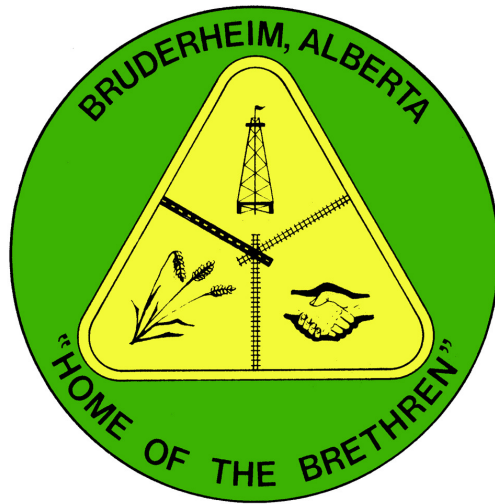


# Town of Bruderheim



## Engineering Servicing Standards

October 2008

**TOWN OF BRUDERHEIM ENGINEERING SERVICING STANDARDS  
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## **ENGINEERING DESIGN APPROVAL PROCESS**

### **Engineering Information Submissions**

#### **1. In Conjunction With Area Structure Plans**

Three copies of the following information must be submitted as part of an Area Structure Plan:

1. The results of a Geotechnical/Hydrogeological Investigation completed by a qualified geotechnical engineering firm. At this stage, the level of detail of this investigation should be to an extent sufficient to allow the engineer to generally assess the site geotechnical/hydrogeological conditions and their effect on the development and whether or not any contamination exists. The report should outline their findings and any general recommendations. The Developer may choose to complete the detailed Geotechnical/Hydrogeological Investigation (as outlined under .3 Detailed Engineering Design) at the Area Structure Plan stage.
2. An Environmental Site Assessment of the development area completed in accordance with the applicable Canada Standards Association (CSA) and other Standards.
3. If a Creek or major water course crosses the site, a plan of the floodplain and a letter outlining the recommended solution to ensure that the development would not be exposed to flooding.
4. Overall plans of the water and sanitary sewer servicing and storm water management schemes together with a discussion of the schemes and particularly addressing confirmation (in consultation with the Town) that capacity is available in existing Town systems to accommodate the flows required or generated by the development. Supporting calculations are required.
5. A Transportation Impact Analysis (TIA) for all developments that result in more than 100 peak hour trips.
6. The Town shall have the authority to amend the standards when required in accordance with good engineering practices.

#### **2. Before First Stage Subdivision Application**

Three copies of the following information must be submitted prior to submission of the subdivision application for the first stage of development in an Area Structure Plan area:

1. An Engineering Design Report for the Area Structure Plan area presenting:
  - a. Overall plans of the proposed water and sanitary sewer systems showing sizes and locations of all lines, discussion, and supporting detailed network analyses and calculations to demonstrate that the systems will provide the required level of service.

- b. Overall road layout of local roads, collector roads, intersections with arterial roads, road and right-of-way widths, and cross-sections. For developments that generate in excess of 100 vehicles per hour, a traffic impact analysis is required, that details: trip generation rates; morning and afternoon peak turning volumes at all collector/collector intersections, arterial road access points, and any other surrounding intersections / road segments that may be impacted by the development; projected daily traffic volumes; and proposed traffic control strategy and/or traffic control modifications that the aforementioned locations that will be required to accommodate the development traffic.
  - c. A storm water management analysis presenting the proposed scheme; an overall plan depicting the storage facility location, its drainage basin, and the downstream receiving stream; supporting detailed hydrology and hydraulic calculations for the facility and including an analysis of the capacity of the downstream receiving channel; preliminary facility cross-sections and details of inlets and the outfall control structure; description of storm water quality improvement methods to be incorporated and erosion and sedimentation control works proposed. If the implementation of the scheme is to be staged, the staging method should be presented.
  - d. A Noise Impact Assessment. The assessment must address present and future noise levels and identify measures required to adequately maintain noise to the Town's standard.
2. A Watershed Master Drainage Plan for the total drainage basin (if not yet completed) in which the Area Structure Plan area is located in accordance with the requirements outlined in the latest edition of the Storm water Management Guidelines For the Province of Alberta. Specific Terms of Reference would be developed for each Watershed Master Drainage Plan.
  3. Periodic updates of the above which will be required to reflect Provincial and Town Standards changes or land use or plan configuration changes.

### **3. Detailed Engineering Design**

1. The following will be submitted as part of the application for detailed design approval:
  5. A covering letter indicating the subject and purpose of the application, an estimated construction starting date and the proposed schedule for site meetings. Attached to covering letter shall be a:
    5. "Town of Bruderheim Application for Acceptance of Detailed Engineering and Landscaping Design Drawings" which must be stamped and signed by a Professional Engineer or a Registered Professional Technologist as well as by a Landscape Architect who is licensed to practice in Alberta (Enclosure I).
    6. "Application for a Letter of Authorization for Extension to a Waterworks, Wastewater or Storm Drainage System" which must be stamped and signed by a Professional Engineer or a Registered

Professional Technologist who is licensed to practice in Alberta. This application is required for submittal to Alberta Environment (Enclosure II).

2. Eight complete sets of the engineering drawings. Sets which do not contain the required drawings as outlined in Section A2 will not be accepted for processing.
3. One set of specifications, complete with tender form.
4. Three copies of a Geotechnical/ Hydrogeological Report presenting the results of a field investigation completed by a qualified geotechnical engineering firm. At this stage, the level of detail of this investigation, analysis, and report should be much more extensive than at the Area Structure Plan stage and address the following:
  1. Identify areas of high groundwater tables and estimate weeping tile flow rates.
  2. Identify conditions that will require special design considerations.
  3. Provide detailed recommendations for design and construction of roadways, pavement structure designs, deep and shallow utilities, site grading, storm water management facilities, and buildings.
  4. Clearly identify the limits of any site contamination and outline the site remediation to be completed.
  5. Soil alkalinity (sulphate levels) and resistivity test results and recommendations regarding concrete to be used and corrosion protection.
  6. Identify any conditions that will have special operation and/or maintenance implications.
  7. Top of bank setbacks adjacent to Creeks or ravines with stability problems.
5. Three copies of an Engineering Design Brief for the stage of development clearly demonstrating that the designs of the infrastructure systems for the stage fit into the overall development systems designs presented in the Engineering Design Report for the Area Structure Plan area. A water network analysis should be included to demonstrate that the system for the isolated stage of the development will provide the necessary fire flows. The details of any interim storm water management or staged servicing schemes or temporary facilities (emergency access, construction access, etc.) must also be presented.
6. An estimated construction schedule outlining the sequence of construction to be followed and applicable critical dates.
7. Additional technical detail required to satisfy the conditions of subdivision approval.
8. A cost estimate for proposed Underground Improvements and Aboveground Improvements.

9. A detail schedule of the length of local roads (including cul-de-sacs) and cost per metre and the length of collector roads and cost per metre.
10. Copies of all letters of application for all applicable approvals, permits, licenses, or agreement from Provincial, Federal or private agencies.
11. Copies of the formal approvals, permits, licenses or agreements must be received before construction commencement.

#### **4. Responsibilities**

1. The Developer will be responsible for complying with the requirements outlined in these Standards and all other applicable legislation, regulations, codes, standards, agreements, permits, and licenses. Additional information may be requested by the Town as deemed necessary.
2. The Developer will apply to Alberta Environment for all Letters of Authorization, Interim and Storm water Management Licensing.
3. The Developer will arrange and negotiate any and all easements across private lands, private utility crossing agreements and other similar agreements which may be needed with land owners in the area. The Town will only become involved if a mutually agreeable solution cannot be reached through negotiation between the parties involved and the viability of an approved subdivision is jeopardized. Note that a Development Agreement must be in place before any action can be taken by the Town.
4. The Town will, on request, supply all available information on existing utilities including available capacities, locations, restrictions and limitations. However the applicant must confirm the information provided, in the field, as the Town does not guarantee the accuracy or completeness of any information provided.
5. Periodically the Town will amend the Standards and issue a formal addendum to all holders of the Standards who are registered with the Town.
6. Nothing in these Standards relieves either the Town or the Developer of any of the obligations contained in the Development Agreement.
7. Engineering drawings shall be submitted a minimum of six weeks before the proposed start-up date of on site construction.

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## **A SUBMISSION STANDARDS**

### **A1 Design Drawings**

#### **A1.1 General**

1. All detailed engineering plans submitted for review and approval must comply with the specifications herein stated.
2. Clarity and legibility shall be the governing criteria when preparing drawings.
3. Refer to Appendix I for detailed information on drawing requirements.

### **A2 Required Engineering Drawings**

The drawings identified shall clearly highlight the detail as indicated.

#### **A2.1 Cover Sheet**

1. This shall show the name of the subdivision, stage of development and names of the Developer, planner and consulting engineer, and the Town of Bruderheim. A key plan of Bruderheim shall be included depicting the location of the overall development and identifying the stage of development which the drawings apply to.

#### **A2.2 General Legend and Abbreviations Plan**

1. This plan shall indicate and define all symbols and abbreviations used in the remainder of the engineering drawings.
2. Alternatively the Town may grant approval to show legends on individual drawings as required.

#### **A2.3 Index Plan**

1. This plan shall be prepared at a scale of 1:1000 or a reduction thereof to fit the standard size A-1 sheet (594 mm x 841 mm) and shall indicate that portion of the street which relates to a particular plan/profile sheet.
2. This sheet shall list each drawing included in that particular set of drawings. Each drawing name is to be listed sequentially along with its corresponding drawing number. Also included on this plan shall be a key plan in sufficient detail to show the location of the project with respect to major roads and built up centres.

#### **A2.4 Legal, Easement and Land Use Plan**

1. This plan shall indicate proposed land uses in the project along with existing and/or proposed land use on adjacent properties.
2. All legal and easement information shall be shown on this plan.
3. A 4.0m wide utility easement must be provided at the front of all lots. –A 3.0 m utility easement must be provided on the flankage and corner cuts of corner lots except residential lots with the classification of R1C which shall require an easement width of 2.35 m.
4. Public Utility Lot (PUL) widths shall be a minimum of 4.0 m for a single service and 6.0 m for a dual service. A 1.0 m easement is required on each side of a PUL. A single service centered in a 6.0 m PUL will not require additional easements.
5. Public Utility Lots (PUL) used for the purpose of overland drainage shall be a minimum of 6.0 m and the surfacing of the Public Utility Lot shall be at the discretion of the Town.

#### **A2.5 Road and Sidewalk Plan**

1. This plan shall indicate all walks, lanes, carriageway and right-of-way widths and alignments, catch basin locations, base gravel subdrain locations, trails and T-bollards.

#### **A2.6 Storm Drainage and Sanitary Sewer Basin Plans**

1. Large scale plans are required depicting the complete sanitary and storm drainage basins in which the development is located and their limits, location of the overall development, the stage to which the drawing set applies, trunk sewers and sizes for the entire basin, storm water management facilities, and receiving channels and drainage courses, and the major drainage system routes for the entire basin (with heavy arrows).

#### **A2.7 Lot Grading Plans**

1. The plan shall highlight the following:
  1. The proposed finished lot corner elevations, the proposed finished ground grade at key, the direction of flow of surface drainage on the lot, proposed curb alignments, and sanitary sewer and sump pump discharge line connection inverts at the property line.
  2. Lots requiring 1.0 m or more of fill material.
  3. Bench marks used in the construction of the project.

4. Existing contours at a 0.5 m interval shown in a screened format.
5. Notes for builders drawing attention to foundation, weeping tile, and sump pump design considerations and cross-referencing the Geotechnical/Hydrogeological Report.
6. The direction of the overland major drainage system with heavy arrows and ponding areas and flow depths resulting from a 1:100 year storm.
7. Notes dealing with the roof leader discharge and extension requirements, the requirement for sump pumps in all houses and cross-referencing the applicable detail for the discharge piping.
8. Typical three dimensional detail drawings of the lot grading types depicting the house, required slopes around the house and lot grades. Each lot should be labeled to identify the detail applicable for it.

#### **A2.8 Sanitary Sewer System, Water System, and Storm Sewer System Plan**

1. This plan shall indicate the alignment and locations of mains and service connections, size of mains, grade and directions of flow, location of appurtenances, and a Table presenting the criteria used and the hydraulic design calculations for the sanitary sewer system.
2. The storm sewer system, the sump pump discharge collection system, local drainage areas (labeled with size) which contribute to the storm sewer system and tables presenting the criteria and hydraulic design for the storm sewers, sump pump discharge collection lines, catch basins, and catch basin leads.
3. Notes shall include the sanitary sewer system, water system, sump pump discharge collection system and storm sewer system material specifications (type, size, class, standard applicable, etc.). This shall apply to service lines also.
4. Waterline bacteria sampling locations are to be identified.

#### **A2.9 Power, Gas, Telephone and Cablevision Plan**

1. The alignments of power, gas, telephone and cablevision lines. Any surface encumbrances such as light standards, transformers and boxes must also be shown.

2. Road crossings require conduit for new road construction or auguring for existing roadways.
3. Typical cross sections of any non-standard alignments i.e. at entrances to subdivisions, around cul-de-sacs, etc.
4. Utility company approval of alignments shown on the plan must accompany the submission or be contained on the detailed engineering drawings.
5. Gas pipes shall have a minimum bury of 0.8 m. Primary cables shall be buried 1.2 m. Secondary power cables and service drops shall be buried 1.2 m.

#### **A2.10 Street Hardware Plan**

1. This 1:1000 scale plan shall indicate the location of all street furniture and shall be used to identify and avoid conflicts between these features and future driveways.
2. A scale of 1:500 may be used for the plan if required for clarity.
3. All traffic sign locations and the sign to be installed at each location.
4. All surface infrastructure and other features such as hydrants, light poles, power transformers, telephone and cable boxes, Supermail boxes, bus shelters or benches, manhole covers and curb cocks.
5. Sight triangles as required by Section B2.7.
6. Permitted driveway locations on each lot with a standard detail showing the allowable offset from property line. A clearance of less than 1.5 m between edge of driveway and any surface obstruction shall require special approval which should be sought prior to completion of the plans.

#### **A2.11 Plan/Profiles, Standard Detail Drawings and Typical Cross-Sections**

1. The Plan/Profiles, Standard Detail Drawings, and Typical Cross-sections shall be drawn to avoid clutter and promote clarity and legibility.
2. Refer to Appendix I for detailed information on drawing requirements.

## **A2.12 Required Landscaping Plans**

1. The landscaping plans are to include all items identified in “General: Section 5.2 Guidelines to Drawing Submission” of the Open Space Development Standards, such as tree planting, entrance signage, fence locations, trails, playground sites, furniture, T-bollards, etc. Confirmation by the Developer's Consultant that all sight line distances from intersections are detailed as required by Section B2.7.
2. Table A-1 is required presenting distance requirements between trees and shrubs and surface components of deep and shallow utility systems (manholes, hydrants, valves, curb stops, cleanouts, transformers, pedestals, streetlights, etc.). This Table will be included in the Landscaping Drawings.
3. All Reserve Lands to be identified:
  1. Municipal Reserve
  2. Environmental Reserve
  3. Conservation Easements

### **TABLE A-1**

#### **Utility Setbacks**

The Landscape contractor shall have all site utilities located prior to construction and shall plant no closer than the following dimensions from the services:

1. 1.0 m from power lines
2. 3.5 m from all power hardware
3. 1.8 m from water mains, water services, and water valves
4. 2.0 m from sewer mains, manholes, and services
5. 1.5 m from gas and all other services
6. 7.5 m from street corners
7. 3.5 m from fire hydrants
8. 2.0 m from driveways
9. 3.5 m from Yield and Stop signs
10. 3.5 m from Bus Stop signs
11. 2.0 m from all other signs
12. 1.0 m from other underground utilities

The Landscape Contractor is responsible for damages and liabilities incurred by damages to site utilities.

END OF SECTION A

## **B**     **ROADS**

### **B1**   **Geometric Design Standards**

#### **B1.1**   **General**

1. Road classification and designation shall be in accordance with the classification system outlined in the Transportation Association of Canada (TAC) Manual - Geometric Design Standards for Canadian Roads and Streets and the Urban Supplement to the Geometric Design Guide for Canadian Roads.
2. Individual street classification is to be based on functional use established by the Town.
3. The Developer and the Developer's Consultant are responsible to ensure that the infrastructure is designed and constructed to achieve design life expectations consistent with good design and construction practice.
4. The use of traffic calming methods for new residential development will be considered normal practice. Design of traffic calming facilities will be in accordance with the Canadian Guide to Neighbourhood Traffic Calming, Transportation Association of Canada, December 1998, or its most recent version.
5. Roundabouts for new development will be designed in accordance with Roundabouts: An Informational Guide, U.S. Department of Transportation, Federal Highway Administration, Publication No. FHWA-RD-00-067, June 2000, or its most recent version.
6. The traffic control proposed at the intersection of all collectors to collector roads shall be reviewed to provide a traffic control method that will be self-enforcing and reduce traffic operational speeds to less than 50 km/h.
7. Local residential straight or near straight roads shall have a maximum unimpeded length of 215 metres. Traffic calming measures shall be implemented for roads in excess of 215 metres.
8. Long continuous collector roads, in excess of 1000 metres should be avoided wherever possible. Neighbourhood plans are to be designed such that the maximum volume on collector roads are to be 6000 vpd, except within 200 metres of intersections with arterial roads, where volumes could be expected to increase by 50% providing the lane design is adequate to accommodate the traffic volumes and turning movements.

**B1.2 Street Classification**

1. Table B1 indicates the required road cross sections for each street classification.
2. Traffic calming on collector roadways is required and can be accommodated as outlined in drawing B-30 Urban. This cross-sectional drawing may be proposed in Area Structure Plan Design Brief reports.

**TABLE B1**

Street Classification	Roadway Width Curb Face to Curb Face	Right-of-way Width	Operating Speed	Standard Drawing Number
<u>Local Roads</u>				
Residential Cul-de-sac	9.0 m	18.0 m	50 km/h	B-20, B-21, B-38
Residential	9.5 m *1	18.0 m	50 km/h	B-21, B-22, B-23, B-24
Industrial	11.5 m	20.0 m	50 km/h	B-25
<u>Collector Roads</u>				
Minor Residential >1000 vpd < 2500 vpd	11.5 m	20.0 m	50 km/h	B-26,
Major Residential > 2500 vpd < 6000 vpd	13.5m*2	24.0 m	50 km/h	B-28, B-29
Major Residential >2500 vpd < 6000 vpd with Traffic Calming	Variable	24.0 m	50 km/h	B-30a & B-30b
Industrial	13.5 m	24.0 m	50 km/h	B-31
<u>Arterial Roads</u>				
Undivided Arterial	15.8 m	40.0 m	60 km/h	
Minor Divided Arterial	2 - 8.4 m*	50.0 m	70 km/h	
Major Divided Arterial	2 - 12.1 m* *plus 4.5 median	50.0 m *3	70 km/h	
<p>*1 Pavement width on crescents with an overall maximum of 50 units (or 600 vpd) can be reduced from 9.5 m to 9.0 m.</p> <p>*2 An 11.5 m pavement width centered in the right-of-way will be acceptable for major residential collector roadways provided that lots do not front on to the roadway (including lots with back lanes) and "No Parking" signs are provided. The right-of-way width shall remain at 24.0 m to accommodate easier transitions. Major residential collector roadways with lots fronting will be required to maintain a 13.5 m pavement width to accommodate parking.</p> <p>*3 Final right-of-way shall be dependent upon the requirement for noise abatement.</p>				

### B1.3 Vertical Alignment

#### 1. Grade

1. The minimum grade shall be 0.6% along all gutters, 1.0% around curb returns and 0.8% on lanes.
2. The maximum grade shall be 6.0%.
3. A maximum gradient of 2% for a distance of 30 m from the curb return for all roadways connecting to any intersection.
4. All roads shall be crowned or shall have a crossfall as shown on the applicable standard drawings B-21 through B-31 and B-38.

#### 2. Vertical Curves

1. All vertical curves shall be designed to meet the minimum requirements as shown in Table B2.

**TABLE B2**

DESIGN SPEED KM/H	K VALUE	
	CREST M	SAG M
50	8	7
70	22	15
80	35	20

Where  $K = L/AL =$  Length of Vertical Curve in Metres  
A = Algebraic Difference in Grade Percent

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

### B1.4 Horizontal Alignment

#### 1. Curves

1. The minimum degree of curvature of the centreline of the carriage way is dependent on the road classification and its design speed.
2. All horizontal curves shall be designed to meet the minimum design requirements as shown in Table B3.

**TABLE B3**

CLASSIFICATION	MINIMUM RADIUS OF CURVE M	MAXIMUM GRADIENT %	MINIMUM TANGENT LENGTHS M	INTERSECTION SPACING M
Residential Cul-de-sac	90	6	30	60
Local Residential	90	6	30	60
Local Industrial	90	6	30	60
<u>Collector</u>				
Minor Residential	90	6	60	60
Major Residential	130	6	60	60
Industrial	130	6	60	60
<u>Arterial</u>				
Minor Arterial	450	5	60	400
Major Arterial	500	5	60	400
NOTES:	<ol style="list-style-type: none"> <li>1. See TAC B-16 for super elevation requirements on arterial.</li> <li>2. Design speeds are 50 km/h except minor and major arterials which are 70 and 80, respectively.</li> </ol>			

### B1.5 Survey Control Markers and Legal Pins

#### 1. Existing Control

1. The Developer or their Consultant shall make every effort to protect existing markers.
2. Markers which are destroyed or disturbed shall be replaced by the Developer at his sole expense.

2. Survey Control Density
  1. Additional markers shall be provided by the Developer at a maximum spacing of 500 m with a minimum of two other markers in clear view subsequent to development.
3. Legal Posts
  1. Legal posts shall be placed subsequent to the installation of all utilities.
  2. All legal posts in the subdivision area shall be located within 60 days prior to application for Final Acceptance of the surface improvements.
  3. The Developer shall instruct the legal surveying consultant to replace any missing or disturbed posts as required by the Town. All costs are to be borne by the Developer.

## **B2 General Requirements**

### **B2.1 Pavement Structure**

1. The Geotechnical Report for the proposed project shall be submitted to the Town for review as part of the overall submission.
2. The Geotechnical Report must include specific recommendations for pavement structure construction based on insitu conditions and projected traffic volume. The stronger of the 20 year structure recommended by the Geotechnical Consultant and the structure shown in Table B4 shall be used.
3. Table B4 indicates the minimum thicknesses of granular and asphaltic concrete materials required for each street classification. Note that a minimum cement stabilized subgrade preparation of 150 mm is required in every case. The subgrade and base gravel must be compacted to 100% Standard Proctor Density.
4. Provision for drainage of granular material shall be by means of Mebra Wick Drain #7407, Layfield LP8WD Horizontal Wick Drain or accepted equivalent, between catch basins and storm sewer manholes in all sag locations. The wick drain or equivalent shall be placed parallel to the curb in the lowest layer of the granular material in accordance with Drawings B-19 through B-27 and connected to the nearest catch basin or storm manhole in accordance with Drawing E-4.
5. The subgrade of Local and Collectors roadways shall be cement stabilized to the specification as outlined in the Section VII – 4D of the Town of Bruderheim Standard Documents.
6. Alternative pavement designs of equivalent strength along with supporting material may be submitted to the Town for review and approval prior to construction. All designs must incorporate a drained gravel base.

7. A phased pavement construction is required. The surface course shall be constructed not more than 6 months prior to Final Acceptance of surface improvements. The base course shall be 75 mm thick minimum, with the surface course 40 mm thick minimum. Maximum thickness shall not exceed 100 mm per lift.
8. When tying in a previous phase, a minimum 0.75m width shall be ground out of the old phase and a 1.5 m Type 8502 or approved alternate glass grid shall be placed to tie the new and old pavement together at the joint.
9. The Final Acceptance Certificate for roads excluding surface course asphalt shall be issued, subject to all deficiencies being rectified, two years after the issuance of the Construction Completion Certificate for roads or one year after the issuance of the Final Acceptance Certificate for underground improvements, whichever occurs later. An additional twelve (12) month materials and workmanship warranty period shall be required on the surface course of asphalt.

Notwithstanding the above, if a pavement structure, other than the ones specified in this document is authorized by the Town then a two year maintenance period shall be required from the date of issuance of a Construction Completion Certificate. Note that prior approval must be obtained from the Town for alternative pavement structures.

10. If an interim or temporary entrance is necessary to provide access to a new subdivision, cul-de-sac or other residential street the pavement structure must be designed to accommodate the projected traffic for the life of the facility.
11. Pavement markings shall be:
  1. applied in paint on longitudinal lines at CCC & FAC,
  2. applied in paint on traverse lines at CCC,
  3. applied in plastic on traverse lines at FAC,
  4. applied in plastic on longitudinal and transverse lines at CCC & FAC on Arterial roadways.

**TABLE B4**

STREET CLASSIFICATION	MINIMUM PAVEMENT STRUCTURE		TYPE	
	20 MM GRANULAR (MM)	ASPHALTIC CONCRETE (MM)	BASE	SURFACE
Lanes (No Garbage Pickup)	150	100		ACR or ACO
Residential Cul-de-sac	150	75/40	Type III	ACR or ACO
Local Residential	150	75/40	Type III	ACR or ACO
Local Industrial	200	100/50	Type III	ACO
Minor Collector	150	100/50	TYPEIII	ACO
Major Collector	200	100/50	TYPEIII	ACO
Industrial Collector	280	200	TYPEIII	ACO
New Minor Arterial	300	95/40 40	ACB/ACO	ACO
New Major Arterial	300	95/40 40	ACB/ACO	ACO

## **B2.2 Sidewalks and Walkways**

1. Separate sidewalks shall be a minimum width of 1.5 m and shall be constructed in accordance with drawing number B-17. Separate sidewalks shall be constructed on all minor & major collector roadways and may be used on local residential streets.
2. Monolithic 1.5 m sidewalk and gutter with rolled curb shall be constructed in accordance with Drawing Number B-18 or B-19.
- ~~3.~~ Collector monolithic sidewalk and gutter with straight faced curb shall be constructed in accordance with Drawing Number B-20.
4. Sidewalks are required on both sides of all streets except arterials and cul-de-sacs. Sidewalks shall terminate near the cul-de-sac bulb in accordance with Drawing Number B-37.
5. The requirements for sidewalks in an industrial area shall be reviewed on an as required basis in conjunction with the proposed commercial character of the area, the need for bus routes and other municipal services.
6. Paraplegic ramps are to be used at all curbed intersections and shall be constructed monolithically or securely dowelled and in accordance with Drawing Numbers B-1, B-2 and B-3.
7. All sidewalks shall be imprinted with the Contractor's stamp showing company name and year of construction. Frequency of stamps shall be one per residential block or every 200 m whichever is less.
8. Sidewalks shall be imprinted with a "CC" to identify all CC locations and a "W" to identify water valve locations.
- ~~9.~~ All concrete structures are to be adequately reinforced. All vertical face curb structures require a minimum compressive strength of concrete at 28 days of 30 MPa. All other concrete structures require a minimum compressive strength of concrete at 28 days of 25 MPa

The pouring of concrete in cold weather conditions must have prior approval from the Town. Approval requests must include mix design, additives and hoarding details.

10. The design of the subdivision should consider pedestrian needs and allow for walkways through cul-de-sacs and other appropriate locations.

## **B2.3 Concrete Curb and Gutter**

1. Concrete curb and gutter shall be constructed on all streets in accordance with Drawing Numbers B-10 through B-11, B-13 through B-15, and B-18 through B-20.

2. Vertical face curb and gutter shall to be used on all collector (minor and major) and arterial roads. All roads fronting parks, public utility lots, (other than emergency accesses) and walkways shall also require vertical face curb and gutter unless another means of preventing vehicular access onto these public lands is provided.
3. Curb returns on residential street intersections shall be constructed with a minimum radius of 10.0 m. There shall be a transition to a vertical face curb cross-section 1.0 m prior to the beginning of the curb return and a reverse transition 1.0 m after the end of the curb return at intersecting roadways. A 1.0 m transition into the curb return may be accepted to accommodate catch basin locations.
4. Curb returns in industrial/commercial areas shall be constructed with a minimum radius of 15.0 m to accommodate truck turning movements.
5. Minimum Compressive Strength of Concrete at 28 days for straight faced curb and gutter as noted in B2.3.2 shall be 30 MPa. All other curb and gutter to have 25 MPa compressive strengths at 28 days. Cured in place samples must be provided when requested.
6. Local residential streets will be permitted to utilize low profile curb provided separate sidewalks are used or where there are no sidewalks in cul-de-sac bulbs.

#### **B2.4 Driveways**

1. Residential subdivision lot layout shall be such that driveways shall not access directly onto arterial roadways. In addition, no driveways shall be permitted direct access onto those major collector roads or portions thereof which have an estimated traffic volume of 4,000 vehicles per day or greater. Trip generation rates used to generate the volume shall be based on a minimum of 12 trips per dwelling per day external to the subdivision.
2. All driveways shall be constructed to provide a minimum clearance of 1.5 m from any structure including hydrants, light standards, service pedestals, curb cocks and transformers in accordance with the Street Hardware Plan.
3. No driveways or any portion thereof shall be permitted to access an abutting road through a curb return area.
4. For corner lots the driveway zone must be indicated for the street of lesser traffic only.

#### **B2.5 Berming, Fencing and Landscaping**

1. Consistent noise attenuation fencing shall be required on all lots that back or side onto arterial. Berming and fencing shall be required to separate residential developments from high volume arterial traffic. Fencing shall be placed 150 mm inside the residential lot property line.

2. Residential development adjacent to the major arterial roadways, as outlined in Section B.2.5.1, requires a Noise Impact Assessment to be submitted during the development approval process. The Assessment must address present and future noise levels and identify measures required to adequately maintain noise at the levels outlined as follows:

Outdoor Criterion Levels

(measured or calculated at a distance of 5.0m from the nearest dwelling facade)

Design Objective      55 dBA\*

\* Under extenuating circumstances and at the discretion of the Town, the design noise level may be relaxed; however, it will not be permitted to exceed 60 dBA.

The Developer will be required to address noise levels based on transportation facilities operating at capacity as planned by the Town or other agencies.

Berms shall have maximum side slopes of 4:1, a top width of 1.0 m and be topsoiled and sodded/seeded. Berm tops shall be centered on the property line. Where berm design provides for less than 6.5 m from toe of berm to lip of gutter additional land must be dedicated for the right-of-way.

3. Fencing proposals are to be reviewed for acceptance by the Town prior to construction. Construction of fencing may not start until an acceptable plan has been provided and written acceptance granted. Fencing along arterial roads and utility lots shall be of a close boarded type and extend to ground level. Fencing is required along parks, schools and other public open space and shall be 1.5 m high in accordance with the Open Space Development Standards. All fences shall be constructed on private property approximately 150 mm from the property line.
4. In landscaped areas the subgrade preparation, topsoil, seeding and/or sodding requirements must conform to the Open Space Development Standards.

**B2.6 Cul-de-Sacs**

1. The normal maximum length of a cul-de-sac is one hundred and twenty (120) metres from the street curb line to the start of the bulb. Cul-de-sacs in excess of 120 metres and less than 170 metres will require an additional hydrant. Watermain looping will be required as outlined in D1.1 and D1.2. Where cul-de-sacs in excess of 170 metres are proposed, provision must be made for a 6.0 m wide Public Utility Lot (PUL) for emergency vehicle access and water service looping. Emergency vehicle access PUL's shall be developed to a standard acceptable to the Town.
2. Cul-de-sacs with steep grades are to be avoided. If cul-de-sacs cannot be graded to drain towards the intersection then an outlet for the overland flow must be provided by way of a PUL.

3. The minimum radius of cul-de-sac bulbs is 14.0 metres to face of curb. (See Drawing Number B-37).
4. Cul-de-sac islands are a required design feature to accommodate utilities & street furniture, planting and parking.
5. A teardrop island shall have a diameter of 12 metres and shall be landscaped in accordance to the Open Space Development Standards.
6. Islands shall be constructed with standard curb, gutter and catch basins and must contain a sub surface drainage system draining to the catch basin. Barrier curb will be allowed on Cul-de-sac islands and Traffic Calming medians on local residential roads.
7. Cul-de-sac road surface is to be crowned except the bulb portion which may be crossfall.

## **B2.7 Intersections**

Intersections include the crossing of two public roadways or the connection of a public access to a roadway.

1. The minimum angle of intersection for two roadways shall be 75 degrees.
2. Acceptance of intersection design, driveway locations and fencing shall be subject to review of available sight distances and other safety considerations. Tapering of berms at intersections may be required to provide for the necessary sight distances. Acceptance shall be granted on a case by case basis.

Minimum sight distances for local and collector roads measured from 5 m back of the intersecting street curb line shall be a minimum of 65 m based on a 50 km/h design speed.

3. The Developer shall provide confirmation that sight distances, and horizontal and vertical visibility constraints at the access to arterial roadways, Range Roads and Township Roads meet the applicable stopping sight distances.
4. Minimum centre line to centre line spacing of intersections shall be 60 m along local and collector roadways. Under normal circumstances (i.e. on the 1.6 km or 3.2 km sections of grid roads) access to arterial roads may be permitted as follows:
  1. signalized where warranted but potentially signalized intersections spaced and capacity designed for minimum arterial impact.

Where traffic volumes or existing conditions make the above standards inappropriate the Town shall determine the appropriate spacing of intersections to provide for uninterrupted movement of through traffic.

5. At the intersection of arterial roads and where the traffic volume at entrance roads indicates a need for acceleration/deceleration turning lanes the Developer shall

provide an additional 3.7 m for widening of the arterial right-of-way.

6. Standard corner cutoffs in accordance with Table B5 shall be used at all intersections unless in the opinion of the Town circumstances dictate more stringent requirements. Developer subdivision entrance signage may be located on additional dedicated right-of-way located behind the minimum cut off specified.

**TABLE B5**

CUTOFF REQUIREMENTS		
Arterial	Arterial	15 m x 15 m corner cut*
Arterial	Major Collector	8 m x 15 m corner*
Arterial	Minor Collector	8 m x 15 m corner*
Major Collector	Major Collector	10 m Corner Cut
Major Collector	Minor Collector	6 m Corner Cut
Minor Collector	Minor Collector	6 m Corner Cut
Minor Collector	Local	6 m Corner Cut
Local	Local	6 m Corner Cut
Commercial Access	Arterial	6 m Corner Cut
*In addition to 3.7 m auxiliary lane widening.		

### B2.8 Laneways

1. All laneways shall be a minimum of 6.0 m in width with a minimum 0.8% longitudinal grade.
2. Laneways shall be paved over their full width with a minimum structure of 100 mm depth of asphalt over 150 mm of an approved granular base.
3. An inverted cross-section shall be used for laneway construction with a minimum longitudinal grade of 0.8%.

### B2.9 Utility Trenches

In all new subdivisions it shall be the Developer's responsibility to ensure that utility trenches are adequately compacted. Within the road carriage way, 98% Standard Proctor Density shall be required; 95% Standard Proctor Density in all other areas. In existing subdivisions, the utility companies shall be responsible to ensure adequate compaction in utility trenches for any new installations or modification of existing lines.

The Developer's consultant is to coordinate locations of shallow utility crossings of roadways with the respective utility company. All shallow utilities are to be contained in conduit of appropriate size and number for all roadway crossings.

### **B2.10 Traffic Control & Street Name Signs**

1. Diamond Grade reflective material is required for the lettering and background for all signage, except the black components of a sign.
2. Street name signs at intersections shall consist of white lettering on a green metal plate. Lettering sizes shall be as follows:
  1. Arterial roadways - 250 mm (10") on a 300 mm (12") blade
  2. Major collector roadways – 250 mm (10") on a 300 mm (12") blade
  3. (12") blade
  4. Minor collector and local roadways – 100 mm (4") on a 150 mm (6") blade
3. 100mm (4") white address numbering on a green metal plate will be required on all cul-de-sacs in addition to the street name signage.
4. Developers may be permitted to install additional decorative street name signage or signage support when adequate maintenance funding provisions have been approved by the Town.

## **B3 Roadway Lighting**

### **B3.1 Design Criteria**

1. The illumination of roadways in the Town of Bruderheim shall be designed to the following criteria:
  1. Arterial Roads: Transportation Association of Canada Guide for the Design of Roadway Lighting
  2. Collector Roads: Transportation Association of Canada Guide for the Design of Roadway Lighting
  3. Local Road: Illuminating Engineering Society of North America, Roadway Lighting, RP 8-00

Intersections will be designed to the higher roadway criteria.

2. The illumination of intersections of roadways in the Rural Service Area shall be designed to the following criteria:
  1. All Roads: Transportation Association of Canada Illumination of Isolated Rural Intersections

END OF SECTION B

## **C SANITARY SEWER SYSTEM**

### **C1 System Design**

#### **C1.1 General**

The sanitary sewer system shall be of sufficient capacity to carry peak flows plus an inflow and infiltration allowance. The flows and factors outlined in the following sections shall be used in the design of sanitary sewer systems.

The Developer and the Developer's Consultant are responsible to ensure that the infrastructure is designed and constructed to achieve design life expectations consistent with good design and construction practice.

#### **C1.2 Estimating Average Sewage Flows**

1. Residential - 375 L/person/day
2. Commercial/Industrial - Since these flows vary greatly with the type of development, each case must be considered on an individual basis. For preliminary planning purposes, 18.0 m<sup>3</sup>/ha/day may be used for Commercial/Light Industrial.
3. In determining residential flows a minimum of 3.5 persons per household shall be used unless otherwise determined by the Town.

#### **C1.3 Peaking Factor**

1. The peaking factor for residential development shall be calculated using the Harmon Formula. The minimum peaking factor shall be 3.0. Peaking Factor =  $1 + 14 / (4 + P^{1/2})$
2. Where P = the design contributing population in thousands.
3. The peaking factor must reflect the projected population of the subdivision being designed.
4. The peaking factor for commercial/industrial development varies greatly with the type of development. Each case must be considered on an individual basis.

#### **C1.4 Estimating Extraneous Flow Allowances**

1. A general infiltration allowance of 0.5 L/sec/gross ha shall be added to the above flow.

2. In addition, a separate allowance of 0.4 L/sec shall be added for each manhole located in a street sag with some degree of water inflow control in place.

### **C1.5 Pipe Sizing**

1. Minimum Pipe Size:
  1. Commercial/Industrial/Institutional: 250 mm
  2. Residential: 200 mm
2. Pipe sizing shall be determined by utilizing the Manning's Formula using a minimum "n" value of 0.013 and the following formula:

$$\text{Required sewer capacity} = \frac{\text{Estimated Design Flow}}{0.86}$$

3. Minimum flow velocity = 0.60 m/sec. Maximum flow velocity = 3.0 m/sec.
4. The minimum grade of the first upstream leg of sanitary sewer shall not be less than 1.0%.
5. Minimum slope:

<u>Size</u>	<u>Slope %</u>
200 mm	0.40 (except first upstream leg)
250 mm	0.28
300 mm	0.22
375 mm & larger	0.15

Minimum slopes shall be increased by 50% on all curves.

### **C1.6 Weeping Tiles (Foundation Drains)**

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.
2. Weeping tiles must be connected to sumps with pumped discharge into a sump pump discharge collection service which is a component of the storm drainage system as specified in Section E of these Standards. The required general arrangement of the sump pump and discharge piping to the sump discharge collection service is depicted on the Typical Sump Pump Discharge Connection Detail Drawing C-14. The detailed arrangement must also comply with the Plumbing Regulations.

The auxiliary surface discharge piping shown on the Detail must be installed to provide an overflow in the event that 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. The Developer shall insure that the builders install sump pumps and make the required sump pump connections.

### **C1.7 Sanitary Sewer Main Alignments and Locations**

1. In residential/commercial subdivisions, sanitary sewers shall be installed on the alignments depicted on the Typical Right-of-Way Cross-section Drawings. For industrial areas and multi-family site developments, typical cross-sections depicting infrastructure locations must be developed to suit the particular development.
2. The installation of a main into a multi-family site development would normally be completed at the time the site develops. However, the Developer's Consultant must address the depth requirements for servicing the site in the establishment of the design depth for the main located on the abutting street.
3. Sanitary sewers must be located at least 2.5 m horizontally from any water main and at least 1.8 m horizontally from gas lines.
4. Public Utility Lots (PUL) widths shall be a minimum of 4.0 m for a single utility and 6.0 m for one containing two utilities. A 1.0 m easement is required on the lots on each side of a PUL.
5. Mains shall be at a depth adequate to provide a minimum 3.0 m cover from finished grade to top of pipe and the required minimum depth of cover over service connections.
6. Curved sewers shall be permitted with the following restrictions:
  1. The curve shall run parallel to the curb or street centre line.
  2. The minimum grade for sewers on a curve shall be 50% greater than the minimum grade required for a straight run of sewer.
  3. Manholes shall be located at the beginning and end of each curve and intermediate locations as required.
7. At water main crossings of sanitary and storm sewers, the following shall apply:
  1. Under normal conditions, water mains shall cross above sewers with a sufficient vertical separation to allow for proper bedding and structural support of the water and sewer mains.
  2. Where it is necessary for the water main to cross below the sewer, the water main shall be protected by providing:
    1. A vertical separation of at least 0.5 m from water main crown to sewer invert;
    2. Structural support of the sewer to prevent excessive joint deflection and settling; and

3. A centering of the length of water main at the point of crossing so that the joints are equidistant from the sewer.

### **C1.8 Manholes**

1. The maximum spacing between manholes shall be 150 m.
2. Manholes are also required at all transitions in size, grade, or direction, and at junctions and the ends of mains. They should be located to avoid driveway conflicts.
3. At manholes where size changes occur, the crowns (obverts) of the mains shall be designed to match.
4. Inverts in manholes shall have a minimum 12 mm drop for straight run sewer manholes. At changes in direction, manholes shall have at least 50 mm fall across the manhole in the direction of flow from inlet to outlet elevation.
5. Drop sections are required for invert grade differences greater than 300 mm in sanitary sewer manholes. For 200 mm and 250 mm mains, internal drops may be used. Benching is required for invert grade differences 300 mm or less.

### **C1.9 Service Connections**

1. Each lot or multi-family unit shall have its own separate sanitary service connection.
2. The minimum size of a sanitary sewer service connection shall be 150 mm inside diameter.
3. Non-residential and apartment service connections shall be sized according to anticipated user requirements. These service connections would normally be installed at the time that the lot is developed.
4. The minimum grade on the service line shall be 2.0%.
5. In the case of single family lots, the minimum depth of cover shall be 2.6 m to the top of pipe from finished grade at a point 0.15 m from the back (house side) of the easement required along the front of all lots.
6. For non-residential and apartment service connections, the Developer's Consultant must address the depth requirements for servicing of these lots in the establishment of the design depth for the sanitary sewer main on the abutting street.
7. Services shall be located such that they do not conflict with driveway locations.
8. A sanitary sewer sampling manhole shall be provided within the road right-of-way or easement for each service to an Industrial or Commercial lot. The sampling manhole shall be installed at the time that the lot develops and the

service is installed.

## **C2 System Materials**

### **C2.1 General**

The Developer shall supply and install only new materials. All such materials which are defective in manufacture or has been damaged in transit or have been damaged after delivery shall be replaced by the Developer at his expense. All Standards referred to mean the latest edition of that Standard. The applicable standards are summarized at the back of this section. Where specific products are specified, it is intended that approved equals are also acceptable. The approval of the equal must be obtained from the Town before the equal product is used.

### **C2.2 Sanitary Sewer Mains**

1. Sanitary sewer mains shall be PVC or concrete pipe.
2. PVC Pipe
  1. PVC pipe shall be DR35 in the 200 mm - 900 mm size range conforming to CSA B182.2 and ASTM D3034, ASTM F679, NQ 3624-130 and NQ 3624-135 standards with a minimum stiffness of 320 kPa. The pipe must be manufactured from 12454-B or 12364-C compound.
  2. Sealing gaskets shall meet requirements of CSA B182.2 and ASTM F477 with the additional requirement that joints shall be able to withstand 345kPa/50 psi hydrostatic pressure.
  3. For the in-line Tees or Wyes required at all service connections, injection molded gasketed fittings shall conform to CSA B182.1 or CSA B182.2 and fabricated fittings must conform to CSA B182.2 and ASTM F679.
  4. 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, petro storage areas or petro refinery sites.
  5. Any pressurized sanitary sewer main installed within the Urban or Rural service Area made of PVC, PE, HDPE or any similar nonconductive material is to have tracer wire installed. The tracer wire is to have connection points exposed at every opportunity (all valves and air reliefs). This would facilitate locating a mainline with locating equipment.
  6. The tracer wire used shall be a minimum of 14 gauge coated copper wire complete with sacrificial 5 lb. Anodes spaced every 1000 lineal metres, used for corrosion protection.
3. Concrete Pipe

1. All concrete pipe shall be manufactured using sulphate resistant Type 50 cement.
2. Non-reinforced concrete pipe in the 200 mm - 375 mm sizes shall be a minimum Class 3 conforming to CSA A257.1 and ASTM C14.
3. Reinforced concrete pipe in the 250 mm and larger sizes shall conform to CSA A257.2 and ASTM C76.
4. All joints shall be confined “O” ring rubber gasket conforming to ASTM C443 and CSA 257.3.

### **C2.3 Sanitary Services**

1. For single family dwellings and multi-family units, sanitary service pipe and fittings shall be 150 mm DR35 meeting the same specifications as the PVC main pipe.
2. For non-residential services, PVC or concrete pipe shall be used and comply with specifications in C2.2.

### **C2.4 Manholes**

1. Manholes shall be manufactured using sulphate resistant Type 50 cement.
2. Manhole sections shall be pre-cast reinforced concrete sections conforming to ASTM C478 and CSA A257.4.
3. All manholes shall be 1200 mm inside diameter.
4. Manhole steps shall be standard safety type, hot dipped galvanized iron conforming to ASTM A615 and ASTM A123 or aluminum (forged of 6061-76 alloy having a minimum tensile strength of 200 MPa).
5. All joints shall be sealed with rubber gaskets conforming to ASTM C443 and grouted inside and outside with non-shrink grout.
6. Manholes shall be fitted with the appropriate asphaltic coated cast iron frame and cover conforming to Class 20 ASTM A48 as follows:
  1. Norwood NF80 solid cover or equal for all manholes in streets and driveways.
  2. Norwood NF90 solid cover or equal with rubber gasket-seal for all manholes in street sags or other low areas.
  3. Norwood F39 with solid cover or equal in all other locations.

All castings shall be true to form and dimensions, free from faults, sponginess, cracks, blowholes, or other defects affecting their strength.

“Town of Bruderheim” shall be on all frames and covers.

7. Pre-benched manhole bases shall be used wherever possible with pre-cored connection holes and water tight Duraseal or G-Loc joints or approved equal.
8. Tee Riser manholes shall conform to CSA 257.2/ASTM C76 (pipe component) and CSA A257.4/ASTM C76 for the manhole riser component.
9. Perched manholes are required on 600 mm - 1050 mm mains.
10. Aluminum safety platforms shall be required in all manholes with a depth greater than 7.0 m. A platform design shall be submitted to the Town for acceptance and shall include structural details, fastening details and location within the manhole.
11. All manholes located on any Arterial Roadways, Park Reserves, Public Utility Lots, School Grounds, vacant lots and undeveloped land shall be required to have a Locking Manhole Cover or NF80 or NF90 frame and solid cover or equal.
12. All Locking Manhole Cover Devices shall require the Town’s acceptance prior to installation.

#### **C2.5 Bedding and Initial Backfill Sand**

1. The bedding and initial backfill shall extend from a minimum of 100 mm in depth below the pipe, up both sides to the trench wall, to 300 mm in depth above the pipe and meet the specifications outlined in SectionVII-5A of the Town of Bruderheim Standard Documents.

#### **C2.6 Concrete**

1. All concrete where required for the construction of the system, shall develop a compressive strength of not less than 25 MPa in 28 days.
2. All reinforcing steel shall conform to the requirements of CSA G30.12 and G30.16 for new billet steel, grade 400. Welded wire mesh shall conform to CSA G30.5. Minimum concrete cover on all reinforcing steel = 75 mm.

### **C3 System Installation**

#### **C3.1 General**

The system standards are intended to address key points only and not to be considered as a substitute for a detailed material and construction specification to be prepared by the Developer's Engineer.

#### **C3.2 Trenching, Bedding, and Backfilling**

1. All trenching and backfilling shall be completed in strict conformance with Occupational Health and Safety and any other applicable regulations and the directions of the Town. A typical trench in suitable soil conditions is depicted in the Detail Drawing.
2. It is the Developer's responsibility to insure that his Consultants and Contractors are familiar with the "Safe Procedures for Pipeline and Utility Crossings" document produced by the Edmonton Area Pipeline and Utility Operators Committee. This document is in its entirety from the Alberta One Call. The following excerpts from the 1997 publication of the referenced document are located in Appendix I.

Section 1.4 Contractor Responsibilities

Section 1.5 Pipeline Owner Responsibilities

The Developer shall, as a minimum, include the most recent version of the appended sections in their Contract Documents for Construction.

3. If unsuitable soil conditions (i.e. organics, high moisture content, rock, etc.) are encountered, the method for dealing with these conditions shall be assessed by a qualified Professional Engineer commissioned by the Developer, and a letter report submitted to the Town.
4. Class "B" bedding as depicted on the Detail Drawing shall be used for the system in suitable soil conditions. If unsuitable pipe foundation conditions exist, the design for a special pipe foundation and bedding shall be prepared by a qualified Professional Engineer and submitted to the Town.
5. In all new subdivisions it shall be the Developer's responsibility to ensure that utility trenches are adequately compacted. Within the road right-of-way 98% Standard Proctor Density shall be required; 95% Standard Proctor Density in all other areas.
6. If the above compaction standards cannot be achieved because of abnormal weather or wet ground conditions the Town may at his sole discretion establish a more appropriate standard for the individual case on receipt of an acceptable proposal from the Developer's engineer.

### **C3.3 Pipe Installation**

1. The pipe installation shall be conducted in conformance with the pipe manufacturer's specifications.
2. Construction tolerances: Alignment -  $\pm 150$  mm, Grade - 5 mm + 20 mm/1.0 m diameter.

### **C3.4 Connection to Existing Utilities**

Breaking into existing manholes shall be performed in a manner acceptable to the Town, according to the dictates of good practice. Existing manhole floors shall be re-channeled and properly benched, the junction area shall be grouted to form a smooth joint, all debris including concrete and excavated material shall be removed and the vicinity of the connection shall be left in a tidy condition acceptable to the Town.

### **C3.5 Manholes**

1. Manholes and T-Riser manholes shall be installed as depicted on the Detail Drawings and in accordance with material manufacturer's instructions.
2. Backfill around manholes shall be compacted with mechanical tampers to a minimum of 98% Standard Proctor Density.
3. An area 0.6 metres wide from the bottom of the cone to the subgrade elevation in roadways shall be backfilled with insulcrete or an acceptable alternative.
4. Class A. Bedding is required for all Tee Riser Manholes.
5. Sanitary sewer sampling manholes are required for all commercial/industrial service connections.
6. Aluminum safety platforms are required in all manholes exceeding 7 metres in depth.

### **C3.6 Service Connections**

1. Each lot shall have a separate service connection.
2. For single family dwellings, sanitary sewer services shall be installed in common trench with the water and sump pump discharge collection service as depicted on the Detail Drawings. Class B bedding is required.
3. Inline Tee or Wye fittings must be installed during sewer main construction at all service connections. Saddles are allowed only for service connections to existing mains. Tee fitting service connections for sanitary sewer will be allowed provided they discharge into the top half of the main.
4. Where sewer services are required to connect to mains in excess of 4.5 m

deep, risers shall be installed to 4.5 m below finished surface in accordance with the Detail Drawing.

5. In residential subdivisions with front yard gas servicing, water, sanitary sewer, and sump pump discharge collection services shall be extended beyond the gas line and sump pump discharge collection main and terminate a minimum of 0.15 m from the back of the easement line. All services shall be properly capped.
6. Red painted stakes of size 38 mm x 89 mm shall be extended from the end of the service connection to a minimum of 0.50 m above ground level.

### **C3.7 Auguring of All Service Connections and Main Extensions Into Multi Family Sites**

1. All service connections and main extensions into multi-family site shall be installed by auguring under proposed and existing streets and sidewalks except where auguring is not feasible due to adverse soil conditions. Open trenching may be permitted subject to the Town's acceptance of the need and acceptance of the backfill material.
2. All auger pit excavations shall be backfilled with granular bedding material and mechanically compacted, in lifts not to exceed 150 mm in depth, to a minimum of 95% Standard Proctor Density to 300 mm above the pipe.
3. 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 98% Standard Proctor Density.

### **C3.8 Inspection and Testing**

1. Prior to the initial and final acceptance of the project, all sewer mains shall be subject to inspection by the Town. Video inspection reports prior to F.A.C. shall be required.
2. The maximum acceptable long-term deflection for any PVC or other flexible pipe is 7½% of the normal internal diameter.
3. All sewers shall be inspected by camera after backfilling of the trench to finished grade.

The Town of Bruderheim will conduct the television inspection with qualified personnel at Final Acceptance (F.A.C.) at the Developer's expense and issue a formal inspection report, pictures and video tape to all parties. An optional inspection can also be conducted at Construction Completion (C.C.C.) at the Developer's expense.

All television inspection shall be carried out by the Town of Bruderheim qualified personnel who shall be given 10 days advance notice of any testing to be carried out.

#### 1. Testing Equipment

The closed circuit television crew shall provide all equipment and materials necessary to conduct the inspection as specified herein. The television equipment shall be a self-contained camera and a monitoring unit connected by cable. It must be waterproof and be capable of lighting the entire pipe. Picture capabilities must be of quality to show the entire pipe periphery. There must be capability of providing measurement within the line to an accuracy of one third of a metre per kilometre. Picture quality must be such to produce a continuous 600 line resolution picture showing the entire periphery of the pipe. The following capabilities and items must be available:

1. a direct voice communication
2. a camera towing service
3. self-contained electrical power
4. proper safety equipment to protect employees and the general public.

The cameras rate of progress shall be uniform during inspection and shall not exceed 6 m/min.

#### 2. Report

A television log shall be maintained during the inspection showing locations of leak, fault, open joint, break, crack, collapse, deflection, settlement, obstruction, infiltration, or any other defect affecting the overall performance of the sewer line. The location of the defect shall be referenced from the manhole.

A separate log shall be kept of service connections with comments of condition.

Photographs shall be taken as directed or at the discretion of the television scanning operator. A minimum of one photo per manhole reach is required plus one of every deficiency.

Manhole identify shall be noted clearly as indicated on the drawings.

A final typewritten report with corresponding photograph secured properly and referenced to the text along with a copy of the video tape shall be submitted within two weeks after compilation of inspection.

3. Cleaning

The Developer is responsible for cleaning and flushing all lines.

4. Miscellaneous

The crew shall be responsible for all works performed by any subcontractors, for traffic control and any other related work incidental to the completion of television inspection.

5. Inspection and Acceptance

The location of all deficient work will be recorded and the Developer will be required to repair, re-lay, restore or otherwise make good, to the satisfaction of the Town any deficient work including the repair of alignment problems, cracked or broken pipe, deformed pipe, leaks or any other faults not conforming with these specifications or the pipe manufacturers which the television inspection revealed.

After the deficiencies are repaired and corrected and before final acceptance, the Town reserves the right to have the faulty areas re-televised at the Developer's expense.

4. Where deemed necessary by the Town, an exfiltration and/or infiltration test shall be conducted. These tests shall not be required if video inspections are done immediately after sewer construction and no deficiencies are observed. Any deficiencies shall be corrected by the contractor and those portions of sewer affected shall be subject to an additional video inspection.

SEWER LEAKAGE ALLOWANCES

<u>Pipe Material</u>	<u>Leakage Allowance</u>
PVC	<p>Infiltration Test: 5.0 L/day/mm dia/km is allowable with no allowance for external hydrostatic head. The groundwater table is to be above pipe crown at all locations of the test section.</p> <p>Exfiltration Test: 5.0 L/day/mm dia/km is the combined allowable exfiltration from pipe and manholes with hydrostatic head at the high manhole is to be a minimum 0.6 m higher than crown of pipe or groundwater table, whichever is higher. The water level is not to exceed 7.6 m above top of pipe at low manhole.</p>
Concrete	<p>Infiltration Test: 20.0 L/day/mm dia/km is allowable with average depth of groundwater a minimum of 0.6 m above crown of pipe. Where the average head of groundwater is 1.8 metres or more above the crown, the infiltration limit is increased by the ratio of the square root of the actual head to a base head of 1.8 metres.</p> <p>Exfiltration Test: 20.0 L/day/mm dia/km is the combined allowable exfiltration from pipe and manholes when average head on the test section is 0.9 metres above crown of pipe or groundwater table, whichever is higher.</p> <p>Exfiltration limit is increased by the ratio of the square root of the actual head to a base head of 0.9 metres when the average head on the test section is greater than 0.9 metres above crown of pipe or groundwater table, whichever is higher.</p>

### **C3.9 Summary of Sanitary Sewer System 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 revision apply.

#### ASTM

A48	Gray Iron Castings
C14	Concrete Sewer, Storm and Drain, and Culvert Pipe
C76	Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
C443	Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
C478	Pre-cast 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

END OF SECTION C

## **D WATER DISTRIBUTION SYSTEM**

### **D1 System Design**

#### **D1.1 Water Mains**

1. In residential/commercial subdivisions the water main alignments and hydrant locations shall be as depicted on the Typical Right-of-Way cross-section drawings. For industrial areas and multi-family site developments, typical cross-sections depicting infrastructure locations must be developed to suit the particular development.
2. The installation of a main into a multi-family site development would normally be completed at the time the site develops.
3. Water distribution and transmission systems in new subdivisions shall be looped. For the initial purely residential stages of a large development area the Town may temporarily waive this requirement provided that the developer can demonstrate that the necessary fire flows can be delivered via the single water feed. In any event, a maximum of 50 lots may be serviced temporarily without looping of the system. Looping must be provided within two years of temporarily servicing without looping.

In the case of cul-de-sacs, distribution lines must all be looped except those serving single residence cul-de-sacs of less than 120 m as measured from the street curb line to the start of the bulb.

4. A minimum of 2.5 m horizontally must be maintained between a water main and any sewer main.
5. A minimum distance of 1.8 m horizontally must be maintained between a water main and any gas line.
6. At street intersections, a minimum clearance of 1.5 m horizontally shall be maintained between water mains and any catch basins or storm manholes.
7. Public Utility Lot (PUL) widths shall be a minimum of 4.0 m for a single utility and 6.0 m for one containing two utilities. A 1.0 m easement is required on the lots on each side of a PUL.
8. Mains shall be at a depth adequate to provide a minimum 3.0 m cover from finished grade to top of pipe and the same depth of cover over service line goosenecks (in the case of single family dwelling services).
9. The minimum diameter for distribution mains shall be 150 mm for a residential development unless one or more hydrants are located on the line in which case the minimum diameter shall be 200 mm. For commercial/industrial development, the minimum watermain size shall be 300 mm.
10. At water main crossings of sanitary and storm sewers, the following shall apply:

1. Under normal conditions, water mains shall cross above sewers with a sufficient vertical separation to allow for proper bedding and structural support of water and sewer mains.
2. Where it is necessary for the water main to cross below the sewer, the water main shall be protected by providing:
  1. A vertical separation of at least 0.5 m from water main crown to sewer invert;
  2. Structural support of the sewer to prevent excessive joint deflection and settling; and
  3. A centering of the length of water main at the point of crossing so that the joints are equidistant from the sewer.
11. In the vicinity where a change in elevation greater than two pipe diameters between the obvert of the lower pipe and the invert of the upper pipe where no service line exists, a blow-off or similar device must be added for the removal of trapped air.
12. Any water main installed made of Polyethylene, HDPE or similar non-conductive material is to have tracer wire installed. The tracer wire shall have connection points exposed at every opportunity (all valves, blow-offs and hydrants).
13. Tracer wire used must be a minimum of 14 gauge coated copper wire complete with sacrificial 5lb anodes spaced every 1000 lineal metres.

## **D1.2 Hydrants**

1. Maximum allowable spacing between fire hydrants shall be 150 m in single family residential areas and 90 m in multiple family residential, school or industrial/commercial areas.
2. They shall be located at the beginning of the curve of the curb return at the corners of intersections or at the extension of property lines.
3. In cul-de-sacs of 75 m in length or less, the hydrant shall be installed at or near the intersection of the intersecting street.
4. Hydrants shall be located in accordance with “Water Supply for Public Fire Protection – A Guide to Recommended Practice” published by Public Fire Protection Survey Services.

### **D1.3 Valves**

1. Distribution main valves shall be located as follows:
  1. on the projection of property lines at mid block,
  2. at the beginning of curb returns at road intersections.
2. Distribution main valves shall be located such that in the event of a shutdown:
  1. no more than one hydrant is taken out of service,
  2. no more than four valves are required to affect a shutdown,
  3. no more than 25 single family units are involved in a shutdown,
3. maximum length of a dead end line is 120 m and a 50 mm copper or equal blow off valve must be installed at the end of dead end lines,
4. Valves on hydrant leads are to be located in the boulevard area. All hydrants must be separated from the distribution system by a valve. Valves shall be spaced far enough away from the hydrant body to allow for easy operation.
5. Valves shall be the same size as the main they are installed on.

### **D1.4 Service Connections**

1. Each lot or multi-family unit shall have its' own separate water service connection.
2. Services to single family dwellings or multi-family units shall be 20 mm diameter unless the length of the service, measured from the main to the property line or unit, is greater than 20 m in which case 25 mm diameter shall be used.
3. Non-residential or apartment service connections shall be sized according to anticipated user requirements. These services would normally be installed at the time that the non-residential lot is developed. A shut-off valve must be installed at property line when the lot is serviced.
4. In the case of single family lots, the minimum depth of cover shall be 3.0 m from finished grade over a horizontal gooseneck and to the top of pipe at a point 0.15 m from the back of (house side) of the easement required along the front of all lots.
5. Curb stops shall be located such that they do not conflict with driveway locations. They are not to be placed in concrete sidewalks or driveways.
6. Parks may require a water service. The size, type and requirement will be

determined by the Town.

### **D1.5 Hydraulic Network Analysis**

1. The Developer shall perform hydraulic network analyses for all developments.
2. The criteria for network analysis shall be as follows:
  1. The normal operating range for residential pressure shall be between 350 kPa to 700 kPa with a maximum velocity of 3.0 m/sec.
  2. Design population shall be the ultimate population for the area under construction.
  3. Design consumption:
    1. Average Day Demand      375/L/person/day
    2. Maximum Day Demand    750/L/person/day
    3. Peak Hour Demand        1125/L/person/day
  4. The maximum value of "C" in the Hazen-Williams formula shall be 120 regardless of pipe material.
  5. An analysis shall be made for peak hour demand and the mains shall be sized such that there shall be a minimum residual pressure of 350 kPa at ground level at any node in the network.
  6. A separate analysis shall also be made for maximum day demand plus a fire flow of 15,000 Litres per minute at a node adjacent to a high value property, e.g. school or shopping centre or industrial site. The minimum residual pressure at any node in the system shall be 140 kPa at ground level under this situation.
  7. Fire flow conditions shall also be analyzed using the criteria contained in the most recent edition of "Water Supply For Public Fire Protection, A Guide to Recommended Practice" as published by Fire Underwriters Survey. The analysis must take into consideration the various factors which may impact on the fire flow requirements.
  8. In commercial/industrial areas, a separate analysis shall also be made to determine what system configurations and sizes would be required to provide direct flow to sprinkler systems in combination with hydrant flows in accordance with National Fire Protection and Fire Underwriter's Survey standards.
  9. All calculations, schematic diagrams, computer printouts, etc., shall be submitted.

## **D2 System Materials**

### **D2.1 General**

The Developer shall supply and install only new materials. All such materials which are defective in manufacture or has been damaged in transit or have been damaged after delivery shall be replaced by the Developer at his expense. All Standards referred to mean the latest edition of that Standard. The applicable standards are summarized at the back of this section. Where specific products are specified, it is intended that approved equals are also acceptable. The approved of the equal must be obtained from the Town before the equal product is used.

### **D2.2 PVC Pipe**

Polyvinyl chloride (PVC) pipe shall be DR18, Class 150, (1035 kPa) Cast Iron Outside Diameter, with bell and spigot ends. The pipe shall be supplied with integral wall thickened bell ends and continuous (jointless) elastomeric gasket. Gaskets shall be of a pressure actuated seal design. PVC pipe shall be certified under CSA 137.3 - "Rigid Poly Vinyl Chloride Pipe for Pressure Applications". The interior of the pipe shall be clean and no debris or PVC shavings shall be trapped inside the pipe. Pipe sizes 100 mm to 300 mm shall also conform to the AWWA C900 and pipe sizes 350 - 900 mm shall also conform to the AWWA C905 Standard. The pipe shall be manufactured from clean, 12454B PVC compound conforming to ASTM resin specification D1784.

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, petro storage areas or petro refinery sites.

### **D2.3 Fittings**

#### Cast and Ductile Iron Fittings

Cast and ductile iron fittings (i.e. tees, crosses, bends, reducers) sizes 100 mm to 400 mm shall conform to the AWWA C110. Fittings shall have bell-ends and shall be supplied complete with vulcanized synthetic rubber gaskets conforming to the AWWA C111 Standards. Flanges, if approved, shall be flat face conforming to ASME/ANSI B 16.1 Class 125. The exterior of all fittings shall be factory coated with an asphaltic coating or a fusion bonded, epoxy coating conforming to AWWA C213. Corrosion to be reduced with installation of a zinc sacrificial anode.

#### Polyvinyl Chloride (PVC) Fittings

PVC injection-molded fittings, sizes 100 - 200 mm Class 150 (1035 kPa) conforming to AWWA C907. Tees, elbows, tapped (AWWA thread) couplings and reducers sizes 100 - 200 mm shall also conform to CSA - B137.2. Fittings shall be supplied with continuous (jointless) elastomeric gaskets. All gaskets for PVC fittings (except for repair coupling) shall be of a pressure actuated seal design.

PVC extruded fittings, sizes 250 - 400 mm shall be Class 150 (1035 kPa), DR 18, conforming to AWWA C900 and CSA 137.3.

PVC fittings 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, petro storage areas or petro refinery sites.

#### **D2.4 Surface Quality of Castings**

All castings for fittings, valve bodies, hydrant barrels, valve and service bottom and top boxes and any other castings which are to be incorporated in the water system shall be free from injurious defects. All surfaces of castings shall be free of burned-in sand and shall be reasonably smooth, sharp edges shall be rounded to a minimum radius of 3 mm. Runners, risers, fins and other useless cast-on pieces shall be removed by the Manufacturer prior to the delivery of the casting to the coating applicator.

#### **D2.5 Hydrants**

1. Hydrants shall be of a style and make acceptable to the Town and shall:
  1. be compression type conforming to AWWA Specification C502, latest revision, for dry barrel fire hydrants,
  2. include two 63.5 mm hose nozzles,
  3. include one 146 mm pumper connection,
  4. have threads on hose and pumper connections which are the same as on existing hydrants in the Town,
  5. consist of a minimum 2.45 m barrel with a 300 mm extension,
  6. have inlet elbow with bell-end compatible with 150 mm Cast Iron Outside Diameter pipe.
  7. have O-ring seals. Packing glands and staffing boxes are unacceptable.
  8. have hydrant body painted with corrosion resistant fluorescent yellow paint with pumper nozzle caps and hose nozzle caps painted black.
  9. have barrel with asphaltic or epoxy coating.
  10. have corrosion reduced with installation of a zinc sacrificial anode.
2. Storts fittings are required on the steamer port for fire hydrants.

## D2.6 Valves

### 1. Gate Valves (150 mm - 300 mm)

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.
5. Extension stem to be 25 mm square mild steel with 50 mm operating nut and flange suitable for 3.0 m bury.
6. All valves in roadways or sidewalks shall be Norwood Foundry Type B screw type valve box 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.

### 2. Butterfly Valves (400 mm and Larger)

1. All butterfly valves shall be iron body, EPDM seat material, bronze disc, conforming to AWWA C504.
2. All wetted parts are to be stainless steel.
3. Minimum pressure rating of 1050 Kpa.
4. Valve ends compatible with pipe joint type (Cast Iron Outside Diameter).
5. Actuator appropriately selected for valve size and in consultation with the Town.
6. Exterior and interior epoxy coating. Corrosion reduction to be provided by installation of a zinc sacrificial anode.
7. All 400 mm and larger butterfly valves shall be located in a vault or vault chamber. Direct bury of 400 mm butterfly valves will be allowed on

acceptance by the Town.

### **D2.7 Service Connections and Blow Offs**

1. Service pipe shall be Type K Copper conforming to AWWA C800, up to and including 50 mm in size. For 20 mm and 25 mm sizes, Blue Kitec Water Service Tubing (200 psi rating) and conforming to CSA B137.10, or approved equal, is also acceptable.
2. For 100 mm and larger service connections, PVC or Ductile Iron pipe shall be used and comply with the specifications in D2.2 and D2.3.
3. Corporation main stops shall be copper flare or compression to Mueller thread Mueller A-220 or equal without thaw out connector. For Kitec pipe, Cambridge Brass main stops are required.
4. Curb stops shall be copper flare or compression to copper flare or compression curb valve, no drain, Mueller Oriseal H15204 or equal. Curb stops for blow offs shall be 50 mm draining type.
5. For Kitec pipe, Cambridge Brass curb stops (equivalent in quality to the Mueller stops specified above) are required.
6. Water service saddles (straps, nuts and bolts) shall be stainless steel, bronze, or a combination of both. Stainless steel shall be Type 304. Service saddles shall comply with the pipe manufacturer's specifications.
7. Curb stop boxes shall be epoxy coated with stainless steel rod, brass cap, and manganese bronze clevis and bronze cotter pin for connection to the curb stop. Newer style residential service valve operating rods with 16mm diameter rod and a 38mm operating nut are not accepted.
8. On copper service lines, a zinc sacrificial anode shall be installed to reduce corrosion.

### **D2.8 Corrosion Reduction**

1. All system components shall be manufactured of or coated with corrosion resistant materials - stainless steel, bronze, galvanized, epoxy coated, asphaltic coated, cement mortar lined, yellow jacket coated, etc.
2. As a minimum, corrosion reduction shall be provided for hydrants, valves, fittings and service lines by installation of 2.3 kg (5 lb) zinc anodes on valves and cast or ductile iron fittings and 5.5 kg (12 lb) zinc anodes on hydrants. Lead wire shall be of AWG #10/7 copper wire. Zinc anodes shall conform to ASTM B418 Type II and shall have the following compositions:

Aluminum	0.005% maximum
Cadmium	0.003%

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Iron	0.001%
Zinc	Remainder

3. Exterior nuts and bolts on valves, hydrants, couplings, etc. shall be stainless steel type 304.

### **D2.9 Bedding and Initial Backfill Sand**

The bedding and initial backfill sand, free from organic material, shall be coarse grained with minimal silt and meet the following grading requirements: 100% passing the 25 000 Sieve, 95% passing the 5 000 Sieve and a maximum allowable 10% passing the 63 Sieve. The liquid limit shall not exceed 25 and the Plasticity Index shall not exceed 6. The bedding and initial backfill shall extend from a minimum of 100 mm in depth below the pipe, up both sides to the trench wall, to 300 mm in depth above the pipe.

### **D2.10 Concrete**

All concrete where required for the construction of water mains, shall develop a compressive strength of not less than 25 MPa in 28 days.

All reinforcing steel shall conform to the requirements of CSA G30.12 and G30.16 for new billet steel, grade 400. Welded wire mesh shall conform to CSA G30.5. Minimum concrete cover on all reinforcing steel = 75 mm.

## **D3 System Installations**

### **D3.1 General**

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

### **D3.2 Trenching, Bedding and Backfilling**

1. All trenching and backfilling shall be completed in strict conformance with Occupational Health and Safety and any other applicable regulations and the directions of the Town. A typical trench in suitable soil conditions is depicted in the Detail Drawing.
2. It is the Developer's responsibility to insure that his Consultants and Contractors are familiar with the "Safe Procedures for Pipeline and Utility Crossings" document produced by the Edmonton Area Pipeline and Utility Operators Committee. This document is in its entirety from the Alberta One Call. The following excerpts from the 1997 publication of the referenced document are located in Appendix I.

Section 1.4 Contractor Responsibilities  
Section 1.5 Pipeline Owner Responsibilities

The Developer shall, as a minimum, include the most recent version of the appended sections in their Contract Documents for Construction.

3. If unsuitable soil conditions (i.e. organics, high moisture content, rock, etc.) are encountered, the method for dealing with these conditions shall be assessed by a qualified Professional Engineer commissioned by the Developer, and a letter report submitted to the Town.
4. Class "B" bedding as depicted on the Detail Drawing shall be used for all water mains in suitable soil conditions. If unsuitable pipe foundation conditions exist, the design for a special pipe foundation and bedding shall be prepared by a qualified Professional Engineer and submitted to the Town.
5. In all new subdivisions it shall be the Developer's responsibility to ensure that utility trenches are adequately compacted. Within the road right-of-way 98% Standard Proctor Density shall be required; 95% Standard Proctor Density in all other areas.
6. If the above compaction standards cannot be achieved because of abnormal weather or wet ground conditions the Town may establish a more appropriate standard for the individual case on receipt of an acceptable proposal from the Developer's engineer.

**D3.3 Operation of Existing Hydrants & Valve & Water Use**

1. The Developer shall not open or close any existing valves. Town personnel shall be notified and they will open or close valves.
2. The Developer shall obtain permission for using a hydrant as a water source for construction and also arrange for payment of water used. If permission is granted, the Town will outline the conditions of use which would address backflow prevention and possible installation of a meter on the hydrant.

**D3.4 Pipe Installation**

1. The pipe installation shall be conducted in conformance with the pipe manufacturer's specifications.
2. Construction tolerances: Alignment -  $\pm 100$  mm  
Grade -  $\pm 50$  mm

### **D3.5 Hydrants**

1. Hydrants shall be installed as depicted on the Detail Drawing and in accordance with manufacturer's instructions.
2. There shall be an isolating gate valve on a 150 mm lead to each hydrant.
3. Hydrants shall be set so that the bottom flange is approximately 50 mm above final ground elevation at the hydrant.
4. Hydrants must have breakaway flanges installed at the base of the body and must not extend below the ground grade line.
5. Hydrant drain ports shall be left open except in areas with high water tables and where the possibility of contamination exists. In these areas, the port shall be closed and the Town informed and they will label the hydrant "NO DRAIN".

### **D3.6 Valves**

1. Valves, valve boxes, and fittings shall be installed as depicted on the Detail Drawings and in accordance with manufacturer's specifications.
2. When connection into the side of an existing water main is required, the connection shall be accomplished by use of a tapping valve and sleeve and not shutting down the water service, unless otherwise approved by the Town.
3. A valve must be installed near the end of a water main that will be extended in the future as depicted to avoid disruption of service.
4. Valve boxes complete with operating extension stems and rock disk nut are required on all valves.
5. The top of the valve box is to be set at final grade elevation on unpaved areas and between 5 to 15 mm below finished grade on paved areas.
6. The rock disk nut shall not be more than 600 mm below finished grade.
7. An approved screw down Type B valve is required in concrete with a PVC sleeve and asphalt, and a sliding type cast iron valve casing in other areas shall be installed over each valve and the top ends shall be adaptable to the plugs specified.

### **D3.7 Water Service Connections**

1. Each lot or multi-family unit must have a separate service.
2. Residential water services shall be installed in common trench with sanitary sewer and sump pump discharge collection services as depicted on the Detail Drawings. Class B bedding shall be used. Common trench installation is only

permitted for sizes up to 50 mm.

3. Tapping for residential service connections shall be done with full operating pressure in the main unless otherwise approved by the Town and in strict compliance with manufacturer's instructions.
4. Each residential service connection shall incorporate a horizontal gooseneck and utilize a corporation main stop. Connections shall be staggered radially as required by PVC pipe manufacturers.
5. Service saddles must be used for larger size copper services as stipulated by the main manufacturer.
6. For 100 mm and larger services, a tapping valve and sleeve must be used for connection to an existing main.
7. For residential services, the symbol CC shall be stamped in the sidewalk opposite the location of the curb cock.
8. Parks may require a water service. The size, type and requirement will be determined by the Town.

### **D3.8 Auguring of All Service Connections and Main Extensions Into Multi-Family Sites**

1. All service connections and main extensions into multi-family sites shall be installed by auguring under proposed or existing streets and sidewalks except where auguring is not feasible due to adverse soil conditions. Open trenching may be permitted subject to the Town's acceptance of the need and acceptance of the backfill material.
2. All auger pit excavations shall be backfilled 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.
3. 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 98% Standard Proctor Density within the road right-of-way and 95% outside the road right-of-way.

### **D3.9 Installation of Anodes**

1. Anodes and leads shall be installed on hydrants, valves, and cast or ductile iron fittings as depicted on the Detail Drawings.
2. Connection of the anode lead shall be by Cad welding. The connection point shall be then coated with Polyken primer and tape.
3. A minimum of 2 L (0.5 gallon) of water is to be poured on each 2.3 kg (5 lb)

anode and 3 L (0.75 gallons) on 5.5 kg (12 lb) anode to initiate the anode operation. An alternative is to soak the above anodes in water for a minimum of 10 minutes.

### **D3.10 Inspection and Testing**

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

The water distribution system may only be charged through one valve. Only one valve may be operated during pressure and leakage testing as well.

Prior to the start of pressure and leakage, chlorination and bacteria testing, the Developer's consultant 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 to be accomplished, and locations when chlorine residual and bacteria tests are to be taken. Testing will not be allowed to proceed until the above is approved by the Town representative.

The Developer will be required to give 24 hour notice to the Town representative.

The system shall be filled with water slowly and air bled off at each hydrant. If there are sections that cannot be bled from hydrants, due to the profile of the main, the Developer may be required to tap the main at high points and install temporary bleeder valves. At the completion of testing, these taps shall be satisfactorily plugged at the Developer's expense.

When the line has been filled and most of the air expelled, time should be allowed for the remaining air and water to reach a constant temperature.

The test section may be pressured through a hydrant or a tap may be installed in the line. After testing the pipe shall be plugged at the Developer's expense.

The mains or section of mains shall be subject to a pressure of not less than 1035 kPa. Test sections shall not exceed 450 m of main.

2. Leakage tests shall be made only after completion of services, partial or complete backfill, and a minimum of 24 hours after the pipe has been filled with water. No test shall be applied until at least 36 hours after the last concrete reaction or thrust block has been cast with high early strength cement, or at least 7 days after the last concrete reaction or thrust block has been cast with standard cement. The duration of each test shall be two (2) hours.

The allowable leakage shall be determined by the following formula:

$$L = \frac{ND \sqrt{P}}{128,225} \quad \text{For PVC Pipe}$$

Where:

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

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

No mains shall be charged and no pressure and leakage tests shall be permitted from October 15th to April 15th inclusive, unless approved by the Town.

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

3. Prior to the initial acceptance of the water system, water mains are to be disinfected in accordance with AWWA C651 continuous feed method. Procedural method of disinfection including chlorine concentration calculations and contact times are to be submitted to the Town representative for acceptance. Upon completion of the disinfection one bacteria sample is to be submitted for each 90 linear metres of water main installed unless otherwise approved by the Town representative. Upon 48 hours notice samples will be taken by Town personnel and the water main is to remain valved off until such time as the bacteria sample results are approved.

Under Alberta Environmental Protection standards and regulations, super chlorinated water used for disinfection of the system cannot be directed into a storm sewer or open water body. Dechlorination will be required before being discharged into the environment.

4. Prior to initial acceptance of the water system and the system put into service, bacteriological testing shall be carried out on all water mains and acceptable test results achieved.
5. Prior to issuance of the Construction Completion Certificate, hydrants flow testing shall be conducted by the Developer's consulting engineer to verify that the flows and pressures identified in the design calculations are being provided in the field. The Developer's consulting engineer shall coordinate the testing with the Town representative to ensure he is present for all testing. Results of the testing shall be compiled by the Developer's consulting engineer and submitted to the Town representative with a comparison of the actual flows and design flows for the same hydrant. Where the actual flows do not meet the minimum fire and service requirements all hydrants in the project must be tested and the Developer must advise the corrective action he shall be taking to provide the necessary service level. The location and extent of initial testing shall be as required by the Town representative.

## 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.

<b>Standard</b>	<b>Title</b>
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 Service
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 Fittings
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

END OF SECTION D

## **E STORM WATER MANAGEMENT SYSTEM**

### **E1 System Design**

#### **E1.1 General**

1. The concept of a major and minor storm drainage system has three purposes:
  1. the control of storm water to minimize inconvenience or disruption of activity as a result of runoff from more frequent but less intense storms, and
  2. control of storm water runoff to prevent or minimize damage to property, physical injury and loss of life which may occur during or after a very infrequent or unusual storm and
  3. provide improved water quality by filtering contaminants prior to entering receiving down stream water courses.
2. Where the entire system is to be designed to provide a level of protection commensurate with the fundamental purposes stated above, the minor system is to be designed to an appropriate level of convenience. This level of convenience refers to the frequency which the minor system capacity would be exceeded.
3. When the minor system capacity is exceeded the major system must provide a continuous overland flow route for runoff water to follow. Generally major system routing shall utilize roadways and open channels with carefully designed and controlled lot grading and building elevations.
4. Storm sewers shall be designed as a separate sewer system. Effluent from sanitary sewers or any potentially contaminated drainage from industrial, agricultural, or commercial operations shall not be discharged to storm sewers.
5. The Developer and his Engineering Consultant must address the guidelines presented in the latest edition of the publication "*Storm Water Management Guidelines for the Province of Alberta*" prepared by Alberta Environmental Protection.

#### **E1.2 Minor System**

1. Design Criteria
  1. The Minor System must be designed to accommodate the runoff generated by a 1:5 year storm event or greater plus the flows from the sump pump discharge collection system.
  2. The Rational Method shall be used in estimating flows for the design of storm sewers serving areas smaller than 65 hectares (ha) as follows:

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

- Where
- Q = the quantity of runoff in cubic metres per second.
  - I = the intensity of rainfall in millimetres per hour.
  - A = the contributing area in hectares.
  - C = the runoff coefficient.

3. Rainfall data shall be taken from the officially recognized Regional Station located at the Edmonton Municipal Airport. Intensity-duration-frequency data is reproduced in a Table at the back of this Section of the Standards.
4. For a 1:5 year analysis, the following runoff coefficients shall be used:

<u>LAND USE</u>	<u>RUNOFF COEFFICIENT, C</u>
Parks, Reserves and School Grounds	0.15
Residential	
Single Family	0.40
Multiple Family	0.60
High Density	Must be Calculated
Commercial	Must be Calculated
Industrial	Must be Calculated

Due to the wide variation of impervious areas for commercial, industrial and high density residential areas, the runoff coefficient must be calculated using the following formula:

$$C = \frac{(0.95 \times \text{Impervious Area}) + 0.10 (\text{Total Area} - \text{Impervious Area})}{\text{Total Area}}$$

For an analyses for less frequent storms, the runoff coefficient must be increased accordingly to reflect the impact of antecedent moisture conditions.

5. Computer modeling shall be required by the Town for design of the system servicing areas greater than 65 hectares.
6. Maximum inlet time of 15 minutes shall be used for residential areas. The use of shorter inlet times is required in commercial, industrial, or higher density residential areas, where a large percentage of the total area is impervious.

## 2. Pipe Sizing

1. Minimum Pipe Size:
 

Storm Sewer	- 300 mm
Catch Basin Lead	- 250 mm
F51 Catch Basin Lead	- 300 mm

2. Pipe sizing shall be determined by utilizing the Manning's Formula using a minimum "n" value of 0.013.
3. Minimum flow velocity = 0.60 m/sec. Maximum flow velocity = 3.0 m/sec.
4. The minimum grade of catch basin leads shall not be less than 1.0%.
5. Minimum slope:

<u>Size</u>	<u>Slope %</u>
300 mm	0.22
375 mm & larger	0.15

Minimum slopes shall be increased by 50% on all curves.

### 3. Storm Sewer Main Alignments and Locations

1. In residential/commercial subdivisions, storm sewers shall be installed on the alignments depicted on the Typical Right-of-Way Cross-section Drawings. For industrial areas and multi-family site developments, typical cross-sections depicting infrastructure locations must be developed to suit the particular development.
2. The installation of a main into a multi-family site development would normally be completed at the time the site develops. However, the Developer's Consultant must address the depth requirements for servicing the site in the establishment of the design depth for the main located on the abutting street.
3. Storm sewer service must be provided to all commercial and industrial lots.
4. Storm sewers must be located at least 2.5 m horizontally from any water main and at least 1.8 m horizontally from gas lines.
5. Public Utility Lots (PUL) widths shall be a minimum of 4.0 m for a single utility and 6.0 m for one containing two utilities. A 1.0 m easement is required on the lots on each side of a PUL.
6. In residential areas, mains shall be at a depth adequate to provide the required minimum depth of cover over sump pump discharge collection service connections and catch basin leads. In other areas, the minimum depth of cover must be 1.5 metres to top of pipe.
7. Curved sewers shall be permitted with the following restrictions:
  1. The curve shall run parallel to the curb or street centre line.
  2. The minimum grade for sewers on a curve shall be 50% greater

than the minimum grade required for a straight run of sewer.

3. Manholes shall be located at the beginning and end of each curve and intermediate locations as required.
8. At water main crossings of sanitary and storm sewers, the following shall apply:
  1. Under normal conditions, water mains shall cross above sewers with a sufficient vertical separation to allow for proper bedding and structural support of the water and sewer mains.
  2. Where it is necessary for the water main to cross below the sewer, the water main shall be protected by providing:
    1. A vertical separation of at least 0.5 m from water main crown to sewer invert;
    2. Structural support of the sewer to prevent excessive joint deflection and settling; and
    3. A centering of the length of water main at the point of crossing so that the joints are equidistant from the sewer.

#### 4. Manholes

1. The maximum spacing between manholes shall be 150 m.
2. Manholes are also required at all transitions in size, grade, or direction, and at junctions and the ends of mains. They should be located to avoid driveway conflicts.
3. At manholes where size changes occur, the crowns (obverts) of the mains shall be designed to match.
4. Inverts in manholes shall have a minimum 12 mm drop for straight run sewer manholes. At changes in direction, manholes shall have at least 50 mm fall across the manhole in the direction of flow from inlet to outlet elevation.
5. Manhole locations within any Municipal Reserve or Conservation Easement should be avoided when possible.

#### 5. Catch Basins

1. The maximum run between catch basins shall be 120 m and maximum run to first catch basin 150 m with minimum grades.
2. Spacing and capacity of catch basins shall be such that ponding shall not occur during a 1:5 year storm.

3. The minimum inside diameter for a catch basin barrel shall be 900 mm. Where the catch basin barrel is one piece construction including the connection to the lead the Town may permit a reduction in the diameter of the barrel.
4. The minimum sump depth in catch basins shall be 600 mm.
5. Catch basins shall be installed to intercept all overland flows, including back lanes, prior to crossing walkways. At curb returns, catch basins shall be installed to intercept runoff on the uphill side of cross walks.
6. Concrete swales crossing roadways will not be permitted.
7. Ramneck or equivalent shall be used to seal grade rings and water tight joints must result.

#### 6. Catch Basin Leads

1. The minimum size of catch basin leads shall be 250 mm inside diameter. Hydraulic calculations shall be presented to justify the various catch basin lead sizes.
2. The maximum length of a catch basin lead shall be 30 metres. A catch basin manhole shall be required at the upper end if the lead exceeds 30 metres.
3. The minimum grade on a catch basin lead shall be 1.00%.
4. Minimum depth of cover shall be 1.5 metres to top of pipe.
5. All leads shall be connected to a main line manhole or a catch basin manhole.

#### 7. Storm Sewer Service Connections

1. Non-residential, apartment, and multi-family site service connections shall be sized according to anticipated site requirements. These service connections would normally be installed at the time that the lot is developed.
2. For non-residential, apartment, and multi-family site service connections, the Developer's Consultant must address the depth requirements for servicing of these lots in the establishment of the design depth for the storm sewer main in the abutting street.
3. Services shall be located such that they do not conflict with driveway locations.
4. All proposed school sites shall be provided with a storm sewer service. The size, type and location will be determined by the Town.

### **E1.3 Sump Pump Discharge Collection System**

#### **1. General**

1. The sump pump discharge collection system is a component of the storm drainage system in the new development areas of the Town of Bruderheim. Sump pump discharge collection service must be provided to the property line of each newly developed single family lot or to each multi-family unit.
2. It is a system strictly dedicated to the collection of discharge from sump pumps which must be installed in all buildings with basements and weeping tiles (foundation drains). In the case of residential single family lots and multi-family units, roof leaders (downspouts) or any other storm water source must not be connected to this system.
3. It is required to address the problems experienced in developed areas with surface discharge of sump pumps. Problems have included winter icing on driveways and sidewalks and dead lawns due to saturation in the summer.
4. A design objective must be to provide collection mains and services which are installed at a depth which will provide frost protection and connecting to a storm sewer system (down to the outfall structure into a storm water management facility) installed at a depth which also provides frost protection. In areas where the system must be connected to existing previously installed shallower mains (without complete frost protection), the level of service will drop since the risk of freezing and blocking of lines increases and could result in overflows to surface during part of the winter and possibly causing icing problems.

#### **2. Estimating Weeping Tile (Foundation Drain) Flows**

5. The Developer's Engineering Consultant must estimate weeping tile flows as a component of the detailed Geotechnical/ Hydrogeological Investigation (see Engineering Information Submissions Section of these Standards) to be completed by a qualified geotechnical engineer or hydrogeologist. This investigation must assess the predevelopment subsurface soil, groundwater, and other conditions and the anticipated post-development conditions; estimate weeping tile flows; and define any special design and construction measures to be taken for foundations or other infrastructure that may be impacted by weeping tile flows causing settlements or other problems.
6. If considerable flows are anticipated during the summer, they must be added to the flows used to size the storm sewers in order that the level of service provided by the storm sewer system does not drop considerably.

7. If high flows are expected such that sump pumps would be required to pump continuously or excessively, then alternatives and a recommended solution must be presented by the Developer.

### 3. Alignments And Locations Of Mains

1. For the system where a depth adequate to provide frost protection can be achieved, sump pump discharge collection services can be connected to the storm sewer which would be extended to in front of all lots or sump pump discharge collection mains can be installed in the 3.5 m easement provided at the front of all lots (3.0 m on flankage) with service branches (see Service Detail Drawings).
2. For the system where a depth adequate to provide frost protection cannot be achieved, sump pump discharge collection mains must be installed in the 4.0 m easement required in front of all lots (3.0 m on flankage) with service branches (see Service Detail and Typical Cross-section Drawings ). This alignment may result in the lines not freezing as easily (possibly more snow cover in a landscaped area) and would provide a location where any repairs could be completed more economically.
3. The system mains shall be connected to storm sewer system manholes or deep catch basins with lead sizes which address the additional sump pump discharge flows.
4. Other alignment and location requirements would be the same as specified for storm sewer mains in E1.2.3.

### 4. Pipe Sizing

1. Minimum Pipe Size: Residential Lots - 150 mm
2. Pipe sizing shall be determined by utilizing the Manning's Formula using a minimum "n" value of 0.013.
3. Minimum grade - 0.6%.

### 5. Cleanouts

1. The criterion for cleanout locations is the same as for manhole locations on the storm sewer system.
2. The maximum spacing for cleanouts is 100 metres.
3. All cleanouts not located at the end of a line shall be a bi-directional tee design. Dwg. C-15.
4. Cleanouts are required at every junction or where a 22 ½ degree bend or greater is utilized. Sweeping bends and multiple 22 ½ degree bends are allowed.

## 6. Sump Pump Discharge Service Connections

1. Each lot or multi-family unit shall have its own separate service connection.
2. The minimum size of a sump pump discharge collection service connection to a single family dwelling or multi-family unit shall be 100 mm inside diameter.
3. The minimum grade on the service line shall be 2.0%.
4. The minimum grade on the mainline shall be 1.0 % where possible.
5. In the case of single family lots, the minimum depth of cover shall be 2.60 m to the top of pipe from finished grade at a point 0.15 m from the back (house side) of the easement required along the front of all lots. A minimum cover of 1.8 metres at the property line will be accepted on service mains connected to the storm sewer main installed in the centre of roadways.
6. Services shall be located such that they do not conflict with driveway locations.

### **E1.4 Major System and Storm Water Management Facilities**

#### 1. General

1. The overall major drainage system for the Town of Bruderheim 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 Master Drainage Plan to be developed by the Developer's Engineering Consultant for new drainage basins (watersheds).
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 modeling and design calculations shall be submitted to the Town for review. The Town 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. Arterial roads shall not be 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 Town may grant the Developer permission to discharge primary drainage

flow on to the arterial right-of-way subject to:

1. no adverse impact on the drainage on the arterial road, or
  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. the Developer's agreement to pay for the cost of such additional works or changes needed to accommodate the increased discharge.
4. Provisions must be taken to employ control/abatement measures to that construction material and debris does not enter any storm water management facility at any point during subdivision construction.

## 2. Lot Grading

1. Carefully designed and controlled lot grading is an important component of the Major System.
2. Lots shall be designed to drain from back to front except under extreme cases where the Developer can satisfy the Town 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 Town may permit more than 2 lots to be crossed provided a concrete drainage swale and easement are established. The potential problem areas shall be identified in the Design Brief.
3. Minimum and maximum slopes on landscaped areas to be 2% and 10% respectively. An initial minimum grade of 10% over a distance of 1.5 m is to be provided around all buildings. Driveway slopes must be no less than 2% and no greater than 8%.
4. Parks, school sites and open areas shall be graded in accordance with the requirements of the Town. On site ponding shall not be permitted.

## 3. Storm Water Management Facilities

### 1. General

1. Large scale storm water management facilities shall be classified as either "natural wetlands" or "constructed wetlands": depending on whether the installation is intended to permanently retain water or temporarily store peak flows.
2. Small scale storm water management is also required for

commercial, industrial or higher density residential (apartment or multi-family sites) developments.

3. These Standards present only the engineering requirements for these facilities. Developers must consult with the Town concerning any landscaping, fencing, lighting, recreational or any special operation/maintenance requirements.
4. The Developer and his Engineering Consultant must address the guidelines presented in the latest edition of the publication "Storm Water Management Guidelines for the Province of Alberta" prepared by Alberta Environmental Protection.
5. Storm water quality best management practices shall be an objective in the design of storm water management facilities.

## 2. Storm Water Management Analysis and Report

1. Storm Water Management Reports must be prepared and submitted as required under the Engineering Information Submissions Section of these Standards.
2. The design of the storm water management facility shall be based on determining the critical volume for the 1:100 year storm event and as outlined in the Provincial guidelines. The analysis must incorporate calculations for a range of storm durations to assess which will result in the critical volume for the specific drainage basin and outlet characteristics involved and must also address the requirement that the stored volume in the facility must drain within a few days.
3. The scope of the report must also include an analysis of the capacity and characteristics of the downstream receiving drainage course or creek and identification of works needed to avoid downstream flooding or erosion or sedimentation problems.
4. For commercial, industrial, or higher density residential (apartment or multi-family sites) developments, onsite storm water management is required. This must include storage of storm water generated by a 1:25 year storm event at the critical duration and provision of an overflow route for storm water generated by more major events. A report must be submitted along with plans presenting design calculations for the onsite storm water management scheme, site grading, and locations of storage and depth of ponding, and detail drawings of the proposed outlet control device. A more comprehensive summary of design and submission requirements is presented in the Appendix of these Standards.

### 3. Wetland Ponds

1. The land required shall be designated a Public Utility Lot.
2. The minimum surface area at normal water level for any single pond shall be 2 hectares.
3. Storm water quality best management practices shall be reflected in the design.
4. An overflow channel and overland drainage route must be provided at the high water level to the satisfaction of the Town.
5. The design of the pond and permitted water level fluctuations must ensure that:
  1. The lowest basement weeping tile of any building on a lot adjacent to the lake shall be a minimum of 300mm above the high water level.
  2. The lowest manhole invert shall be at or above the normal water level elevation.
  3. The pipe obvert at the lowest manhole upstream of the pond shall be above the high water level during a one in five year storm event.
  4. A minimum distance of six metres shall be maintained from any basement wall to the high water level.
  5. The minimum depth of the body of the pond, at normal water level, shall be 2.5 metres.
  6. The lake bottom and side slopes shall be composed of an impervious material.
  7. Areas of stagnant or poorly circulated water shall be eliminated.
  8. Shoreline improvements shall be subject to review and acceptance by the Town.
  9. The shoreline treatment between the high water level and the normal water level shall be chosen to ensure that erosion does not occur and natural wetland vegetation develops.
6. Easements, in favor of the Town, shall be granted over any private property situated between the normal and high water levels.

7. The design shall incorporate a semi-annual turnover at average annual precipitation.
8. Pond side slopes shall be as shown on the Detail Drawing E-5.
9. Submerged inlets/outlets are preferred and shall be constructed such that the top of the pipes are a minimum of 1.0 m below normal water level.
10. Inlets/outlets not submerged shall be above normal water level and require fencing along adjacent shoreline for 5.0 m in each direction from the centre line of pipe. In addition all exposed inlets/outlets, including the downstream end of outlets, shall be provided with a galvanized removable grate permanently fixed to the structure.
11. Minimum width of the water surface at the normal water level shall be 25 metres.
12. A silt trap shall be provided at the inlets of each pond. 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.
13. The lake and perimeter area design must allow for vehicle access to inlets, outlets, and other facilities requiring maintenance.

#### 4. Constructed Wetlands

1. The use and designs of constructed wetlands or combined wet pond - constructed wetlands for storm water management must be reviewed on a site specific basis in order to integrate the existing environmental factors.

#### 5. 3.5 Storm Water Management Facility Inlets, Outlets, Outfall Structures

This Section shall apply to pond inlets/outlets and outfall structures.

1. Obverts of outfall pipes shall be above the 5 year flood level of receiving streams.
2. Inverts shall be above winter ice or the pipe must be completely submerged with obverts 1.0 m below normal water level.
3. Located such that there is minimal adverse effect on surrounding property.
4. Aesthetically blended into the landscape design.

5. Drop structures and energy dissipaters shall be used where necessary to prevent erosion in combination with appropriate rip-rap and filter fabric treatment at structures and in the downstream water course.
6. Galvanized grates shall be provided to restrict access. Provisions for opening or removing the grate are required.
7. Outfall pipe shall be constructed using Class A bedding.
8. Provisions shall be made to manage the migration of water along the pipe zone.
9. Outlet velocity and depth shall be kept within the following limits:

<b>Water Velocity (m/s)</b>	<b>Permissible Depth (m)</b>
0.5	0.80
1.0	0.32
2.0	0.21
3.0	0.09

10. Provide key or cutoff wall at outfalls to prevent undermining of the structure, if necessary.

## **E2 System Materials**

### **E2.1 General**

The Developer shall supply and install only new materials. All such materials which are defective in manufacture or has been damaged in transit or have been damaged after delivery shall be replaced by the Developer at his expense. All Standards referred to mean the latest edition of that Standard. The applicable standards are summarized at the back of this section. Where specific products are specified, it is intended that approved equals are also acceptable. The approval of the equal must be obtained from the Town before the equal product is used.

### **E2.2 Storm Drainage System Mains and Catch Basin Leads**

1. Storm sewer and sump pump discharge collection mains and catch basin leads shall be PVC or concrete pipe. Concrete pipe must be used for systems in industrial subdivisions or along arterial roads that are dangerous goods routes.

In areas of retrofit or where directional drilling is required, polyethylene pipe will be acceptable. Materials and installation specifications are subject to the approval of the Town.

2. PVC Pipe

1. PVC pipe shall be DR35 in the 200 mm - 900 mm size range conforming to CSA B182.2 and ASTM D3034, ASTM F679, NQ 3624-130 and NQ 3624-135 standards with a minimum stiffness of 320 kPa. The pipe must be manufactured from 12454-B or 12364-C compound.
2. Ultra Rib PVC or approved equal is also acceptable in the 200 mm - 600 mm size range. It shall conform to CSA B182.4 and ASTM F794 with a minimum stiffness of 320 kPa.
3. Sealing gaskets shall meet requirements of CSA B182.2 and ASTM F477 with the additional requirement that joints shall be able to withstand 345kPa/50 psi hydrostatic pressure.
4. For the in-line Tees or Wyes required at all sump pump discharge collection service connections, injection molded gasketed fittings shall conform to CSA B182.1 or CSA B182.2 and fabricated fittings must conform to CSA B182.2 and ASTM F679.
5. 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, petro storage areas or petro refinery sites or the locations defined in .1 above.

### 3. Concrete Pipe

1. All concrete pipe shall be manufactured using sulphate resistant Type 50 cement.
2. Non-reinforced concrete pipe in the 200 mm - 375 mm sizes shall be a minimum Class 3 conforming to CSA A257.1 and ASTM C14.
3. Reinforced concrete pipe in the 250 mm and larger sizes shall conform to CSA A257.2 and ASTM C76.
4. All joints shall be confined "O" ring rubber gasket conforming to ASTM C443 and CSA 257.3.

### **E2.3 Sump Pump Discharge Collection Services**

1. Sump pump discharge collection service pipe and fittings shall be a minimum 100 mm diameter DR35 meeting the same specifications as the PVC main pipe above except the minimum pipe stiffness must be 625 kPa (90 psi).

### **E2.4 Manholes**

1. Manholes shall be manufactured using sulphate resistant Type 50 cement.
2. Manhole sections shall be pre-cast reinforced concrete sections conforming to

ASTM C478 and CSA A257.4.

3. All manholes shall be 1200 mm inside diameter.
4. Manhole steps shall be standard safety type, hot dipped galvanized iron conforming to ASTM A615 and ASTM A123 or aluminum (forged of 6061-76 alloy having a minimum tensile strength of 200 MPa.
5. All joints shall be sealed with rubber gaskets conforming to ASTM C443 and grouted inside and outside with non-shrink grout.
6. Manholes shall be fitted with the appropriate asphaltic coated cast iron frame and cover conforming to Class 20 ASTM A48 as follows:
  1. Norwood NF80 solid cover for all manholes in streets and driveways.
  2. Norwood F39 with solid cover or equal in all other locations.

All castings shall be true to form and dimensions, free from faults, sponginess, cracks, blowholes, or other defects affecting their strength.

7. Pre-benched manhole bases shall be used wherever possible with pre-cored connection holes and water tight Duraseal or G-Loc joints or approved equal.
8. Tee Riser manholes shall conform to CSA 257.2/ASTM C76 (pipe component) and CSA A257.4/ASTM C76 for the manhole riser component.
9. Perched manholes are required on existing 600 mm - 1050 mm mains.
10. Aluminum safety platforms shall be required in all manholes with a depth greater than 7.0 m. A platform design shall be submitted to the Town for acceptance and shall include structural details, fastening details and location within the manhole.
11. All manholes located on any Arterial Roadways, Park Reserves, Public Utility Lots, School Grounds, vacant lots and undeveloped land shall be required to have a Locking Manhole Cover or NF 80 frames and solid covers.
12. All Locking Manhole Cover Devices shall require the Town's acceptance prior to installation.

## **E2.5 Catch Basins**

1. Catch basin frames and covers shall be cast iron complying with same Standard as manhole frames and covers and shall be required to provide sufficient inlet capacity. Standard models to be as follows:
  1. top inlet round top catch basins equal to Norwood F-38 or Norwood F-39 open grate,

2. side inlet for 190 mm straight face curb and gutter equal to Norwood F-51 or F-36A for all sag locations,
  3. side inlets for rolled curb and gutter shall be Norwood F-33, K-2, DK-7 (for low profile curb) or equal,
  4. other types shall require acceptance by the Town.
2. Catch basins shall be a minimum 900 mm barrel with 500 mm sump complying with the same Standards as manholes.
  3. Catch basin manhole shall be standard safety type, of hot dipped galvanized iron or aluminum.

### **E3 System Construction**

#### **E3.1 General**

The system standards are intended to address key points only and not to be considered as a substitute for a detailed material and construction specification to be prepared by the Developer's Engineer.

#### **E3.2 Trenching, Bedding, and Backfilling**

1. All trenching and backfilling shall be completed in strict conformance with Occupational Health and Safety and any other applicable regulations and the directions of the Town. A typical trench in suitable soil conditions is depicted in the Detail Drawing.
2. It is the Developer's responsibility to insure that his Consultants and Contractors are familiar with the "Safe Procedures for Pipeline and Utility Crossings" document produced by the Edmonton Area Pipeline and Utility Operators Committee. This document is in its entirety from the Alberta One Call. The following excerpts from the 1997 publication of the referenced document are located in Appendix I.

Section 1.4 Contractor Responsibilities

Section 1.5 Pipeline Owner Responsibilities

The Developer shall, as a minimum, include the most recent version of the appended sections in their Contract Documents for Construction.

3. If unsuitable soil conditions (i.e. organics, high moisture content, rock, etc.) are encountered, the method for dealing with these conditions shall be assessed by a qualified Professional Engineer commissioned by the Developer, and a letter report submitted to the Town.

4. Class "B" bedding as depicted on the Detail Drawing shall be used for the system in suitable soil conditions. If unsuitable pipe foundation conditions exist, the design for a special pipe foundation and bedding shall be prepared by a qualified Professional Engineer and submitted to the Town.
5. In all new subdivisions it shall be the Developer's responsibility to ensure that utility trenches are adequately compacted. Within the road right-of-way 98% Standard Proctor Density shall be required; 95% Standard Proctor Density in all other areas.
6. If the above compaction standards cannot be achieved because of abnormal weather or wet ground conditions, the Town will establish a more appropriate standard for the individual case on receipt of an acceptable proposal from the Developer's engineer.

### **E3.3 Pipe Installation**

1. The pipe installation shall be conducted in conformance with the pipe manufacturer's specifications.
2. Construction tolerances: Alignment -  $\pm 150$  mm, Grade - 5 mm + 20 mm/1.0 m diameter.

### **E3.4 Connection to Existing Utilities**

Breaking into existing manholes shall be performed in a manner acceptable to the Town, according to the dictates of good practice. Existing manhole floors shall be rechanneled and properly benched, the junction area shall be grouted to form a smooth joint, all debris including concrete and excavated material shall be removed and the vicinity of the connection shall be left in a tidy condition acceptable to the Town.

### **E3.5 Manholes and Catch Basins**

1. Manholes, perched manholes, T-Riser manholes and catch basins shall be installed as depicted on the Detail Drawings and in accordance with material manufacturer's instructions.
2. Backfill shall be compacted with mechanical tampers to a minimum of 98% Standard Proctor Density.
3. For manholes, an area 0.6 metres wide from the bottom of the cone to the subgrade elevation in roadways shall be backfilled with insulcrete or an acceptable alternative.
4. Class A. Bedding is required for all Tee Riser Manholes.
5. Aluminum safety platforms are required in all manholes exceeding 7 metres in depth.

### **E3.6 Sump Pump Discharge Collection Service Connections**

1. Each lot or multi-family unit shall have a separate service connection.
2. For single family dwellings, sump pump discharge collection services shall be installed in common trench with the water and sanitary service as depicted on the Detail Drawings. Class B bedding is required.
3. Inline Tee or Wye fittings must be installed during sewer main construction at all service connections. Saddles are allowed only for service connections to existing mains. Tee fitting service connections will be allowed provided they discharge into the top half of the main.
4. Where sump pump discharge collection services are required to connect to mains in excess of 4.5 m deep, risers shall be installed to 4.5 m below finished surface in accordance with the Detail Drawing.
5. In residential subdivisions with front yard gas servicing, water, sanitary sewer , and sump pump discharge collection services shall be extended beyond the gas line and sump pump discharge collection main and terminate a minimum of 0.15 m from the back of the easement line. All services shall be properly capped.
6. Red painted stakes of size 38 mm x 89 mm shall be extended from the end of the service connection to a minimum of 0.50 m above ground level.

### **E3.7 Auguring of All Services Connections and Main Extensions Into Multi-Family Sites**

1. All service connections and main extensions into multi-family sites shall be installed by auguring under proposed and existing streets and sidewalks except where auguring is not feasible due to adverse soil conditions. Open trenching may be permitted subject to the Town's acceptance of the need and acceptance of the backfill material.
2. All auger pit excavations shall be backfilled with granular bedding material and mechanically compacted, in lifts not to exceed 150 mm in depth, to a minimum of 95% Standard Proctor Density to 300 mm above the pipe.
3. 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 98% Standard Proctor Density.

### **E3.8 Inspection and Testing**

1. Prior to the initial and final acceptance of the project, all storm drainage system components including the sump pump discharge collection mains shall be subject to inspection by the Town at the time of Final Acceptance (F.A.C.) for streets. Video inspection reports prior to F.A.C. shall be required.
2. The maximum acceptable long-term deflection for any PVC or other flexible pipe is 7½% of the normal internal diameter.
3. All sewers shall be inspected by camera after backfilling of the trench to finished grade.

The Town of Bruderheim will conduct the television inspection with qualified personnel at Final Acceptance (F.A.C.) at the Developer's expense and issue a formal inspection report, pictures and video tape to all parties. An optional inspection can also be conducted at Construction Completion (C.C.C.) at the Developer's expense.

All television inspection shall be carried out by qualified personnel who shall be given at least 21 days advance notice of any testing to be carried out.

#### **1. Testing Equipment**

The closed circuit television crew shall provide all equipment and materials necessary to conduct the inspection as specified herein.

The television equipment shall be a self-contained camera and a monitoring unit connected by cable. It must be waterproof and be capable of lighting the entire pipe. Picture capabilities must be of quality to show the entire pipe periphery. There must be capability of providing measurement within the line to an accuracy of one third of a metre per kilometre. Picture quality must be such to produce a continuous 600 line resolution picture showing the entire periphery of the pipe. The following capabilities and items must be available:

1. a direct voice communication
2. a camera towing service
3. self-contained electrical power
4. proper safety equipment to protect employees and the general public.

The cameras rate of progress shall be uniform during inspection and shall not exceed 6 m/min.

## 2. Report

A television log shall be maintained during the inspection showing locations of leak, fault, open joint, break, crack, collapse, deflection, settlement, obstruction, infiltration, or any other defect affecting the overall performance of the mains. The location of the defect shall be referenced from the manhole.

A separate log shall be kept of service connections with comments of condition.

Photographs shall be taken as directed or at the discretion of the television scanning operator. A minimum of one photo per manhole reach is required plus one of every deficiency.

Manhole identify shall be noted clearly as indicated on the drawings.

A final typewritten report with corresponding photograph secured properly and referenced to the text along with a copy of the video tape shall be submitted within two weeks after compilation of inspection.

## 3. Cleaning

The Developer is responsible for cleaning and flushing all lines.

## 4. Miscellaneous

The crew shall be responsible for all works performed by any subcontractors, for traffic control and any other related work incidental to the completion of television inspection.

## 4. Inspection and Acceptance

The location of all deficient work will be recorded and the Developer will be required to repair, re-lay, restore or otherwise make good, to the satisfaction of the Town any deficient work including the repair of alignment problems, cracked or broken pipe, deformed pipe, leaks or any other faults not conforming with these specifications or the pipe manufacturers which the television inspection revealed.

After the deficiencies are repaired and corrected and before final acceptance, the Town reserves the right to have the faulty areas re-televised at the Developer's expense.

5. Where deemed necessary by the Town, an exfiltration and/or infiltration test shall be conducted. These tests shall not be required if video inspections are done immediately after sewer construction and no deficiencies are observed. Any deficiencies shall be corrected by the contractor and those portions of line affected shall be subject to an additional video inspection.

#### SEWER LEAKAGE ALLOWANCES

<u>Pipe Material</u>	<u>Leakage Allowance</u>
PVC	<p>Infiltration Test: 5.0 L/day/mm dia/km is allowable with no allowance for external hydrostatic head. The groundwater table is to be above pipe crown at all locations of the test section.</p> <p>Exfiltration Test: 5.0 L/day/mm dia/km is the combined allowable exfiltration from pipe and manholes with hydrostatic head at the high manhole is to be a minimum 0.6 m higher than crown of pipe or groundwater table, whichever is higher. The water level is not to exceed 7.6 m above top of pipe at low manhole.</p>
Concrete	<p>Infiltration Test: 20.0 L/day/mm dia/km is allowable with average depth of groundwater a minimum of 0.6 m above crown of pipe. Where the average head of groundwater is 1.8 metres or more above the crown, the infiltration limit is increased by the ratio of the square root of the actual head to a base head of 1.8 metres.</p> <p>Exfiltration Test: 20.0 L/day/mm dia/km is the combined allowable exfiltration from pipe and manholes when average head on the test section is 0.9 metres above crown of pipe or groundwater table, whichever is higher.</p> <p>Exfiltration limit is increased by the ratio of the square root of the actual head to a base head of 0.9 metres when the average head on the test section is greater than 0.9 metres above crown of pipe or groundwater table, whichever is higher.</p>

### **E3.9 Summary of Storm Drainage System Standards**

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

#### ASTM

A48	Gray Iron Castings
C14	Concrete Sewer, Storm and Drain, and Culvert Pipe
C76	Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
C443	Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
C478	Pre-cast 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)
B182.4	Profile PVC Sewer Pipe and Fittings
B182.11	Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings
G30.12	Billet Steel Bars for Concrete Reinforcement

END OF SECTION E

**IDF Curves Intensity Table & Formula****IDF Curves Formula**

Edmonton Municipal Airport - IDF Period : 1914-1995

Max Years of Record 63

Constants	Return Frequency					
	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
a=	221.51	335.29	410.83	505.47	576.99	647.86
b=	1.580	1.545	1.535	1.522	1.528	1.536
c=	0.647	0.654	0.656	0.658	0.660	0.661

$$I = a / (t + b)^c$$

**I** Intensity (mm/hr)

**t** Time (minutes)

**a,b,c** Constants from table above

Note: Constants were derived from a least squares solution of raw data.

G:\EXCEL\Utilities\storm\[Edm IDF 1914-1995.xls]Sheet3

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## **I PLAN STANDARDS**

### **I1 Design Drawings**

All detailed engineering plans submitted for review and approval to the Town of Bruderheim must comply with the following specifications.

#### **I1.1 Drawing Techniques**

Points of drawing technique that are significant to the preparation of drawings are as follows:

1. Clarity and legibility will be the governing criteria when preparing drawings.
2. Care should be taken in ensuring balanced distribution of detail throughout the drawing.
3. Letters and figures will be clearly legible, 2 mm size or larger (AutoCad or equivalent), well spaced, properly formed and proportioned.
4. Lines will be uniform in weight and density.

#### **I1.2 Scales**

Plans will be drawn to the following scales:

- |                                       |                                   |
|---------------------------------------|-----------------------------------|
| 1. Overall Plan                       | 1:1000                            |
| 2. Plan/Profiles                      | Horizontal 1:500<br>Vertical 1:50 |
| 3. Typical Cross Sections and Details | As Required                       |

#### **I1.3 Geodetic Datum**

1. Elevations will be relative to Geodetic datum (3TM). Bench mark numbers, locations and elevations can be obtained from the Town. Reference bench marks and elevations will be identified on the Index Plan.
2. A north arrow will be shown on each drawing. In general, north arrows should be directed towards the top of the plan.

#### **I1.4 Plan Size**

1. The standard A-1 drawing size (594 mm by 841 mm) will be used.

## **I2 Plan and Profile Drawings**

### **I2.1 General**

1. Plans are to be drawn to a scale of 1:500 horizontal and 1:50 vertical.
2. Existing and proposed features are to be clearly delineated.
3. All drawings must clearly show the following in the title block:
  1. developer's/owner's name,
  2. consultant's name,
  3. subdivision name including staging and/or phasing,
  4. drawing name,
  5. drawing number and job number, if applicable,
  6. revision number,
  7. horizontal and vertical scales,
  8. space for the signature of the designer, draftsman, checker and approving principal,
  9. space for the number, date, description, designer and approving principal of all revisions,
  10. space for issue dates including preliminary, approval, tender, construction, as built and microfilming, and in addition the date and initials of person approving each issue must be shown,
  11. space for professional stamps and permits,
  12. a space measuring 10 cm x 1.5 cm will be provided at the bottom right hand corner for the Town numbering system, and
  13. scale bar

### **I2.2 Road and Right-of-Way Information**

1. The following information is to be shown on the plan portion of the drawing:
  1. legal subdivision information including lot and block numbers,
  2. alignment of proposed street easement or right-of-way; name or temporary designation of the above,

3. alignment of immediately adjacent existing and proposed streets, walks, lanes, ditches, interim or temporary connections, utility rights-of-way, easements and reserves. Identification of the above is to be by name (i.e. streets) or ownership (i.e. easement, rights-of-way),
  4. existing and proposed surface features such as carriageways, curb and gutter, sidewalk, walkway connections, wheelchair ramps, bus stop pads and boulevard areas,
  5. dimensions, relative to property lines, of carriageway and right-of-way widths, sidewalk and curb and gutter locations, and boulevard locations,
  6. horizontal curve data including chainages of the BC and EC, delta angle, radius, chord length and arc length for centre line of each roadway. All curb returns must show the radius. Note, alternatively this information can be shown in a table format.
  7. elevations along curb and gutter of all changes in vertical alignment,
  8. elevations of the BC and EC of all curb returns, including the grades and distances around the curve, and
  9. location of all existing survey monuments, if applicable.
2. The following information is to be shown on the profile portion of the drawing:
    1. existing ground profile along the centre line of the proposed roadway, lane or utility as required,
    2. proposed top of curb elevations including proposed grade to two (2) decimal places,
    3. vertical curve information including chainage and elevations of BVC, PVI and EVC; external value,  $e$ ; length of curve; elevation and chainage of low point of sag curves and high point of crest curves,  $k$  values,
    4. top of curb and lane grade, if applicable, at all intersecting proposed and existing roads, and
    5. chainage of all BC and EC curb returns.

### **I2.3 Sanitary, Sewer, Storm Sewer, and Sump Pump Discharge Collection Systems Information**

1. The following information is to be shown on the plan portion of the drawing:

- 
1. alignment of mains and sump pump discharge collection lines, including distance from property lines,
  2. diameter of mains and sump pump discharge collection lines,
  3. all appurtenances such as manholes, catch basin frame and cover type, plugs, cleanouts, inlet and outlet structures,
  4. sequential numbering of manholes. Numbers will be supplied by the Town to the Consultant for inclusion into the record drawings,
  5. leads between catch basins and manholes,
  6. elevations of catch basins at gutter,
  7. direction of flow,
  8. service lateral location,
  9. radius of curved sewers, and
2. The following information is to be shown on the profile portion of the drawing:
1. vertical alignment of proposed mains and the sump pump discharge collection lines along the profile,
  2. elevation and diameter of existing and proposed mains and other utilities crossing or intersecting the profile and which will impact on the construction. Where possible these should be verified in the field.
  3. diameter, length and percent grades of sewer mains between manholes and the sump pump discharge collection lines,
  4. inverts of all pipes connecting to a manhole,
  5. type and class of pipe,
  6. class of bedding,
  7. proposed rim elevations for all manholes,
  8. capacity of sewer between manholes along with calculated flow and velocity in the particular section.
  9. augured sections,
  10. any special construction areas such as shored construction or limited space areas, and

11. chainage of BC and EC of curved sewers.
  12. special appurtenances such as drop structures and safety platforms.
  13. radius and length of curve for curved sewers.
3. Hydraulic design calculations in Tables for the sanitary sewers, storm drainage, catch basins and leads and the sump pump discharge collection lines is to be summarized as indicated on pages 82 and 83.

**STORM DRAINAGE AND SANITARY SEWER SYSTEMS DESIGN TABLES (EXAMPLE)**

**STORM DRAINAGE**

Street Name	From	To MH	Added Ha	Total Ha	C	CA	Total CA	Initial Time	Time in Pipe	Total Time	Int. mm/hr	Design Flow m <sup>3</sup> /s	Length m	Pipe Size mm	Slope %	Cap. m <sup>3</sup> /s	Vel. m/s
Foxhaven Place	EX.10 0	EX.101	0.75	0.75	0.40	0.300	0.30	15.00	0.98	15.98	53.51	0.045	51.60	300	0.40	0.064	0.875
Foxhaven Place	EX.10 1	EX.103	0.74	1.49	0.40	0.296	0.60	15.98	1.25	17.23	51.53	0.085	89.86	300	0.75	0.088	1.198
Foxhaven Place	EX.10 2	EX.103	0.91	0.91	0.40	0.364	0.36	15.00	0.83	15.83	53.51	0.054	43.70	300	0.40	0.064	0.875
Foxhaven Place	EX.10 3	EX	0.28	2.68	0.40	0.112	1.07	17.23	0.77	18.00	49.26	0.147	41.76	450	0.25	0.149	0.906

Per Capita Flow =  
Commercial/Industrial Flow =  
Infiltration Allowance =  
Inflow Allowance =  
N = 0.013

**SANITARY SEWER SYSTEM (EXAMPLE)**

Location	From MH	To MH	Added Lots	Total Lots	Pop. Den	Pop.	Pop. Sum.	Peak Factor	Peak Flow m <sup>3</sup> /s	Added Area ha	Total Area ha	MH Inf. Pipe Inf. m <sup>3</sup> /s Inflow	Design Flow m <sup>3</sup> /s	Pipe Size mm	Slope %	Length m	Pipe Cap. m <sup>3</sup> /s	Vel. M/s
Foxhaven Place	5	EX.1	14	14	3.50	49	49	4.316	0.0011	0.84	0.84	0.0030	0.0041	200	1.00	110.95	0.0328	1.044
Foxhaven Place	EX.1	EX.2	9	23	3.50	32	81	4.268	0.0018	0.54	1.38	0.0049	0.0067	200	0.60	60.48	0.0254	0.809
Foxhaven Place	EX.2	EX.4	10	33	3.50	35	111.50	4.226	0.0025	0.69	2.07	0.0074	0.0099	200	0.60	104.79	0.0254	0.809

<b>CATCH BASIN AND LEAD DESIGN TABLE HEADINGS (EXAMPLE)</b>								
Number	Location (Street)	Type of Cover	Depth of Flow or Ponding	Lead Diameter	Lead Slope	Design Flow	Capacity of C.B.	Capacity of Lead

## **I2.4 Water Distribution Information**

1. The following information is to be shown on the plan portion of the drawing:
  1. alignment of mains including distance from property lines,
  2. diameter of mains,
  3. all appurtenances such as hydrants, tees, bends, crosses, valves, blow offs and plugs,
  4. service lateral location, and
  5. augured or cased sections.
2. The following information is to be shown on the profile portion of the drawing:
  1. vertical alignment of proposed mains along the profile,
  2. elevation and diameter of existing and proposed mains and other utilities crossing or intersecting the profile and which will impact on the construction. Where possible these should be verified in the field.
  3. top of pipe elevations at all tees, bends, crosses, plugs and grade changes,
  4. size, type and class of pipe,
  5. class of bedding,
  6. extent of work required to connect to existing mains, and
  7. augured and cased sections.

## **I2.5 Standard and Special Detail Drawings and Typical Cross Sections**

1. Standard and special detail drawings must be included as part of the set of engineering drawings for each project.
2. Standard size A-1 sheets will be used.
3. The scale of individual details will be commensurate with the amount of information to be shown along with clarity and legibility.
4. Typical cross sections of right-of-ways, walkways, public utility lots, and easements are required depicting typical locations of streets, curb and gutter, sidewalks, all utilities, streetlights, hydrants, and other proposed and existing infrastructure and landscaping relative to the property lines.

**I3 Record Drawings**

**I3.1 General**

1. Clear reproducible Mylar prints of the record construction drawings and computer disks capable of being used with the latest version of AutoCad containing identical information must be submitted to the Town within six months prior to issuance of the Final Acceptance Certificate for underground and aboveground servicing.
2. Record drawings will provide all the information outlined in Section I2.
3. On record drawings submitted to the Town, the following information will be included on each the cover sheet:
  1. date of construction completion,
  2. date on which record details were added, and
  3. the following table

Record Drawings			
Improvement	Contractor	Dates	
Sanitary			
Storm			
Water			
Surface			
Sidewalks			
Landscaping			

4. signature and stamp of professional engineer approving record drawings.
5. A Table summarizing all underground utility systems components installed and information regarding material, type, size, class, pressure rating, manufacturer, supplier, reference standard, make and model for equipment, etc. on each drawing.

### **I3.2 Water, Sanitary, and Sump Pump Discharge Service Connection Information**

1. A table drawing shall be prepared and incorporated on the record drawings giving the following information with respect to service connections.
  1. lot number,
  2. distance of service saddle or wye from downstream manhole, and
  3. invert elevation of sanitary service, and sump pump discharge collection line, and top of pipe of water service at property line.
2. The service connection provided to each lot shall be shown on the plan and the location referenced to the property lot corner.
3. Riser connections will be shown on the profile portion of the plan/profile drawing.

### **I3.3 Standard Details**

1. Standard detail drawings will be revised to reflect as built information.

### **I3.4 Street Address Numbers**

1. Street address numbers, supplied by the Town, will be shown on the Legal Plan at the record stage.

**I. Submission Requirements for Site Developments**

1. Submission of a report that briefly explains the drainage system and the methodology used. The report and plan must be sealed and signed by an Engineer Licensed to Practice in the Province of Alberta. A coordinated submission with other site plans should be made in order to ensure proper compliance. All utility construction should be in accordance with Town Standards.

The report must contain all pertinent information on the storm water management system, including but not limited to the following:

1. Orifice sizing calculations.
  2. Required Storage volume calculations and how they are achieved.
  3. Calculation showing maximum allowable outflow.
  4. The equation used to calculate the runoff rate. Areas and associated runoff coefficients.
  5. Calculations showing the depth, velocity and flow in the overflow swale for events exceeding the 1:25 year event.
2. Overall Utility Plan  
(Showing all utility lines and appurtenances, inverts and rims, type and size of flow control device, materials, etc.). Provide a note stating "No ground water or storm water shall be discharged to the sanitary sewer.
  3. Lot Grading Plan  
(Showing ponding depths, storage areas, basin boundaries, overflow location, finished grades, original contours, building main floor elevation, etc.).
  4. The applicant must contact the Town and arrange to prepare a water, sanitary and storm sewer service application. Each connection has a fee of \$50. A plan will be required to present the design of the service connections and utility lines in accordance with Town requirements. A water shutoff valve will be required at property line.
  5. Before designing on-site fire protection systems, a hydrant flow test must be conducted on a nearby hydrant to determine the flows available from the Town water system. The onsite system must then be designed based on this existing condition information. The Town must be contacted before this testing is done and coordinated with them.
  6. The Town Fire Chief must be contacted to determine onsite hydrant requirements. Fire flow and water network analysis calculations must be submitted.

## **II. Guideline Limitations**

1. This document shall guide developers and their consultants in the preparation of on-site storm water management and utility submissions. The owner should be aware that all on-site systems require routine maintenance to ensure proper operation. It is the responsibility of the Owner to ensure these guidelines are implemented and maintained.
2. Each site will be unique in its' storm water management and how it complements and interacts with the existing system. The Town of Bruderheim may request additional information than what is presented in this document.

## **III. Enforcement**

1. The development and/or building permit will not be issued until the Lot Grading and Overall Utility Plan has been accepted. Once constructed please arrange for an inspection to ensure that the required storage areas are provided and that the approved controls are in place. As-built drawings must be prepared and delivered to the Town of Bruderheim once the site is constructed.

## **IV. Technical Requirements (Storm Water Management)**

1. Peak outflow rate is based on the receiving storm systems' 1 in 5 year capacity or .035 m<sup>3</sup>/s/ha.
2. Minimum orifice of 50 mm and a minimum pipe size of 150 mm.
3. Roof leaders must discharge to a landscaped area where ever possible. Where this is not practical they shall be connected to a storm service with provisions to ensure operation at all times. (Provide overflow outlet due to service line surcharging or freezing).
4. The entire site, defined as the legal boundary, must be incorporated into the design. Calculations should be based on the ultimate development plan including any future building or parking additions.
5. Where conditions are favorable the sump pump should discharge directly to the storm system. An overflow relief to the ground surface should be provided during periods of surcharging.
6. Though not required, consideration should be given to water quality facilities to limit Point Source Pollution.

For further information phone 780-796-3731.

**CHLORINE RESIDUAL AND BACTERIAL SAMPLING REPORT  
FOR ENVIRONMENTAL OPERATIONS**

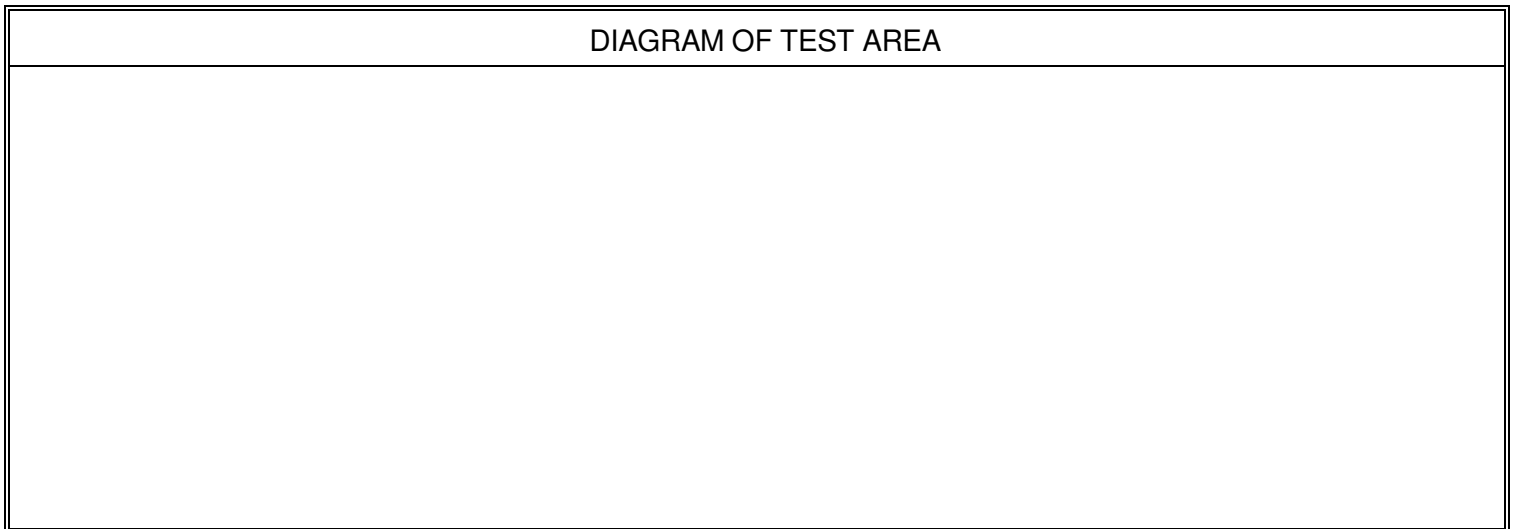
CONTRACTOR: \_\_\_\_\_

DEVELOPER: \_\_\_\_\_ SUBDIVISION: \_\_\_\_\_

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

CONTRACTOR: \_\_\_\_\_ PUMP LOCATION: \_\_\_\_\_

LOCATION: \_\_\_\_\_  
\_\_\_\_\_



NOTE:

LOCATION	TEST DATE	TOTAL CL <sub>2</sub> (mg/l)	Free (CL <sub>2</sub> (mg/l))	Total (CFu/100ml)	Standard Plate Count (CFu/ml)
1)					
2)					
3)					
4)					
5)					
6)					

**COMBINED WATER PRESSURE AND LEAKAGE TEST  
FOR ENVIRONMENTAL OPERATIONS**

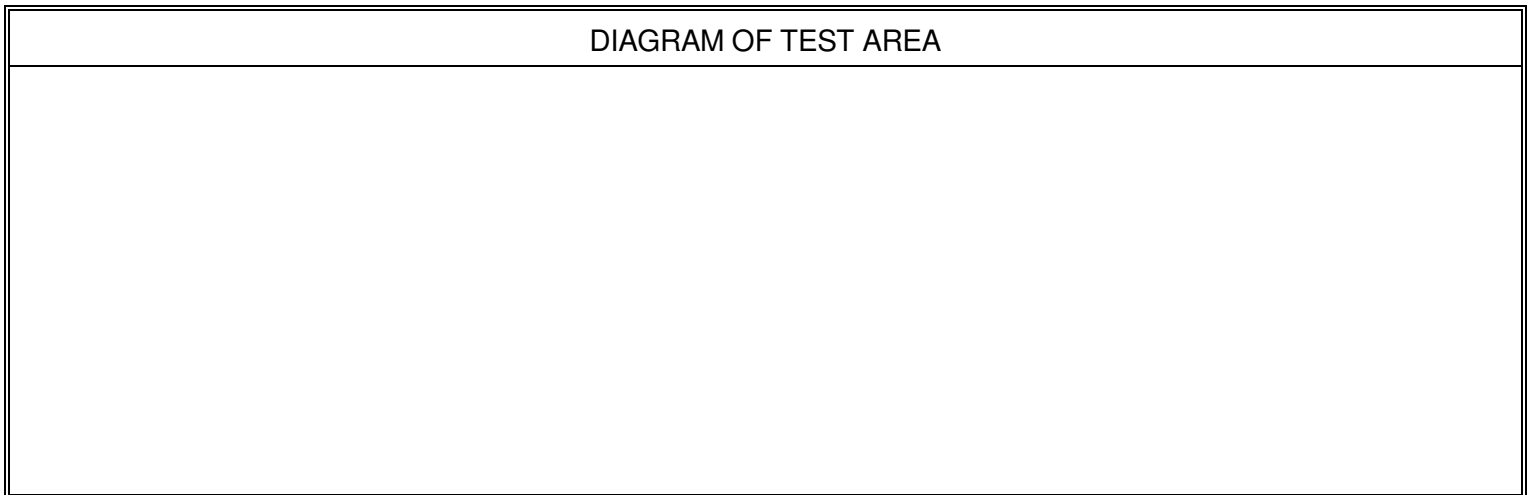
DEVELOPER: \_\_\_\_\_ SUBDIVISION: \_\_\_\_\_

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

CONTRACTOR: \_\_\_\_\_ PUMP LOCATION: \_\_\_\_\_

LOCATION:  
\_\_\_\_\_  
\_\_\_\_\_

DIAGRAM OF TEST AREA



NOTE:

	TIME	READ	PRESSURE
START			kPa
FINISH			kPa
CENTIMETRES			
LITRES			

LENGTH	SIZE & TYPE	NO. OF JOINTS	LEAK ALLOWABLE
m	mm		L
m	mm		L
HYDRANTS			L
TOTAL ALLOWABLE LEAKAGE			L
TOTAL ACTUAL LEAKAGE			

CONTRACTOR – TESTER:

\_\_\_\_\_

DEVELOPER'S REPRESENTATIVE:

\_\_\_\_\_