented mat area may be accepted subject to a pay factor as outlined below. The pay factor will be applied to the unit price for the supply and placement of asphalt pavement in the mat area.

Actual Density (%)	Pay Factor (%)
98.0	100.00
97.5-97.99	99.0
97.0-97.49	97.8
96.5-96.99	94.4
96.0-96.49	88.9
Less than 96.0	Reject

No Adjustment to the unit price will be made for areas where the density may exceed the specified density.

- 20.3** It shall be the responsibility of the Developer’s Engineer to submit the pay factor calculations as applied to the contract price to the County for approval prior to acceptance of the Construction Completion Certificate.

21 PARKING FACILITIES

21.1 Off-Street Vehicular Parking

21.1.1 When any new development is proposed, including a change of use of existing development, or when any existing development is, in the opinion of the Development Authority, substantially enlarged or increased in capacity, off-street vehicular parking or garage spaces shall be provided in accordance with the Standards of Off-Street Vehicular Parking.

21.1.2 All off-street vehicular parking spaces shall conform to the requirements outlined in the table below.

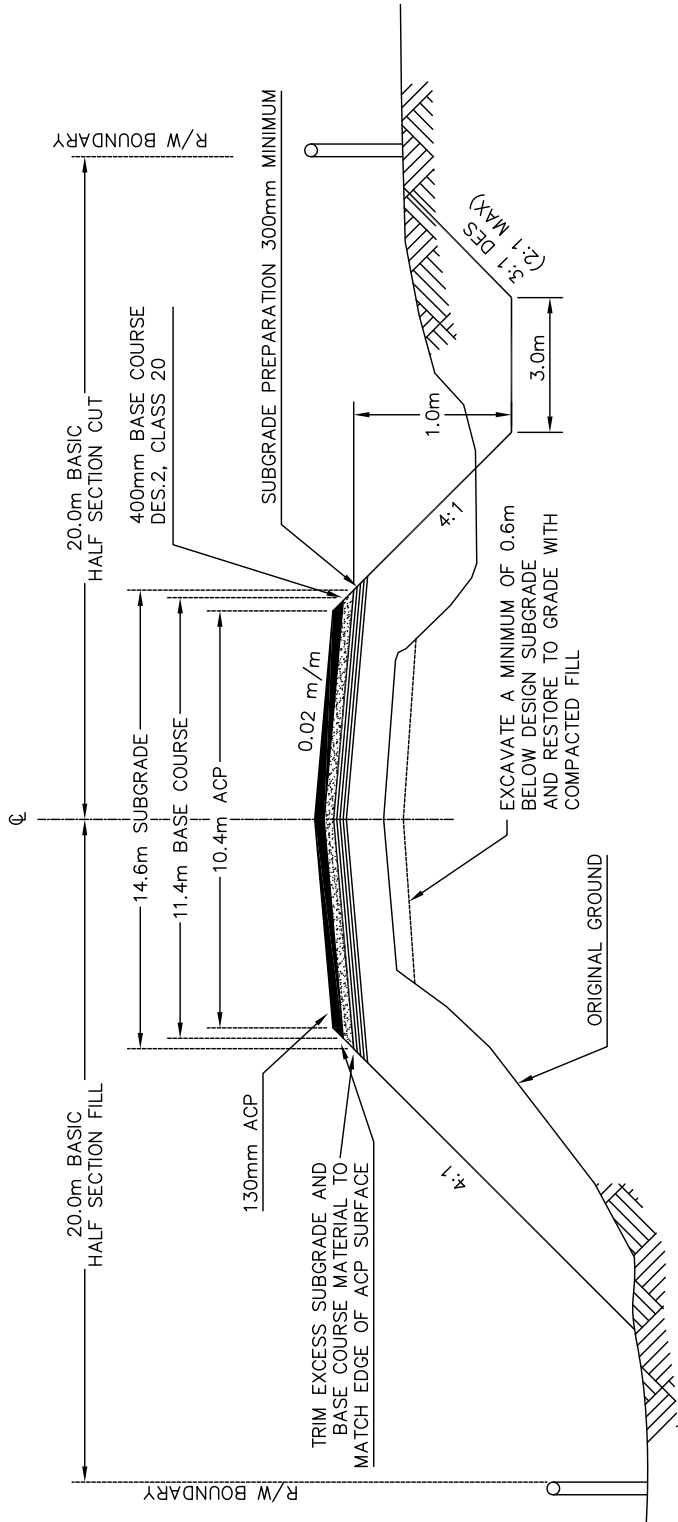
Table 1.2: Minimum Parking Standards

a Parking Angle in Degrees	b Width of Space	c Depth of Space Perpendicular to Aisle	d Width of Space Parallel to Aisle	e Overall Depth	f Width of Maneuvering Aisle
0	2.8 m	2.8 m	7.0 m	9 m	One Way 4 m
45	2.8 m	5.8 m	4.0 m	15 m	One Way 4 m
90	2.8 m	6.1 m	2.8 m	18 m	One Way 7 m

21.1.3 For other requirements for Off-Street Vehicular Parking see County of Vermilion River Land Use Bylaw.

21.1.4 Handicapped Spaces are to be provided as per land use bylaw or Alberta building code whichever is greater.

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NOTE: THIS STANDARD AND SURFACING STRUCTURE IS INTENDED FOR ARTERIAL ROADS WITH AN AADT > 1000.

- 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 MAXIMUM



General Municipal Servicing Standards

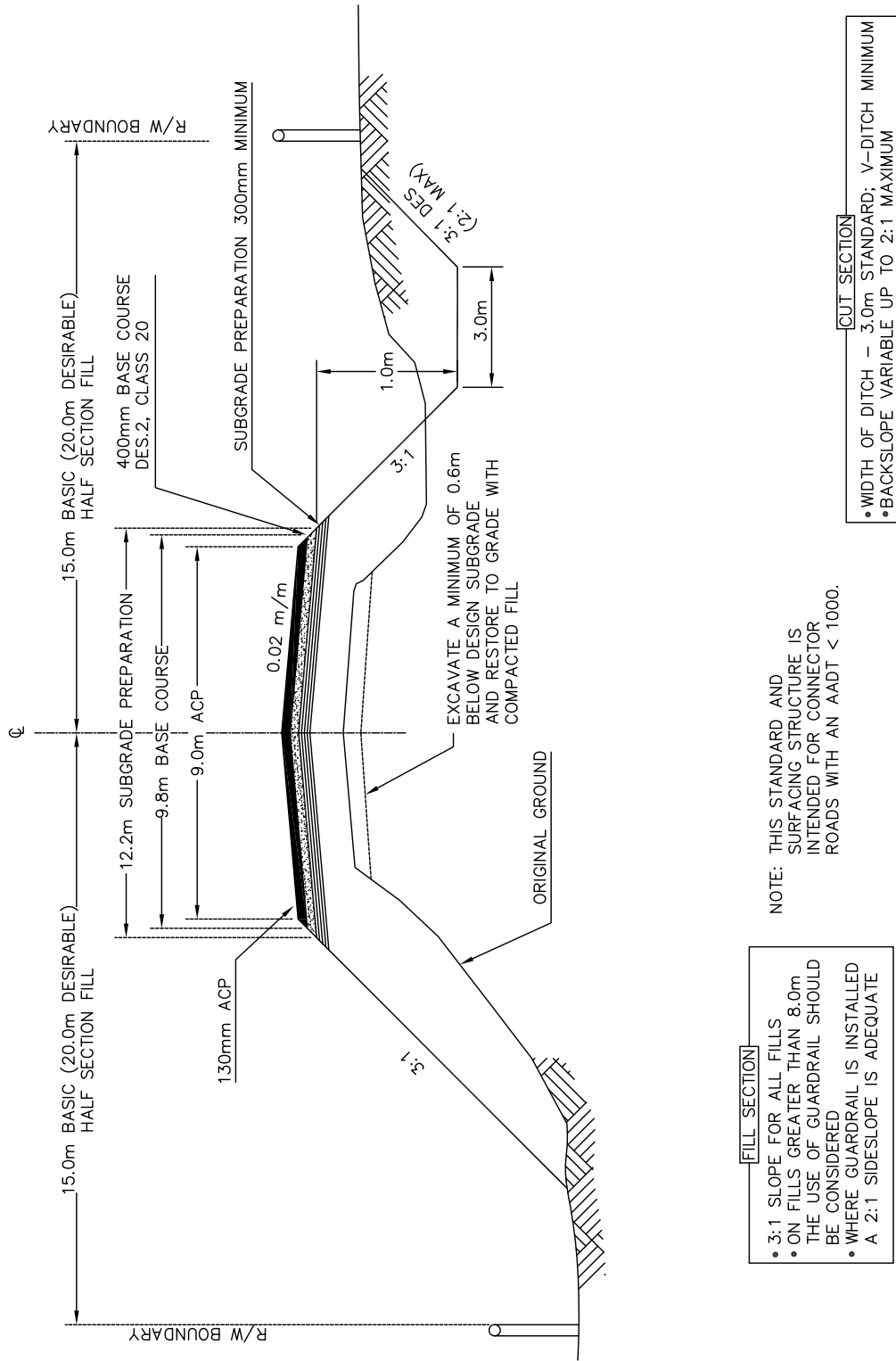


Rev.
Rev.
Rev.
Date: APRIL 2021
Scale: N.T.S.

TYPICAL ARTERIAL CROSS SECTION – ASPHALT CONCRETE PAVEMENT SURFACING

Approved:

Drawing:
G-01



General Municipal Servicing Standards

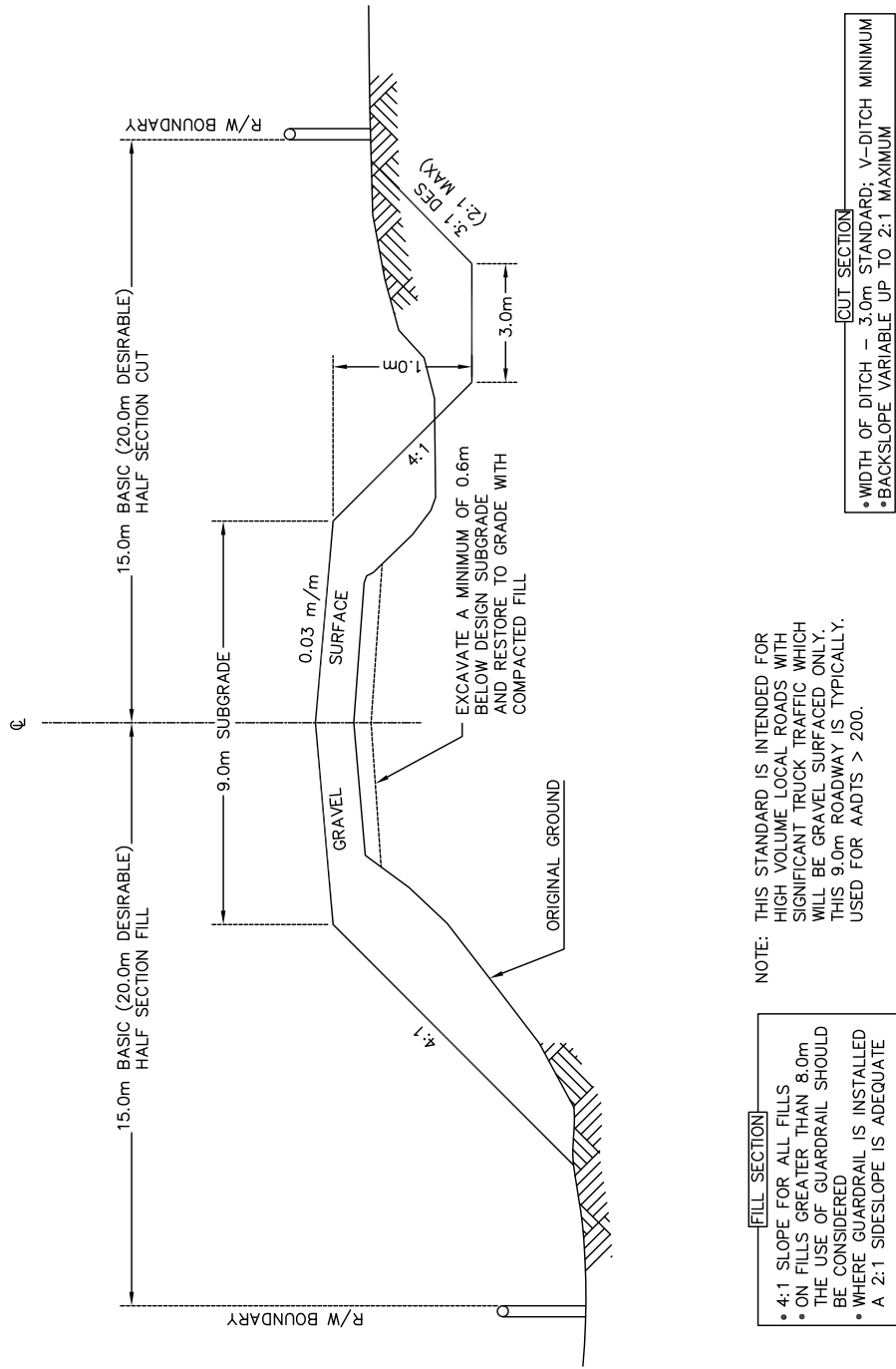


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Rev.	
Date:	APRIL 2021
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TYPICAL CONNECTOR CROSS SECTION – ASPHALT CONCRETE PAVEMENT SURFACING

Approved:

Drawing:
G-02



NOTE: THIS STANDARD IS INTENDED FOR HIGH VOLUME LOCAL ROADS WITH SIGNIFICANT TRUCK TRAFFIC WHICH WILL BE GRAVEL SURFACED ONLY. THIS 9.0m ROADWAY IS TYPICALLY USED FOR AADTS > 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 MAXIMUM

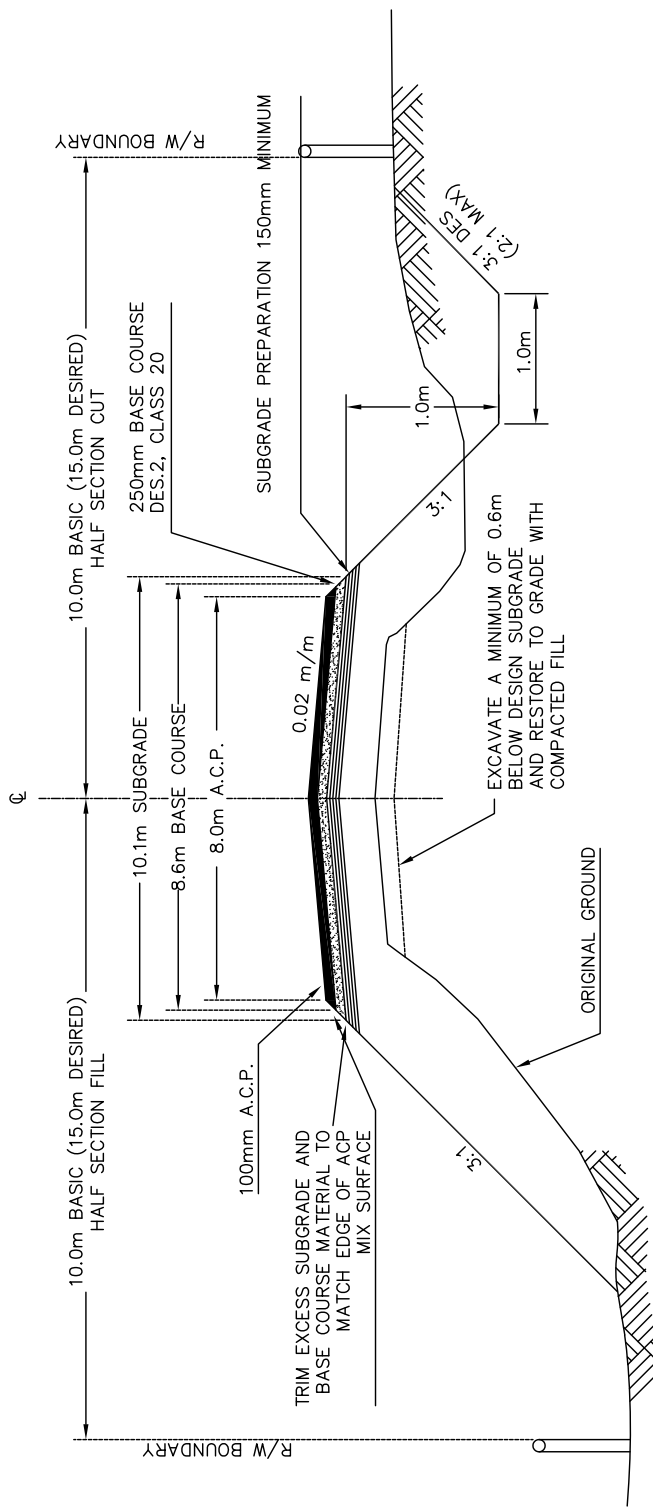


General Municipal Servicing Standards



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Rev.	
Date:	FEBRUARY 2020
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TYPICAL CROSS SECTION FOR GRADING AND GRAVEL SURFACING - CONNECTOR	
Approved:	Drawing: G-03



NOTE: THIS STANDARD AND SURFACING STRUCTURE IS INTENDED FOR HIGH VOLUME LOCAL ROADS (AADT < 200)

- 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 - 1.0m STANDARD; V-DITCH MINIMUM
 - BACKSLOPE VARIABLE UP TO 2:1 MAXIMUM



General Municipal Servicing Standards

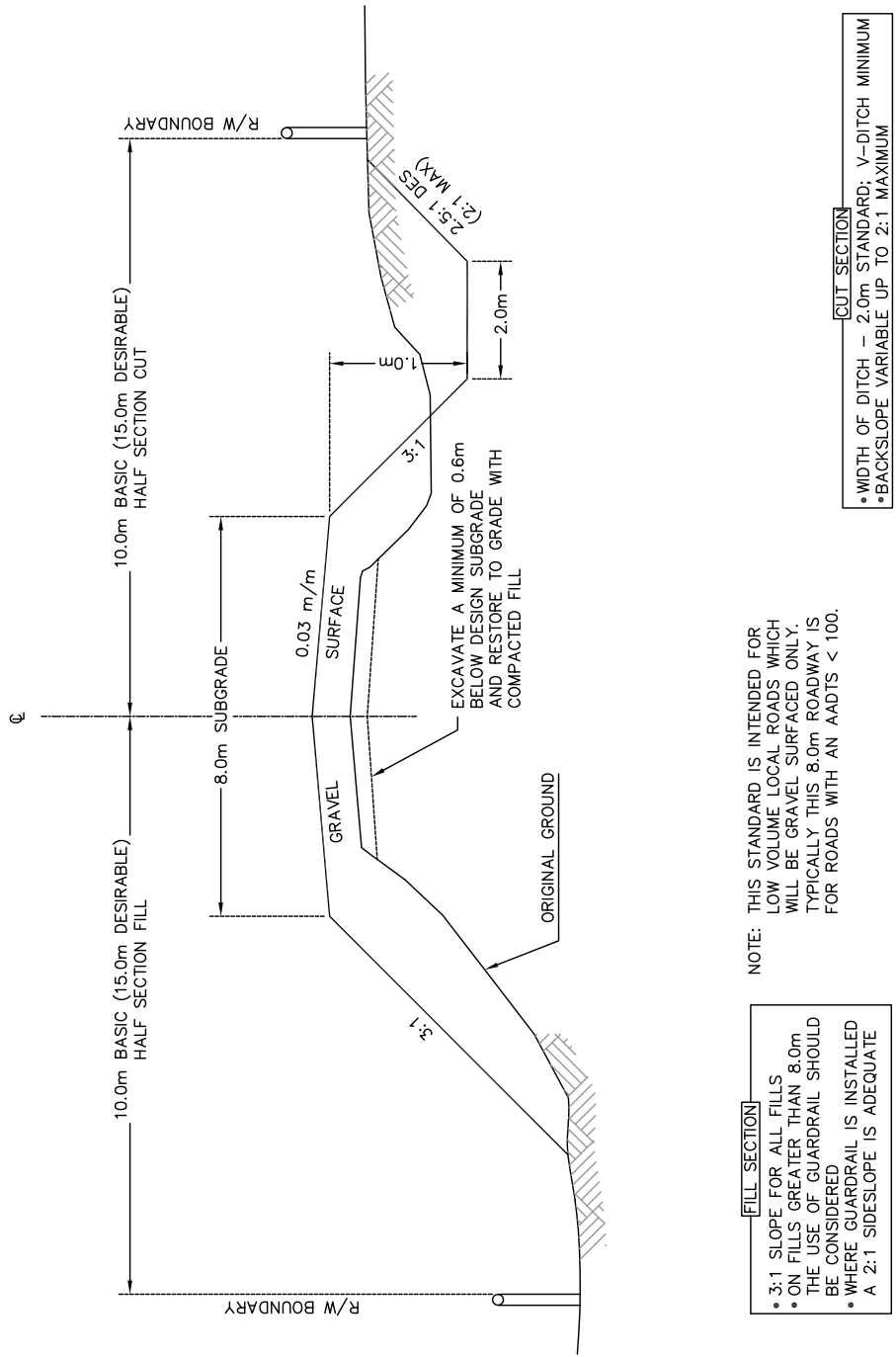


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Rev.	
Date:	FEBRUARY 2020
Scale:	N.T.S.

TYPICAL CROSS SECTION FOR ASPHALT CONCRETE PAVEMENT SURFACING - LOCAL ROAD

Approved:

Drawing:
G-04



FILL SECTION

NOTE: THIS STANDARD IS INTENDED FOR LOW VOLUME LOCAL ROADS WHICH WILL BE GRAVEL SURFACED ONLY. TYPICALLY THIS 8.0m ROADWAY IS FOR ROADS WITH AN AADTS < 100.

CUT SECTION

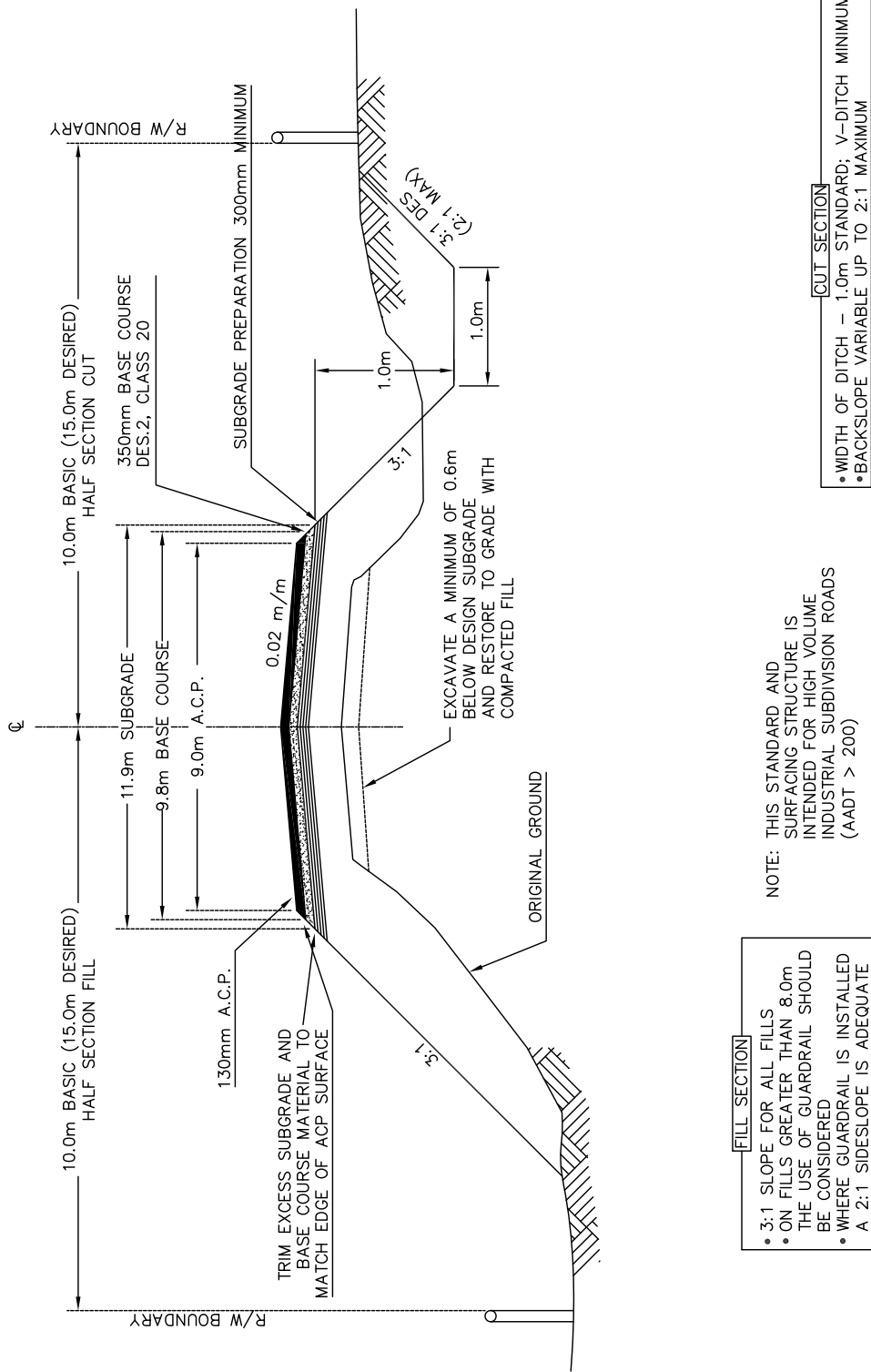
- 3:1 SLOPE FOR ALL FILLS
- ON FILLS GREATER THAN 8.0m THE USE OF GUARDRAIL SHOULD BE CONSIDERED
- WHERE GUARDRAIL IS INSTALLED A 2:1 SIDESLOPE IS ADEQUATE

- WIDTH OF DITCH – 2.0m STANDARD; V-DITCH MINIMUM
- BACKSLOPE VARIABLE UP TO 2:1 MAXIMUM



General Municipal Servicing Standards

	Rev.	TYPICAL CROSS SECTION FOR GRADING AND GRAVEL SURFACING – LOCAL ROAD	
	Rev.		
	Rev.		
	Date: FEBRUARY 2020		Approved:
	Scale: N.T.S.		Drawing: G-05



General Municipal Servicing Standards

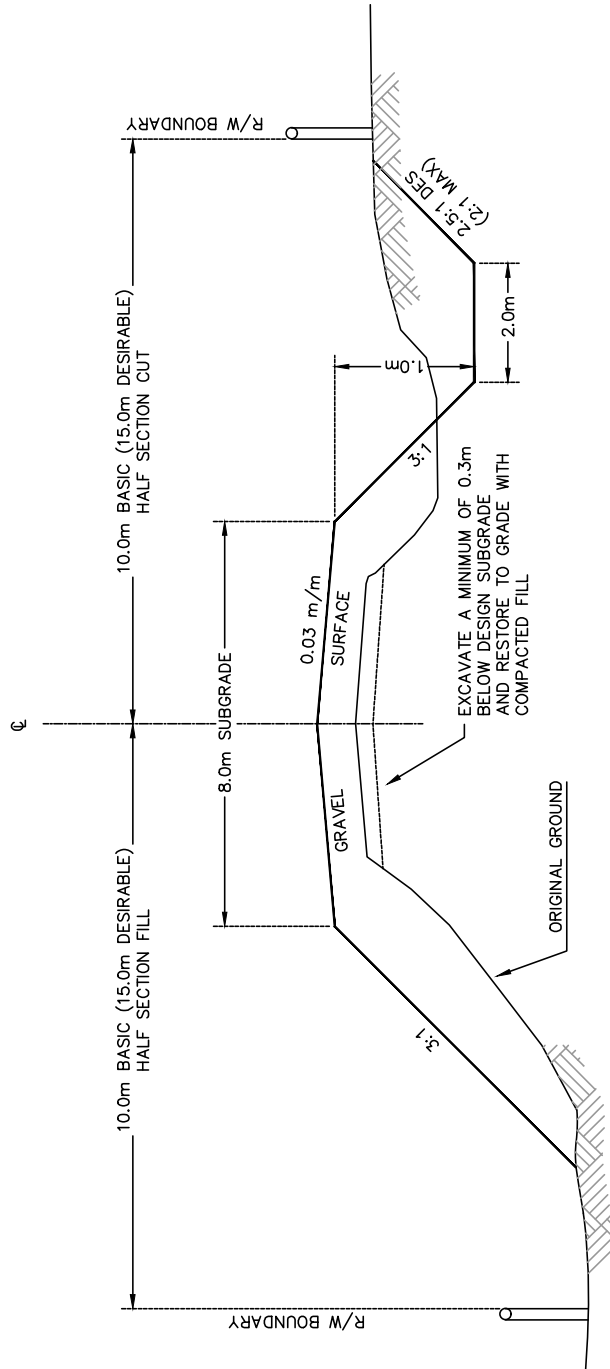


Rev.	
Rev.	
Rev.	
Date:	APRIL 2021
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TYPICAL SUBDIVISION (INDUSTRIAL) CROSS SECTION
– ASPHALT CONCRETE PAVEMENT SURFACING

Approved:

Drawing:
G-06



NOTE: THIS STANDARD IS INTENDED FOR LOW VOLUME LOCAL ROADS WHICH WILL BE GRAVEL SURFACED ONLY. TYPICALLY THIS 8.0m ROADWAY IS FOR ROADS WITH AN AADTS < 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 MAXIMUM



General Municipal Servicing Standards

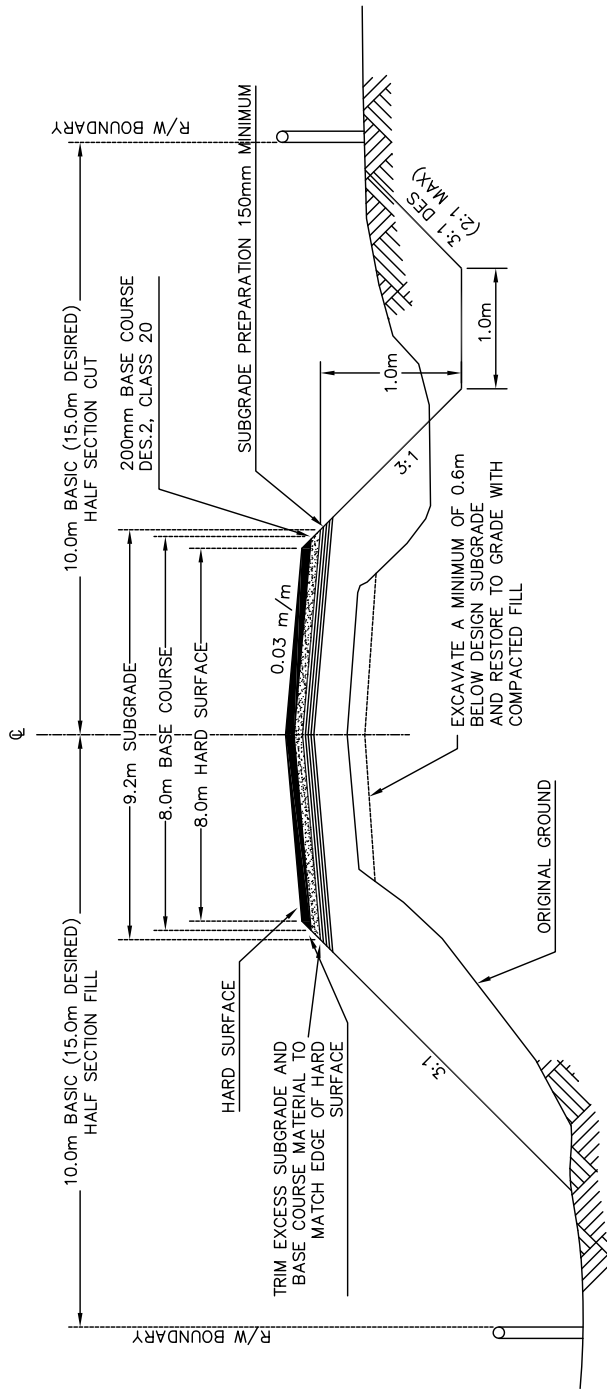


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Rev.	
Date:	FEBRUARY 2020
Scale:	N.T.S.

TYPICAL CROSS SECTION FOR GRADING AND GRAVEL SURFACING - INDUSTRIAL SUBDIVISION

Approved:

Drawing:
G-07



- 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

NOTE: THIS STANDARD AND SURFACING STRUCTURE IS INTENDED FOR HIGH VOLUME RESIDENTIAL SUBDIVISION ROADS (AADT > 200) WITH MINIMAL TRUCK TRAFFIC.

- CUT SECTION**
- WIDTH OF DITCH – 1.0m. STANDARD; V-DITCH MINIMUM
 - BACKSLOPE VARIABLE UP TO 2:1 MAXIMUM



General Municipal Servicing Standards

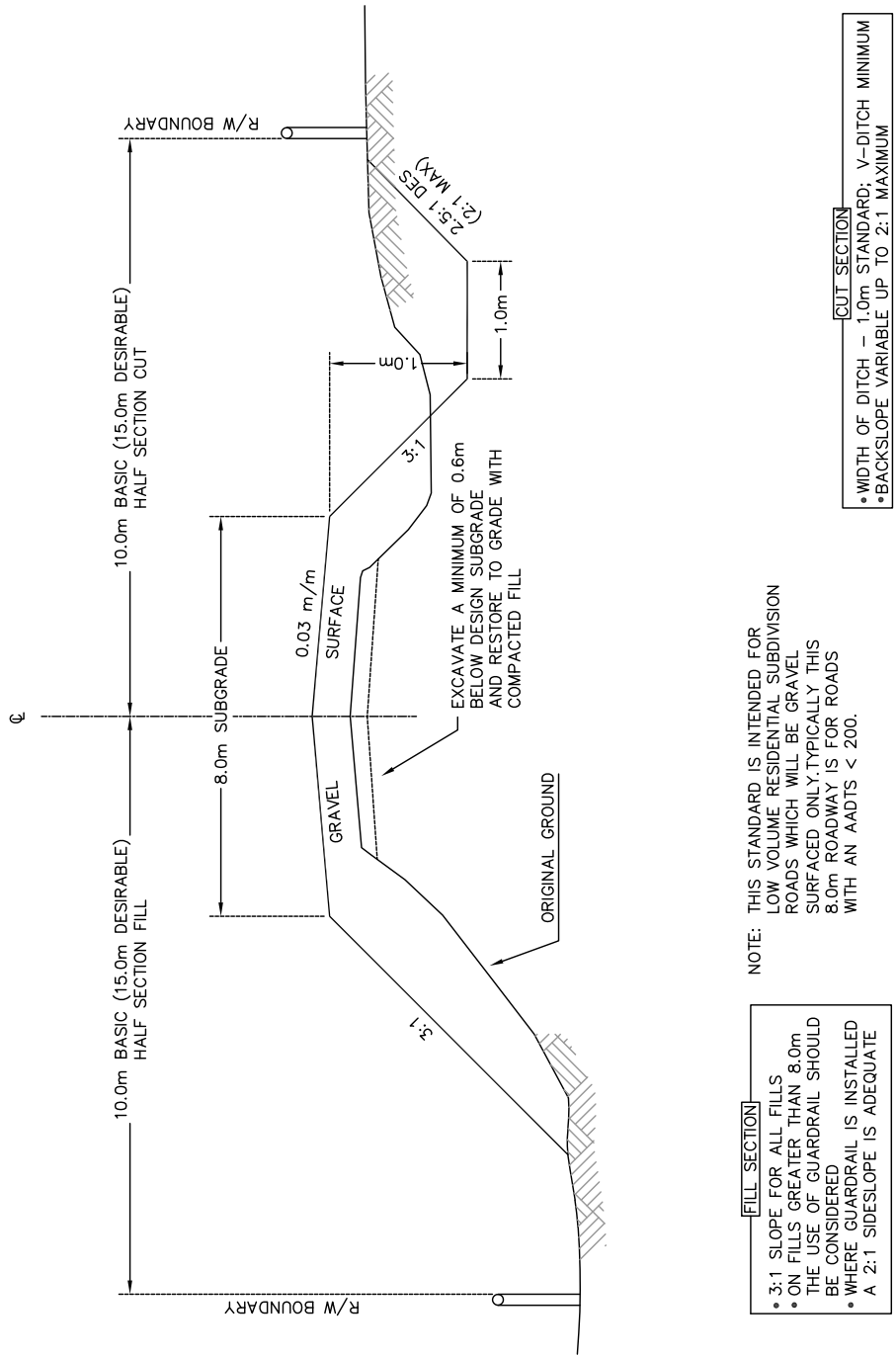


Rev.
Rev.
Rev.
Date: FEBRUARY 2020
Scale: N.T.S.

TYPICAL CROSS SECTION FOR ASPHALT STABILIZED BASE COURSE SURFACING – RESIDENTIAL SUBDIVISION

Approved:

Drawing:
G-08

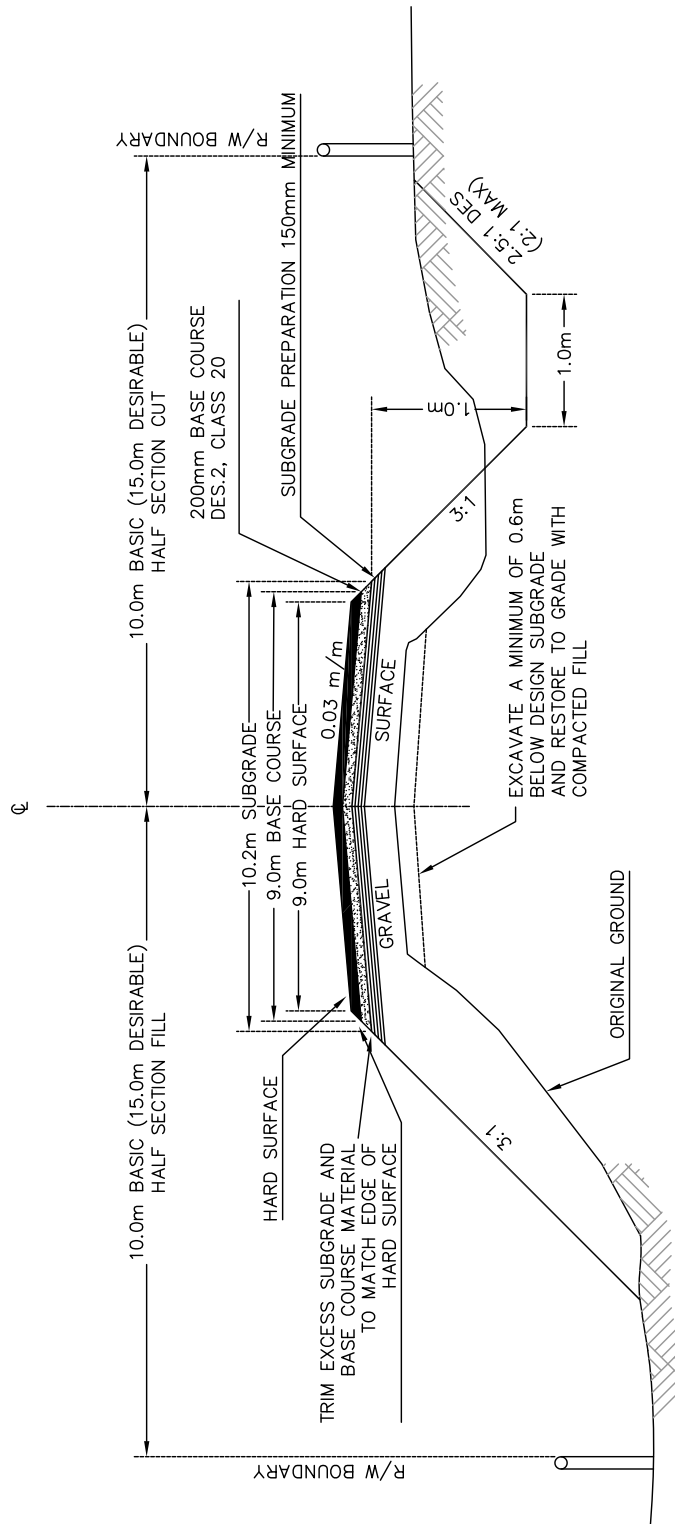


General Municipal Servicing Standards



Rev.
Rev.
Rev.
Date: FEBRUARY 2020
Scale: N.T.S.

TYPICAL CROSS SECTION FOR GRADING AND GRAVEL SURFACING – RESIDENTIAL SUBDIVISION	
Approved:	Drawing: G-09



FILL SECTION

NOTE: THIS STANDARD IS INTENDED FOR HIGH VOLUME RURAL HAMLET ROADS WHICH WILL BE GRAVEL SURFACED ONLY. TYPICALLY THIS 8.0m ROADWAY IS FOR ROADS WITH AN AADTS > 200.

- 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 – 1.0m STANDARD; V-DITCH MINIMUM
- BACKSLOPE VARIABLE UP TO 2:1 MAXIMUM



General Municipal Servicing Standards

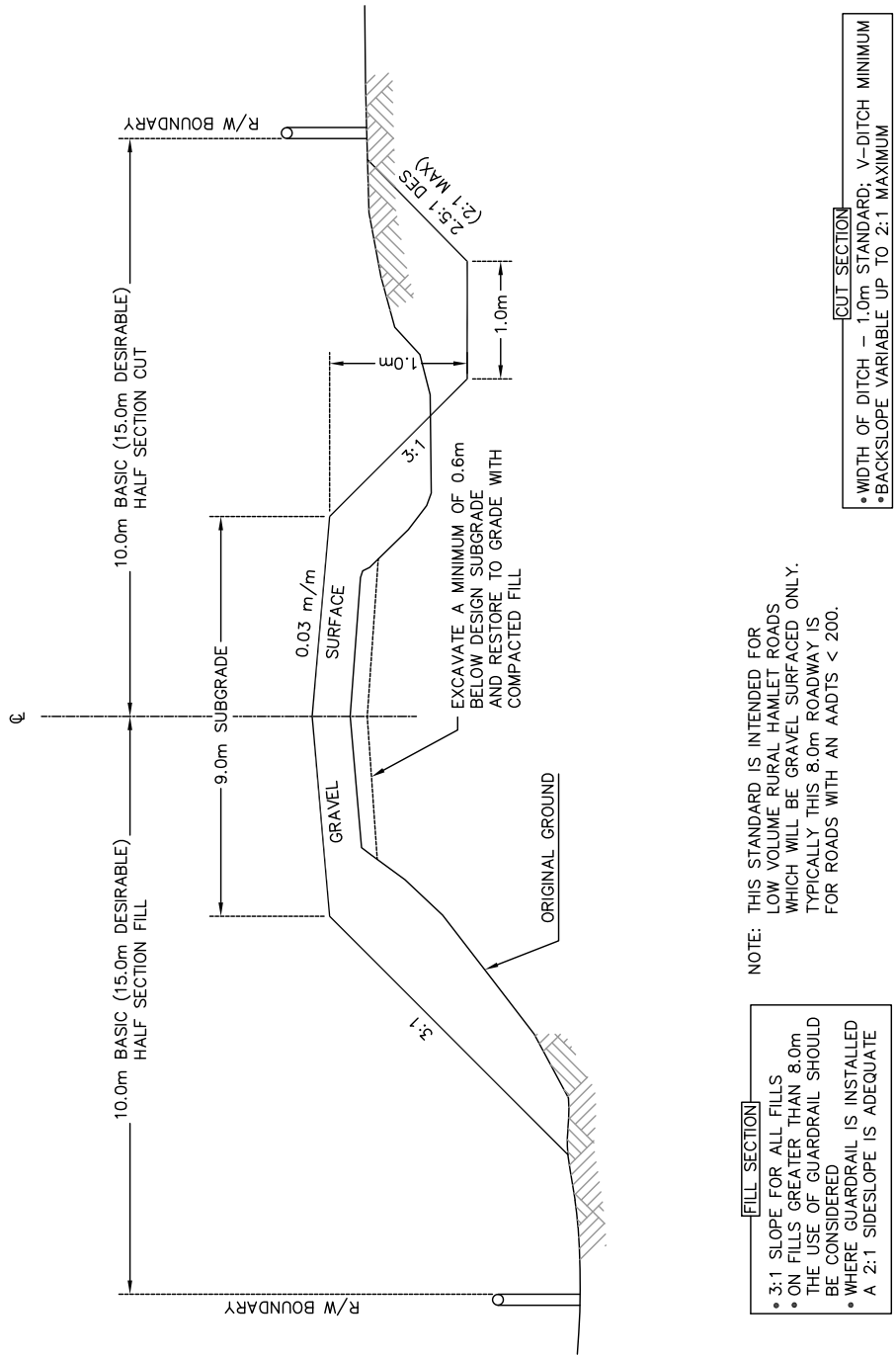


Rev.	
Rev.	
Rev.	
Date:	FEBRUARY 2020
Scale:	N.T.S.

TYPICAL CROSS SECTION FOR ASPHALT STABILIZED BASE COURSE – RURAL HAMLET

Approved:

Drawing:
G-11



FILL SECTION

NOTE: THIS STANDARD IS INTENDED FOR LOW VOLUME RURAL HAMLET ROADS WHICH WILL BE GRAVEL SURFACED ONLY. TYPICALLY THIS 8.0m ROADWAY IS FOR ROADS WITH AN AADTS < 200.

CUT SECTION

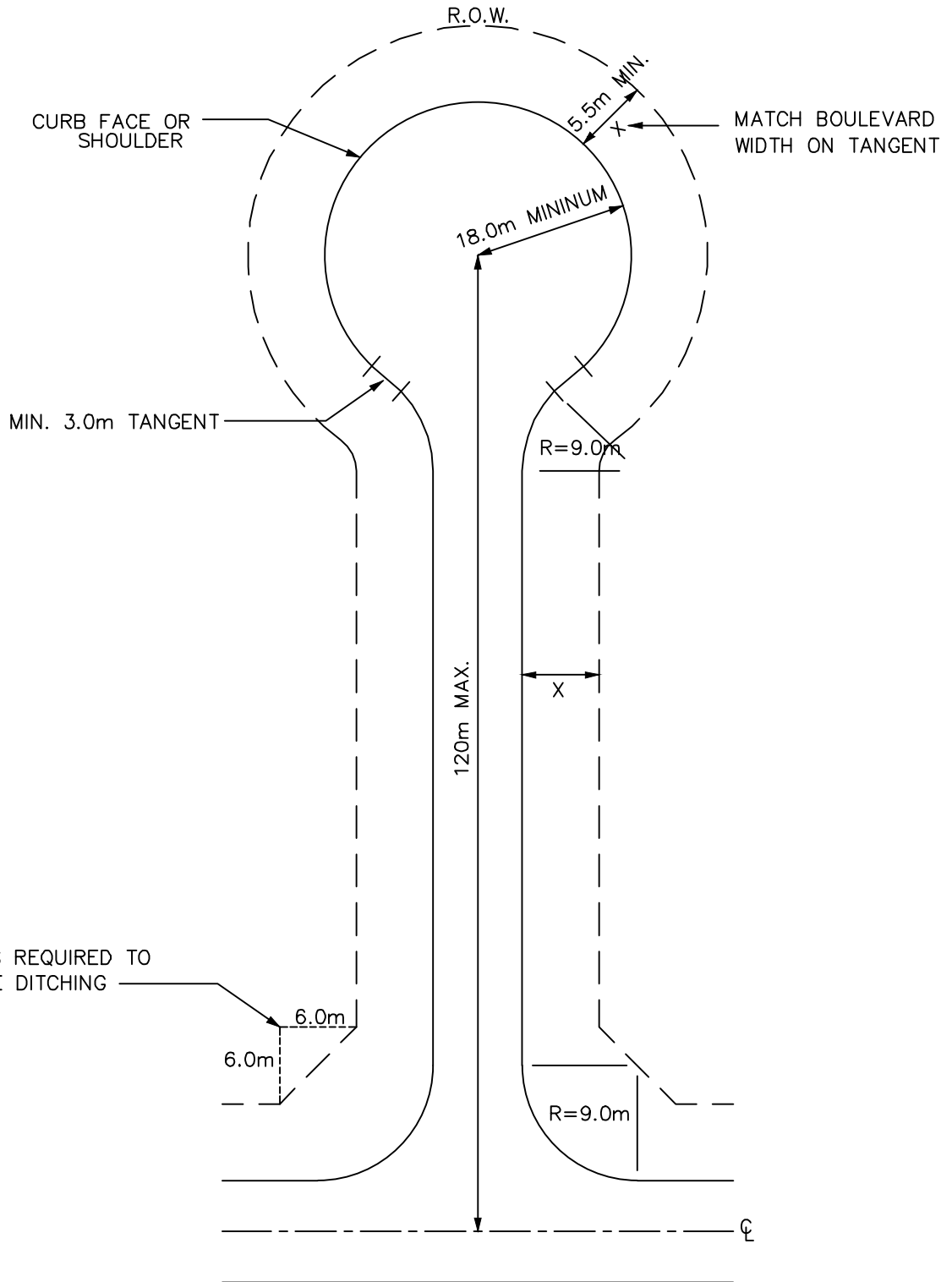
- 3:1 SLOPE FOR ALL FILLS
- ON FILLS GREATER THAN 8.0m THE USE OF GUARDRAIL SHOULD BE CONSIDERED
- WHERE GUARDRAIL IS INSTALLED A 2:1 SIDESLOPE IS ADEQUATE

- WIDTH OF DITCH – 1.0m STANDARD; V-DITCH MINIMUM
- BACKSLOPE VARIABLE UP TO 2:1 MAXIMUM



General Municipal Servicing Standards

	Rev.	TYPICAL CROSS SECTION FOR GRADING AND GRAVEL SURFACING – RURAL HAMLET	Approved:	Drawing: G-12
	Rev.			
	Rev.			
	Date: FEBRUARY 2020			
	Scale: N.T.S.			



General Municipal Servicing Standards



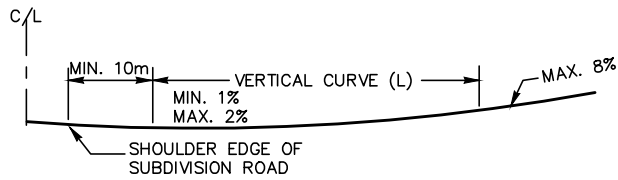
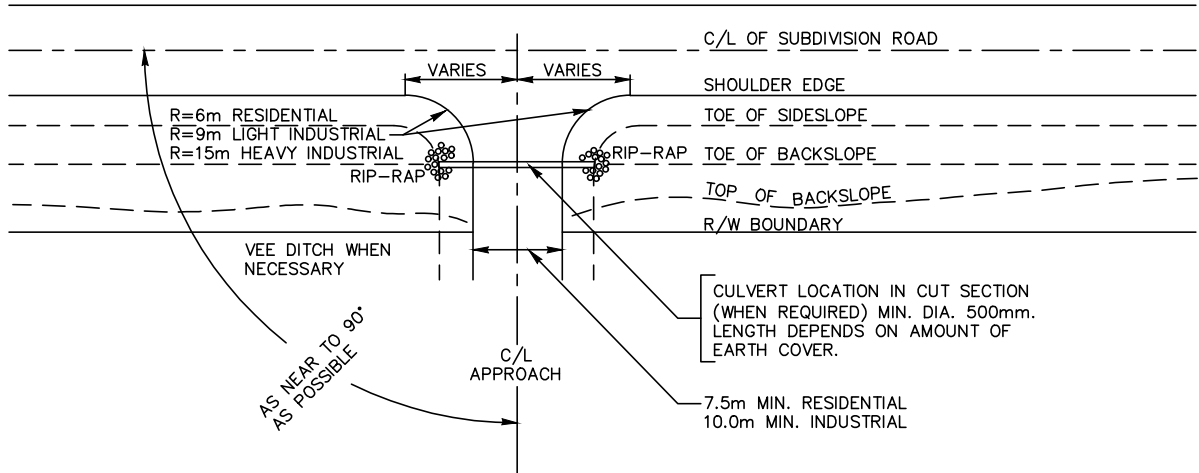
Rev.	
Rev.	
Rev.	
Date:	SEPTEMBER 2020
Scale:	N.T.S.

TYPICAL CUL-DE-SAC DETAIL – URBAN
AND RURAL STANDARD

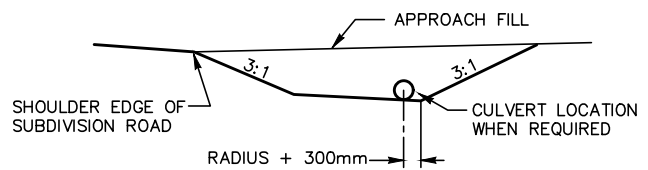
Approved:

Drawing:

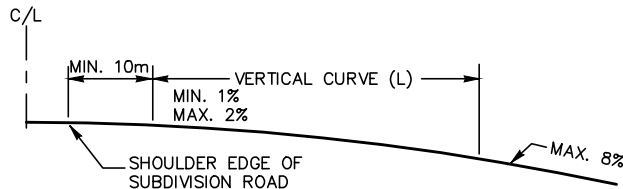
G-13



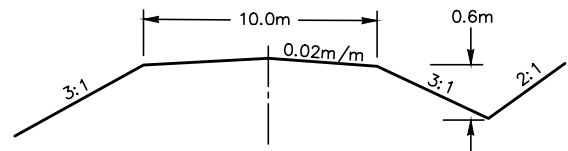
PROFILE - APPROACH IN CUT



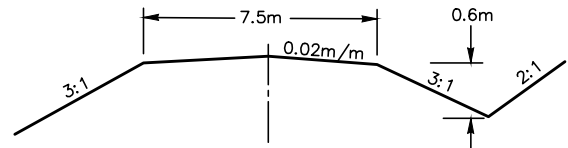
DETAIL OF DITCH & CULVERT LOCATION



PROFILE - APPROACH IN FILL



MINIMUM INDUSTRIAL APPROACH CROSS SECTION



MINIMUM RESIDENTIAL 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

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.



General Municipal Servicing Standards

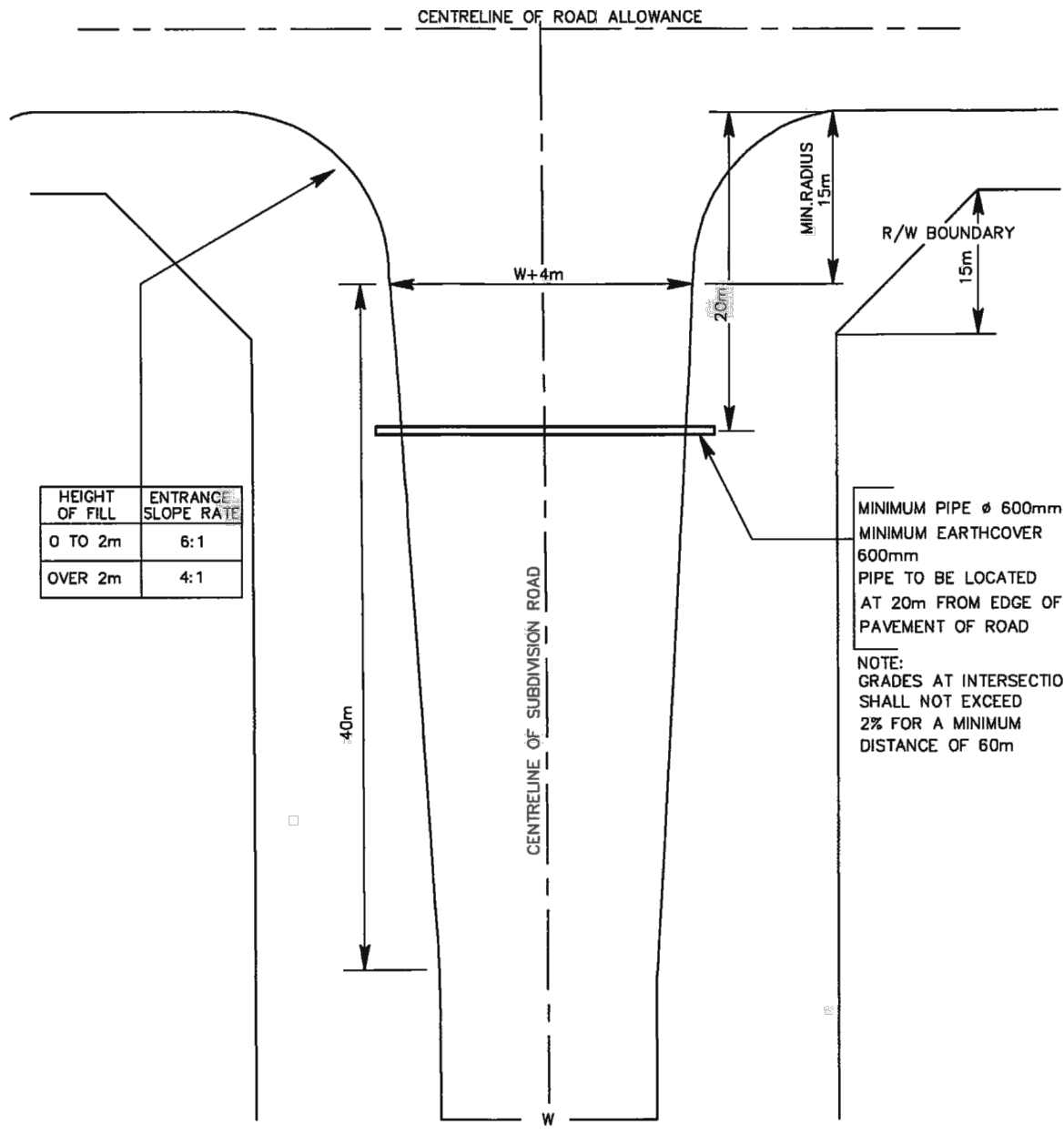


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Date:	SEPTEMBER 2020
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RESIDENTIAL OR INDUSTRIAL APPROACH STANDARD

Approved:

Drawing:
G-14



W = FINISHED PAVED WIDTH



General Municipal Servicing Standards

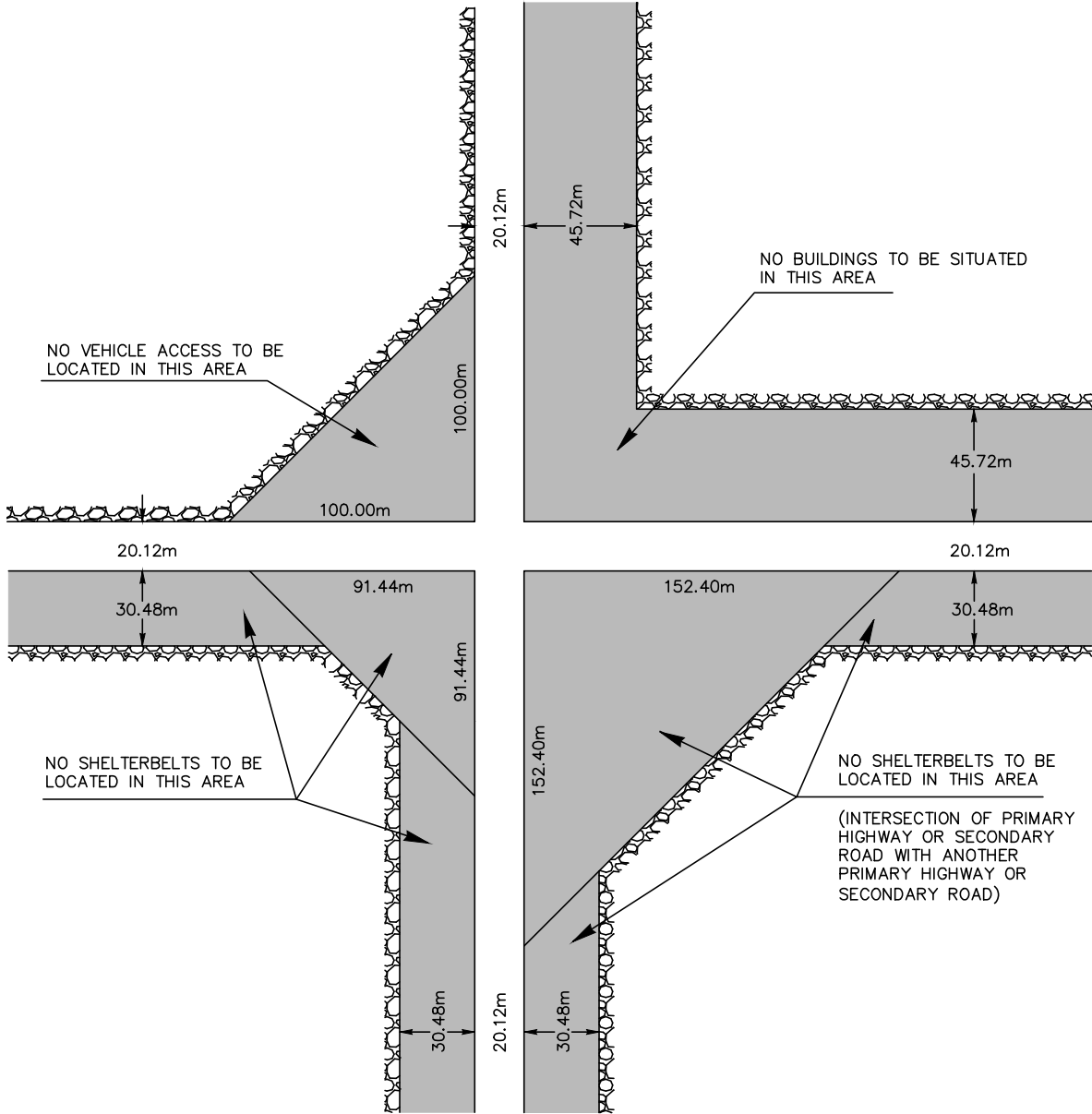


Rev.	
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Rev.	
Date:	SEPTEMBER 2020
Scale:	N.T.S.

Approved:

MAJOR INTERSECTION LAYOUT
INDUSTRIAL – RURAL STANDARD

Drawing:
G-15



General Municipal Servicing Standards



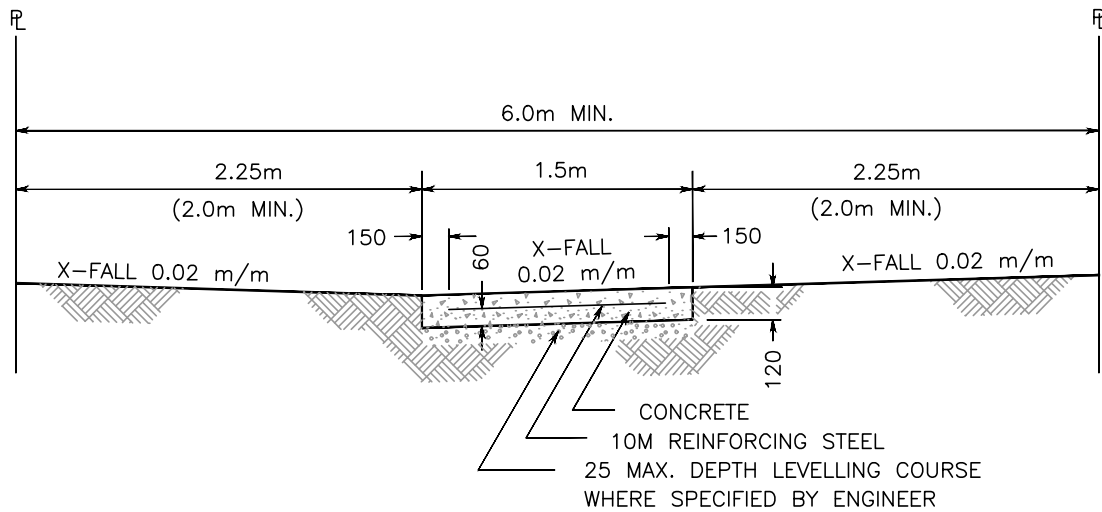
Rev.	
Rev.	
Rev.	
Date:	SEPTEMBER 2020
Scale:	N.T.S.

ACCESS AND DEVELOPMENT CONTROL
MUNICIPAL GRID ROAD INTERSECTION

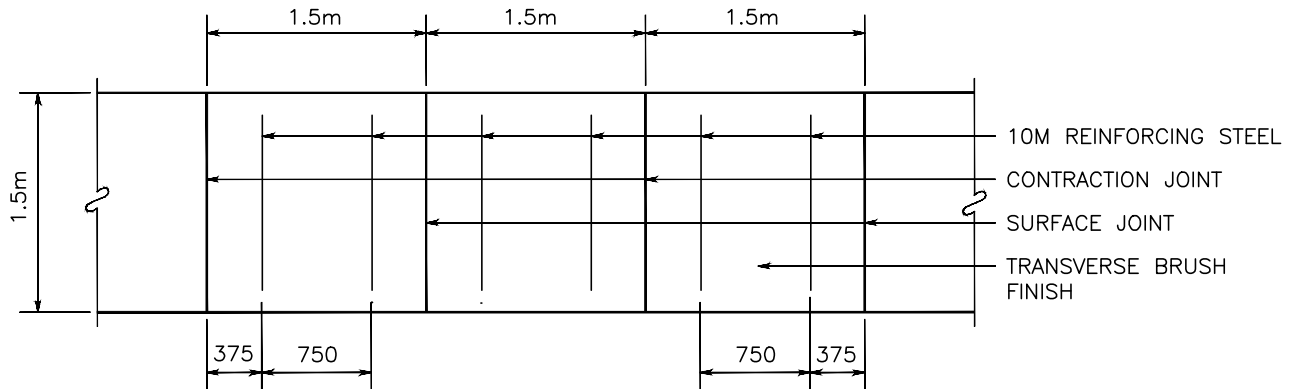
Approved:

Drawing:

G-16



TYPICAL SECTION



PLAN VIEW

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED



General Municipal Servicing Standards



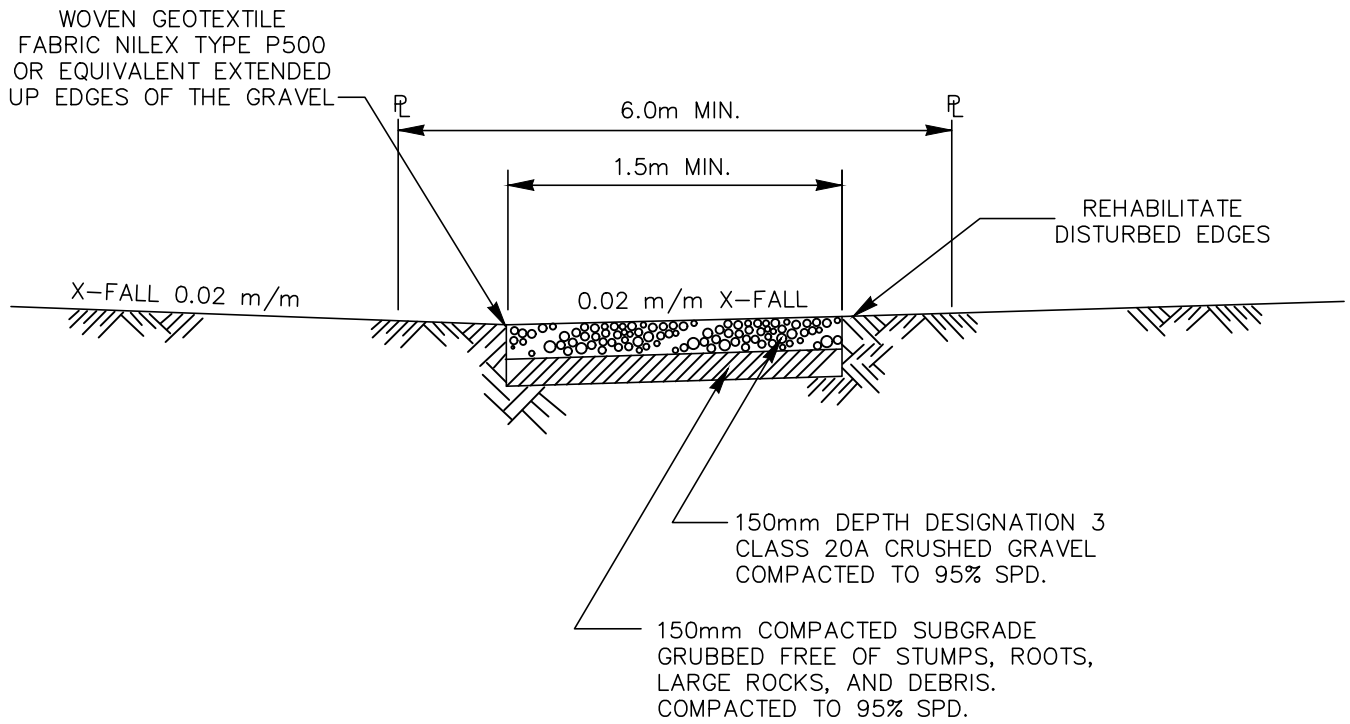
Rev.	
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Rev.	
Date:	SEPTEMBER 2020
Scale:	N.T.S.

CONCRETE WALKWAY

Approved:

Drawing:

G-19



TYPICAL SECTION



General Municipal Servicing Standards

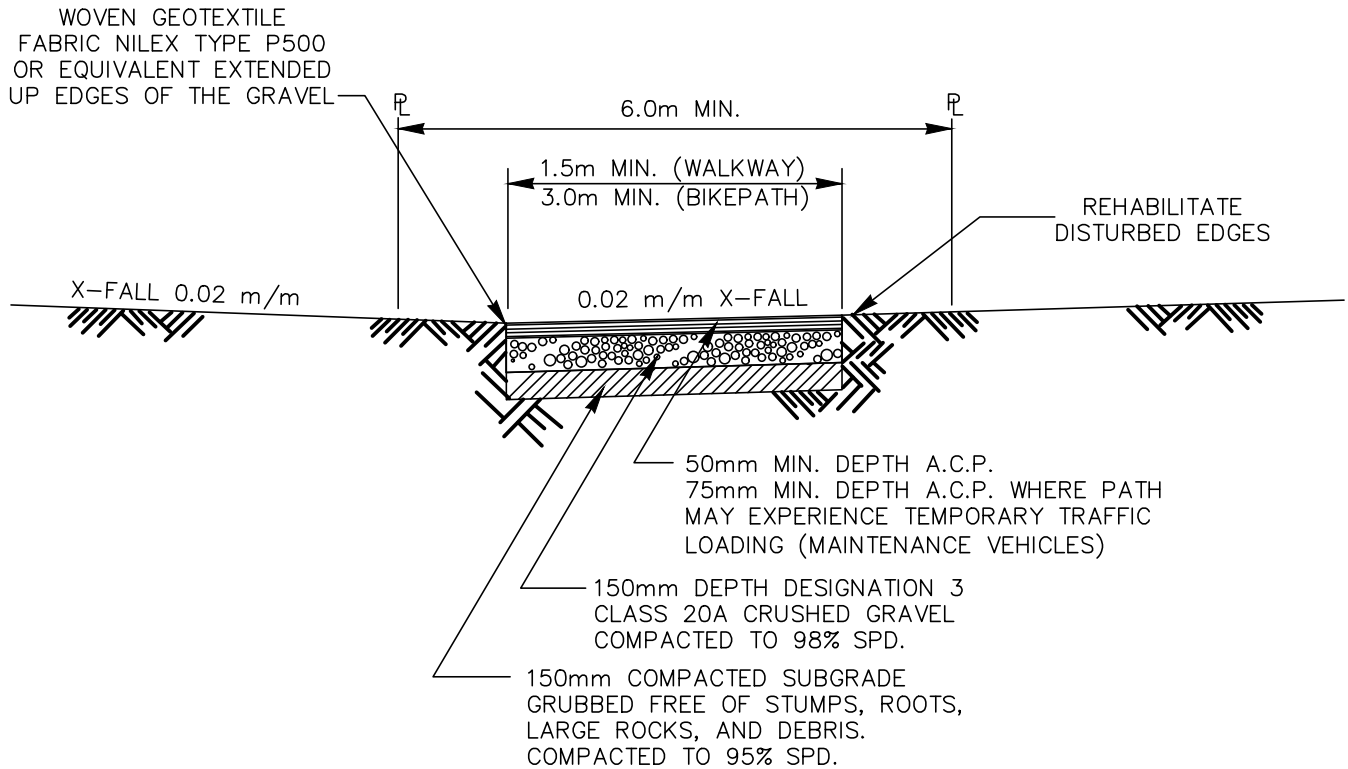


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Rev.	
Date:	SEPTEMBER 2020
Scale:	N.T.S.

GRANULAR WALKWAY

Approved:

Drawing:
G-20



TYPICAL SECTION



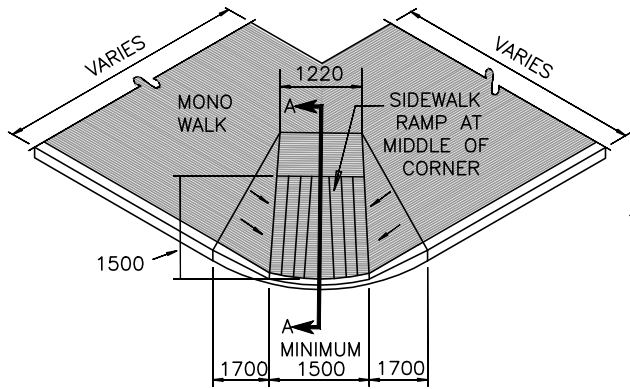
General Municipal Servicing Standards



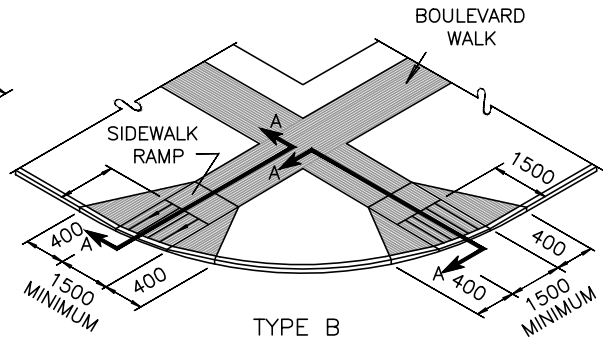
Rev.	
Rev.	
Rev.	
Date:	SEPTEMBER 2020
Scale:	N.T.S.

PAVED WALKWAY / BIKE PATH	
Approved:	

Drawing:	G-21
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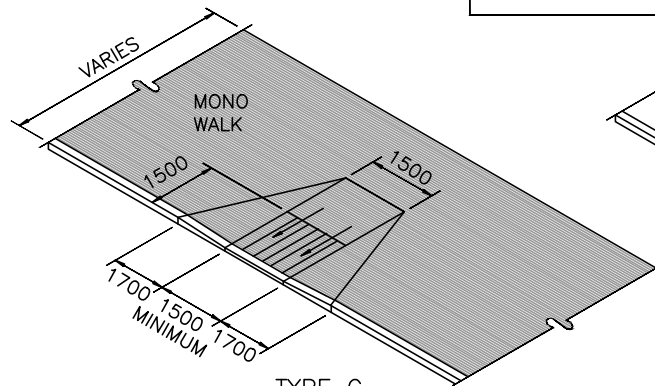


TYPE A

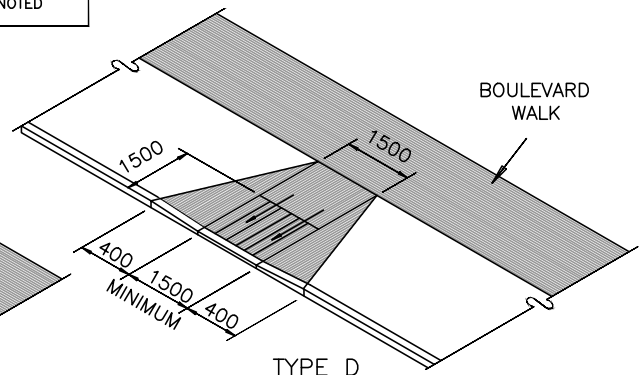


TYPE B

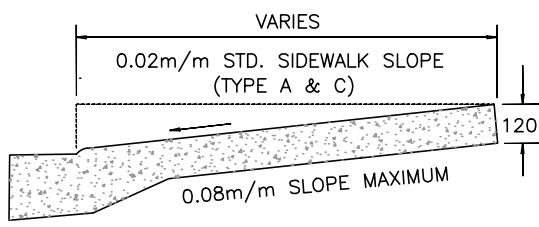
ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED



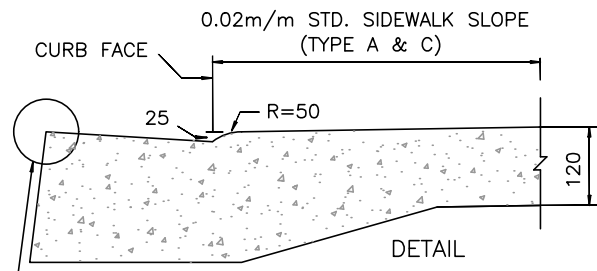
TYPE C



TYPE D



TYPICAL CROSS SECTION A-A



- a) MATCH ASPHALT SURFACE TO OUTER LIP WITHIN 3mm:
- b) IF ASPHALT TOPLIFT IS DEFERRED, PLACE ASPHALT RAMP FOR THE WIDTH OF PARARAMP, AND EXTEND MINIMUM 1.0m INTO ROAD.

NOTES:

1. TOOLED GROOVES 5mm WIDE X 10mm DEEP, BROOM FINISH GROOVE SPACING 150mm o.c. ADJACENT TO CURB.
2. WHERE RAMP IS TO BE USED AS A TRANSITION, USE THE CENTER OF THE 1500mm RAMP AS THE CENTER OF THE TRANSITION.
3. CURBS AND RAMPS TO BE POURED MONOLITHICALLY.
4. IT MAY BE NECESSARY TO BUILD RAMPS WIDER AT HIGH VOLUME PEDESTRIAN TRAFFIC LOCATIONS.
5. WHEN THE CURB RETURN RADIUS IS LESS THAN 4.0m TWO RAMPS ARE REQUIRED.



General Municipal Servicing Standards

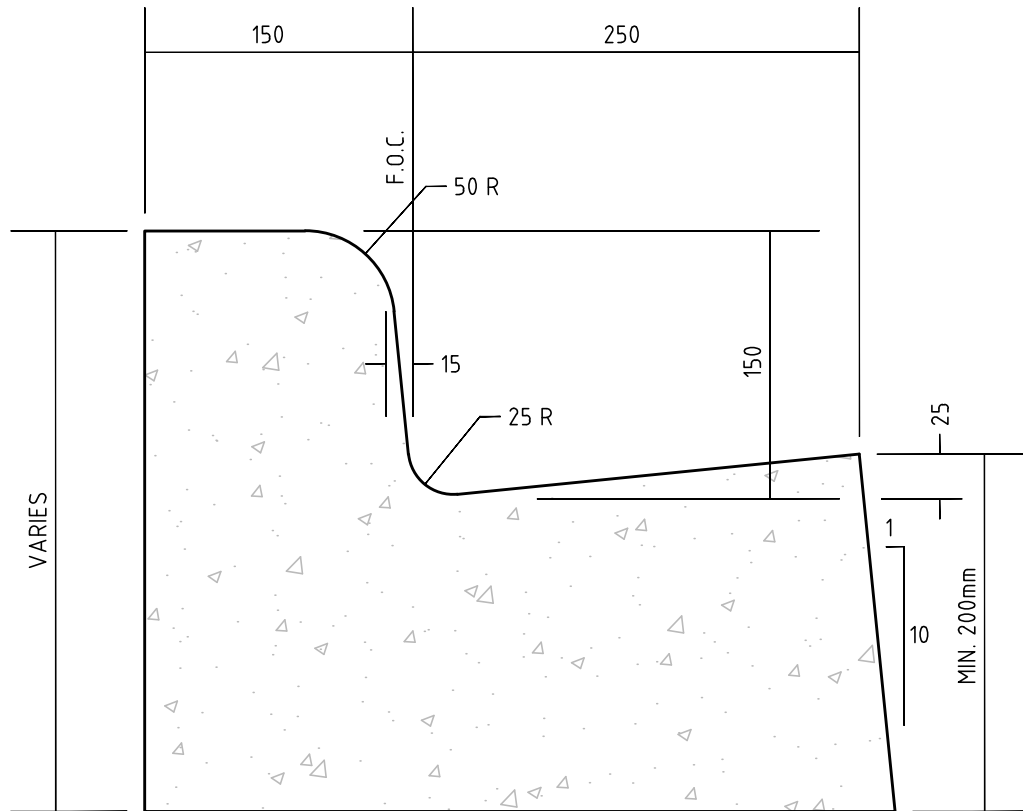


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Date:	SEPTEMBER 2020
Scale:	N.T.S.

Approved:

WHEELCHAIR / BIKE RAMP

Drawing:
G-22



ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

- NOTES:
1. DEPTH OF GUTTER FACE TO MATCH DEPTH OF ROAD STRUCTURE.



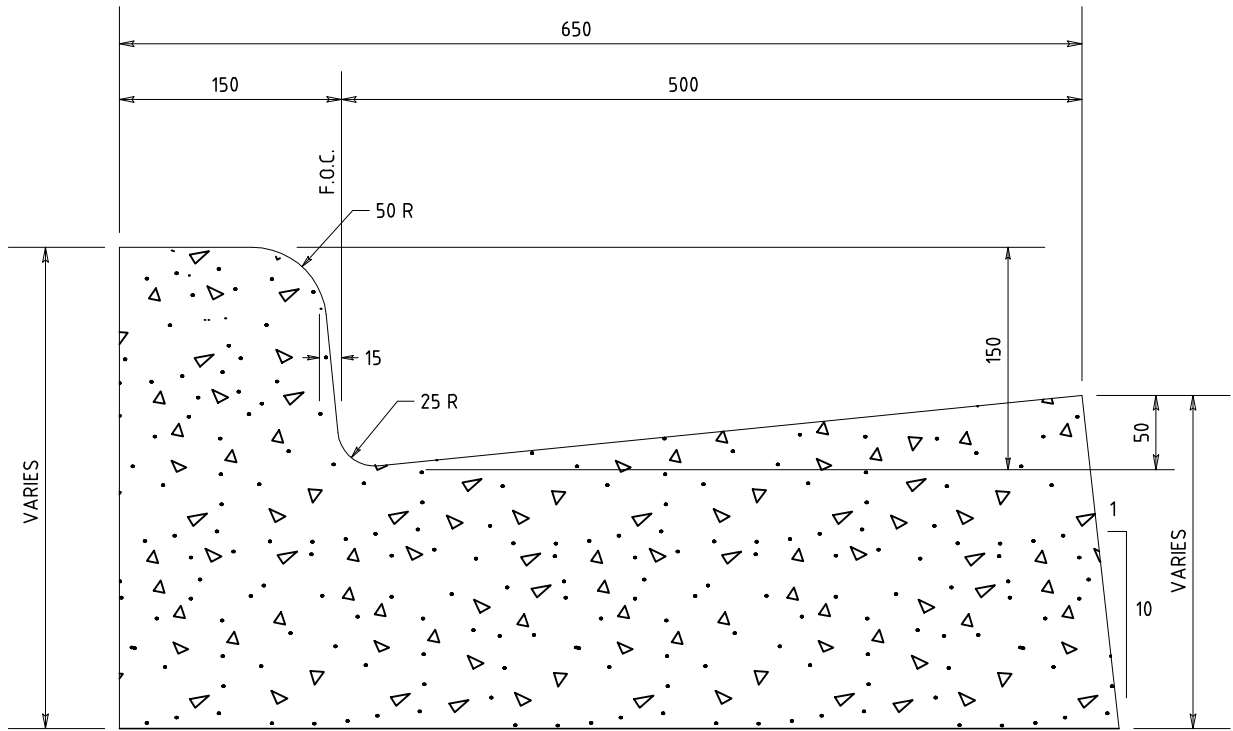
General Municipal Servicing Standards



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Rev.	
Rev.	
Date:	SEPTEMBER 2020
Scale:	N.T.S.

150 CURB WITH 250 GUTTER	
Approved:	

Drawing:	G-23
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NOTES:
 1. DEPTH OF GUTTER FACE TO MATCH DEPTH OF ROAD STRUCTURE.

ALL DIMENSIONS
 IN MILLIMETRES UNLESS
 OTHERWISE NOTED



General Municipal Servicing Standards

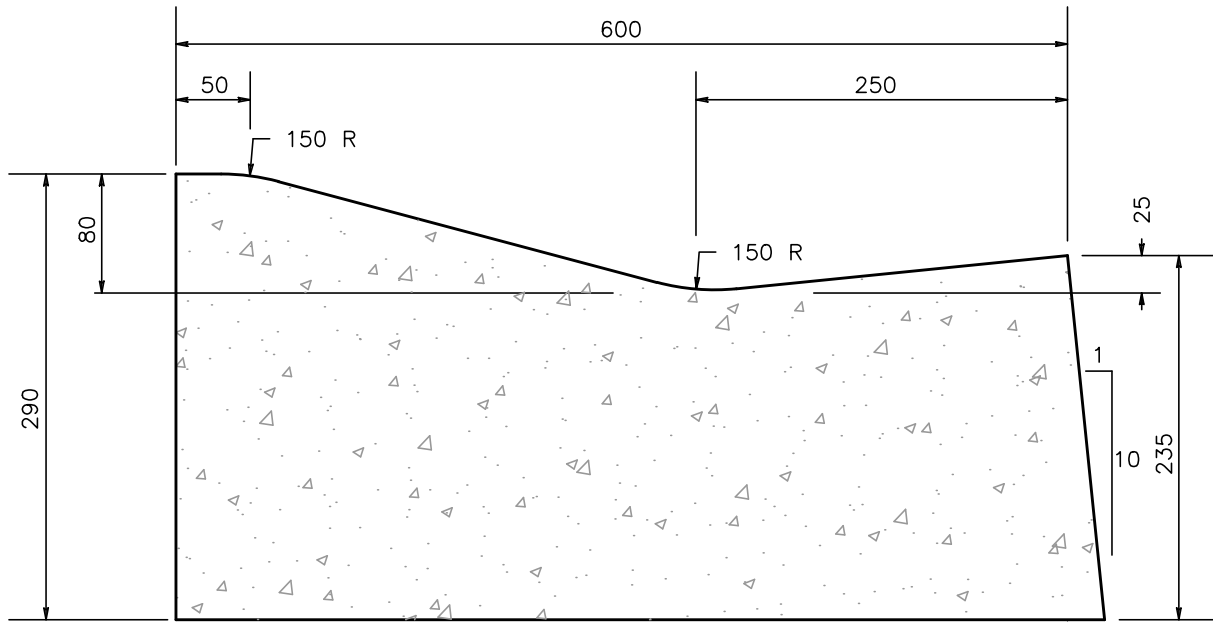


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Rev.	
Rev.	
Date:	SEPTEMBER 2020
Scale:	N.T.S.

150 CURB WITH 500 GUTTER

Approved:

Drawing:
 G-24



NOTES:

1. DEPTH OF GUTTER FACE TO MATCH DEPTH OF ROAD STRUCTURE.

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED



General Municipal Servicing Standards



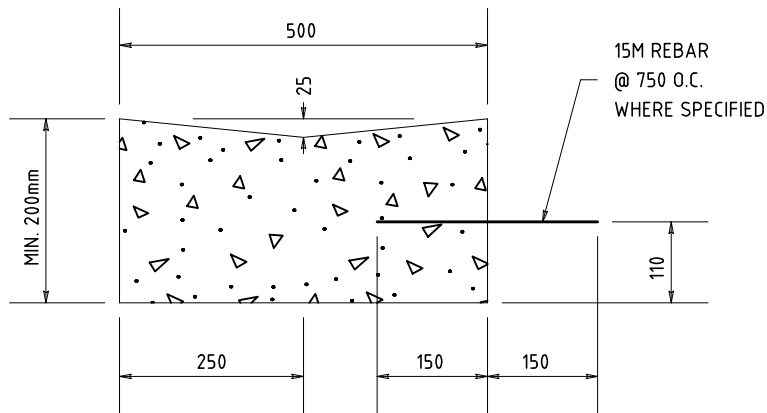
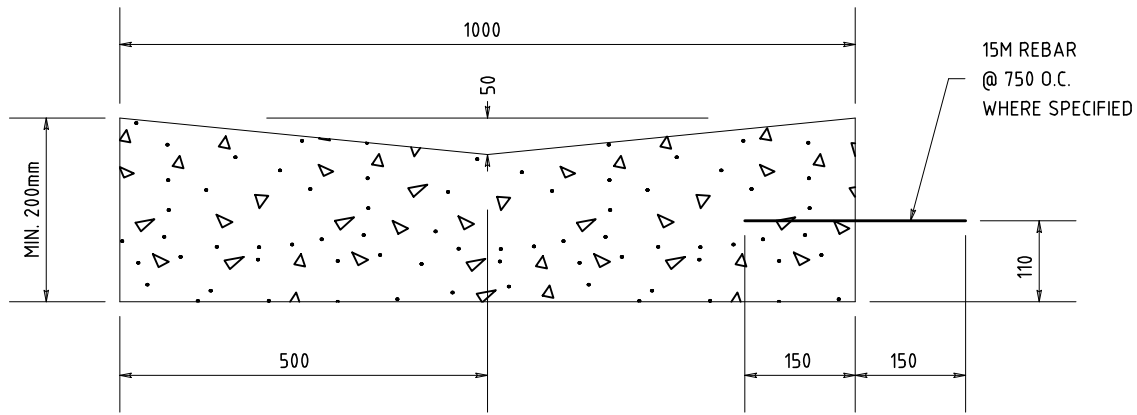
Rev.	
Rev.	
Rev.	
Date:	SEPTEMBER 2020
Scale:	N.T.S.

ROLL FACE CURB AND GUTTER

Approved:

Drawing:

G-25



ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

- NOTES:
1. DEPTH OF GUTTER FACE TO MATCH ROAD STRUCTURE.



General Municipal Servicing Standards

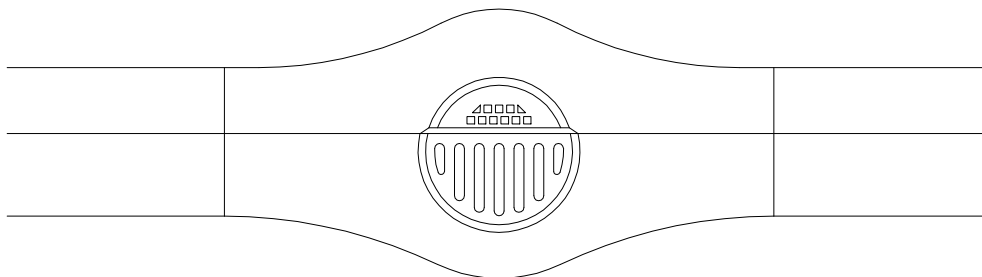
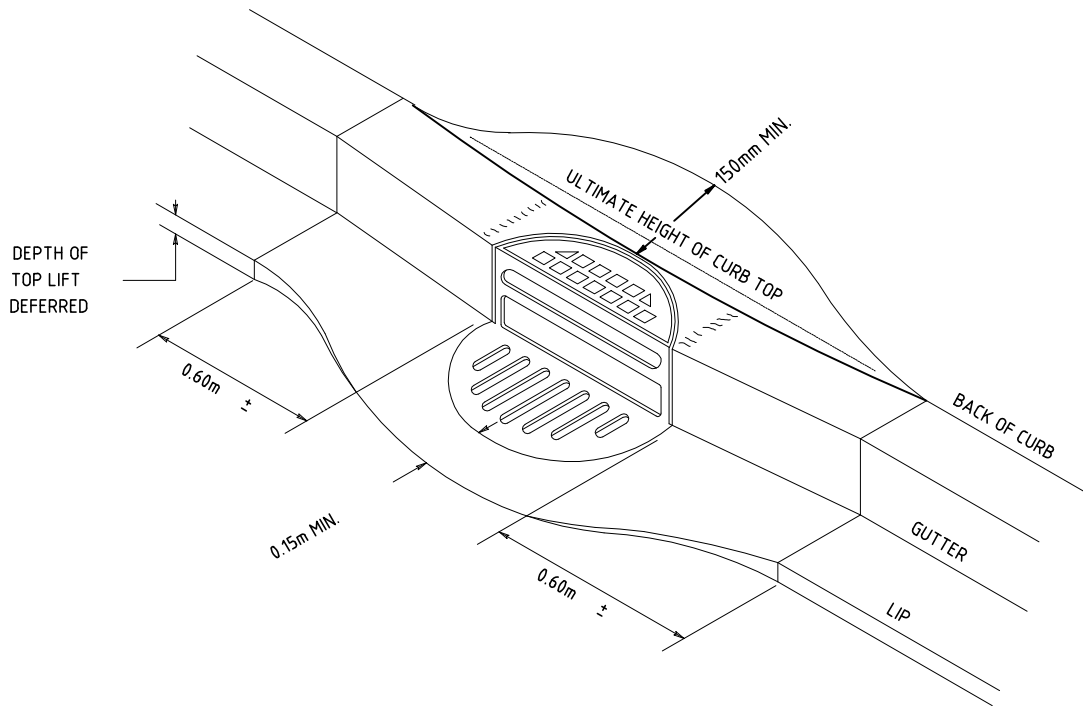


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Date:	SEPTEMBER 2020
Scale:	N.T.S.

500 AND 1000 CONCRETE GUTTER (SWALE)

Approved:

Drawing:
G-26



PLAN VIEW

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

NOTES:

1. TYPICAL CURB & GUTTER TREATMENT AT CATCH BASIN WHEN ASPHALT TOP LIFT IS DEFERRED.
LOCATION TO BE DETERMINED BY ENGINEER.



General Municipal Servicing Standards

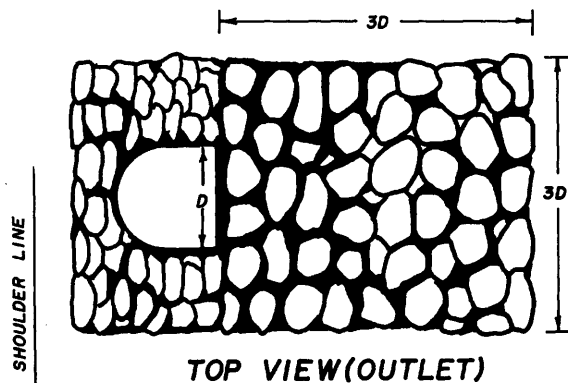


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Date:	SEPTEMBER 2020
Scale:	N.T.S.

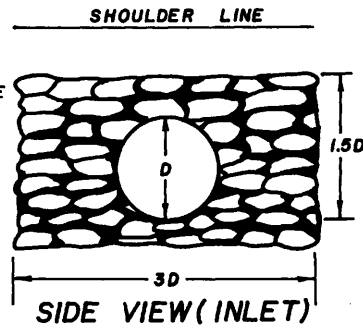
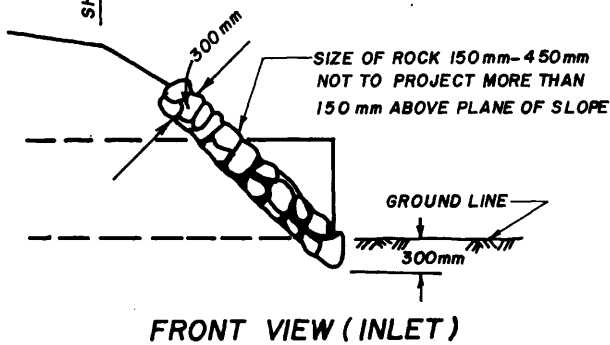
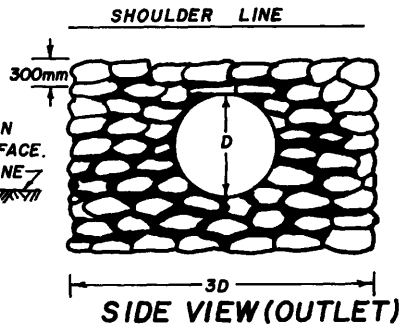
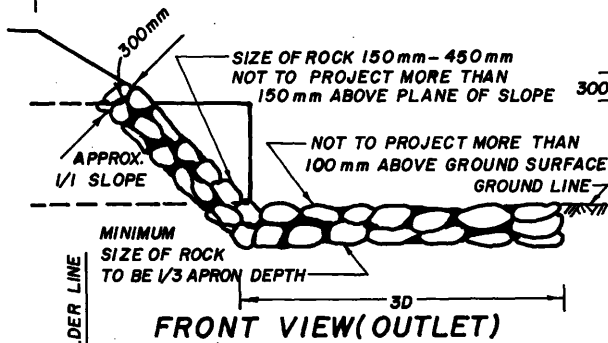
DEPRESSED CURB AND GUTTER
FOR CATCH BASIN

Approved:

Drawing:
G-27



DIAMETER OF PIPE D	EQUIVALENT SIZE OF PIPE ARCH
400mm	450mm x 340mm
500mm	580mm x 390mm
600mm	680mm x 480mm
800mm	930mm x 645mm
1000mm	1160mm x 800mm
1200mm	1425mm x 960mm
1400mm	1660mm x 1090mm
1600mm	1870mm x 1230mm
1800mm	2130mm x 1400mm



DIAMETER OF PIPE - D	400mm	500mm	600mm	800mm	1000mm	1200mm	1400mm	1600mm	1700mm	1800mm
* QUANTITY	1	2	3	5	10	13	16	20	28	33
APRON DEPTH	300m.m	500mm			600mm			750mm		

*TOTAL QUANTITY OF RIP-RAP IN CUBIC METRES



General Municipal Servicing Standards



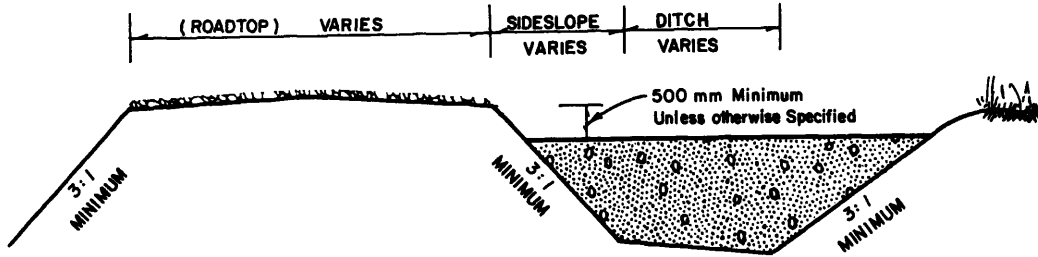
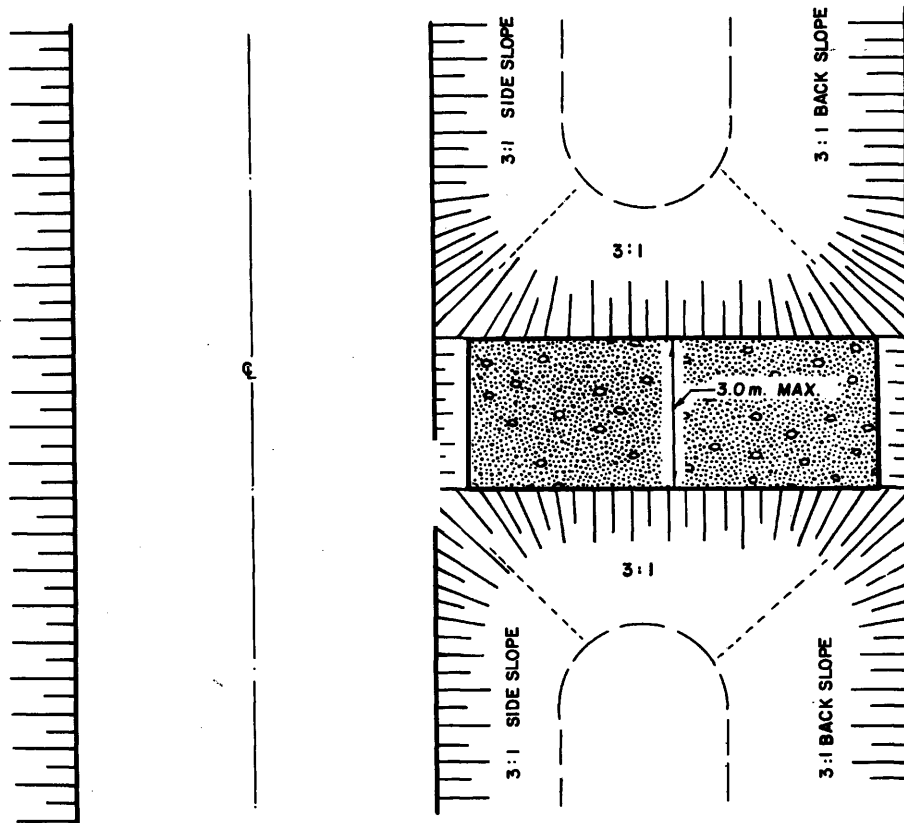
Rev.	
Rev.	
Rev.	
Date: SEPTEMBER 2020	
Scale: N.T.S.	

HAND PLACED RIP-RAP FOR PIPE CULVERTS

Approved:

Drawing:
G-28

PLAN VIEW



TYPICAL CROSS-SECTION



General Municipal Servicing Standards

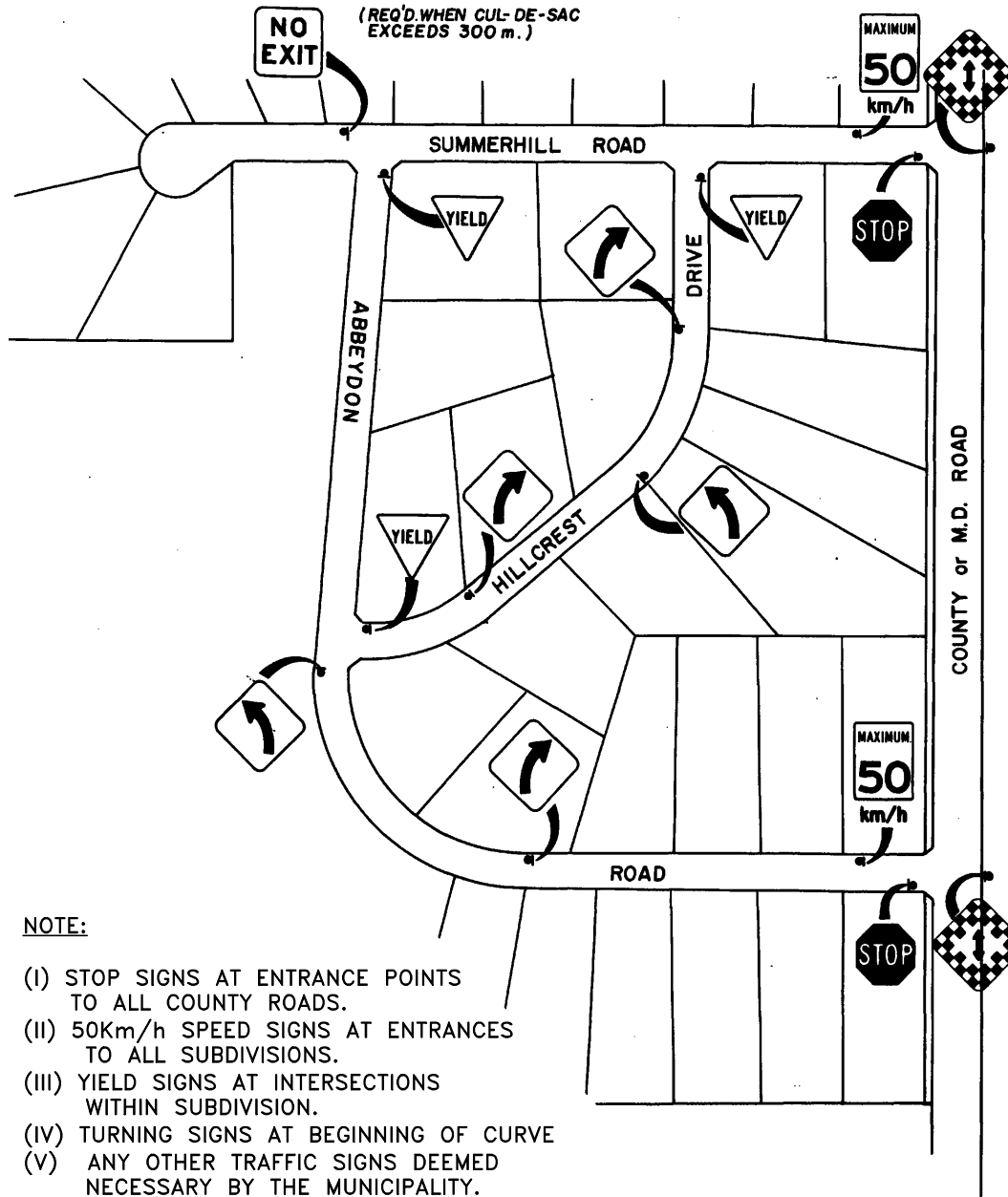


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Rev.	
Rev.	
Date:	SEPTEMBER 2020
Scale:	N.T.S.

TYPICAL VIEWS OF A DITCH BLOCK

Approved:

Drawing:
G-29



NOTE:

- (I) STOP SIGNS AT ENTRANCE POINTS TO ALL COUNTY ROADS.
- (II) 50Km/h SPEED SIGNS AT ENTRANCES TO ALL SUBDIVISIONS.
- (III) YIELD SIGNS AT INTERSECTIONS WITHIN SUBDIVISION.
- (IV) TURNING SIGNS AT BEGINNING OF CURVE
- (V) ANY OTHER TRAFFIC SIGNS DEEMED NECESSARY BY THE MUNICIPALITY.
- (VI) STANDARD AND INSTALLATION SHALL CONFORM TO RTAC.
- (VII) ALL SIGNS SHALL BE REFLECTORIZED



General Municipal Servicing Standards



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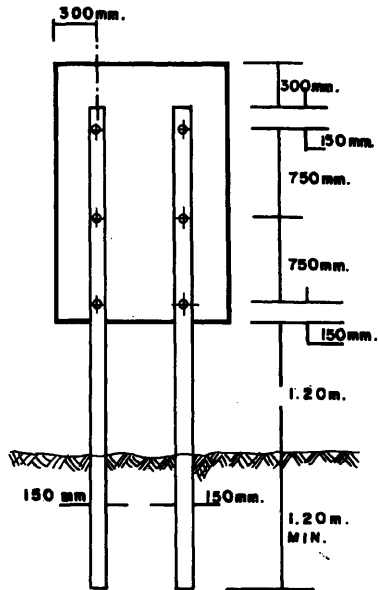
TYPICAL TRAFFIC SIGN LAYOUT
RURAL STANDARD

Approved:

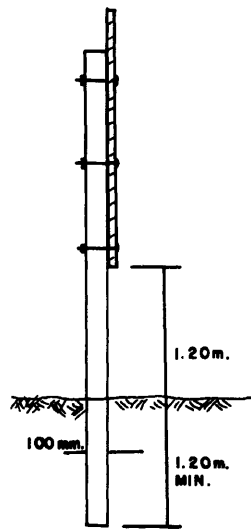
Drawing:
G-30

NOTES: (MINIMUM REQUIREMENTS)

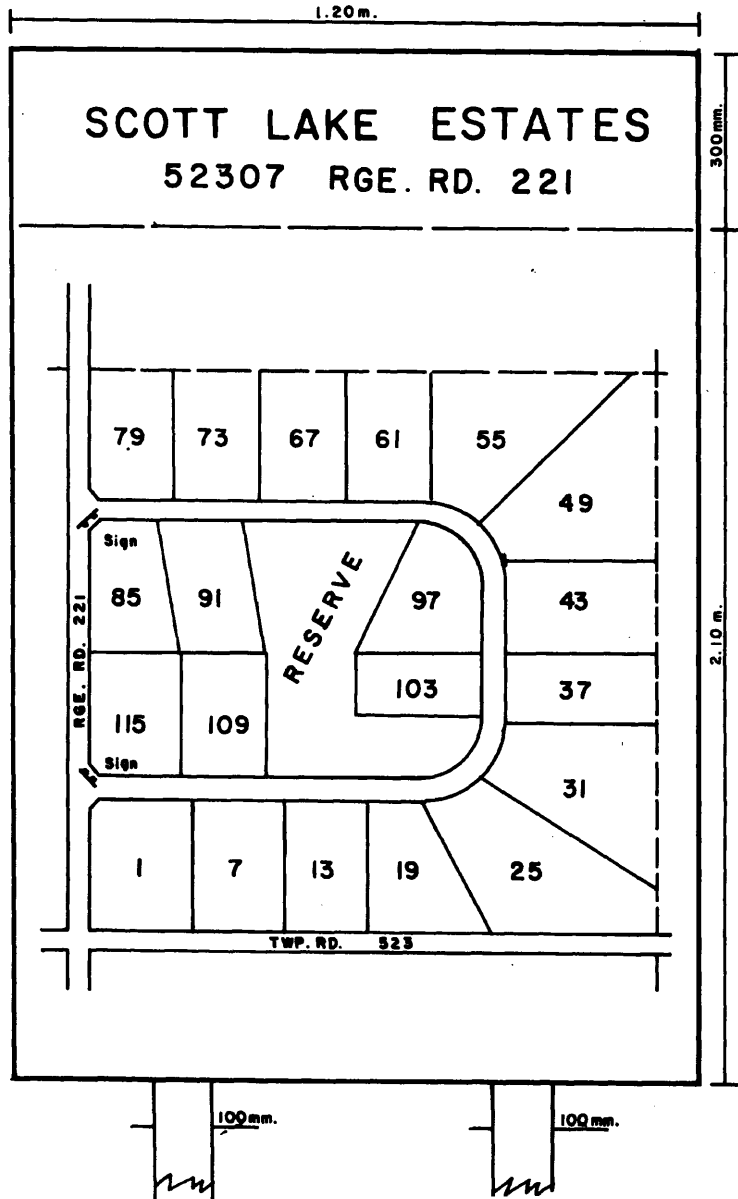
- (1) SIGN TO BE 1.20mX2.40mX19mm METAL OR WATERPROOF RESIN BONDED PLYWOOD.
- (2) SIGN POST TO BE 100mmX150mm PRESSURE TREATED CEDAR—PAINTED WHITE.
- (3) POSTS TO BE A MINIMUM 1.20m IN GROUND.
- (4) 2 POSTS PER SIGN.
- (5) SIGN TO BE BOLTED TO EACH POST WITH 3-8"X3/4" GALVANIZED BOLTS.
- (6) SIGN TO BE LOCATED AT EACH ENTRANCE AS SHOWN ON DRAWING.
- (7) LETTERS FOR NAME TO BE BLACK AND AS LARGE AS POSSIBLE.



BACK VIEW
N.T.S.



SIDE VIEW
N.T.S.



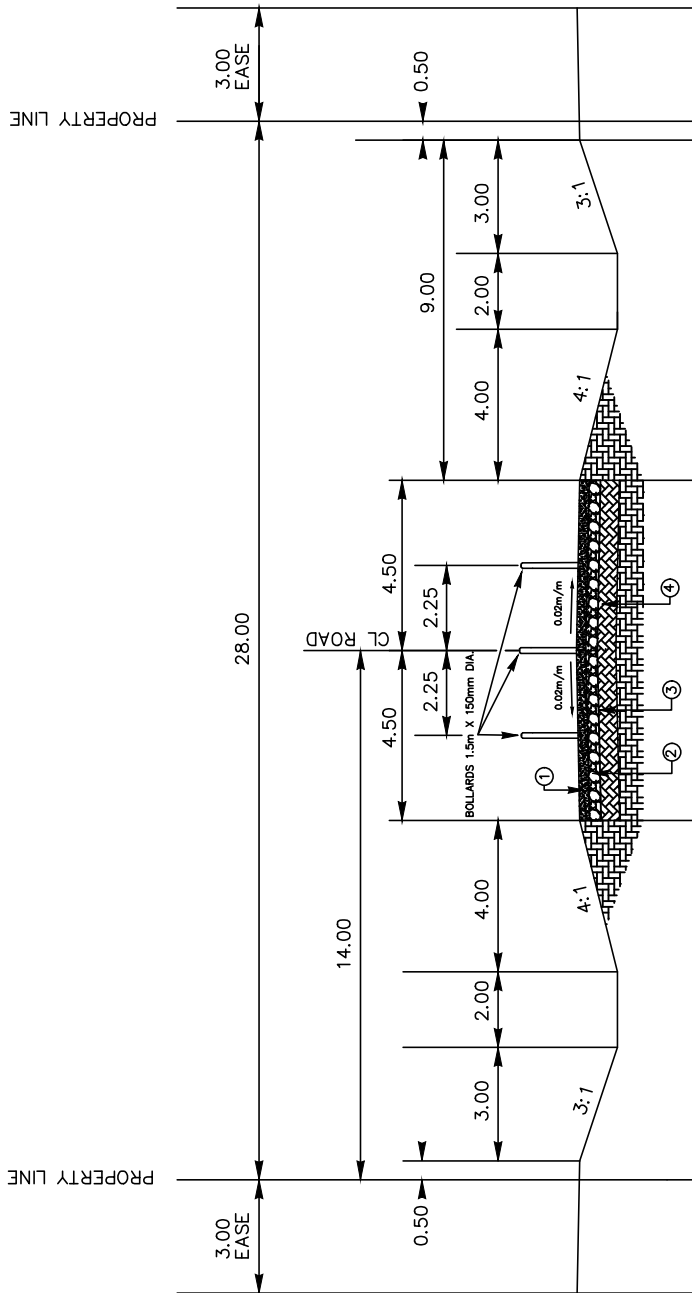
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Date:	SEPTEMBER 2020
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SUBDIVISION SIGNS	
Approved:	

Drawing:	G-31
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- NOTES
1. 50mm DEPTH COMPACTED GRAVEL/SHALE 10mm - 20mm DIAMETER
 2. 75mm DEPTH 20mm DIAMETER CRUSHED GRAVEL BASE COMPACTED TO 98% S.P.D
 3. WOVEN FABRIC UNDER GRAVEL (TENSAR SS1 GEOGRID/NILEX 2006 AMOCO GEOTEXTILE OR APPROVED EQUIVALENT)
 4. 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



General Municipal Servicing Standards

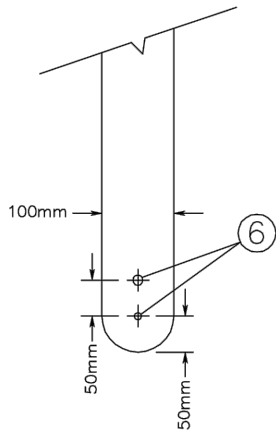


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Date:	SEPTEMBER 2020
Scale:	N.T.S.

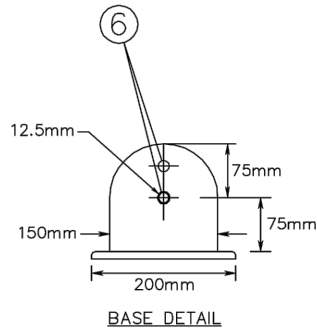
EMERGENCY LANE ACCESS DETAILS

Approved:

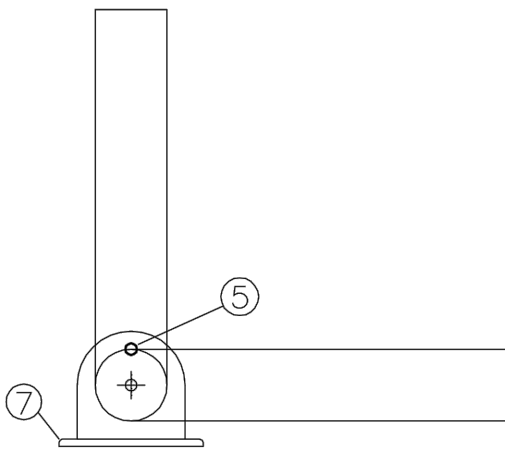
Drawing:
G-32



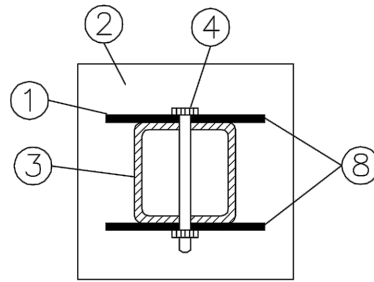
BOLLARD SECTION



BASE DETAIL



SIDE ELEVATION



BASE CROSS SECTION

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

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.



General Municipal Servicing Standards



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Date:	SEPTEMBER 2020
Scale:	N.T.S.

Approved:

COLLAPSIBLE BOLLARD

Drawing:
G-33

1 GENERAL

- 1.1** All roadway ditch bottoms, side slopes, back slopes, and open areas disturbed during construction shall be topsoiled, fertilized and seeded to grass or sodded.
- 1.2** When landscaping or planning is a condition of the approval of a development permit, all such landscaping and planting must be carried out, to the satisfaction of the Development Authority, within one year of the occupancy or the commencement of operation of the proposed development.
- 1.3** The topsoil shall be removed from areas requiring levelling, filling, excavation or grading before work commences. The topsoil shall be stockpiled and replaced following the completion of the work.
- 1.4** Alternative erosion control measures for road ditches with grades steeper than 5%, outfall ditches and stormwater management facilities shall be proposed in order to protect the topsoil. Reinforcing mats may be required to control erosion until vegetation is established.

2 COMMERCIAL AND INDUSTRIAL

- 2.1** Commercial developments in or adjacent to Residential Districts shall be screened from view by means of a fence, not less than 1.5 m and not more than 2.1 m in height, which shall be designed and constructed to the satisfactory of the Development Authority.
- 2.2** Commercial developments may use alternative methods with approval from the County.
- 2.3** Landscaping shall be provided for 10% of the lot for commercial developments in or adjacent to Residential Districts.
- 2.4** All yards, setbacks and buffer strips in Commercial and Industrial Districts shall be landscaped to the satisfaction of the Development Authority. Details of such landscaping shall be included in development permit applications for all developments in these Districts.

3 STREET NAMES

- 3.1** The landscaping plan shall include up to three alternative names for each street. Street naming approval will be completed by the County of Vermilion River Council. The County of Vermilion River reserves the right to select or reject proposed names.
- 3.2** See Section B Guidelines for General Compliance for drawing submission requirements.

4 TOPSOIL AND SEEDING**4.1 Weed Control**

- 4.1.1** The Contractor shall be responsible for the control of existing weeds and all subsequent weed growth within the contract site as shown on the plans or in the list of locations from the date the contract is awarded or the date that the location is made available until the completion certificate has been issued. The *Alberta Weed Control Act* shall govern.

4.2 Subsurface Preparation

- 4.2.1** All weeds, roots, and stones larger than 50 mm in diameter and other foreign matter shall be removed from the surface of the subsoil. Immediately before placing topsoil, the subsoil shall be loosened to a depth of not less than 50 mm by means of a disc, spike tooth harrow or other means satisfactory to the County and leveled to a firm, even surface. The final grade shall be 150 mm below finished grade (or as specified) and sloped so that no ponding or runoff onto adjacent private property occurs.

4.3 Existing Appurtenances

- 4.3.1** All existing utilities shall be adjusted to finished grade elevations and all existing features (trees, hydrants, valves, etc.) shall be protected against any damage.

4.4 Topsoil Placement

4.4.1 The topsoil shall uniformly spread on the prepared subsoil to a minimum compacted depth of at least 100 mm and shall be free of rock, roots, weeds and other deleterious material. All material used are subject to inspection, testing and approval by the County.

4.4.2 Topsoil shall not be placed when either the topsoil or subsoil is frozen, excessively wet, extremely dry, or in a condition detrimental to proper grading, compaction or cultivation.

4.4.3 To prevent damage, manually spread topsoil around trees, plantings or the structures.

4.4.4 The upper 50 mm shall be of a fine texture and free of stones or lumps 6 mm or larger.

4.4.5 If required, lime shall be well worked into the soil before the application of any fertilizers to obtain a minimum pH value of 6.0.

4.4.6 Fertilizer shall be applied evenly over the pit at a rate of 112 kg per hectare.

4.5 Seeding

4.5.1 The grass seed mixture shall be Canada No. 1 certified grass seed mixture with zero tolerance on noxious weeds. Certificate of seed analysis is required to be supplied to the County.

4.5.2 Seed shall be applied by means of an approved method as specified by the County.

4.5.3 The seed shall be applied at a rate of 65 kg per hectare.

4.5.4 If watering is required it shall be with a fine spray which will not create any erosion problems.

4.5.5 Wind Seeding shall not be carried out when wind velocities are above 8 km/h.

4.6 Sodding

4.6.1 The Contractor shall obtain approval from the County before proceeding with any sodding.

4.6.2 Sod shall be laid evenly with staggered joints closely butted together and matched to the existing grades or surrounding areas.

4.6.3 All areas shall be rolled with a medium roller (90 to 114 kg) to provide close contact between sod and topsoil and to produce a smooth and even surface. Sod shall be laid at right angles to the slope along the contours of the slope. On slopes of three horizontal to one vertical or steeper, pegs/staples shall be driven full depth on intervals of 1 m.

4.6.4 Sod shall be watered sufficiently to saturate the upper 100 mm of soil immediately after installation. After sod and soil has dried sufficiently to prevent damage, the area shall be again rolled with a medium roller to ensure a good bond between sod and soil and to remove minor depressions and irregularities.

4.6.5 Adequate watering shall again be applied immediately following rolling to saturate the upper 100 mm of soil. Watering shall be carried out when required to prevent grass and underlying soil from drying out for a minimum period of 15 days after placement or until the sod is well rooted and established.

4.6.6 Areas showing deterioration, bare spots or thin areas within the warranty period shall be re-seeded or re-sodded at the Developer's expense.

4.7 Growing Season

4.7.1 Grass Planting: Grass seed shall not be planted before May 1 or after September 15.

4.7.2 Sod laying: Sod shall not be laid before May 1 or after September 30. Sod laying on slope 3:1 or steeper shall not be done when temperature is above 23°C.

4.7.3 The County or an approved professional landscaper may approve an alternative method of installation.

4.8 Professional Turf & Reclamation Products 2011

05001	T-6 All Purpose Blend	40% Kentucky BG 4 lbs per 1000	5 kgs	Playgrounds
25001		40% Creeping Red Fescue 20% Diploid Annual Rye	25 kgs	Economy Mixture
90073	T-3 Playground / Rural Lawn Mix	35% Kentucky BG 4lbs per 1000 35% Creeping Red Fescue 20% Fairway Crested Wheatgrass 10% Diploid Annual Ryegrass	25 kgs	Playgrounds Rural Lawns Drought Tolerant High Quality Mixture

4.9 Maintenance

4.9.1 Maintenance shall commence immediately after sodding or seeding and shall continue until the date of acceptance by the County. Such maintenance shall include all measures necessary to establish and maintain grass in a vigorous growing condition, including but not limited to:

- Mowing (Hamlets) – Mowing shall be done as required to maintain the grass at a maximum height of 25 cm with not more than 1/3 of the blade cut at any one mowing. Heavy clippings shall be removed immediately after mowing.
- Mowing (remainder of County) – Same as above; height of 40 cm, clippings shall be mulched.
- Top Dressing – Top dressing and rolling shall be done as required to repair tests or erosion. Bare spots shall be repaired by either

cultivating and re-seeding or by replacing the dead sod with new sod as required by this specification.

- Cleanup – Cleanup shall be a continuous operation and at no time shall topsoil or debris of any kind be allowed to remain on roadways overnight.

5 TREES AND SHRUBS

- 5.1** No trees or shrubs will be permitted within any road right-of-way including boulevards unless a Homeowners Association is in place that will take responsibility for the maintenance and replacement thereof.
- 5.2** Trees and shrubs located within or near a pipeline or power line right-of-way shall conform to the type, spacing, and offset required by the company operating the utility. Landscaping shall be in accordance with all relevant Federal and Provincial legislation or acts and any regulations established by the Energy and Utilities Board.
- 5.3** Coniferous trees and shrubs will be considered on landscape berms. Number and spacing shall be approved by the Development Authority.
- 5.4** A landscape plan must be prepared showing the species, location and spacing of the proposed trees and/or shrubs and submitted to the County for approval prior to installation. The Developer may be required to demonstrate the necessity of the landscape features.
- 5.5** The Developer shall be responsible for the replacement of unsuccessful trees or shrubs within the warranty period specified in the Development Agreement.
- 5.6** No trees or shrubs or other similar obstructions to visibility which are more than 1.0 m above road grade shall be permitted within 30 m of the intersection of two roads as required in the Land Use Bylaw.
- 5.7** All plant materials included in landscaping plans shall be tolerant to the climatic conditions of the County of Vermilion River as outlined in the Alberta Shelter Belt Program & Prairie Shelterbelt Program.

- 5.8** Existing trees and shrubs that are to be retained within the development must be protected to the furthest extent of the drip line. Final grading of the site is not to impact the root zone by more than 0.2 m.
- 5.9** Tree species included on the landscaping plans shall meet the following specifications:
- 5.9.1** Tree species at maturity shall have an average spread of crown greater than 3.0 m.
 - 5.9.2** Deciduous trees shall be at least 60 mm calliper at time of planting.
 - 5.9.3** Coniferous trees shall have a minimum spread of 2.5 m at time of planting.
 - 5.9.4** Coniferous shrubs shall have a minimum spread of 0.5 m at time of planting.
 - 5.9.5** Deciduous shrubs shall have a minimum height of 0.5 m at time of planting.

6 **FENCING**

- 6.1** Wherever possible, fencing shall be designed to match or compliment existing fencing on adjacent properties. All materials are subject to inspection and approval by the County.
- 6.2** Fencing shall be designed to be maintenance free for a minimum of 15 years.
- 6.3** Fencing shall be located entirely within private property, including foundations.
- 6.4** A landscape plan shall be prepared by the Developer and submitted to the County showing the fence design including alignment, elevations, materials, foundations, coatings and dimensions. The plans shall include installation details.
- 6.5** Fencing shall comply with all setback and height requirements specified in the County of Vermilion River Land Use Bylaw.

7 **LANDSCAPE BERMS**

- 7.1** A landscape plan shall be prepared by the Developer showing the proposed berm design including alignment, elevation, dimensions and slopes. The plan must be approved by the County prior to construction.
- 7.2** Berms required for noise attenuation purposes shall be designed by a Professional Engineer or Landscape Architect. The Developer may be required to provide design information including projected traffic volumes and noise exposure.
- 7.3** Berm side slopes shall not be steeper than 4H : 1V to facilitate maintenance.
- 7.4** Berms shall have a flat top not less than 1 m wide.
- 7.5** All berms shall be topsoiled and seeded as per section 4 Topsoil and Seeding.

8 **LANDSCAPING REQUIREMENTS FOR PARKING FACILITIES**

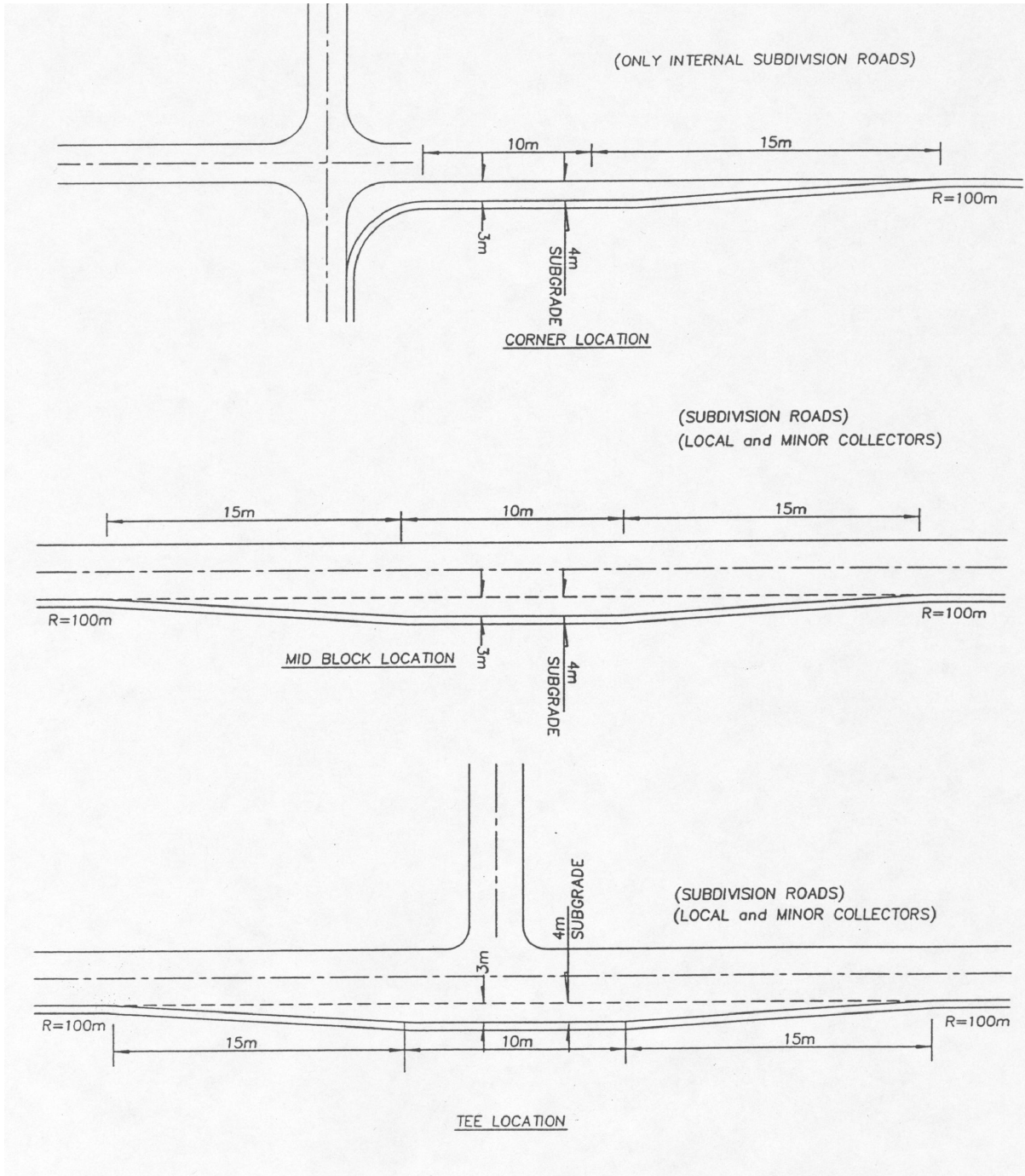
- 8.1** A parking and loading area for development in a commercial district or industrial development in a prominent location requiring two or more parking spaces and which is adjacent to a residential district shall have a landscaped buffer between uses. The location, planting type, thickness and height of the landscaped buffer will be at the discretion of the Development Authority.
- 8.2** A parking and loading area for a commercial or industrial use in a prominent location requiring twenty (20) or more parking spaces shall include landscaped areas within the parking lot.
- 8.3** The minimum landscaped areas shall be calculated as 1.0 m² (10.8 ft²) per required on-site parking space. Landscaped areas shall be provided throughout the parking lot and shall not be provided in a single landscaped area.

9 **MAIL BOXES**

- 9.1** Residential, Condominium, Internal Subdivision, and Industrial / Commercial Roads shall have a Postal Box Turnout. Sightline requirements, in accordance with the latest version of TAC's *Geometric Design Guide for Canadian Roads*, shall be maintained at all times.

- 9.2** The Postal Box Turnout shall be located a minimum distance of 50 m from the edge of pavement on an intersecting road or cul-de-sac and shall be located on the right-hand side. The final location must be approved by the County.

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General Municipal Servicing Standards

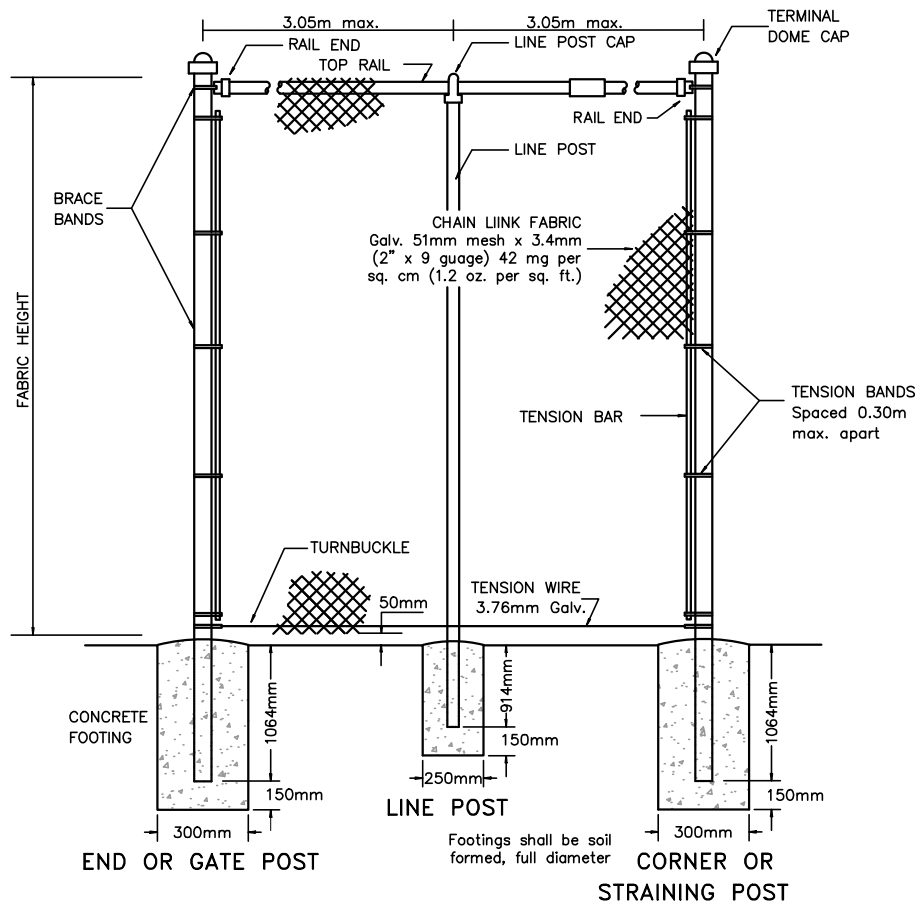


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Date:	FEBRUARY 2020
Scale:	N.T.S.

TYPICAL MAILBOX PULLOUT LOCATIONS

Approved:

Drawing:
H-01



TOP RAIL: 33.4mm O.D. galvanized steel. Rails to be connected by slip-on sleeves.
 LINE POSTS: 48.3mm O.D. galvanized steel. Spaced 3.05m max. apart. Straining posts shall occur at min. 152m.
 GATE POST: 88.9mm O.D. galvanized steel for panels up to 3.05m (6.1m Double Swing Gate).
 END OR CORNER POST: 88.9mm O.D. galvanized steel.
 CONCRETE: 20 MPa (2900 P.S.I.) Strength in 28 days.
 TIE WIRE: 3.55mm (9 gauge) aluminum wire every 305mm for line posts, every 457mm for top rail.
 NOTE: All pipes to be sufficient strength to support fabric weight and tension, and to support weight of gate.
 All fittings to be designed and manufactured of materials having sufficient strength to perform the necessary function.



General Municipal Servicing Standards

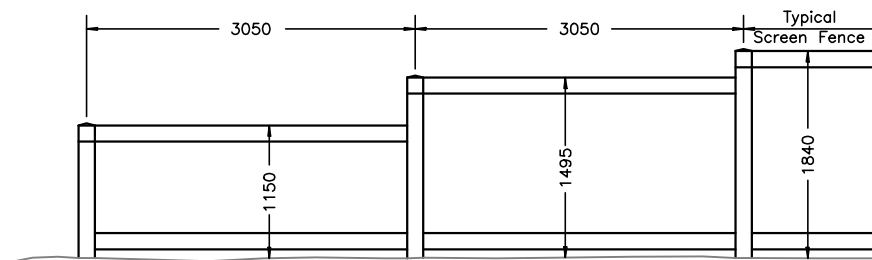
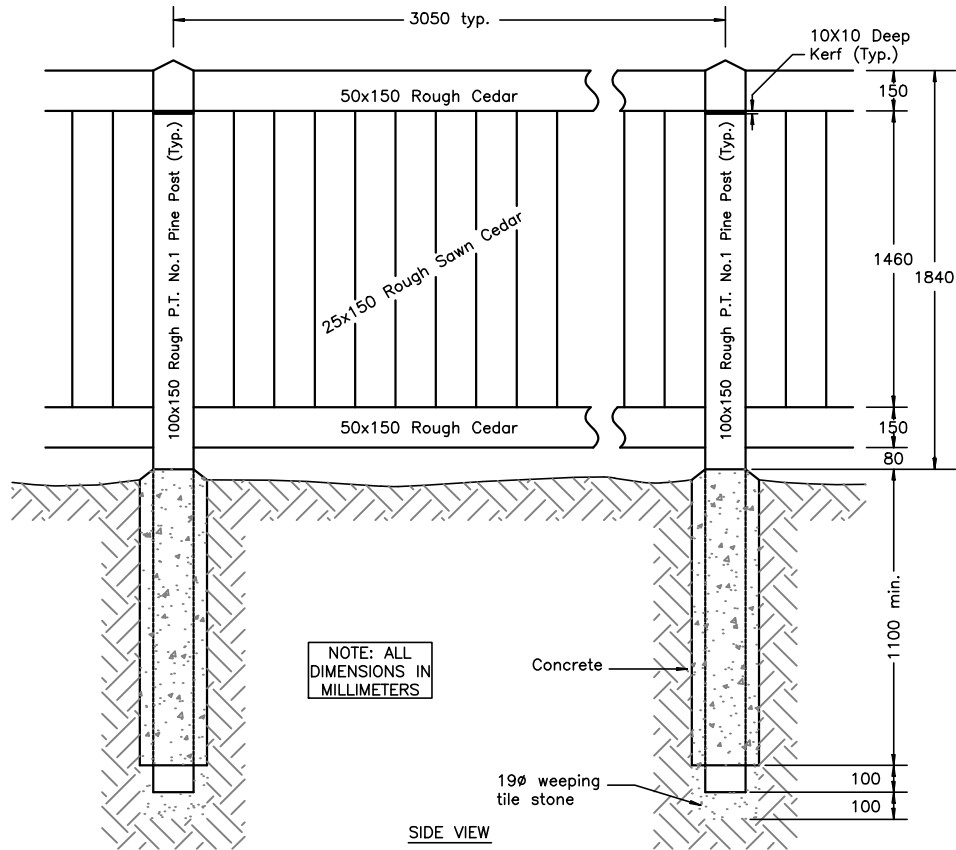
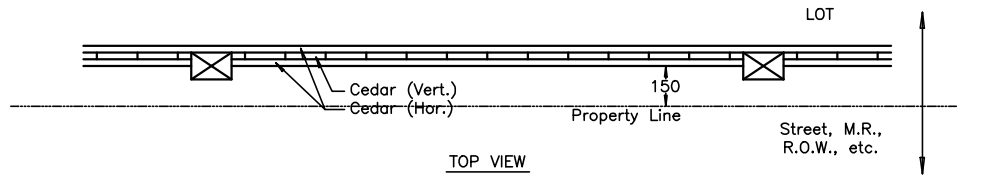


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Rev.
Date: FEBRUARY 2020
Scale: N.T.S.

CHAIN LINK FENCE DETAIL

Approved:

Drawing:
H-02



General Municipal Servicing Standards



Rev.	
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Rev.	
Date:	FEBRUARY 2020
Scale:	N.T.S.

WOOD SCREEN FENCE DETAIL

Approved:

Drawing:
H-03

1 STANDARDS AND GUIDELINES

- 1.1** The street lighting design shall be in accordance with the “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).
- 1.2** All roadway lighting systems shall be installed in strict compliance with the Canadian Electrical Code.
- 1.2** The Developer shall be responsible for all arrangements with the local wire owners for necessary approvals and power connections.

2 ENGINEERING DRAWINGS & APPROVAL

- 2.1** The Developer is responsible for the preparation and submission of design drawings prepared by a licensed professional engineer in the province of Alberta showing the layout, pole spacing, types and heights and luminaire wattages. The street lighting plan shall include all surface features and utilities. The layout, products and materials are subject to approval by the County.

3 DESIGN AND OPERATIONS

- 3.1** The Developer shall be responsible to work with supplier for the design, supply and installation of the street lighting system. The light standards chosen shall be readily available from the suppliers’ regular inventory. The responsibility for energizing the street lighting system shall be with the County.
- 3.2** The operating cost of the Street lighting system shall be the responsibility of the Developer until the Subdivision Area is seventy-five (75%) percent occupied. The Developer will pay these costs upon receipt of an invoice from the County.
- 3.3** Upon the energizing of the streetlights the Developer shall, provide County of Vermilion River with an irrevocable letter of credit as security for the ongoing maintenance and costs of energizing of the streetlights based on current rates. County of Vermilion River shall release the letter of credit upon the expiration of

60 months from the date of energizing or if the Subdivision Area is seventy-five (75%) percent occupied, whichever occurs first.

4 SAFETY

4.1 The lighting design shall ensure the proper illumination of conflict areas such as intersections and crosswalks. The design shall be prepared with public safety in mind.

5 ENERGY USAGE

5.1 The street lighting design should be optimized to allow for the least possible energy consumption while still maintaining acceptable safety standards. County of Vermilion River encourages the use of the highest efficiency lamps available at the time of installation.

6 POLE LOCATIONS

6.1 In some cases, the road and lot configuration will dictate the pole layout. Wherever possible, poles should be located at the projection of lot lines. Pole locations shall not conflict with other utilities or approaches. The face of the posts shall be at least 1 meter clear of the face curb or road shoulder. Spacing shall be selected by the Developer's Engineer and the Municipal Engineer based on the optimum spacing/height/light distribution combination but shall not exceed the minimum standards published by the TAC.

6.2 Pole setbacks shall be as outlined in the TAC guidelines. Where roadways are designated for widening within five years of pole installation, the pole setback shall allow for side widening.

7 TYPE OF POLE

7.1 Pole type, material and base to be approved by the County prior to purchase. A sample may be required for inspection.

- 7.2** Breakaway poles shall not be required for design speeds of less than 80 km/hr. Yielding poles are recommended for all roadways with a design speed less than 80 km/hr and a pole setback of less than 4 m from edge of pavement.
- 7.3** Steel poles shall be galvanized and powder coated. Aluminium poles to be powder coated. Composite poles are to be pultrusion manufacture method.
- 7.4** Pole types shall be consistent with adjacent developments. All poles within a new development shall be of the same type and height to obtain continuity.
- 7.5** All poles shall be resistant to all climatic and environmental conditions encountered within the County of Vermilion River.

8 AESTHETICS

- 8.1** The developer shall ensure that the street lighting design is compatible with the type of development and proposed buildings.
- 8.2** The use of decorative poles shall be subject to approval by the County. Proposed decorative poles and luminaires should share common optical systems and components as other decorative items found in existing developments within the County.

9 FOUNDATIONS

- 9.1** Foundations shall be designed based on the specific soil conditions on site. The foundations shall be designed to withstand all loading, including wind loading.

10 LUMINAIRES

- 10.1** Luminaires must be approved by the County prior to purchase. A sample may be required for inspection.
- 10.2** All luminaires to be complete with IP66 Certified Sealsafe optical chamber.
- 10.2.1** All luminaire optical systems to have a seal value R rating of greater than 600.

- 10.2.2** All luminaires to be tool free type.
- 10.2.3** All luminaires to be complete with a ¼ turn shutter system for lamp replacement.

11 COSTS

- 11.1** Any capital contribution that the utility company may charge for the installation of underground street lighting shall be paid for the Developer.
- 11.2** The County will pay monthly rental charges to the utility company providing street lighting, for the operation of street lights installed on streets, rights-of-way and parks after acceptance by the County.
- 11.3** The County will accept street lights only after completion and acceptance of street, sidewalk and boulevard improvements.

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1 GENERAL

- 1.1** The purpose of this section is to aid developers in meeting the County of Vermilion River’s rural fire protection needs through the proper construction and location of “dry hydrant” fire suppression facilities in rural areas and rural subdivisions not serviced by a pressurized municipal fire protection system. These guidelines are intended as a minimum standard only and higher standards should be sought when practical. The County maintains its discretion to require higher standards where specifically required.
- 1.2** This document is a summary of guidelines only and is not meant to be comprehensive. More specific details should be obtained directly from the reference documents.
- 1.3** The minimum water supplies required by the Alberta Building Code (ABC) shall be established in, or transportable to, the designated area. If there are no provisions for natural or developed water sources for firefighting in the proposal, the County may require that the developer conduct a flow test to determine if sufficient water can be provided for a minimum of 30 minutes as required by NFPA 1142.
- 1.4** The standards of this document and NFPA 1142 are not required if:
- a) NFPA 13, 13D, or 13R are fully met to provide an adequate sprinkler system protecting a building; or
 - b) a pressurized municipal system is present which NFPA 1142 considers as a piped communal system capable of 950 L/min flow for a minimum of 2 hours at 140 kPa pressure from fire hydrants at an adequate spacing.
- 1.5** Although a pressurized system is preferred, the County recognizes that such a system is not always practical due to high costs, low development densities, or specific land use bylaws and regulations. The County has therefore developed these guidelines to identify the level of fire protection that is to be maintained if a pressurized water system is not provided.
- 1.6** In general, this document is aimed at low-density “acreage” type country residential developments that are becoming more prevalent throughout the County. However, these standards and NFPA 1142 can also provide guidance for fire protection within business, commercial, institutional and industrial developments, though more detailed and site-specific standards may have to be

adopted. This document and NFPA 1142, have limitations due to their general focus. In very specialized or extremely hazardous situations, standards may be applied that exceed the standards set out in this document.

2 PURPOSE AND PROFESSIONAL INVOLVEMENT

- 2.1 NFPA 1142 identifies “*minimum requirements for water supplies for structural firefighting purposes in rural and suburban areas where adequate and reliable water supply systems for firefighting purposes, as determined by the authority having jurisdiction, do not otherwise exist.*” These minimum requirements can be increased at the discretion of the local authority.
- 2.2 These standards provided are for general reference only, for use by the development community, facility designers, and in the review and approval process by the County Planning and Development department (P&D), Public Works department (PW), and the County of Vermilion River Fire Services (CVRFS).
- 2.3 As part of the requirements of the Subdivision Conditions, Development Permit, and/or Development Agreement, a fire protection system may be required at the County’s discretion. All calculations and design drawings for such a system must be prepared and stamped by a Professional Engineer registered to practice in the Province of Alberta (Consulting Engineers).

3 DEFINITIONS AND FORMULAS

- 3.1 Following are select definitions and calculations from NFPA 1142 to be made by the Consulting Engineers:

Minimum Water Supply (MWS) – The quantity of water required for fire control is calculated as follows. The factors are summarized below, but should be derived directly from NFPA 1142:

- For structures without exposure hazards:

$$MWS = \frac{VS_{tot}}{OHN_{adjusted}} * CCN * EH$$

Where:

MWS = minimum water supply in liters

V_{tot} = total volume of structure in m^3

$\text{OHN}_{\text{Adjusted}}$ = Occupancy Hazard Classification x metric conversion factor

CCN = Construction Classification Number

EH = Exposure Hazard

For SI (metric) conversions use the following adjusted OHN numbers:

OHN	3	4	5	6	7
Adjusted OHN	0.0224	0.0299	0.0373	0.0448	0.0523

The MWS shall be a minimum of 7,600 L if there is no exposure hazard and a minimum of 11,355 L if an exposure hazard is present.

Construction Classification Number (CCN) – A series of numbers from 0.5 to 1.5 based on building construction classifications outlined in NFPA 220 Standard on Types of Building Construction. Refer to NFPA 1142 and NFPA 220 for details. The CCN closely follows the Type of construction classification as summarized below. Generally Type I (CCN=0.5) construction provides the highest fire resistance, while Type V (CCN=1.5) provides the lowest.

Occupancy Hazard Number (OHN) – A series of numbers from 3 to 7 that are mathematical factors used in a formula to determine total water supply requirements.

Exposure Hazard (EH) – A structure is considered to be an Exposure Hazard, and have an EH factor of 1.5 if:

- It is 9.29 m^2 or larger in area and is within 15.24 m of another structure; or
- It has an OHN of 3 or 4 (Severe or High Occupancy Hazard) and is within 15.24 m of another structure.

All others are considered to be No Exposure Hazard, and an EH factor of 1.0 is applied.

Dry Hydrant – An arrangement of pipe permanently connected to a water source other than a piped, pressurized water supply system that provides a ready means

of water supply for firefighting purposes and that utilizes the drafting capability of fire department pumpers.

4 WATER SUPPLY REQUIREMENTS

4.1 The following shall be addressed in the design of any fire protection system (Based on NFPA 1142):

- Water source(s) shall be acceptable to the County, of suitable quality and be maintained and accessible on a year-round basis;
- If the water is from a private source, a water use agreement acceptable to the County shall be required to ensure access to the water source. An example agreement is provided in NFPA 1142;
- Adequate water source indicators (signs and/or painted indicators) acceptable to the County shall be provided, and shall consider potential for snow depth accumulation and snow plowing operations;
- Means of access to any required water supply or dry hydrant shall be constructed and maintained to meet NFPA 299 *Standard for Protection of Life and Property from Wildfire*; NFPA 1141 *Standard for Fire Protection in Planned Building Groups*; and the County of Vermilion River Municipal Servicing Standards;
- Locations for and the immediate area around dry hydrants shall provide for firefighter safety;
- Dry hydrants shall be located to be accessible under all weather conditions;
- System and site accessibility criteria shall ensure the dry hydrant can be reached with no more than 6 m of hard suction hose;
- Dry hydrants shall have a minimum clearance of 6.1 m on each side and to be located a minimum of 30 m from any structure. Vehicle traffic shall not be impaired during the use of the dry hydrant;
- Dry hydrants shall be protected from damage by vehicular and other perils, including freezing and damage from ice and other objects;

- Dry hydrant locations shall be made visible from the main roadway during emergencies by reflective marking and signage approved by the County. All identification signs shall be approved by the County and/or Alberta Transportation prior to installation if they are to be located on the right-of-way or are subject to local or provincial laws;
- Vehicle access shall be designed and constructed to support the heaviest vehicle the County currently utilizes;
- Static lift should not exceed 3.1 m to 3.7 m. At design flow, head losses should be less than 6.1 m; and
- The hydrant shall be painted as needed in colors determined by the County, with reflective material to maintain visibility during emergencies.

4.2 The Minimum Water Supply volume shall be:

- A minimum of 7,600 L if there is no exposure hazard;
- A minimum of 11,355 L if an exposure hazard is present. The County reserves the right, at its discretion, to require a larger minimum volume to provide a higher level of fire protection for multi-lot subdivisions; or
- As identified in the individual “In-Ground Open Storage Pond” and “Cistern” sections of this document.

4.3 If there is no developed or natural water sources contemplated in the proposal, the Developer shall make arrangements for an alternative water source that can maintain the rates below as required in NFPA 1142.

TABLE 3.2.3.1. SPECIFICATIONS FOR AGGREGATE

DESIGNATION	1			2			3				4			5		6		7	8	9			
	10	12.5	16	*16(N2)	20	25	40	12.5AW	12.5BW	12.5C	16	20	25	40	10A	10B	80	125	40	25	8		
Percent Passing Metric Sieve (CGSB 8-GP-2M) • m	125 000																	100					
	80 000																100						
	50 000																55-100	55-100					
	40 000						100							100					100				
	25 000					100	70-94							100					38-100	38-100		100	
	20 000					100	82-97						100		55-90								
	16 000		100		100	84-94	70-94	55-85				100							32-85	32-85		90-	
	12 500		100	80-92	89-100				100	100	100	72-95											
	10 000	100	83-92	70-84	78-94	63-86	52-79	44-74	35-65	55-75	70-93	53-82	35-77	30-77	25-72	100	100				85-100	45-75	
	8 000																						100
	5 000	60-75	55-70	50-65	55-70	40-67	35-64	32-62	0-15	0-15	30-60	27-54	15-55	15-55	8-55	70-90	45-70	20-65	20-65		0-15	85-100	
	1250	26-45	26-45	26-45	26-45	20-43	18-43	17-43	0-3	0-3	9-28	9-28	0-30	0-30	0-30	20-45	20-45				40-100	0-5	45-75
	630	18-38	18-38	18-38	18-38	14-34	12-34	12-34															30-50
315	12-30	12-30	12-30	12-30	9-26	8-26	8-26			0-15	0-15				9-22	9-22	6-30	6-30		17-100		18-30	
160	8-20	8-20	8-20	8-20	5-18	5-18	5-18								5-15	5-15						10-21	
80	4-10	4-10	4-10	4-10	2-10	2-10	2-10	0-0.3	0-0.3	0-8	0-8	0-12	0-12	0-12	0-10	0-10	2-10	2-15		6-30		5-15	
% FRACTURE BY WEIGHT (2 FACES)	ALL +5000	60+	60+	* SEE NOTE (N1)	60+	60+	60+	50+	75+ (100% 1 Face)	75+ (100% 1 Face)	60+	60+	40+	40+	25+	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
PLASTICITY INDEX (PI)	NP	NP	NP	NP	NP-6	NP-6	NP-6	N/A	N/A	NP-4	NP-4	NP-8	NP-8	NP-8	NP-6	NP-6	NP-8	NP-8	NP-5	NP-5	NP		
L.A. ABRASION LOSS PERCENT MAX.	40	40	40	50	50	50	50	35	35	35	35	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	35	
FLAKINESS INDEX	N/A							MAX 15				N/A											
COEFFICIENT OF UNIFORMITY (Cu)	N/A																		3+	N/A			

Designations:

- Designation 1 - Asphalt Concrete Pavement
- Designation 2 - Base Course Aggregate
- Designation 3 - Seal Coat Aggregate
- Designation 4 - Gravel Surfacing Aggregate
- Designation 5 - Sanding Material
- Designation 6 - Pit- Run Gravel Fill
- Designation 7 - Cement Stabilized Base Course Aggregate
- Designation 8 - Granular Filter Aggregate
- Designation 9 - Slurry Seal Aggregate

*** Notes:**

- N1. Asphalt Concrete Mix Type 1 - 90+ (98% 1 face)
Asphalt Concrete Mix Type 2 - 70+
Other Asphalt Concrete Mix Types - 60+
- N2. Designation 2 Class 16 Material is for ASBC
- N3. For crushed aggregates other than all Designation 5 and Designation 9 materials, a tolerance of three percent in the amount passing the maximum size sieve will be permitted provided all oversize material passes the next larger standard sieve size.

Total Water Supply Required Liters	Rate Water is Available at Scene L/min
9,459	950
9,460 – 37,849	1,900
37,850 – 75,699	2,850
≥75,700	3,800

5 FACILITY PLANNING CONSIDERATIONS

In addition to the requirements of NFPA 1142, the County has developed the following criteria:

- 5.1** The County recognizes that there are several methods for water supply storage. The preferred facility types are constructed in-ground storage tanks (cisterns) and open storage ponds.
- 5.2** The County will consider applications involving locations within a natural stream, lake or other water body, as long as adequate measures are taken to address issues of seasonal fluctuations in water level, access restrictions, and environmental concerns.
- 5.3** The County may, where typical installations are not possible, provided satisfactory measures are taken to address concerns with freezing, construction, maintenance, and supply logistics accept the following installations in unusual circumstances:
 - Shallow installations;
 - Shallow or seasonal ponds;
 - Above-ground storage tanks; or
 - Bridge installations and/or facilities that include a roadway obstruction between the water source and the dry hydrant.
- 5.4** Dry hydrants, including their required lands and water storage facilities, shall be zoned as Public Utility Lots.
- 5.5** There shall be no overhead utilities on the Public Utility Lot.
- 5.6** There shall be no underground utilities permitted on the Public Utility Lot where there may be interference with operation of the dry hydrant and/or its water supply, or where the dry hydrant and/or the water supply operations could impede the utility.
- 5.7** As outlined in NFPA 1142, the need and locations for a dry hydrant depends on several factors, including but not limited to:
 - Current and future population and building trends;

- Property values being protected;
 - Potential for loss;
 - Proximity to structures (dry hydrant to be min. 30 m from structure it is protecting);
 - Fire history of the area protected;
 - Current water supply systems;
 - Potential water supply sources and reliability;
 - Cost of project, and
 - Other factors of local concern (location of responding fire department, etc).
- 5.8** The spacing and locations of dry hydrants will remain within the discretion of the County, CVRFS and P&D, with input from engineering professionals and other agencies (i.e. ASRD). For any subdivision, many factors must be considered, such as nearest responding fire department, proximity to existing lakes and ponds, proximity to forested areas, the nature of and value of proposed structures, setbacks and other factors.
- 5.9** Provided an elevated fire hazard risk does not exist, and on approval by the County, dry hydrant requirements may be reduced where a proposed development is within a reasonable distance and response time from an existing hamlet or community with a pressurized municipal water system that has adequate capacity to provide fire water flow.
- 5.10** Shared dry hydrant systems may be considered by the County on a site by site basis to reduce cost among proposed developments, or to improve fire protection in existing areas adjacent to proposed developments.

6 GENERAL DESIGN CONSIDERATIONS

- 6.1** The design of the dry hydrant, including miscellaneous materials and liners, shall be for a minimum life span of 25 years.

- 6.2** The materials of construction shall be suitable to meet fire flow needs and shall be appropriate for the installation conditions. Buried pipe should be rated for suction conditions. Should rubber gasket PVC be proposed, it shall meet AWWA C900 or C905 with a minimum Class 150 (DR18) rating and wall thickness. Should HDPE pipe be proposed, it shall be rated a minimum 150 psi (DR11). Should Steel Pipe be considered, it shall be a minimum of Schedule 40, with corrosion protection and sacrificial anodes considered. Minimum size suction and buried piping is 250 mm diameter. Above ground metal pipe shall be primed and painted to color acceptable by the County.
- 6.3** The dry hydrant shall be designed and constructed to provide a minimum flow of 840 L/min at draft.
- 6.4** The fire department connection shall consist of a 100 mm Storz type quick connect fitting steamer port or equal. The Protective cap on the connection shall be acceptable to the County and meet the requirements of NFPA 1963 *Standard for Fire Hose Connections*.
- 6.5** All pipe shall be adequately bedded and all trenches and excavations fully compacted to 98% SPD minimum. Pipe Cover should consider the potential for frost penetration of a least 2.6 m.
- 6.6** The dry hydrant riser shall be primed and painted above ground in Hi-viz Yellow. Riser shall be protected from vehicular damage by a minimum of four bollards placed in a square configuration at a distance of 1.2 to 2.0 m from the riser. Bollards shall be constructed of concrete filled 100 mm diameter steel pipe also primed and painted Chromium Yellow.
- 6.7** Signage shall be provided at the dry hydrant location as follows:
- Minimum size, 300 mm x 600 mm;
 - Mounted with standard Telespar post system; and
 - Signage to read as follows, in 65 mm red letters against a bright yellow background.
- 6.8** A gravelled approach shall be constructed with adequate gravel base (minimum 150 mm depth of 25 mm crush gravel on 300 mm compacted native material), culvert (min. 400 mm diameter), and of sufficient length and width to allow the

responding fire truck to pull fully out of traffic with a minimum 1.5 m clearance on all sides to allow for safety during filling operations.

- 6.9** Access to a dry hydrant location shall be designed as right-in/right-out, however, access to or from the opposite traffic direction shall not be inhibited by any type of barrier.
- 6.10** A reliable water source for filling and topping up, the dry hydrant must be identified and approved by the County prior to approval of the development permit. The dry hydrant assembly, as well as the method of topping up, shall be approved by the County and any other Provincial and/or Federal approving agency as required. Filling can be achieved by a dedicated well, stream access, or in the case of buried tank storage only, trucked in. For open ponds, topping up by trucking in is not acceptable due to the larger volumes typically stored within ponds, and the potential for larger losses due to seepage and evaporation when compared to buried tanks. Open ponds filled by storm water flows may be acceptable, provided adequate sedimentation traps are provided upstream of the fill location, and emergency overflow provisions are made. Storm water routes that flow adjacent to the facility, allowing off-stream filling, are preferred rather than routes that directly flow through the facility, which can have higher maintenance and potential for damage due to flood events.
- 6.11** The area within a distance of 3.0 m around the hydrant assembly shall be surfaced with gravel or similarly inert material to minimize growth of grass, brush, or other vegetation.
- 6.12** The County reserves the right to request, at its discretion, materials and geo-technical information relating to the design of roads, approaches, backfill, bedding, foundations, material tests (i.e. concrete, liner materials, etc.) as required. All such information shall be provided by and stamped by a Professional Engineer registered in Alberta.

7 IN-GROUND OPEN STORAGE PONDS – DESIGN CONSIDERATIONS

- 7.1** When calculating the MWS, consideration shall be given to the practicality of constructing an open storage pond. Based upon the criteria outlined below, assuming a square pond with a 3 m x 3 m bottom, the minimum active Water Supply Volume (below the ice allowance and above the suction line intake) that

can be provided by a constructed open pond is 182 m³. The following design criteria should be considered:

- Minimum 3H:1V side slopes inside and outside;
- Minimum horizontal bottom dimension of 3.0 m;
- Minimum depths as per table below;
- Minimum driving bank of 4.0 m width around pond, and
- Fencing typically 2.0 m beyond driving bank.

	Depth	Volume
Minimum freeboard above ice	0.3 m	151,400 L (152 m ³)
Minimum ice depth allowance	1.0 m	371,687 L (372 m ³)
Minimum active storage depth	1.05 m	182,058 L (182 m ³)
Dead Storage	1.15 m	52,422 L (53 m ³)
Minimum Total Pond Depth	3.5 m	758,324 L (758 m ³)

Note: 1 m³ = 1,000 L

- 7.2** The above design criteria accommodate the minimum desired frost cover of 2.6 m above pipes. Vertical risers that may contain water within the frost zone and area thereby subject to freezing may require special treatment (i.e. heat trace, insulation, etc.) to prevent a frost plug from forming. See NFPA 1142 for examples. Satisfactory operation of the riser must be demonstrated over a period of two winters before final acceptance by the County, including necessary field proof tests witnessed by the County.
- 7.3** The minimum site area required is 30 m x 30 m, or approximately 0.09 ha based upon a square pond and the above criteria not including any allowance for an approach. Given this, plus the additional area required for an approach and other geometries, for example; the minimum total site area required for an open pond

and dry hydrant would be in the order of 0.2 ha. Larger areas may be required depending on site conditions.

- 7.4** Ponds shall only be considered in areas where water sources for topping up by means other than trucking in are available (i.e. wells, stormwater routes, stream access).
- 7.5** The ponds must hold and maintain water on a continuous basis;
- where groundwater conditions merit it, the pond may be unlined to allow for replenishment by natural infiltration. If unlined, deepening of all or a portion of the pond should be considered to allow for anticipated fluctuations in water level; and
 - in all situations, lining is required. Lining can be *in situ* native clay materials or synthetic liners. Both must be properly designed by a qualified geo-technical Engineer. Synthetic liners can include plastic (HDPE or PVC) and clay (i.e. bentonite) materials, or variations thereof. Generally plastic liners should be a minimum of 1.0 – 1.5 mm, with the HDPE on the thicker end of the range. Joints should be fused or similarly sealed. HDPE liners are generally more resistant to ultraviolet radiation from sunlight than PVC and bentonite liners typically require compacted clay or gravel armor cover. Gravel armor is also necessary to hold down a liner in areas subject to high water table. The minimum acceptable thickness for a compacted clay liner is 0.6 m. The minimum requirement for cover by gravel armor is a 0.3 m thick layer containing at least 25% by weight material with a size range of 100 mm to 200 mm.
- 7.6** Should an exposed PVC or HDPE plastic liner be used, the side slopes can be slippery to maintenance personnel and animals, especially if wet. For safety, consideration should be given to roughening the liner surface to provide adequate traction, covering the exposed liner with clay or gravel to allow footing, and/or decreasing the side slopes. These measures should be applied to all sides of the liner. If the liner is left exposed, the pond must be fenced.
- 7.7** Ponds equipped with an exposed plastic liner, a 2.0 m high chain link fence shall be provided around the exterior of the open storage pond and driving bank. The fence shall be located 2.0 m outside of the outside shoulder of the driving bank to allow adequate vehicular access around the entire perimeter of the pond. A sliding gate shall be provided to not block the entrance or gravel driving surface when

open. Preference should be given to locating the fire department connection outside of the gate.

7.8 Warning signage at open ponds shall meet the following requirements:

- A minimum of four signs, one on each corner of the pond, installed diagonally;
- Minimum size, 600 mm x 900 mm;
- Mounted with a standard Telespar post system; and
- Signage to read as follows, against a bright yellow background:

CAUTION (75 mm Red Letters)

THIN ICE (65 mm Black Letters)

DROWNING HAZARD (65 mm Black Letters)

7.9 The pond shall be provided with a means to monitor water level, such as by staff gauge. The developer shall supply tables indicating storage volumes at various water levels.

8 STORAGE TANKS/CISTERNS – DESIGN CONSIDERATIONS

8.1 Cisterns and buried underground tanks are acceptable storage facilities for dry hydrants. They are an alternative in rural subdivisions where open surface water sources are not readily available, where available land and/or top-up capabilities for open ponds are severely limited, where development densities and property values are high, or where several other factors and considerations make them more feasible. Cisterns and tanks should be sized based upon NFPA *Minimum Water Supply Calculations*. Sizing shall be such that Minimum Water Supply volume is provided as active storage, meaning the volume of water available to be pumped out of the tank or cistern, not including water below the suction intake.

8.2 Tanks shall be provided with an adequate dry hydrant head assembly, vent assembly and fill assembly. Examples are provided in NFPA 1142.

8.3 For larger more intensive developments, large concrete cisterns illustrated in NFPA 1142 may be required by the County of Vermilion River. Some specifics of the cisterns are as follows:

- Cisterns located no more than 671 m truck travel distance from the nearest lot line of the furthest lot;
- Minimum capacity of 113,560 L;
- Concrete construction (alternative may be considered);
- Suction system capable of 3,800 L/min for 75% of the cistern capacity;
- Access approach complete with protective bollards.

9 FEES AND DEVELOPMENT LEVIES

9.1 The County of Vermilion River reserves the right to develop levies and fees for equitable distribution of costs for provision of rural fire protection facilities. Where warranted, the County of Vermilion River will endeavor to assist policies.

10 REFERENCES

- Alberta Building Code/National Building Code (ABC)
- NFPA Standard 1142, Water Supplies for Suburban and Rural Fire Fighting (NFPA 1142)
- County of Vermilion River's Municipal Servicing Standards (Standards)

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The following reference materials were predominantly used with Municipal consent in the preparation of these Servicing Standards:

“General Municipal Servicing Standards”, Sturgeon County, 2009.

“General Municipal Servicing Standards”, Lac La Biche County, 2019.

“The City of Edmonton Design and Construction Standards”, City of Edmonton, 2001.

“Land Use Bylaw”, County of Vermillion River, 2020.

“Municipal Development Plan”, County of Vermillion River, 2020.

Additionally, the following reference materials were used in the preparation of these Servicing Standards:

“Design and Construction Standards”, Strathcona County, 2021.

“Minimum Design Standards”, County of Grande Prairie No.1, October 2018.

“Design and Construction Standards”, Town of Calmar, 2020.

“Municipal Engineering Standards”, City of St. Albert, 2013.

“Procedures and Design Standards for Development”, Town of Westlock, 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 Water, Land & Air Protection, July 2006.

“Alberta Private Sewage Systems Standard of Practise”, Government of Alberta, 2015.

“Design Guidelines and Construction Standards, For Subdivision Developments” County of Wetaskiwin No. 10, September 2010

“Design Guidelines” City of Red Deer, 2020.

“Municipal Development Standards”, City of Lloydminster, October 2020

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