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SECTION 1 – GENERAL INFORMATION

1. DEFINITIONS

In this Manual, unless the context otherwise requires, the following words shall have the meaning hereinafter assigned to them.

- "Aquatera" shall mean Aquatera Utilities Inc.
- "ASP" shall mean Area Structure Plan.
- "CCC" shall mean Construction Completion Certificate.
- "City" shall mean the municipal corporation of the City of Grande Prairie, or the area contained within the boundaries thereof, as the context requires.
- "City Standards" means the standards and specifications as set out by;
  - The "Design Manual" being the City of Grande Prairie Standard Guidelines for Design and Development of Municipal Improvements.
  - The "Construction Manual" being the City of Grande Prairie Standard Specifications for Construction of Municipal Improvements.
  - any additional standards, conditions or requirements imposed upon the Development Area by the City's Development Authority, Subdivision Authority, Subdivision and Development Appeal Board or Development Officer or by Aquatera;
  - any condition of the approval of the Plans imposed by the City or Aquatera;
  - all codes, regulations, legislation, design and engineering standards applicable to the servicing and development of the Development Area that are presently in effect and as may be amended in the future, from time to time, for design, construction and installation of all Municipal Improvements.
- "Consulting Engineer" shall mean a professional engineering firm retained by the Developer to be responsible for the design, layout, supervision of installation, preparing record drawings and performing those duties in connection with the provision of Municipal Improvements as set out in these Guidelines. The engineering firm must possess a valid Permit to Practice as issued by the Association of Professional Engineers, and Geoscientists of Alberta (APEGA) or the Association of Science and Engineering Technology Professionals of Alberta (ASET).
- "Contractor" shall mean any person, persons or corporation which shall undertake the installation of Municipal Improvements on behalf of either the Applicant or the City.
- "Developer" shall mean the person(s) or entity that has executed a Servicing Agreement with the City, the Developer has undertaken to comply with the specified technical and contractual standards required by the City.

- "Developer's Consultant" shall mean the consulting professional retained by the Developer and shall include but is not limited to Professional Engineers, Professional Technologists, Professional Licensee (Engineering), landscape architects, land use planners and legal surveyors, all of whom are members in good standing of their respective professional associations created under the laws of Alberta.
- "Developer's Engineer" shall mean the Professional Engineer, Professional Technologist, Professional Licensee (Engineering), or Certified Consulting firm acting on behalf of the Developer. Certified shall mean possessing a valid Permit to Practice as issued by the Association of Professional Engineers and Geoscientists of Alberta.
- "ER" shall mean Environmental Reserve.
- "FAC" shall mean Final Acceptance Certificate.
- "Infill Development" shall mean any new development that is sited on a vacant or undeveloped land within an existing community, and that is enclosed by other types of development
- "LUB" shall mean Land Use By-law.
- "Lane or Lanes" means dedicated subdivision lands created for the purpose of, and intended for pedestrian and vehicular traffic, through alignments and locations other than roads or streets.
- "Maintenance Period" Commences upon issuance of the CCC and ends with issuance of the FAC. If a time is not specified, it is deemed to be the period of Two (2) years. This includes necessary repairs and replacements to meet City Standards and guarantee of the quality of work and material.
- "Maintenance Activity" Commences immediately upon installation and ends with the issuance of the FAC. Includes all work necessary to meet City Standards.
- "MDP" shall mean Municipal Development Plan.
- "MR" shall mean Municipal Reserve.
- "Municipal Engineer" shall mean the Municipal Engineer of the City, or their authorized representative who for the time being is acting for the City in their respective positions, or any person engaged by the City to act for the City. Generally, this shall mean the City's Development Engineer.
- "Municipal Improvement" shall mean any proposed addition or modification to a service or facility which will ultimately be the responsibility of the City of Grande Prairie. These include, but are not necessarily limited to: watermains, sewers, service connections, roadways, lanes, walkways, trails, park areas, street signs, entrance features, street lights, walkway lights and sound attenuation structures.
- "Municipal, Municipality or City" shall refer to the City of Grande Prairie.
- "Plans" means the plans for Municipal Improvements approved by the City and Aquatera, and any changes approved by the City and Aquatera in writing.

- "Public Lands" means roads, lanes, municipal easements, public parks, public utility lots, municipal reserves, environmental reserves, school reserves and other properties within and in the vicinity of the Development Area which are owned or administered by the City or any school authority, or which are to be dedicated by the Developer to the City or any school authority.
- "Professional Engineer": shall mean an Engineer in good standing and meeting the qualifications as set forth by the Association of Professional Engineers and Geoscientists of Alberta. Designated as P.Eng.
- "Professional Licensee (Engineering)" shall mean a member in good standing of the Association of Professional Engineers and Geoscientists of Alberta (APEGA) that has been given the right to independently practice engineering within a defined individualized scope of practice as specified by the APEGA Board of Examiners. Designated as P.L. (Eng.)
- "Professional Technologist" shall mean a member in good standing of the Association of Science and Engineering Technology Professionals of Alberta (ASET) that has been given the right to independently practice engineering within a defined approved scope of practice as specified by the joint ASET/APEGA Board of Examiners. Designated as P.Tech or P.Tech (Geo.).
- "PUL" shall mean Public Utility Lot.
- "Road or Street" includes streets, avenues, and service roads.
- "Walkway or Walkways" means dedicated subdivision lands created for the purpose of, and intended for, the passage of pedestrian traffic only.

2. GENERAL

The development process includes both planning and engineering. The planning process is available in a booklet called "Guide to Land Development Process" at the City Planning and Development Department. Engineering components in this Section are discussed in greater detail in other Sections in this manual.

This document has been prepared to guide design of municipal improvements and systems to ensure that City operation and maintenance needs are met. These are minimum design standards that the City considers in typical situations. Consultants are encouraged to continuously seek new and better solutions to achieve better technical and economical results. Where a variation to the standard is proposed it shall be submitted for approval.

This manual is to be used in conjunction with the Aquatera Design Manual; refer to the Aquatera Design Manual for guidelines pertaining to the water distribution and wastewater collection infrastructure systems.

If a relevant government body or approval agency has approved standards that exceed the City's minimum standards, the higher standards shall prevail. Generally, no departure

from these design standards shall be permitted without prior written approval of the Municipal Engineer.

Should the design drawings contain proposed specifications, procedures or other instructions that conflict with City of Grande Prairie or Aquatera Standard Guidelines for Design and Development of Municipal Improvements or Standards Guidelines for Construction of Municipal Improvements, the applicant shall provide a written explanation to the City/Aquatera detailing why the proposed conflict or non-compliance is necessary or required.

When using these standards the Developer and Consultant remain fully responsible for design and construction of municipal improvements according to good engineering practices that address the specific needs and site conditions of their project.

This document shall be used for the preparation of engineering drawings and approval of projects for Developers under the terms of a servicing agreement with the City.

The Municipal Engineer approval covers only compliance with these standards and is not warranty of the design work. The City is not responsible for the design of a particular site and requires the Consultant to assume full responsibility.

The performance and responsibilities of all parties and persons carrying out the installation of services shall be as set out in the Servicing Agreement.

3. ENGINEERING COMPONENTS

3.1 MASTER PLANS

These are non-statutory policy documents, adopted by Council resolution, that provide an overall framework for the provision of municipal infrastructure. It is intended that the installation and design of all municipal improvements be consistent with the recommendations and guidelines established in the most recent versions of these Plans, which include:

- Transportation Master Plan
- Water Distribution System Master Plan
- Wastewater Collection System Master Plan
- Storm Drainage System Master Plan
- Parks Master Plan
- Transit Master Plan

3.2 DESIGN REPORTS

Design Reports are prepared by the Developer and are intended to provide technical backup for a development proposal, demonstrating the “functional viability” of the proposed development and showing its impact on existing and future system requirements. Although generally required at the quarter section level as supporting information to the applicable land use plans, it is critical that the Design Reports address impacts on adjacent lands, including both upstream and downstream influences.

Once approved, these documents provide the basis for the preparation of detailed engineering drawings. They are also used as a means of identifying unique issues to be addressed in the servicing agreement (e.g. noise attenuation measures, burial of overhead power lines, etc.). Section 5 of the Design Manual is further dedicated to a detailed summary of the requirements of Design Reports.

3.3 SUPPLEMENTARY REPORTS

Supplementary Reports are prepared by the Developer and are intended to provide technical backup for a development proposal, demonstrating the “practical viability” of the proposed development. Typical reports include, but are not limited to Geotechnical Investigations, Environmental Site Assessments (ESA), Hydrogeological Assessments, Biophysical Assessment Report, Historical Resources Overview, and Flooding Potential Assessment. Section 5 of the Design Manual discusses these reports in greater detail.

Due to the nature of these reports, they may be required at various stages of the development process and it is important to liaise with the City on a regular basis to determine which reports may be required at what time. In some cases, these reports may be required as early as the ASP, and in other cases they may be required to support the Outline Plan, the Design Report and/or the Detailed Engineering Drawings.

3.4 TENTATIVE PLAN OF SUBDIVISION

A Tentative Plan of Subdivision is a relatively simple plan provided by the Developer as an inclusion with his Subdivision application. This plan must incorporate some aspects of a legal plan but is generally intended more for illustration purposes than for legal purposes. This plan is generally provided by a legal survey firm.

3.5 PLAN OF SURVEY

This is a legal plan showing subdivided lot boundaries, locations and descriptions of legal evidence, and plan designations including legal description as to quarter section, section, township, range, and meridian. Approval of the plan constitutes approval of the subdivision of the larger lot into separate legal lots and public areas, in terms of sizes and alignments,

but does not constitute approval as to utility or road designs. Such designs require separate City approval by means of detailed engineering drawings.

3.6 REGISTERED PLAN OF SUBDIVISION

A Registered Plan of Subdivision is often used to describe an endorsed Plan of Survey. Although the two plans differ in purpose, a Plan of Survey may be used as a Tentative Plan of Proposed Subdivision if the Developer elects to develop such a detailed plan prior to approval. It is a fully approved Plan of Survey, signed by the City, and subsequently registered by the Developer at Alberta Land Titles.

3.7 DETAILED ENGINEERING DRAWINGS

Detailed Engineering Drawings and accompanying specifications provide the necessary detailed design for the infrastructure required to service a specific phase of a development area. Detailed Engineering Drawings must be provided by a Professional Engineering firm licensed to practice in Alberta. These Drawings are subject to approval by the City, form part of the Servicing Agreement, and once approved, will serve as the basis of construction with only minor modifications allowed.

All drawings shall conform to the general standards noted in Section 2 of the Design Manual and are required to be stamped by a Professional Engineer recognized by APEGA or a Professional Licensee (Engineering) recognized by APEGA with the appropriate defined scope for submission along with the companies permit to practice stamp.

4. MUNICIPAL IMPROVEMENTS

4.1 GENERAL SERVICING

The type and extent of servicing shall be in accordance with the approved Design Reports, this manual and the Servicing Agreement as well as City plans, specifications and regulations for each municipal improvement. All municipal improvements must be extended to the boundary of the subdivision & include a right-of-access for adjacent property owners to connect to these services following written approval by the City.

4.2 UTILITIES

The Developer is responsible for coordinating the location of the water, sanitary, power, gas, telephone and cable TV, including obtaining alignment and utility right of way approvals. The location of the shallow utilities must be confirmed to ensure that all of the required utility right of ways are shown on the Utility Right of Way Plan before it is submitted to Land Titles for registration. The Legal Plan and the Utility Right of Way Plan, together with the Utility Right of Way Agreements, are released for registration when the Servicing Agreement has been signed by Developer and the City.

Shallow Utility drawing requirements are included in Section 2 – Constructed and As Constructed Drawing Standards. The procedure for the preparation, submission and approval of shallow utility alignments is included in Section 13 – Utilities. It is the consultant's responsibility to provide the required digital base plans to the utility companies, as required.

5. SERVICING AGREEMENTS

5.1 INTRODUCTION

A Servicing Agreement is a contractual agreement between the City and/or Aquatera and the Developer ensuring that infrastructure on and possibly offsite required to service a proposed development is constructed to the City's standards. Servicing Agreements also contain provisions for the payment of applicable levies and securities, and may contain provision for payment for services previously installed by others that benefited the new subdivision, or alternatively any moneys that will be owing to the developer when further development occurs by others. These agreements are required as a condition of some development permits and most subdivision approvals in accordance with Section 655 of the Municipal Government Act.

5.2 EXECUTION OF SERVICING AGREEMENT

5.2.1 Information Required

Approvals / acceptance required prior to the request of a Servicing Agreement are as follows:

- Subdivision or Development Permit Approval.
- Accepted Design Reports.
- Accepted Geotechnical Report and other applicable Supplementary Reports.
- Finalized Detailed Engineering Drawings.
- Environmental Construction Operations (ECO) Plan if applicable.
- Alberta Transportation approval (where project is in close proximity to provincially controlled roadway).

To commence preparation of a Servicing Agreement, a request in writing from the Developer, or representative, expressing a desire to enter into a Servicing Agreement is required with the following information:

- Developer's company name, address, phone number, fax number, and email of contact person.

- Consultant's company name, address, phone number, fax number, and email of contact person
- Schedule A - Land Description, identifying Legal description of parcel.
- Schedule B – Development Area, Plan of Subdivision, identifying Legal description of parcel and subdivision area and name.
- Schedule E – Security, Value of Services to be installed conforming with the following Section 5.2.2 including detailed cost estimates used to arrive at value of Services.
- Schedule F - Levies and Fees, Levy and Fee payment conforming with the following section 5.2.2.
- Schedule G– Excess Capacity
  - Recovery from other developments, if applicable (Example: Oversizing)
  - Payments to other developments, if applicable
  - Other special conditions that may be required

5.2.2 Schedules Required

Schedules A, B, E, F, and G are required as part of the Service Agreement approval process and Schedules C and D are required as part of the construction approval process.

Design Approval Process

Schedule A – Land Description

This is the legal land description as described on title for the land.

Schedule B – Development Area Map

This is a copy of the unregistered Plan of Subdivision conditionally approved by the City, showing the legal description of the land, the gross area in hectares, number of lots, and the subdivision name, with the developed area highlighted by hatch, or thick line surrounding.

Schedule E – Value of Security

Security Calculations

As a requirement of the Servicing Agreement, it is necessary for the Developer to post a letter of credit, cash deposit or subdivision bond with the City as security to ensure the orderly, timely, and proper completion of the municipal improvements attributed to the development.

The dollar value of Security is calculated taking several factors into account:

- history of project development within the City of Grande Prairie
- past record of construction completion timelines
- quality of workmanship by contractors
- the type of municipal improvements being completed
- the total estimated value of major municipal improvements

At the discretion of the Municipal Engineer the dollar value of Security is then calculated as a percentage of all major municipal improvement estimated construction costs. Historically the Municipal Engineer has calculated the percentage based on the scope of the project undertaken.

As a minimum, the security shall consist of:

(a) (i) Fifty (50%) percent of the estimated costs of constructing and installing of all major Municipal Improvements, which includes, but is not limited to, water system, sanitary sewer system and storm water system infrastructure, and roads, sidewalks and trails, curbs and gutters, street lighting and other related infrastructure when the Developer is providing security in the form of an Irrevocable Letter of Credit; or

(ii) One hundred (100%) percent of the estimated costs of constructing and installing of all major Municipal Improvements, which includes, but is not limited to, water system, sanitary sewer system and storm water system infrastructure, and roads, sidewalks and trails, curbs and gutters, street lighting and other related infrastructure when the Developer is providing security in the form of a Subdivision Bond; and

(b) One Hundred (100%) percent of the estimated costs of constructing and installing all of minor Municipal Improvements, which includes, but is not limited to landscaping, fencing, park development and the second lift of asphalt on all roads.

The Consulting Engineer shall submit to the City detailed cost estimates in the form of a Schedule of Quantities of the improvements with extended costs derived from current construction unit rates, along with a calculation of the required Security in the form as shown following this text. The extended costs shall include a Contingency of (10%) and Engineering at (6%).

As each phase of construction is completed and the Construction Completion Certificate (CCC) issued, the Developer may request, in writing, a review of the Security requirements.

The City may, under their discretion, reduce the amount of Security held for that particular phase of improvement by up to ninety (90%) percent of the improvement cost. The remaining ten (10%) percent would be held until the issuance of the Final Acceptance Certificate (FAC), at which time the City would accept full responsibility for the municipal improvement and all the Securities would be released.

Schedule F – Levies and Fees

Total Levies are payable to the City are on a per Gross Developable Hectare (GDH) including Municipal Reserve but not Environmental Reserve basis and may vary from time to time as adjustments are made in terms of current costs. Levies payable by the Developer include, but are not limited to:

Transportation System Levy

Contribution towards costs of arterial roadway development and upgrading as per City of Grande Prairie Bylaw C1197 Transportation Off-Site Levies.

Fees

Contribution towards cost of available capacity in existing systems where endeavor or cost sharing agreements are in place.

Fees as per Bylaw C-1100 Fee Schedule, Schedule F.

Schedule G - Excess Capacity

- Recovery from other developments, if applicable (Example: Oversizing)
- Payments to other developments, if applicable
- Other special conditions that may be required

Construction Approval Process

Schedule C –Construction Completion Certificate (CCC)

Schedule D - Final Acceptance Certificate (FAC)

5.2.3 Endorsement Requirements

For the Servicing Agreement to be endorsed, the following must be provided:

- Securities in the form of a letter of credit, cash deposit or subdivision bond acceptable to the City as per Schedule E.
- Payment of levies and fees as per Schedule F.
- Payment of Servicing Agreement Fee as per Bylaw C-1100 Fee, Schedule F.
- Provision of certificate of insurance acceptable to the City.

- Provision of Copies of Final Detailed Engineering Drawings with hard, and digital format.

6. CANADA POST MAILBOXES

6.1 GENERAL

The Consulting Engineer shall submit a copy of the Outline Plan and a copy of the current subdivision plan along with a request for mailbox locations to:

Manager Delivery Planning
Canada Post Prairie West Region
9828 104 Avenue NW Suite 400
Edmonton, Alberta T5J 0J8

6.2 LOCATION CRITERIA

The location of Canada Post community mailboxes shall be coordinated with Canada Post by the Developer, shown on the Detailed Engineering Drawings and subject to approval by the Municipal Engineer.

Canada Post has prepared a document entitled “Delivery Planning Standards Manual for Planners and Developers” which is available at the following address:

Manager, Delivery Planning and Postal Code Management
Address Management
Suite N0813 - 2701 Riverside Drive
Ottawa, Ontario K1A 0B1

City of Grande Prairie will determine the final desired location of community mailboxes based on various criteria, including the effect to the ratepayer who is immediately adjacent to the scheduled community mailbox location.

Upon receipt of the mailbox location plan from Canada Post, the Consulting Engineer shall ensure that the community mailbox locations conform to the requirements noted in the Postal Delivery Standards Manual.

7. ALBERTA ENVIRONMENT PROTECTION – STANDARDS AND GUIDELINES FOR MUNICIPAL WATERWORKS, WASTEWATER AND STORM DRAINAGE SYSTEMS IN ALBERTA

7.1 ALBERTA ENVIRONMENT APPROVALS

7.1.1 General

The purpose of this publication is to provide Standards and Guidelines for Municipal Water Supply, Wastewater, and Stormwater Drainage Systems in Alberta. Under the Environmental Protection Enhancement Act (EPEA), municipal water supply, wastewater, and stormwater drainage systems must be designed to meet these Standards or to a standard required by the Director of Standards and Approvals.

The current edition of the above noted Standards is to be used in conjunction with the City's Design Guidelines and the minimum requirements of each must be met.

Construction of water distribution systems, wastewater collection systems and storm drainage systems, including major components; such as water pumping stations, water reservoirs, sewage lift stations, storm ponds, storm outfall structures, etc. require approval from Alberta Environmental Protection.

The following Acts govern construction activities: (www.environment.alberta.ca)

1. Environmental Protection and Enhancement Act - Chapter E-12,

2. Water Act - Chapter W-3.

Effective October 2003, Alberta Environment has introduced Codes of Practice for the operation of water, sanitary sewer and stormwater systems. Alberta Environment has also revised the notifications and approval procedures as noted in Clauses 7.1.2 and 7.1.3.

The following documents are to be submitted to Alberta Environment and copied to the City and/or Aquatera:

1. Written Notifications for Extension to a Waterworks, Wastewater or Storm Drainage System for extension to a waterworks, wastewater or storm drainage system.

2. A Letter of Authorization for an amendment to the City of Grande Prairie’s Wastewater and Storm Drainage Permit.

3. Submission details are included in Clause 7.1.4 of this Section.

Effective February 2007, Alberta Environment introduced a revised edition of their "Provincial wetland Restoration/Compensation Guide", which outlines how applications will be reviewed under the Water Act when loss of wetland area occurs. It explains "wetland compensation"; a process to help reduce loss of wetland area by restoring drained or altered naturally occurring wetlands.

Developers and Consultants are advised to contact Alberta Environment if proposed developments contain existing wetlands and if there are changes proposed to those wetlands.

7.1.2 Wastewater and Storm Drainage Regulations 119/93

Wastewater and Storm Drainage Regulations 119/93 apply to the construction and operation of storm drainage treatment facilities.

"Storm drainage treatment facility", as defined in the Regulations, means any structure or thing used for the physical, chemical or biological treatment of storm drainage, and includes any of the storage or management facilities that buffer the effects of the peak runoff.

Note: The Regulations do not apply to stormwater treatment units installed upstream of a stormwater storage facility as these units are included in the Code of Practice for Wastewater (Sanitary Sewer and Storm) Collection Systems.

As specified in the Regulations, the Developer shall apply for a "Letter of Authorization" for the design and construction of storm drainage treatment facilities. A copy of the "Application for a Letter of Authorization for Storm Drainage Treatment Facilities" is appended to this Section.

The City of Grande Prairie will not allow construction to proceed until the required EPEA and/or Water Act approvals have been received.

7.1.3 Codes of Practice

The design and construction of water distribution systems, sanitary sewer collection systems and storm drainage systems is regulated by the following Codes of Practice:

1. For a Waterworks System Consisting Solely of a Waterworks Distribution System

   The Environmental Protection and Enhancement Act, RSA 2000, c.E-12, as amended and the Environmental Protection and Enhancement (Miscellaneous) Regulation, AR 118/93, as amended.

2. For Wastewater (Storm Drainage and Sewage) Systems Consisting Solely of a Wastewater Collection System

This above noted Code is made under the Environmental Protection and Enhancement Act, RSA 2000, c.E-12, as amended and the Wastewater and Storm Drainage Regulation, A.R. 119/93

3. Water, Sanitary and Storm Code Submission Requirements

As specified in the above noted Codes, the Developer shall submit a "Written Notification for Extension to a Waterworks, Wastewater, or Storm Drainage System" for the water distribution systems, sanitary sewer collection systems and storm drainage systems. A copy of the "Written Notification for Extension to a Waterworks, Wastewater, or Storm Drainage System" is appended to this Section.

Detailed submission procedures are included in Clause 7.1.4 of this Section.

7.1.4 Miscellaneous Codes of Practice

The following Codes of Practice have specific submission and approval requirements. Copies of the Application Forms are appended to this Section.

1. Code of Practice for Outfall Structures on Water Bodies [made under the Water Act and the Water (Ministerial) Regulation],

2. Code of Practice for Watercourse Crossings [made under the Water Act and Water (Ministerial) Regulation],

3. Code of Practice for Pipelines and Telecommunications Lines Crossing Water Bodies [made under the Water Act and the Water (Ministerial) Regulation].

The City of Grande Prairie will not allow construction to proceed until copies of the required Code notices have been received and forwarded to Alberta Environment

8. SUBMISSION OF ENGINEERING DESIGN

8.1 SUPPLEMENTARY INFORMATION

The Developer's Engineer shall submit to the Municipal Engineer the following information:

- calculations of sanitary and storm sewer capacity, velocity and pipe loading, only where soil conditions indicate a need to do load calculations;
- water distribution analysis identifying anticipated fire flows at all hydrants; and
- a print of the registerable plan of the subdivision (if not already supplied by the Developer).

8.2 RIGHTS OF WAY

The Developer's Engineer shall bring to the attention of the Developer and the City the need for any rights-of-way outside the subdivision, which the Developer may have to obtain.

The Developer's Engineer shall bring to the attention of the Developer and the City the need for any oil or gas pipeline or other Crossing Agreements, which the Developer may have to obtain.

9. PRELIMINARY DESIGN REVIEW

The Municipal Engineer shall review all Detailed Engineering Drawings and specifications and relevant data. Any revisions or comments requested by the Municipal Engineer shall be incorporated in the final Detailed Engineering Drawings.

10. FINAL DESIGN REVIEW

Upon completion of all revisions, the Developer's Engineer shall submit two sets of Detailed Engineering Drawings to the Municipal Engineer for review. The City's' review of the Detailed Engineering Drawings is only for general compliance with the City's servicing standards as detailed in this document. Review certification does not, in any manner, imply approval of the technical aspects of the reviewed design.

11. RIGHT-OF-WAY DOCUMENTS

Where easement or right-of-way documents are deemed necessary, they shall be prepared and registered by Plan at Land Titles by a registered Land Surveyor at the Developer's expense. The Right-of-Way document must conform to the City standard document.

12. UTILITY CROSSING AGREEMENTS

Where oil and gas pipeline Crossing Agreements are deemed necessary, they shall be obtained from the pipeline owner at the Developer's expense.

It is the responsibility of the Developer to complete a title search with the Alberta Energy

Utility Board (AEUB) to determine the existence of any pipelines in use or abandoned. A sample Pipeline Crossing Agreement Application letter is included in Appendix A.

A Crossing Permit is also required when crossing Aquatera Major Transmission and/or Trunk Lines. http://www.aquatera.ca/services/manuals/transmissionline.htm

13. SAMPLE APPLICATION LETTER

Date

Municipal Engineer
Engineering Services Department
The City of Grande Prairie
PO Bag 4000
10205 - 98th Street
Grande Prairie, AB T8V 6V3

Attention:

Re: Application for a Letter of Authorization for the Design and Construction of Stormwater Drainage Treatment Facilities or Storm Outfall – Permit Number 1091,

AND/OR

Notification for Extension to a Waterworks, Wastewater, or Storm Drainage System
Permit Numbers 1091 and 1092
For [Name of Developer]
[Name of Subdivision] Phase [00]
In [NE] ¼ Section [18] – 38 – 27 – W4 in The City of Grande Prairie

Please accept this letter on behalf of [Name of Consultant] for the above noted project. The following outlines the requested project information.

1.	Owner's Name	"Name of Developer"
2.	Project Name:	"Subdivision Name and Phase Number"
3.	Project Type:	Construction of water mains, sanitary sewer mains, storm sewer mains, and service connections.
4.	Confirmation by Professional Engineer regarding increased flows and/or treatment capacity:	Confirmation to be provided by the City of Grande Prairie Engineering Services Department.
5.	Construction Schedule:	Construction on this project is proposed to start on (Start Date) and to be completed by (Completion Date).

Enclosed please find approved plans for the proposed construction and signed originals of the "Application for Letter of Authorization for the Design and Construction of Stormwater Drainage Treatment Facilities or Storm Outfall" and/or "Notification For Extension to a Waterworks, Wastewater, or Storm Drainage System".

If applicable, add the following sentence:

Please note that this project does not comply with all of the Standards and Guidelines. Attached to the application is a detailed description of the deviation and, in our opinion, why the deviation is necessary.

Yours truly, [Consultant], P. Eng. XX/yy

Encl

14. SAMPLE CITY CONFIRMATION LETTER

Date

Regional Engineer
Alberta Environmental Protection Environmental Protection Services
Grande Prairie Office
Main Floor, Room 1701 10320 - 99 Street
Grande Prairie, AB T8V 6J4

Attention:

Re: Submission of Written Notification for Extension to a Waterworks, Wastewater or Storm Drainage System – Permit Numbers 1091 and 1092,

AND/OR

Application for Letter of Authorization for the Stormwater Drainage Treatment Facilities and/or Storm Outfall – Permit Number 1091
For [Name of Developer]
[Name of Consultant]
[Name of Subdivision] Phase [00]
In [NE] ¼ Section [18] - 38 - 27 - W4 in the City of Grande Prairie.

Please accept this letter on behalf of The City of Grande Prairie for the above noted project.

A. **Submission of Written Notification for Extension to a Waterworks, Wastewater or Storm Drainage System – Permit Numbers 1091 and 1092**

The City has reviewed and approved the attached construction drawing for the above noted project. We hereby confirm that the related water distribution system, wastewater (sanitary sewer) collection system and/or the stormwater drainage system construction will not exceed the design capacity of the distribution and collection systems or the capacity of the treatment facilities.

B. Application for a Letter of Authorization for the Design and Construction of Stormwater Drainage Treatment Facilities and/or Storm Outfall – Permit Number 1091

The City has reviewed and approved the attached construction drawing for the above noted project. We hereby confirm that the related stormwater management storage facility construction will not exceed the design capacity of the downstream stormwater minor system and receiving water body.

C. Summary

Enclosed please find the following:

a. Copy of submission letter to the City of Grande Prairie prepared by the above noted Consultant;

b. Copy of “Written Notification for Extension to a Waterworks, Wastewater or Storm Drainage System” signed by the above noted Consultant.

c. Copy of “Application for a Letter of Authorization for the Design and Construction of Storm Drainage Treatment Facilities” signed by the above noted Consultant.

d. Plans of the proposed construction approved by The City of Grande Prairie.

Yours truly,

[Consultant], P. Eng. XX/yy

Encl

15. ALBERTA ENVIRONMENTAL FACT SHEETS AND APPLICATION FORMS

The following listings have been provided to assist the Consultant in applying for and receiving timely approval for the construction of Municipal Improvements in a development.

Extending Water Distribution and Wastewater Collection System Information Requirements under the Environmental Protection and Enhancement Act and Water Act (Approvals, Applications)

http://aep.alberta.ca/water/forms-applications/drinking-water-and-wastewater-facility-approvals-and-registrations-process.aspx

Temporary Diversion License

http://aep.alberta.ca/water/forms-applications/online-application-for-a-temporary-diversion-licence.aspx

Written Notification for Extension to a Waterworks, Wastewater or Storm Drainage System

Application for a Letter of Authorization for Storm Drainage Treatment Facilities

Application for Shoreline/Water body Modification under the Public Lands Act and the Water Act

Info Sheet
http://aep.alberta.ca/water/education-guidelines/documents/ShorelineWaterBodyModifications-Oct2015.pdf
Application form
http://aep.alberta.ca/forms-maps-services/forms/lands-forms/aer-related-forms/documents/AER-ApplicationShorelineModification-Dec2013.doc

(Includes Application for Aquatic Vegetation Control, Bank Stabilization, Beach Construction, Domestic Waterline, Erosion Protection, Outfall Construction, Permanent Boat Launch, Permanent Pier Site, Reservoir Construction, and/or Other Noted Work)

Extending water distribution and wastewater collection systems

Information requirements

October 2003

Approval or Registration Holders, or their authorized agents (such as developers or consultants) must provide certain information to Alberta Environment, **prior to construction**, as part of the written notice required when extending or replacing watermains, sanitary sewers and/or storm sewers.

INFORMATION THAT MUST BE PROVIDED

- ❑ The Approval or Registration number for the facility/facilities
- ❑ The location of the project (i.e. name of the municipality/development, subdivision name, street, etc)
- ❑ The type of project (i.e. water, sanitary sewer, storm sewer, etc.)
- ❑ Confirmation by a professional engineer that the increased flows associated with the extension are within the design capacity of the existing distribution or collection system
- ❑ Confirmation by a professional engineer that the additional loading as a result of the extension is within the design capacity of the system supplying treatment
- ❑ Confirmation that all aspects of the design meet Alberta Environment's *Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems*
- ❑ Any other pertinent information

The Approval or Registration Holder must also meet the specific requirements of their Approval.

The Director (at Alberta Environment) must authorize any waterworks system being extended to a new development that is not serviced by a wastewater system authorized under the *Environmental Protection and Enhancement Act* (EPEA).

The Director must be satisfied that the wastewater produced as a result of supplying water can be satisfactorily handled by other means.

Construction may proceed on projects where the Director or inspector has requested to review the plans and specifications.

IF THE DESIGN DOES NOT MEET STANDARDS

If all aspects of the design do not meet Alberta Environment's *Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems*, the project **cannot proceed** until the Director has issued written authorization.

The Approval or Registration Holder must indicate why the standards cannot be met and justify the alternative proposed design.

For projects that include new storm water ponds and/or outfall(s) to a water body or drainage course, the Approval or Registration Holder must also obtain an additional authorization or registration as required by EPEA and its associated regulations.

A separate application under the *Water Act* may also be required for projects involving storm water pond(s) and/or outfall(s). Check with your regional district office of Alberta Environment.

RANDOM COMPLIANCE INSPECTIONS

As part of an ongoing compliance inspection program, Alberta Environment may conduct random, unannounced inspections of construction activity.

Extensions to water distribution and wastewater collection and storm drainage systems that do not meet Alberta Environment's *Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems* may be subject to enforcement action.

For more information, contact your regional district Alberta Environment office.

Alberta Environment Regional Offices

Northern Region
Grande Prairie
Box 24, Room 1701
Provincial Building
10320 - 99 Street
Grande Prairie AB T8V 6J4
Ph: (780) 538-5351
Fax: (780) 538-5336

Edmonton
Twin Atria
111, 4999 - 98 Avenue
Edmonton, AB T6B 2X3
Ph: (780) 427-5296
Fax: (780) 427-7824

Central Region
Stony Plain
52322 Golf Course Road
Stony Plain, AB T7Z 2K9
Ph: (780) 963-6131
Fax: (780) 963-4651

Red Deer
304, Provincial Building
4920 - 51 Street
Red Deer, AB T4N 6K8
Ph: (403) 340-7052
Fax: (403) 340-5022

Southern Region
Calgary
200, 3115 - 12 Street NE
Calgary, AB T2E 7J2
Ph: (403) 297-6582
Fax: (403) 297-5944

Lethbridge
2nd Flr, Provincial Building
200 - 5 Avenue South
Lethbridge, AB T1J 4L1
Ph: (403) 382-4254
Fax: (403) 381-5337

Alberta
GOVERNMENT OF ALBERTA

For more information, please visit Alberta Environment's website at www.gov.ab.ca/env or phone (780) 427-6267 (dial 310-0000 first to connect toll-free).

16. NOTIFICATION FOR EXTENSION OF A WATERWORKS, WASTEWATER OR STORM DRAINAGE SYSTEM

Alberta Environment
Municipal Water and Wastewater Branch
Rm 101 Provincial Building
10320 – 99 Street
Grande Prairie, AB. T8V 6J4

ATTN:

Dear Sir,

RE: EXTENSION OF MUNICIPAL SERVICING – ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT
DEVELOPMENT NAME, LOCATION

Enclosed please find one (1) set of plans regarding the above noted subdivision.

We would appreciate your review and comment if required.

Please consider this submission as notification of extension of municipal servicing under the Environmental Protection and Enhancement Act, Wastewater and Storm Drainage Regulation, Section 6. This development falls within the City of Grande Prairie and conforms to existing Statutory Documents and Master Plans. This extension of services complies with the Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems published by Alberta Environment at this time.

If you require further discussion regarding the above, please contact.

Sincerely,

SIGNED AND STAMPED BY A PROFESSIONAL ENGINEER.
NAME
COMPANY

17. APPLICATION FOR A LETTER OF AUTHORIZATION FOR DESIGN AND CONSTRUCTION OF STORM DRAINAGE TREATMENT FACILITIES

Alberta Environment
Municipal Water and Wastewater Branch
Rm 101 Provincial Building
10320 – 99 Street
Grande Prairie, AB. T8V 6J4

ATTN:

Dear Sir,

RE: DESIGN AND CONSTRUCTION OF A STORMWATER TREATMENT FACILITY – ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT DEVELOPMENT NAME, LOCATION

Enclosed please find one (1) set of plans and associated design brief for the above noted subdivision.

We would appreciate your review and comment if required.

Please provide authorization to proceed with construction of the proposed storm drainage facility under the Environmental Protection and Enhancement Act, Wastewater and Storm Drainage Regulation, Section 6.1. This development falls within the City of Grande Prairie and conforms to existing Statutory Documents and Servicing Plans. The storm water system design complies with the Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems published by Alberta Environment at this time.

If you require further discussion regarding the above, please contact.

Sincerely,

SIGNED AND STAMPED BY A PROFESSIONAL ENGINEER.
NAME
COMPANY

18. APPENDIX A

HIGH PRESSURE GAS MAIN CROSSING APPLICAITON

Date

Land and Permits, Crossings
ATCO Gas Limited
10035-105 Street
Edmonton, AB T5J 2V6

Attention:

Re: Permit to Cross High Pressure Gas Main Location Description
Quarter Section Legal Description in the City of Grande Prairie, Alberta

In accordance with the conditions of Master Facility Crossing Agreement MA109, we are hereby forwarding on behalf of The City of Grande Prairie for your approval, plans and profiles for crossing and/or working adjacent to the high pressure gas main at the location shown on the attached drawings.

We propose to start construction in the vicinity of the high pressure gas main on or about "Date".

If any additional information is required regarding this application, please call "_____" at (_) __-_____.

Yours truly,

Project Engineer Encl.

19. SAMPLE UTILITY ALIGNMENT AND UTILITY RIGHT OF WAY APPROVAL LETTER

Company Address

Attention: Name of Company Representative

Re: Approval of Natural Gas, Cable Television and/or Telephone Alignments and Utility Right of Ways for "Name of Development"

Attached is a copy of the Shallow Utility Drawing No. showing the power distribution, street lighting, gas, telephone and cable television alignments and utility right of ways for the above noted development. Please review the drawing for any errors and/or omissions. Please contact _____at (__)_____at your earliest convenience if you have any questions or comments in regards to the information provided.

Please sign a copy of this letter in the space provided if the alignments and utility right of ways for your facilities are shown correctly. If we have not received a reply to this letter by_____(4 weeks from date of letter), we will assume that the alignments and utility right of ways are correctly shown on the Drawings and advise the City of Grande Prairie accordingly.

Thank you.

John Doe, P. Eng. XX/yy
Att.

We have reviewed the drawing and hereby approve the alignments and utility right of ways provided for "Name of Company".

_____	_____	_____
Name of Company Representative (Please Print)	Signed by:	Date

SECTION 2 – CONSTRUCTION AND RECORD DRAWING STANDARDS

1. GENERAL

This Section lists the requirements for the preparation and submission of Construction Drawings, As-constructed Drawings, and Digital Record Drawing Standards.

All drawings shall conform to the general standards noted in this Section. The intention is to standardize all drawing information that is received for review, approval or records by the City of Grande Prairie. Variances in labelling, scale and general format are acceptable, recognizing that legibility and content need to be maintained.

The Construction Drawings shall generally illustrate the information listed in Clauses 2, 3 and 4 of this Section. Specific design standards and requirements are provided in other sections of these Guidelines.

All documentation, including drawings, reports, technical letters and other documentation submitted to the City of Grande Prairie for the purposes of reviewing proposed infrastructure to service and develop lands shall be prepared and sealed by a Professional Engineer licensed to practice in the province of Alberta.

The Engineer's seal on the design drawings, submitted for review and acceptance shall certify that the design has been completed in compliance of these standards, as a minimum criteria, and in the best accepted engineering practice of the day.

2. CONSTRUCTION DRAWING REQUIREMENTS

2.1 GENERAL

The following information should be shown on all plans

1. Development (subdivision) or Project and Construction boundary
2. Legal description (Lot and block number) for each parcel of land
3. Property lines,
4. Road and/or Lane Name (e.g. Lane "A"),
5. Existing Survey control stations and markers
6. Revision block identifying revision number and date of revision
7. Legend identifying line type and symbol meanings
8. All utility rights of way (easements), both existing and proposed.

2.2 DRAWING TECHNIQUE

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

1. Care in ensuring balanced distribution of detail throughout the drawing.
2. Letters and figures shall be clearly legible, well-spaced, properly formed and proportioned.
3. Lines shall be uniform in weight and density.
4. Dimensioning of a drawing is extremely important and should be such that it will not be misinterpreted. Dimensions should be given from an iron pin, lot line, chainage station, a centre line or any other reference that can be readily established. All dimensions shall be in SI System (standard metric system and units).

2.3 SHEET SIZE

Drawing sheet sizes to be 610mm x 915mm (24” x 36”)

2.4 SHEET MATERIAL

Construction drawings are to be submitted using bond paper.

2.5 TITLE BLOCK

Title blocks are to be along the right side of the drawing.

2.6 NORTH ARROW

Place the north arrow in the upper right-hand corner of sheet. The drawing should be oriented such that north faces the upper, right quadrant of the sheet.

2.7 KEY PLAN

A key plan should be located at the top right corner of each sheet. Plan should indicate that portion of the street, lane, utility lot or easement which relates to a particular plan/profile sheet.

2.8 DIMENSIONS

All dimensions on plans and profiles are to be in SI metric units.

2.9 LETTERING

The preferred font is Arial. Bold lettering should represent proposed information. Proposed utility and road improvements should be labelled according to the following examples

Example:

PROP. 200mm or Ø PVC ULTRA RIB STORM SEWER

EX. 200mm or Ø SDR-35 PVC SANITARY SEWER PROP. 300mm or Ø PVC C-900 WATERMAIN

PROP. 190mm VERTICAL CURB AND GUTTER

Labelling should be inserted parallel to the pipe, curb, sidewalk, etc

Discretion is to be used in selection of lettering size and line weight. Plotted lettering size should be readable at a scale of 1:1000.

Preference for letter size is as follows

- DIMENSIONS – 2mm Arial
- CONSTRUCTION NOTES – 2mm Arial
- LEGAL LABELS – 4mm Arial
- STREET NAMES – 5mm Arial
- DEVELOPMENT PHASES – 8mm Arial

Line weight should differentiate between existing and proposed construction.

2.10 DRAWING SCALE

The following scales are to be used for the preparation of the construction Drawings. Exceptions will be noted for specific drawings.

1. A common scale of either 1:500, 1:750 or 1:1000 should be used for all Plan Drawings
2. A drawing scale of 1:500 should be used for all Plan/Profile Drawings, with a 1:50 vertical scale on the profile part of the drawing.
3. A scale of 1:100 horizontal and 1:50 vertical should be used on cross sections
4. Typical alternative scales are acceptable, if required to ensure legibility and content clarity.

3. CONSTRUCTION DRAWING PLAN REQUIREMENTS

3.1 COVER SHEET

1. Name of subdivision or project, should match the name on the servicing or development agreement.
2. Phase and year of development
3. Names of Developer and the Consulting Engineer (Logos optional),
4. Key map showing project location within the City;
5. Site Plan showing the immediate area of subdivision/construction
6. Drawing Index Table that lists each drawing with its associated drawing number, revision number and drawing description

3.2 GENERAL NOTES (GN)

All of the notes specific to the project but of a general nature, such as instructions to contractors, warnings, special provisions, material specifications, etc. should be included on this sheet. A general Legend could also be included.

Depending on the number of notes and space availability on other sheets, alternatively, the General Notes and legend could be shown on the Overall Utilities drawing sheet.

3.3 OVERALL UTILITIES PLAN (OU)

The Overall Utilities Plan shall identify the following information with respect to each component of deep utility (water, sanitary, storm) and shallow utility (power, gas, cable, telephone) infrastructure.

Utility structures and appurtenances should be shown in a way that differentiates between existing and proposed; labels are the preferred way of achieving this, as detailed in Section 2 Clause 2.9.

Manhole (SAN and STM), catchbasin, and catchbasin lead data should be presented in tables; if there is not enough room on this sheet, they may be located elsewhere, for example on the General Notes sheet, as long as there is a sheet reference.

Ponds, channels etc. can be shown in a very general manner, as they should have their own profiles or detail sheets.

Details such as watermain bends, fire flows, jack-and-bore/directional drilling locations, manhole drops etc. shall be shown on the Plan and Profile Drawings, described later in this section. Material specifications such as Pipe Type and Bedding should be included in the General Notes or shown as a note on this sheet.

3.3.1 Water Distribution System

The following items are to be included at a minimum;

1. Pipe size and material (noted parallel to the pipe if space permits)
2. Main alignments
3. Hydrants
4. Valves
5. Fittings
   a) sampling stations
   b) valve chambers
   c) pressure reducing valves
   d) blow offs
   e) air releases

3.3.2 Sanitary Sewer System

The following items are to be included at a minimum;

1. Pipe size and material (noted above and parallel to the pipe if space permits)
2. Main alignments
3. Direction of pipe flow denoted by an arrow on the pipe
4. Manholes with identification numbers
5. Invert elevation at all manholes (rim, upstream, downstream)
6. Identify valves and air releases for forcemains
7. Sanitary Manhole Data Table showing
   a) Manhole type and size
   b) Manhole frame type (i.e. F90, F80) and manhole identification numbers,
   c) Geodetic coordinates (Northing and Easting) with Coordinate system noted
   d) Identify Drop Manholes (interior/exterior)

3.3.3 Storm Sewer System

The following items are to be included at a minimum;

1. Pipe size and material (noted above and parallel to the pipe if space permits)
2. Main alignments
3. Invert elevation at all manholes (rim, upstream, downstream)
4. Direction of pipe flow shown as an arrow on the pipe
5. Manholes, catch basin manholes, and manhole identification numbers
6. Catchbasins with identification numbers
7. Catchbasin leads
10. Manhole frame and cover type
11. Manhole material type and size
12. Storm Manhole Data Table showing:
    a) Manhole material type and size
    b) Manhole frame type (i.e. F90, F80) and manhole identification numbers
    c) Geodetic coordinates (Northing and Easting)
    d) Identify Drop Manholes (interior/exterior)

13. Catchbasin Data Table (if not provided on the Plan and Profile Drawings) showing;
    a) Catchbasin and frame type
    b) Lead diameter, slope, and length

14. Drainage Structures - Outfalls, Culverts, Control Manholes, Weirs, Rural Ditches, Drop Structures, Swales, Drop Structures shown and labeled with only basic information (i.e. name label, centerlines, outlines, etc.)

15. Detention Ponds - shown in a general nature, for example, top and bottom contours inlet/outlet structures, outline of playing field (if applicable), etc.

3.3.4 Other Information Required

1. Alignments for all shallow utilities including power, telephone, cable television, and gas
2. Service locations to each lot (Water, Sanitary, Storm)
3. All lot dimensions

3.4 OVERALL LOT GRADING PLAN (LG)

Where the Overall Utilities Plan pertains mainly to underground infrastructure, the Overall Lot Grading Plan focusses on above-ground improvements, and the implementation of a cohesive land drainage scheme. The Overall Lot Grading Plan shall identify the following:

General Drawing Requirements

1. Existing ground contours, existing spot elevations
2. The portion of the storm drainage system visible above-ground: Catchbasins, Manholes, etc., complete with labels
3. Major overland flow routes, proposed ponding areas and depths
4. Proposed top and bottom ground contours for berms, stormwater management facilities, drainage ditches
5. Any areas of cut or fill greater than or equal to 1.2m in depth delineated
6. Any notes relevant to individual on-site stormwater management, drainage outlet, etc.
7. Location of hydrants and sanitary manholes (no labels required)
8. Test hole locations and original ground elevations at test hole location, elevation of the groundwater level and the date recorded

Lot Grading Details

1. Grading Type for each lot
2. Proposed grades (elevation, slope and directional arrows) at all lot corners
3. Proposed elevations at all corners, grade changes, and spot elevations, and slopes across all public land (i.e. Lane, Public Utility Lot Municipal Reserve) sufficient to demonstrate overall grading scheme and to guide detailed lot-level grading plans
4. Back of walk elevations at lot lines, at critical drainage locations or if slope deviates from standard 2.0% boulevard grade
5. Service locations (represented by a symbol) and invert elevations
6. Proposed minimum first floor and footing elevations if necessary to protect from flooding
7. Recommended ground (landscape) elevation at house

Major Surface Drainage Details

1. Proposed grades (elevation, slope and directional arrows) along gutter line, ditch centerlines, critical swales, and high and low points
2. Roadway PI elevations
3. Location of trapped lows / ponding areas, depth of ponding in 1:100 year event, overflow elevation and location
4. Minor drainage catchment areas, particularly those that drain to municipal reserves, public utility lots and shared swales through easements on private land

3.5 OVERALL TRANSPORTATION PLAN (TR)

If necessary to maintain legibility on the drawing sheets, the transportation design should be presented on its own drawing. The Overall Transportation Plan focusses on the Geometric Transportation Design, and shall identify the following information with respect to each component of Roads, Laneway, and Walkways:

1. All above-ground safety and geometry related road features, such as traffic control signs, road name signs, pavement markings, traffic signals, medians, driveway widths, curb radii, horizontal curve radii, road widths, taper lengths, etc.,
2. Note the type of pavement markings (thermoplastic resin versus paint), all specifications for signage as per TAC Manual of Uniform Traffic Control Devices and City of Grande Prairie Construction Manual,
3. Sidewalk and Paths, Sidewalk Ramps.

Please note that if no Transportation Plan is provided, much of this information shall be shown on the Landscaping and Surface Hardware Plan and/or the Plan & Profile Drawings.

Drawing Basics:

1. Road and Lane names (e.g. Lane "A"),
2. Road Allowance widths,
3. Carriageway widths (Face of Curb to Face of Curb),
4. Sidewalk/Pathway material and width, and Sidewalk Ramps
5. Boulevard widths (Property Line to Face of Curb),
6. Curb and gutter type (curb height if barrier); can be shown as a note.
7. Centreline and Face of Curb Horizontal Curve data (radius, length of curve),
8. Face of curb radii and curve length for all curb returns (general note acceptable),
9. Reinforced lane and/or driveway crossings,
10. Temporary access roads and/or turnarounds,
11. Transit Stops, Bus Bays, etc.
12. Pavement Markings,
13. All traffic control signage.

3.6 LANDSCAPING AND SURFACE HARDWARD PLAN (LSH)

The Landscaping and Surface Hardware Plan, essentially, shows all above-ground street furniture and appurtenances. The following information with respect to each component of landscaping, surface hardware, furniture, park equipment and signage should be shown on this plan:

General Drawing Requirements

1. Show all existing and proposed Municipal Improvements visible above-ground located within and/or adjacent to the site, for example: hydrants and valve locations, catchbasin and manhole covers (symbols only – no labels required), etc.
2. Show proposed basic layout of park, school and recreational facilities including playgrounds, baseball diamonds, sports fields, buildings, pathways, rinks, tennis courts, etc., including appropriate grades. Note that it is expected that these facilities will also have a detailed lot-level landscaping plan for review and construction, discussed in Clause 3.10,
3. If no Overall Transportation Plan is provided, pavement markings, road geometry, and traffic control devices shall also be shown on this drawing.

Landscaping

1. The Landscaping components of the Landscaping and Surface Hardware Plan are intended to be general in nature to guide the requirements of the Servicing

   Agreements and to provide an overall scheme to be refined and conformed to by the Detailed Landscaping Drawings.
2. Show all surface restoration areas (i.e. topsoil and sod/seed landscaping areas or revegetation areas).

3. Location, type (species) and size of all proposed and existing trees and shrub plantings not covered in a Detailed Landscaping Plan.
4. Refer also to Detailed Landscaping Drawing requirements.3.6

Surface Hardware

1. Location of driveways (drawn to scale)
2. Fencing – Park, Noise Attenuation, Silt. Note that if an Erosion and Sedimentation Control Plan is provided, it is not necessary to show Silt Fencing on this drawing.
3. Light Standards, shallow utility boxes and pedestals, if available at the time of submission
4. Bus Bays, Canada Post Box locations*
5. Walkways, sidewalks, and trails

*Please note that it is the Developer's Consultant's responsibility to coordinate with Canada Post on new developments to determine suitable mailbox locations.

Furniture

1. Barricades - Bollards, PUL Barriers
2. Park/Recreation Structures - Benches, Picnic Tables, Litter Receptacles, Dog Waste Bag Dispensers,
3. Rink Light and Hydrant locations

Signage (if not shown on Overall Drawings)

1. Traffic Control Signs,
2. Road Name Identification Signs
3. Playground Signs
4. Storm Pond Information and Warning Signs.

3.7 EROSION AND SEDIMENTATION CONTROL DRAWINGS (ESC)

All development project drawing sets should include an Erosion and Sedimentation Control (ESC) drawing. The following concepts and features should be shown on a dedicated ESC drawing. For very straightforward or small projects, these items could be shown on other drawings, as long as legibility and clarity is maintained.

1. Identify natural features that are to be preserved and/or removed,
2. Show any structures to be removed,

3. Show and dimension any top of bank setbacks, Environmental Preservation setbacks, and any other required “No Touch Zones”,
4. Identify intended clearing and grading on adjacent lands, including details of edge conditions, back sloping requirements, and areas where topsoil is to be placed and/or seeded until natural conditions are restored,
5. Show Phase boundaries: indicate the area expected to be developed during the current year and the type of soil stabilization proposed for areas to be developed in following years,
6. Any unusual site conditions,
7. Details of Borrow Pits, topsoil, spoil or fill stockpiles to be maintained on site; include height/depth, width, length and volumes,
8. Identify all Erosion and Sedimentation Control Measures to be employed such as but not limited to: tree hoarding fence, construction fence, siltation control fence, rock check dams, straw bales, coir logs, erosion control blanket, turf reinforcement mat, mud mats, catchbasin silt traps, riprap treatment, etc.

3.8 WATERMAIN AND TESTING PLAN (WM)

1. Show all watermain pipes and appurtenances (i.e. valves, hydrants, reducers, blow-offs, etc.) complete with labels,
2. Hydrant coverage circles,
3. Calculated Hydrant Fire flow,
4. Testing and sampling sequence (proposed sequence of chlorination, flushing and testing, including valve opening and closing sequence),
5. All sampling / testing points including permanent, and temporary, as well as chlorine injection points. Test points shall be numbered for referencing purposes,
6. Show receiving sanitary sewer manholes.

3.9 POND DRAWINGS

The Pond Drawing(s) are intended to provide additional detail for design review and construction of stormwater management facilities associated with the project. The number of drawing sheets dedicated to this purpose should vary depending on the complexity of the structure(s) being constructed.

Pond Drawings shall typically include a plan view and at least one section/profile, as well as detail drawings of the outlet control structure and any other unique components (such as weirs, inlets, valves/gates, low-flow channel sections, etc.)

As the Pond Drawings are specific to one feature of the development, the maximum scale used should be 1:500 Horizontal. Vertical representations in Profile or Section views should have a 10-times vertical exaggeration.

The Pond Drawings shall generally contain the following details:

1. Plan view of entire pond/stormwater management facility, including all inlet and outlet structures, scour prevention, sediment traps, low-flow channels, specifications for grates.
2. Typical Details of inlet/outlets, weirs, channels, and any other unique components,
3. A profile (and sections, if necessary) of the facility,
4. Elevations, shown as a labeled contour, on both the Plan and Profile/Section views, of the following:
   - Top of Pond
   - Bottom of Pond
   - Permanent Pool / Normal Water Level (NWL), if applicable
   - 100-year / High Water Level (HWL)
   - 5-year return storm ponding elevations
   - Estimated “Landscaping Limit” (approximately the 1:50 year return event, for the purposes of establishing the lowest elevation at which trees shall be planted and landscaping area)
5. The following data shown as a note or table on the drawing:
   - Catchment area in hectares
   - Volumes required for 5 and 100-year storm detention
   - Minimum allowable building opening elevations for lots abutting the pond

3.10 PLAN AND PROFILE CONSTRUCTION DRAWING REQUIREMENTS (PP)

The Plan and Profile Drawing is divided into two parts; one plan view (top) and one profile view (bottom).

3.10.1 General Requirements

The Plan and Profile drawings are intended to show additional detail for review and construction than the Overall drawings, and use a smaller scale (typically 1:500 Horizontal and 1:50 Vertical).

These drawings should show all proposed and existing above and underground servicing complete with labels, along with any detailed construction information that may not be practicable to show on the overall drawing, such as locations of trenchless installation, barricades, dimensions, etc.

Preliminary plan and profile information should be provided for adjoining subsequent phases to demonstrate cohesiveness and confirm serviceability.

3.10.2 Plan View

The following information should be illustrated in the plan view:

Road Geometry

1. Centreline chainage (distance)
2. Carriageway widths (Face of Curb to Face of Curb),
3. Boulevard widths,
4. Sidewalk and walkway type and width,
5. Face of curb radii for all curb returns, with Beginning (BVC) and End (EVC) denoted,
6. Centreline horizontal curve data (radius, length of curve, and deflection angle), identify Beginning of Horizontal Curves (BHC), Point of Curve to Curve (PCC's) and End of Horizontal Curves (EHC's),
7. Reinforced lane and/or driveway crossings,
8. Sidewalk ramps,
9. Temporary access roads and/or turnarounds,

Elevations

1. Roadway PI elevations at Centreline
2. Gutter line and curb return elevations and grade
3. Lane and Public Utility Lot grading information (i.e. PI elevations, distance, slope, spot elevations at property line, centerline)
4. Berms complete with top of berm grades if visible within limits of viewport

Utilities

The following information related to underground utilities should be illustrated in the plan view:

1. Reference drawing number(s) and/or matchlines for adjacent sheets
2. Catchbasin manholes and catchbasins, including type and identification number
3. Location and rim elevation of catch basins
4. All underground utilities, including service connections
5. Any temporary or permanent culverts, utility ducts, bollards, barriers and trenchless installations

6. Pipe diameter, length, pipe material and bedding materials
7. Hydrant locations
8. Valve locations
9. Fitting sizes and locations, including sampling stations, valve chambers, pressure reducing valves, blow offs and air releases
10. Manhole and catch basin locations and identification numbers
11. Catch basin lead sizes, lengths, and alignment
12. Direction of flow (storm and sanitary mains)

3.10.3 Profile View

The profile view should illustrate the following road and utility information:

1. Stationing for road, lane and/or utility lot centre lines, starting at the property line
2. Centreline grade (Existing and Proposed)
3. Vertical and horizontal point of intersection (PI) elevations for utility mains and surface improvements
4. Length and grade between PI's for utility mains and surface improvements,
5. Vertical curve information, if applicable
6. Vertical alignments of manholes, valves, and hydrants
7. Hydrant flange elevations
8. Manhole rim and invert elevations
9. Utility main lengths, sizes, materials, gradients, capacity and velocities
10. Utility Crossing information (to demonstrate vertical separation); data to include vertical separation in metres, station, and pipe elevations

PULs and Drainage Blocks

PULs, Drainage Blocks or other linear blocks should also be represented in the Plan and Profile Drawings. In addition to the above typical Plan and Profile requirements, the following should also be provided:

1. Any linear infrastructure within the Block (crossing or parallel to the alignment)
2. Typical section(s)
3. Construction instructions (i.e. restoration details, construction sequencing, flow bypass methods, etc.)

3.11 TYPICAL CROSS SECTION DRAWING(S) (CS)

This drawing shall show cross sections for all roadway designations. In general, cross section should match those cross sections that are provided in Section 20.

Cross sections will also be required for lanes, public utility lots and linear municipal reserves lands, particularly those that serve as pedestrian or major drainage corridors.

Any other custom details or section drawings specific to the project but not included on other sheets should be found in this section.

3.12 STANDARD DETAIL DRAWING(S) (SD)

These drawings should include construction details for municipal improvements. In general, details shall match those included in the Standards Guidelines for Construction of Municipal Improvements.

All City of Grande Prairie Standard Drawings specified and/or referenced in the design drawings shall be included in the drawing set. This is important for record purposes; the standards change on a regular basis, and it has proven necessary, sometimes long after construction, to know what the contemporary standard was. Further, it is a way of ensuring the contractor(s) have the correct specifications on-site if it is included in the package.

3.13 DETAILED LANDSCAPING DRAWINGS (LS)

While the Landscaping and Surface Hardware drawing is intended to be general in nature to guide the overall development; the Detailed Landscaping Drawings are designed at the lot-level (i.e. individual park blocks, pond blocks, PULs etc.). The Detailed Landscaping Drawings supersede the Landscaping and Surface Hardware Plan, but are expected to conform to the overall principles demonstrated in the LSH Plan.

Detailed Landscaping drawings are to be included as part of the Final Drawing Set, and are not to have their own cover sheet.

The Engineer is not required to sign and stamp the landscaping drawings. However, if the Detailed Lot Grading Plan (commonly part of the Landscaping drawings) varies from, or is more detailed than the Overall Lot Grading Plan, the Detailed Grading Plan must be signed off on by the Engineer. Alternatively, the Overall Lot Grading Plan shall be revised / redlined and signed by the Engineer.

A Planting Species Table shall accompany detailed Landscaping submissions that shows the Latin and common names, size and number of each tree/shrub to be planted.

The Detailed Landscaping Drawings should include all necessary detail such as park equipment, tree and plant species and size, decorative elements, paths, etc. as required by City Staff and Landscaping and Parks Standards (Design Manual Sections 16 and 17).

4. SUBMISSION OF PROPOSED CONSTRUCTION DRAWINGS

One complete set of Construction Drawings shall be submitted to each of the following Agencies for review and approval:

1. Engineering Services Department,
2. Aquatera Utilities,

Additional sets of drawings may be requested if the proposed infrastructure or development may impact on the adjacent municipal jurisdiction or areas that are under the control of provincial or federal authorities.

Upon completion of all revisions, the Consulting Engineer shall submit one set of the revised Construction Drawings to Aquatera and one to Engineering Services for review.

Formal submissions should include a digital version of the drawing set, in PDF format. This may be submitted via email or disk. Preliminary, informational or interim submissions may be made exclusively in PDF if desired.

Preliminary / Informal submissions are encouraged in order to establish dialogue with Engineering Review Staff, and avoids unnecessary expenditures due to finalizing a detailed design based on incorrect assumptions or requirements. This can subsequently assist the expedition of Formal Submission review.

Revisions made pursuant to City/Aquatera comments should be encircled by “cloud” bubbles in order to facilitate subsequent reviews.

Upon incorporation of all revisions, the Consulting Engineer shall submit a set of stamped and sealed Construction Drawings to the Municipal Engineer for signature. If the drawing set includes improvements to the water or sanitary system, then final drawing submission should be submitted to Aquatera for approval prior to City approval.

5. CHANGES (REVISIONS) TO APPROVED CONSTRUCTION DRAWINGS

The Approved Construction Drawings form an integral part of the Servicing Agreement between the Developer and The City for new private development projects.

The Consulting Engineer shall submit revised Construction Drawings if significant design changes are made following approval and submission of the Construction Drawings and for private developments following the execution of the Servicing Agreement. Changes include but are not limited to revisions to drainage boundaries, pipe sizes, pipe or roadway grades, roadway cross-sections, pavement structures and/or other significant changes. All changes shall be identified on the original Approved Construction Drawings by crossing out the original information and adding the revised information (similar to the method used for preparing “As-constructed” Drawings). Changes shall be coloured red on all copies submitted to the City for approval. A new drawing may be submitted if significant changes are being made.

The Municipal Engineer must approve any significant changes to the Approved Construction Drawing.

6. AS-CONSTRUCTION SUBMISSIONS

6.1 GENERAL REQUIREMENTS FOR AS-CONSTRUCTED SUBMISSIONS

Submission of as-constructed information should include, but not be limited to, the following improvements:

- Water, sanitary and storm utility,
- Concrete work and gravel/paved roadways,
- Pavement marking and traffic control signage,
- Gravel and/or paved lanes,
- Sidewalks and Pathways
- MR, PUL and storm pond grading
- Berm and ditch grading
- Noise Attenuation Fencing

The Developer shall submit hard copy, digital and PDF as-constructed drawings.

Digital files of As-constructed Drawings must be submitted in AutoCAD DWG formats. The digital data must conform to the “Digital As-constructed Drawings Standards” as outlined in Clause 8 of this Section.

6.2 AS-CONSTRUCTED SUBMISSION TIMELINES

1. The As-Constructed drawings shall be submitted as part of the application for an Initial Construction Completion Certificate (CCC). Upon request from the Consulting Engineer, the Municipal Engineer may allow the as-constructed drawings to be submitted no later than six (6) months of the issuing of a Construction Completion Certificate.

2. If as constructed information cannot be provided for improvements such as PUL and MR Grading, pathways, berm and fencing at the same time as constructed information is submitted for water, sanitary, storm and roadway improvements, the Consulting Engineer will be required to update the as-constructed drawings to reflect the as-constructed information for those improvements once they are constructed as part of the application for CCC

3. As-constructed information for all Municipal Improvements must be received and accepted prior to the submission of the final FAC

6.3 HARD COPY AS-CONSTRUCTED SUBMISSIONS

Bond paper as-constructed drawings for all improvements, to form a complete line drawing set, must be submitted for scanning to the GIS drawing system. No air photos or solid fills are to be included on these drawings.

The hardcopy drawings should be professionally stamped, signed, and dated to indicate as-constructed information.

6.4 PDF AS-CONSTRUCTED SUBMISSIONS

As-constructed digital files of the complete drawing set (i.e. title page, index page, overall plans, plan / profile pages, details, and sections etc.) equivalent to the hardcopy set are to be submitted in a “PDF” format

The City reserves the right to not process or release any further CCC’s or FAC’s and/or security reductions if any of the above conditions have not been met.

6.5 AS CONSTRUCTED INFORMATION

Submission of as-constructed information should include, but not be limited to, the following details with respect to each type of improvements:

6.5.1 Storm Water Management / Grading

1. Extent of encroachment into adjacent lands for backsloping or other purposes, if applicable,
2. Test hole locations
3. As-constructed ground contours,
4. Details of topsoil stockpiles; include location, height, width, length and volumes,
5. Cut/Fill as-constructed elevations and depth of cut or fill,
6. Areas with fills 1.2 metre are to be highlighted on the drawing(s).
7. Revised lowest top of footing elevation (based on the higher of as- constructed sanitary or storm inverts, plus 0.85 m for lane/utility lot servicing or 0.70 m for street servicing).

8. Revise Back of Walk (BOW) and Lane/PUL elevations if variance from design is greater than 10mm
9. Lot corner surface elevations

6.5.2 Roadways

1. As-constructed elevations are to be provided at the gutter line at the following locations and shown on the Plan/Profile as-constructed drawings:
    a. Vertical Points of Intersection (VPI's). (The as-constructed elevation at a vertical point of intersection on a vertical curve is to be the existing pavement elevation plus or minus mid-ordinate distance (M) to theoretical vertical point of intersection),
    b. Beginning of Vertical Curves (BVC's) and End of Vertical Curves (EVC's),
    c. Beginning of Horizontal Curves (BHC), Point of Curve to Curve (PCC's) and End of Horizontal Curves (EHC's),
    d. Beginning (BVC), Midpoint (MP) and End (EVC) for all curb returns,
    e. Location and rim elevation of any catch basins.
2. Grade and elevation changes must be noted if the difference from design to as-constructed is greater than 10 mm.
3. Spot elevation checks should be completed following paving to verify grades, VPI elevations and slope.
4. Confirm all centreline and face of curb (F.O.C.) radii.
5. Revisions to type of sidewalk and/or curb and gutter installed.
6. Revisions to pavement cross-section, including location of filter fabric.
7. Revisions to pavement markings.
8. If the Developer installs the traffic, street name, and information signs utilizing the services of a Private Contractor, the Developer shall complete the Sign Survey Sheet forms and procedures available from the City Transportation Services department. The City will complete the Sign Survey Sheet if the Developer retains City Forces to install the traffic, street, and information signs.

6.5.3 Lanes and Public Utility Lots

Spot elevation checks should be completed following lane and public utility construction to verify grades, VPI elevations and slope.

6.5.4 Utilities

1. Revisions to lengths, grades, invert elevations, alignments, and locations of vertical points of intersection for sanitary, storm, and water mains.
2. All hydrants, valves, fittings, manholes, catch basins, and other appurtenances shall be noted and dimensioned in two directions. Also note rim and invert elevations of manholes and catch basins and flange elevations of hydrants.
3. As-constructed invert of water, sanitary, and storm service stubs at property/easement line.
4. Location of water, sanitary, storm services, and curb stops dimensioned in two directions.

6.5.5 Completion Date

The month and year of completion of construction shall be shown on each Plan for both underground utilities and surface improvements.

7. DIGITAL AS-CONSTRUCTED DRAWING STANDARDS

7.1 OVERVIEW

Digital files of As-Constructed Drawings must be submitted in AutoCAD DWG format.

Digital files shall be submitted on media such as portable media storage, FTP, or Email that is marked with the drawing names that it contains as well as the subdivision or project name for which it was prepared.

Digital files must match hard copy as-constructed drawings. AutoCAD file names to match or cross reference hard copy sheets. Suggestion is to use the following filename standard “consultantfilename_pagenumber.dwg”

For each hardcopy drawing submitted, there must be an individual AutoCAD drawing. The digitals submitted should not contain more than one drawing layout.

7.2 SUBMITTING FILES

The following illustrates the criteria for preparing an as-constructed file for submission.

1. Ensure all plan design is represented in model space. Paper space design drawings will not be accepted. Plotting layout shall be in paper space.

2. Include all external references files (xrefs), logos, photos and any blocks not stored in the drawing with submissions. AutoCAD files and their attached xrefs are to be located in the same directory. Hardcode directory paths are not allowed.

3. Drawing coordinates, rotation and scale must be relative to the geographic coordinates, rotation and scale of the coordinate and projection system as approved by the City of Grande Prairie.

CANA83-10TM115 coordinate system
Description: Alberta NAD83; 10 degree Zone, centred at 115 deg West
EPSG: **3401**
Datum: NAD83 (NAD 1983, Alaska, Canada, Continental US, Mexico, Central America)

Projection: Transverse Mercator
False Northing: 0
False Easting: 0
Central Meridian: -115° 00' 00"
Origin Latitude: 0 00' 00"
Scale Reduction Factor at the Central Meridian: 0.9992

1. Submit a transmittal form that shows the following

    - Project Name
    - Consultant
    - Contract Number
    - Graphic File Format (DWG)
    - Version (e.g. AutoCAD R14)
    - Coordinate System (NAD83 CANA83-10TM115)

2. Consultant/Contractor must obtain the right for the City of Grande Prairie to use any copyright entities included in the submission at no cost to the City.

3. The Consultant/Contractor should ensure that all datasets provided by GPGIS are updated prior to final submission to the City. Updated data can be acquired through the City's Open Data Portal.

4. Hardcopy record drawings should have original Engineer or Architects' signature on each sheet.

5. Legal survey plan should not be included in the contract set.

6. Use standard AutoCAD fonts, line types and hatch patterns, or ensure they are included in the submission.

7. The acceptable media for submission includes: portable media storage, FTP or Email.

7.3 DRAWING STANDARDS

The following specifications must be used for the preparation of digital as-constructed drawings:

1. The City encourages the submission of Civil 3D files, in the object-based design environment. Design components such as points, surfaces, alignments, profiles, corridors, pipe networks and sections are drawing objects with "intelligence" and associated attribute information should be retained in order to automate the CAD to G.I.S. conversion.
2. All plan designs are to be done in model space, while all profiles are to be in paper space.
3. All objects should be created with attributes set to "by layers".
4. Blocks are to be created on layer "0" with attributes set to "by layer".
5. All layer names should be descriptive and describe the content.
6. Numbered layers will be accepted only if accompanied by test document with full text conversion descriptors, e.g., layer 1 – surveyed block lines.
6. Pipes are to be drawn as a single continuous element from feature to feature (i.e. manhole to manhole, reducer to tee, bend to hydrant). Lines or Polylines are preferred. Multiple pipes at a manhole should all connect to the centre point of the manhole.
7. Flow arrows are to be placed on all pipe segments for the sanitary and storm systems. The insertion point of the arrow must be placed at the downstream end of the pipe, at approximately 2.5 m back from the end of pipe (i.e. to ensure that the flow arrows on sanitary and storm sewers are located on the outer edge of the manhole symbol).
8. Valves are placed on top of the water pipe. The water pipe is not broken at the insertion point of the valve.
9. All dimensions are to be in SI metric units and set to 2 decimal places
10. All mapped objects types must be separated into different layers, i.e. text on text layer(s), line work on line work layer(s), and block on block layer. Multiple object types must not be consolidated on one layer.
11. City datasets can only be used for external references only. They must not be copied or renamed into CAD drawings.
12. Zoom to extents to identify potential orphaned objects and remove.
13. Drawing must be in the newest version of AutoCAD or at least not older than 2013 Version.
14. Layer styling should be used in creating plots. Use the WYSIWG Plot Standard. Ensure that XREF is not on DEFPOINTS layer, it should be in a layer that plots.

8. FUTURE STANDARD REVISION UPDATES

The following is a list of items that may be considered for incorporation into future updates of the guidelines:

1. Digital files of As-constructed Drawings to be submitted with AutoCAD Attribute data attached to various AutoCAD Blocks in support of City streamlining asset record management process.
2. Development/update of layering conventions.
3. Unique requirements for Capital Projects.

SECTION 3 – CONSULTANT GUIDELINES

1. GENERAL

This Section describes the Engineering Services to be provided by a Consulting Engineer relative to the construction, installation, and inspection of Municipal Improvements as listed in a Development Agreement for private development projects and in an Engineering Agreement for City Projects.

The Consulting Engineer is expected to provide a professional level of inspection services culminating with the signing of the certification statement in the Construction Completion Certificate and Final Acceptance Certificate.

It shall be the responsibility of the Consulting Engineer to determine if inspections and/or testing in excess of the levels specified in the Contract Specifications are necessary, and to so advise the Developer and the Municipal Engineer.

2. CONSULTANT ENGINEER / CITY / AQUATERA RELATIONSHIP

2.1 PRIVATE DEVELOPERS

There is no direct contractual relationship between the Consulting Engineer and the City nor Aquatera for private development projects. However, as the Consulting Engineer is the authorized representative of the Developer, the Municipal Engineer and Aquatera have the right to request that the Developer, through the Consulting Engineer, correct deficiencies as the Engineer observes them. It is understood and agreed that the Developer is and shall remain responsible to the City and Aquatera for full and proper performance of all obligations and Work included in the Servicing Agreement.

The Municipal Engineer may, as specified in the Servicing Agreement stop the construction and installation of the Work.

Should the Developer for any reason not fulfil the obligations of the Servicing Agreement, abandon the Project, not complete the works, or elect not to correct the deficiencies identified by the Municipal Engineer or the Consulting Engineer within the specific timelines, the Consulting Engineer shall not be held responsible to complete the Project. In order to complete the obligations of the Servicing Agreement, the City recognizes the advantages of utilizing the same Consulting Engineer and may, at its option, give priority to the said Consulting Engineer where practical.

2.2 CITY DEVELOPMENTS / PROJECTS

For City Developments and Projects, there is a direct contractual relationship between the Consulting Engineer and the City as defined in an Engineering Agreement.

Any directions to the Consulting Engineer shall be as specified in the Engineering Agreement.

3. REQUIREMENTS PRIOR TO CONSTRUCTION

Prior to the start of Construction, the following conditions must be completed:

- Provision of the final Detailed Engineering Drawings, signed off by the City, **Aquatera (if Private Development),** and the Developer's Engineer, to the City in the below noted quantities:
  - Three (3) full sets of drawings, AO 610mm x 915mm (24" x 36") and the City will distribute as follows:
    - City of Grande Prairie – Engineering Services
    - City of Grande Prairie – Transportation Services
    - City of Grande Prairie – GIS department
  - One (1) copy of the Storm Water Management Plan, 610mm x 915mm (24" x 36")
    - Engineering Services
  - Two (2) copies of the Surface Hardware Plan showing driveway locations, 280mm x 432 mm (11" x 17")
    - Engineering Services
    - Canada Post
  - Four (4) copies of each of the Overall Utility, Surface Hardware and Cross Section plans, 610mm x 915mm (24" x 36") and the City will distribute as follows:
    - Atco Electric
    - Atco Gas
    - Telus
    - Eastlink
  - The digital construction drawings should be submitted as follows:
    - All digital drawings should be DWG format with complete LAYOUT for each sheet
    - Include all files that are required to view the drawing package (ex. XREF files)
  - Servicing or Development Agreement endorsed by the City and Aquatera (if Private Development)
  - Environmental Construction Operations (ECO) Plan

- Notification given to the Municipal Engineer, in writing, at least 48 hours prior to the commencement of construction.
- Power, Gas, Telephone and Cable TV Alignment Approvals

A copy of the Overall Utility Plan, Surface Hardware Plan and the Cross Section drawing will be forwarded to each utility company for approval of their alignments. Following a review of their alignments, each utility company is required to submit an approval letter to the City of Grande Prairie. See Section 13 for additional information.

4. REQUIREMENTS DURING CONSTRUCTION

4.1 GENERAL

The following procedures shall be followed during the course of construction.

4.2 ENGINEERING SUPERVISION

The Developer's Engineer shall be responsible for the layout and inspection of all municipal improvements to ensure conformance with the approved detailed engineering drawings, plans and specifications. If changes are required to the design the Developer's Engineer shall provide red line drawings to the City and Aquatera for approval. The Developer's Engineer or their authorized representative shall conduct on-site regular inspections during construction and shall have a presence during critical or sensitive times.

A copy of all approved Detailed Engineering Drawings and contract specifications shall be maintained at the construction site during the installation of improvements.

In addition to supervision carried out by the Developer's Engineer, the Municipal Engineer or their designated representative may periodically inspect the work and assist in coordinating the subdivision works with any related municipal works. The Municipal Engineer shall notify the Developer's Engineer of any unacceptable practices or use of materials. If remedial action is not taken to the satisfaction of the Municipal Engineer, he/she may order the work to cease. The Municipal Engineer shall be given a minimum of 48 hours-notice when requesting a joint inspection with the Developer's Engineer and/or Contractor.

The Developer's Engineer shall inspect all construction including the installation of the shallow utilities to ensure conformance to the servicing standards.

4.3 TESTING

4.3.1 Material Testing

All materials supplied and installed shall comply in all respects to The City of Grande Prairie Construction Specifications. The Developer shall appoint an accredited material-testing firm to carry out quality control and testing to ensure that construction is in accordance with the approved design. It shall be the responsibility of the Developer to provide materials testing services during construction to ensure compliance with standards at the minimum frequency of testing specified in the City Construction Manual and Aquatera's Construction Specifications.

All tests results shall be sorted and organized by the Consulting Engineer in an orderly fashion; by sequence of construction, with retest results attached to original test results for quick identification and review. A Summary analysis of test results shall be required at time of CCC application to include, but not necessarily limited to:

a) the minimum number of tests required,

b) the number of tests completed,

c) number of failed tests and consequently all re-tests,

d) statement of overall compliance to testing standard or standards,

e) explanation of any variations in the testing schedule and/or results, and

f) all applicable proctors and sieve analysis.

The summary shall include sufficient information for readily locating the test areas in the development area. The summary shall be signed and stamped by a Professional Engineer certifying the authenticity and accuracy of the statement.

In addition to laboratory and field material testing, proof-rolls using a fully loaded gravel truck or water truck shall be required on the prepared subgrade prior to gravel placement and on the gravel base prior to paving. All proof-rolls shall be supervised by the City and must be performed in accordance with the Engineer's recommendations.

4.3.2 Deep Utilities

It shall be the responsibility of the Consulting Engineer to ensure that the Contractor disinfects and tests all watermains and tests all sewers prior to the acceptance by Aquatera. The Municipal Engineer and Aquatera shall be advised at least sixteen (16) City business hours prior to any testing that requires witnessing from the City and/or Aquatera.

The Consulting Engineer or their authorized representative shall review all test results immediately once they become available, including CCTV inspections of sewer mains and services. All new sewers shall have CCTV inspections prior to CCC, and shall be

submitted for Storm, to the City, and for Sanitary, to Aquatera. CCTV inspection of storm sewers under roads shall not occur prior to road construction (i.e. placement of asphalt). Where testing indicates that the required standards have not been met, the deficient areas shall be repaired or re-worked and subsequently re-tested until the standards have been met.

4.4 EXISTING UTILITIES

4.4.1 Interference and Operation

Any of the improvements to be installed by the Developer shall be installed in such a manner as to least interfere with existing services. Any additional costs incurred by the City as a result of such interference shall be borne by the Developer. Underground subdivision improvements shall not be permitted to operate as part of existing municipal improvements until the respective subdivision improvements have been inspected, tested and approved in writing by the Municipal Engineer. This is generally upon issuance of an approved Construction Completion Certificate (CCC) by the City and/or Aquatera.

In the event an excavation occurs outside the boundaries of a subdivision to connect to existing utilities the Developer is required to obtain an Excavation Permit from the City.

In the event that road must be partially or fully closed for a crossing, connection, or pavement construction, the Developer is required to obtain a Barricade Permit from the City for any work within the road right-of-way. In addition, the developer shall provide all detours, signs, flag persons, barricades, advertising, etc. necessary to provide for the orderly control of soil / dust contamination and traffic around the construction area.

4.4.2 Closing of Existing Utilities

Approval shall be obtained from the Municipal Engineer prior to closing of existing services, including roadways, when required for construction. Aquatera staff only will operate any existing valves on the water distribution system.

4.4.3 Existing Utilities

The Developer’s Engineer shall be responsible for the location of existing utilities where crossings or connections occur. This shall be considered incidental to the function and layout of Municipal Improvements. The City is to be notified of any variances that are discovered with respect to the location of existing utilities and this information is to be included as part of the as-built drawing submission.

All connections to existing utilities must be approved by the City and/or Aquatera prior to construction and must be completed by a City/Aquatera approved contractor.

4.4.4 Safety

The developer must, during the construction phase, conform to all safety standards. Any violation will result in a cease work order issued by the City and/or Occupational Health and Safety authorities. All construction safety signs must be properly installed throughout all periods of construction. Subsequently, all traffic control signs must be installed following construction. The City reserves the right to hold back the release of building permits until either temporary or permanent traffic control signs are installed to the satisfaction of the Municipal Engineer.

4.5 EROSION AND SEDIMENTATION CONTROL DURING CONSTRUCTION

All Private Developments requiring a Servicing Agreement, and all City Construction Projects shall include the submission of an Environmental Construction operations (ECO) Plan after drawings are accepted for construction, but prior to the commencement of construction. The ECO Plan is outlined in greater detail in Section 6.

It is expected that all projects, private or public, shall be carried out in a way that, as much as possible, limits the transportation of sediments from the site. There are many ways sediment can be mobilized due to construction activities. These include, but are not limited to the following:

- Mud tracking from construction sites onto adjacent properties and roadways,
- Silt and debris washed into existing storm sewer (drainage) system,
- Silt and debris transported to receiving watercourse by surface runoff and the sewer system,
- Windblown dust.

Refer to Section 6 for additional information on Erosion and Sedimentation Control Best Practices.

5. POST-CONSTRUCTION REQUIREMENTS

Appended at the end of this Section are Construction Inspection Checklists for various construction activities. The Check Lists provide an overview of the work to be completed by a Site Inspector in conjunction with the Work specified on the Drawings and in the Contract Specifications.

The checklists are not intended to be a complete comprehensive list, but rather are to be used as a general guideline by the Consulting Engineer prior to and during construction of the various Municipal Improvements.

Project specific requirements of the Drawings and Specifications will require additional inspections and shall take precedence over any comment included in the Check Lists.

5.1 ACTIVITY PRIOR TO ISSUANCE OF A CONSTRUCTION COMPLETION CERTIFICATE (CCC)

When the Municipal Improvements have been constructed and installed in accordance with the requirements of the plans, a Completion Certificate (CCC) can be applied for. Prior to the submission of the CCC, the Consulting Engineer and the Contractor, shall conduct an inspection of the Work to ensure the work is complete. Following this preliminary inspection, the City, Aquatera, Consulting Engineer and Contractor shall inspect the Work to identify all the deficiencies in the construction, installation, repair, restoration or maintenance of the Municipal Improvements. Note that the Consulting Engineer shall prepare a written list of all minor deficiencies identified and propose a repair period for the minor deficiencies. In the event major deficiencies are found on inspection, the deficiency shall be repaired immediately. After the Contractor has repaired the deficiencies, the

Consulting Engineer shall be responsible for arranging a joint inspection with the Contractor and the Municipal Engineer.

Prior to forwarding any CCC's to the Municipal Engineer, all related outstanding change orders are to be resolved and any omissions are to be approved by the Municipal Engineer.

Prior to issuing the CCC, the City requires that all work be complete and all deficiencies corrected, subject to seasonal shutdown as determined by the Municipal Engineer.

5.2 ACTIVITY SUBSEQUENT TO ISSUANCE OF A CONSTRUCTION COMPLETION CERTIFICATE (CCC)

The Consulting Engineer shall conduct periodic checks of the subdivision during the maintenance period and note any failures, settlements, or other deficiencies in the Work, as well as respond to any "complaint" calls forwarded by The City and/or Aquatera.

Following the issuance of a CCC for a part of the Municipal Improvements, Aquatera and the City, as the case may be, shall assume the normal operation and maintenance (excluding repairs or matters arising from inadequate or deficient design or construction)

of the part transferred to them but excluding landscaping, fencing and facilities owned by any other utility supplier.

The Maintenance Period in respect to any part of the Municipal Improvements shall commence upon the date of the City's written CCC for any such part, and the Developer shall repair or replace the whole or any portion thereof during such Maintenance Period where such repair or replacement is required, as determined by the City, as a result of any cause other than the neglect by Aquatera or the City, their servants, agents or contractors in the use and operation thereof.

Prior to the issuance of an FAC for any landscaping work, the City shall be entitled to require the Developer to replace any trees, shrubs or grass which may have died or failed to achieve proper growth, as determined by the City in its discretion; and further, the City shall be entitled to require the replacement or repair of any other landscaping works such as berms, rip-rap, noise attenuation fencing or screen fencing which may have failed in whole or in part as a result of any cause other than neglect by the City, its servants, agents or contractors in the use and operation thereof.

5.3 ACTIVITY PRIOR TO ISSUANCE OF A FINAL ACCEPTANCE CERTIFICATE (FAC)

When the maintenance / warranty period is complete the Developer or the Developer's Engineer shall arrange for an inspection by submitting an "Inspection Request" to the Municipal Engineer. In attendance at the inspection shall be representatives of the Consulting Engineer, the Contractor, and the Municipal Engineer. Prior to the inspection, the Developer or Consulting Engineer shall review the improvement(s) from a cleanliness perspective. If site conditions are poor in terms of routine maintenance and make it difficult to conduct a proper inspection, the Developer shall arrange and pay for power washing and broom sweeping of all roads in the development area, cleaning of all catchbasins, flushing of all sanitary / storm sewers and final asphalt pavement lift where applicable. As part of this inspection, a sanitary sewer and storm sewer video inspection may be required as per the same conditions in the CCC application. Sanitary and storm main cleaning will only be required if video inspection is deemed necessary.

Prior to issuing the FAC, the City requires that all work be complete and all deficiencies corrected. Once all deficiencies have been corrected, the Consulting Engineer shall request a joint inspection with the Contractor and the Engineer of the Works referred to in the Final Acceptance Certificate. The Consulting Engineer shall prepare a list of the deficiencies, if further deficiencies are noted, and submit the list to the Municipal Engineer.

The City reserves the right to apply charges when a re-inspection of the same work is required.

The Consulting Engineer must submit a FAC stamped and signed by a Professional Engineer recognized by APEGA.

5.4 LANDSCAPING MAINTENANCE

See Section 32 94 14 in the City of Grande Prairie Construction Manual

APPENDIX A – INSPECTION CHECKLISTS

A.1 Water Distribution and Transmission Systems

Water systems shall include, but not be limited to: mains, fittings, valves, hydrants, and service connections stubbing into the lots.

	CCC	FAC
1. Completed Inspection Request form	✓	✓
2. Results, summary, and analysis of materials and compaction testing carried out to ensure compliance to construction standards, and including a 11" X 17" Overall plan showing stationing or reference points, related to testing.	✓	
3. Summary and analysis of Combined Water Pressure and Leakage Test including 11" x 17" Overall Plan.	✓	
4. Summary and analysis of Hydrant Flow Tests, witnessed by the Aquatera including 11'' x 17" Overall Plan.	✓	
5. Copy of Chlorine Residual Sampling Reports for both Primary Disinfection and Bacteriological Sampling Report for Environmental Operations including 11'' x 17" Overall Plan.	✓	
6. Inspection report including a detail deficiency list, if applicable, including 11'' x 17" Overall Plan and a commitment date to complete deficiencies in total.	✓	
7. Completed service connection schedule.	✓	
8. Completed Certificate stamped and signed by Professional recognized by APEGA. The CCC maintenance start period date will be entered by the City.	✓	✓
9. As-built drawings as stipulated in the City Design Manual and/or the Servicing Agreement - upon application, 6 months after CCC.	✓	
10. Tangible Capital Assets Report	✓	

A.2 Sanitary Sewer System

Sanitary sewer systems include but not limited to mains, manholes, and service connections, clean outs and stubbing into the lots.

	CCC	FAC
1. Completed Inspection Request form.	✓	✓
2. Results, summary, and analysis of materials and compaction testing carried out to ensure compliance to construction standards, including an 11" X 17" Overall plan showing the stationing or reference points, as related to testing.	✓	
3. Colour CCTV video inspection of all sewer mains and service connections under simulated flow conditions, in DVD format c/w written report. This shall include existing mains that were connected to as a part of development, whether it involved the use of existing in-line fittings or cutting into the pipe to install insert-a-tees. Report to include an 11" x 17" plan with an Index of tape runs to pipe elements or manholes.	✓	✓*
4. If required by the Municipal Engineer, Results and Analysis of Exfiltration and/or Infiltration Tests.	✓	✓
5. Inspection report including a detailed deficiency list, if applicable, including 11'' x 17" Overall Plan and a commitment date to complete deficiencies in total.	✓	
6. Completed service connection schedule.	✓	
7. Completed Certificate stamped and signed by Professional recognized by APEGA. The CCC maintenance period date will be entered by the City.	✓	✓
8. As-built drawings as stipulated in the City Design Manual and/or the Servicing Agreement – sixty calendar days after CCC, or by March 1 of the following year, whichever comes first.	✓	
9. Results and analysis of pipe deflection testing, if requested by the Municipal Engineer.	✓	✓
10. Tangible Capital Assets Report	✓	

A.3 Storm Drainage System

Storm drainage systems include but are not limited to mains, manholes, and storm water management facilities but exclude catch basins and leads which are considered to be part of the road.

	CCC	FAC
1. Completed Inspection Request form.	✓	✓
2. Results, summary, and analysis of materials and compaction testing carried out to ensure compliance to construction standards, and including an 11" X 17" Overall plan containing stationing or reference points, as related to testing.	✓	
3. Colour CCTV video inspection of all mains completed to NASSCO standards with a written report and a colour video in a high quality digital format will be submitted. Report to include an ANSI D size plan with an Index of runs to pipe elements or manholes.	✓	✓*
4. Completed service connection schedule.	✓	
5. If required by the City, an infiltration/exfiltration test shall be conducted and test results, summary, and analysis submitted	✓	✓
6. Completed service connection schedule, if applicable.	✓	
7. Inspection report including a detail deficiency list, if applicable, including 11'' x 17" Overall Plan and a commitment date to complete deficiencies in total.	✓	
8. Completed Certificate stamped and signed by Professional recognized by APEGA. The CCC maintenance period date will be entered by the City.	✓	✓
9. Tangible Capital Assets Report	✓	
10. As-built drawings as stipulated in the Design Manual and/or the Servicing Agreement – upon application, 6 months after CCC	✓	

* If identified as a cause for concern by the City Inspector at FAC inspection, flushing and CCTV reinspection may be requested prior to issuance of the Certificate.

A.4 Roads / Lanes and Concrete / Asphalt Structures

Structures include but are not limited to Carriageways / Curb and Gutters / Monolithic Curb, Gutter and Sidewalks / Separate Sidewalks (if applicable), Asphalt Walkways/Trails, Concrete Slabs, Concrete Drainage Swales. In case of roads street lights, pavement markings and street signs included.

	CCC	FAC
1. Completed Inspection Request form.	✓	✓
2. Results, summary, analysis, and statement of materials and compaction testing carried out to ensure compliance to construction standards, including; subgrade, base course gravel, concrete and pavement structure, and including a 11" X 17" Overall plan containing stationing or reference points, as related to testing.	✓	✓*
3. Inspection report including a detail deficiency list, if applicable, including 11'' x 17" Overall Plan referring the number of the deficiency to a location on the plan, and a commitment date to complete deficiencies in total. The same plan as in 2 above can be used. All structures to be secured by compacted backfill to surface so as to prevent water penetration beneath or beside the structure.	✓	
4. Detailed calculation of penalties, if applicable.	✓	✓*
5. Completed Certificate stamped and signed by Professional recognized by APEGA. The CCC maintenance period date will be entered by the City.	✓	✓
6. Tangible Assets Report	✓	
7. As-built drawings as stipulated in the City Design Manual and/or the Servicing Agreement – upon application, 6 months after CCC	✓	

*Staged road construction

A.5 Traffic Lights

	CCC	FAC
1. Completed Inspection Request form.	✓	✓
2. Inspection report including a detail deficiency list, if applicable including 11'' x 17" Overall Plan and a commitment date to complete deficiencies in total.	✓	
3. Completed CCC or FAC stamped and signed by Professional recognized by APEGA. The CCC maintenance period date will be entered by the City.	✓	✓
4. Tangible Assets Report	✓	
5. As-built drawings as stipulated in the City Design Manual and/or the Servicing Agreement - upon application, 6 months after CCC	✓	

A.6 Landscaping

Landscaping includes but is not limited to earthwork grading, topsoil, seed, tree and shrub planting, u-lot barricades. Landscaping is also applicable to utility lots, boulevards, buffer strips, parks, municipal reserves, right-of-ways, grassed traffic islands, grassed berms, walkways, storm management facilities, etc.

Refer to City of Grande Prairie Construction Manual Section 32 94 14.

		CCC	FAC
1.	Completed Inspection Request form.	Yes	Yes
2.	Inspection report including a detail deficiency list, if applicable including 11'' x 17" Overall Plan and a commitment date to complete deficiencies in total.	Yes	
3.	Completed CCC or FAC stamped and signed by Professional recognized by APEGA. The CCC maintenance period date will be entered by the City.	Yes	Yes
4.	Submission of Topsoil Report as per 32 91 19.13 of City of Grande Prairie Construction Manual	Yes	
5.	Submission of Pesticide Application Logs	Yes	Yes
6.	Landscape Contractor/Consultant shall provide a copy of all soil tests and seed mixture specifications	Yes	
7.	Engineering Consultant to provide plan with surveyed grades confirming all	Yes	

	necessary elevations as part of the main drawing submission package		
8.	Installation of Commercial Tree Wrap in accordance to City of Grande Prairie Construction Manual	Yes	Yes

A.7 Fencing, Sound Attenuation Berms / Facilities, Trail Lighting, Park Equipment

Submissions required at time of application for Certificate (s) unless otherwise stipulated in the chart.

	CCC	FAC
1. Completed Inspection Request form.	✓	✓
2. Inspection report including a detail deficiency list, if applicable including 11'' x 17" Overall Plan and a commitment date to complete deficiencies in total.	✓	
3. A detailed deficiency list, if applicable and a commitment date to complete deficiencies in total.	✓	
4. Completed CCC or FA.C stamped and signed by Professional recognized by APEGA. The CCC maintenance period will be entered by the City.	✓	✓
5. Manufacturer manuals for park equipment	✓	
6. Tangible Assets Report as set with the Municipal	✓	
7. As-built drawings as stipulated in the City Design Manual and/or the Servicing Agreement – upon application, 6 months after CCC	✓	

SECTION 4 – INTENTIONALLY LEFT BLANK

SECTION 5 – ENGINEERING DESIGN AND SUPPLEMENTARY REPORTS

1. INTRODUCTION

Design reports are a critical link between Engineering Planning studies (Master Plans, Basin studies, Functional studies) and Detailed Engineering Drawings, and they connect the engineering design to the approved Outline Plan. Design reports address four components; transportation systems, sanitary sewer, water supply and storm drainage (either in one report or separate reports). Each component must consider relationships to the other components and to the Supplementary reports.

Supplementary reports, that may be required to be submitted as part of the Outline planning or subdivision process typically include geotechnical, environmental, hydrogeology, historical, flooding, slope stability assessment and park design reports. With the exception of the geotechnical and environment report, the remaining reports may or may not be necessary depending on site conditions and location. The Developer is encouraged to liaise with the City in the early stages of the development so as to determine which Supplementary Reports are required and at which stage of development.

Development Agreements will not be issued until the Municipal Engineer has approved all Design Report issues.

Revisions to the Design and Supplementary reports must be provided when the Outline Plan revisions (i.e. roadway realignment, land use revision) are approved. Further Development Agreements will not be issued until revised drawings and/or reports are submitted and approved.

2. CONTENT

2.1 PREPARATION

The preparation of both Design and Supplementary Reports is the responsibility of the Developer at the Developer's cost. Subdivision proposals and Detailed Engineering Drawings related to the area will not be approved in the absence of all required Reports. Prior to proceeding with any of the Reports, the Developer is encouraged to meet with representatives of the City and/or Aquatera to review available background information and to establish Terms of Reference.

2.2 PROFESSIONAL SEAL

Completed reports and support documentation are to bear the professional signature, seal and permit stamp of the engineer and firm responsible, and all responsibilities for authorship of all documents is to be clearly identified. The engineer must be recognized as a professional engineer by APEGA.

3. DESIGN REPORT SUBMISSION REQUIREMENTS

3.1 GENERAL

The design reports are intended to establish the site development and servicing requirements for the staged development of the subdivision. The reports will ultimately form the basis for detailed design of each phase of development.

City/Aquatera preference is for the details of individual components (e.g., transportation, water modeling, sanitary sewer system modeling, stormwater management) to be contained in separate reports.

Four copies of each report, along with a PDF copy, should be submitted to the City and the report should include the following general information;

1. Identification and description of issues/constraints related to capacity, depth, grade, operations, or other unique conditions or features.
2. Existing conditions (e.g. vegetation, soils groundwater, structures, contaminants, topographic feature.).
3. Description and results of analyses and modeling completed.
4. Proposed phase boundaries and phasing.
5. Base plans should be in the form of a tentative legal plan at a scale of 1:2000 (other common metric scales also are acceptable) conforming to the approved Outline Plan.
6. Discussion of conformance to or deviation from City/Aquatera guidelines, Master Plans, Basin Studies, Functional Studies, including justification for deviations;

Further details on the criteria to be considered when preparing each type of Design Report are provided in the following sections.

A copy of the computer modeling analysis may be requested if needed to verify results and review sensitivity of design.

3.2 WATER DISTRIBUTION

While Aquatera operates the water distribution network within the City of Grande Prairie, City Council has established service level expectations for the network, and relies on the City Engineering Department to approve alignments within the City and ensure that the mandated service levels are being met. As such, while Aquatera's Standard Guidelines

shall apply for design, construction, and operational purposes, the City requires signed copies of the Water Distribution Design Report in order to confirm that the City's interests are being met. This is consistent with adopted Policy 610 and Procedure 610-1 "Water Supply for Fire Protection".

The Water Distribution Design Report shall contain all of the requirements set out in Section 2 (Design and Supplemental Report Submission Requirements) of Aquatera's Design Manual.

Detailed water system design criteria are included in Section 8 of Aquatera's Design Manual.

3.3 SANITARY SEWER SYSTEM

The purpose of the sanitary sewer system report is to establish the contributory sanitary service area(s) and discharge points to the existing system, based on topographic considerations and downstream transmission capacities. This may include existing system analysis in terms of planned and projected flows, and assessment and monitoring of existing system capacities and flows. Future growth areas beyond the limits of the Outline Plan area must also be considered, and alternatives for service

Extensions to these areas (e.g. Trunk main extension, oversize main through development, etc.) Must be determined.

While Aquatera owns and operates the wastewater collection system within the City of Grande Prairie, the City Engineering Department approves the alignments of wastewater collection infrastructure and reviews to ensure that adequate consideration has been given to provide service. To this end, the City requires signed copies of the Sanitary Sewer Design Report in order to confirm that the City's interests are being met.

The Sanitary Design Report shall contain all of the requirements set out in Section 2 (Design and Supplemental Report Submission Requirements) of Aquatera's Design Manual.

Detailed sanitary sewer system design criteria are included in Section 9 of Aquatera's Design Manual.

3.4 STORM WATER MANAGEMENT SYSTEM

Generally, the Outline Plan will only cover a portion of the watershed defined by natural topographic features. The watershed will, however, continue to act as a single integrated system during rainfall and snowmelt events. The urban drainage systems must be incorporated into the natural watershed in such a way as to account for flows from

remaining undeveloped areas. Consequently, urban drainage must be carried out on a total watershed basis.

The storm water management report should establish the contributory storm service area(s) and discharge points based on topographic considerations and downstream transmission capacities. This may include existing system analysis in terms of planned and projected flows, and assessment and monitoring of existing system capacities and flows. Future growth areas beyond the limits of the Outline Plan area must also be considered, and alternatives for service extensions to these areas.

The computer modeling analysis will be submitted as a component of the submission. The model shall be submitted in a format compatible with DHI's Mike Urban.

3.4.1 Major Drainage System

The report should discuss the major (overland) system including design methods and criteria used, routing, depths of ponding, flow rates at each basin outlet, connections to and impacts on major systems in adjacent lands and provisions for major system flows from upstream areas;

Planning and design for major drainage systems must include the incorporation of surface drainage and overland flow routes, ponding areas, and runoff storage facilities, and where possible escape routes to receiving watercourses.

Information regarding the storm water management ponding should be provided as per Section 12 – Storm Drainage System.

A plan should be provided that shows the following components of the major drainage system;

1. Major drainage area boundaries,
2. Major drainage routes and elevations of ponding on route,
3. Storm water management pond locations and shapes (e.g. volume, depth, area, elevations), discharge rates, control type and location.
4. The plan should also identify any major drainage flows to be intercepted from areas beyond the boundary of the Outline Plan and show how this drainage is to be redirected or stored.
5. Phasing of improvements

6. Include a Table, listing pond area, volume and discharge table for notable pond elevations and rainfall frequencies for each pond in the development area, as follows:

Design Parameter	Elevation	Pond/ Water Surface Area (ha)	Pond Volume (m_3)	Outlet Discharge (l/sec.)	Notes
Original Ground	*884.3*	*3.6*	*N/A*	*N/A*	
Plugged Outlet (1:100)	*882.2*	*2.8*	*42,000*	*0*	L.T.F. Elevation
1:100	*881.6*	*2.7*	*28,500*	*510*$*_1$	*Weir crest regulated*
1:50	*881.2*	*2.1*	*27,300*	*490*	*Orifice flow regulated*
1:25	*881.1*	*2.0*	*18,600*	*420*	*Orifice flow regulated*
1:10	*880.8*	*1.8*	*12,400*	*380*	*Orifice flow regulated*
1:5	*880.2*	*1.6*	*7,500*	*350*$*_2$	*Orifice flow regulated*
Pond Bottom	*880.1*	*1.2*	*500*	*250*	*Nominal pond bottom*
Inlet Crest	*880.0*	*0.001*	*0*	*245*	
Invert By-pass pipe	*878.0*	*0*	*0*	*0*	
$*_1$ – equates to 0.01 L/sec/ha $*_2$ – equates to 0.001 L/sec/ha					

3.4.2 Site Grading Plan

A site grading plan is to be provided to identify a preliminary earth balance for the quarter section, establish the major drainage routing, establish erosion and sediment control measures and coordinate the utility and site grading designs with respect to depth of cover and grades. The following information should be shown on one or more drawings:

1. Existing elevation contours of the site at a sufficient interval to determine drainage patterns.
2. For developments requiring extensive cut/fill areas, a plan showing preliminary and final contours is required to identify;
   a) Proposed changes in existing contours for each stage of grading.

b) Existing and final site contours at a interval and scale sufficient for distinguishing runoff patterns before and after disturbance,

c) A cut/fill plan showing existing and proposed contours.

3. Identify critical areas within or near the project area, such as streams, lakes, wetlands, highly erodible soils, public streets and residences,
4. Locate and identify trees, shrubs, grass, water bodies, streams and other natural features that are to be retained, removed and/or altered. Identify any future variances in natural grade adjacent to these areas which would either impact drainage or root systems.
5. Show the dividing lines flow direction for the different drainage areas before and after development.
6. Add lines defining the boundary of the area to be disturbed and if possible limits of each phase of clearing and grading,
7. Identify proposed stockpile locations. Consideration should be provided to include proximity to homes, watercourses, escarpments, existing roadways etc.
8. Storm Water Management System

   a) Locations of permanent storm drain inlets (catchbasins), pipes, outlets, detention/retention pond, etc.

   b) Cross-section of swales and/or channels, including depth of flow,

   c) Volumes, depth, overflow rates and the routes the flow will follow after overtopping the sediment basins.

9. Geotechnical Information

   a) Test hole locations,

   b) Boundaries of different soil types within the development,

   c) Areas within or near the proposed development with potential for serious erosion or sediment problems.

3.4.3 Roadway Grading Plan

The purpose of the Roadway Grading Plan is to confirm the major drainage routing along streets, lanes, and public utility lots and to evaluate the lot grading. The plan should show the following:

1. Proposed contours,
2. Tentative road and lane centreline grades,

Detailed roadway design criteria are included in Section 14 of this document

3.4.4 Minor Drainage System

1. Proposed minor (piped) system including method and criteria used, discharge rate from each basin, allowance for upstream flows, and impacts on downstream systems;
2. Plan identifying the following:
    a) Proposed main sizes,
    b) Manhole locations,
    c) Outfall or outlet locations
    d) Manhole invert elevations,
    e) Grades between manholes, and
    f) Proposed manhole depth
    g) Catchment areas for the minor system

Detailed storm sewer system design criteria are included in Section 12 of this document.

3.5 TRANSPORTATION DESIGN REPORT

3.5.1 General Format Requirements

The main goal of a Transportation Design Report is to analyze the impact of a proposed new development or neighbourhood on the City's transportation system, and determine if the internal transportation network has adequate capacity for the anticipated traffic patterns generated by the development. The components of the transportation system that should be addressed in the report include vehicular traffic, pedestrians, cyclists and transit.

The following discussion is primarily related to developments for which there has been an Outline Plan application or amendment. The main component of the Transportation Design Report is a Traffic Impact Assessments (TIA). The City, at times, may require TIAs to be completed at the subdivision or development permit stage for developments requiring new access or increasing the use of an existing access. The format and scope for TIAs at those stages of development may vary slightly from what is discussed in this section. For information on Traffic Impact Assessments as they relate to infill or lot-level developments, please refer to Section 18.

The following format recommendation is intended as a minimum guide for the Transportation Study, but does not necessarily cover all situations. Prior to initiating the assessment, the Developer's Engineer should discuss with the Municipal Engineer the project scope, including study area, and intersections and accesses to be studied to

identify the concerns of the and issues of the project, which in turn, should improve the overall efficiency of the City's review.

The Transportation Design Report should include the following sections:

Background Information

1. Proposed development, including the name of the development / developer, location, type, size, and staging.
2. Roadways, including names, numbers, and classifications.
3. Study Area, including a key map and site plan.

Existing Infrastructure Condition and Road Geometry

1. Existing roadway infrastructure conditions, including:
    a) Pavement width;
    b) Pavement markings;
    c) Right-of-way width;
    d) Vertical alignment;
    e) Horizontal alignment;
    f) Design and posted speed limits;
    g) Locations of speed limit changes;
    h) Existing access vicinities;
    i) Existing illumination;
    j) Existing pedestrian / active transportation network
    k) Traffic control type; and
    l) Traffic Operation Signage

2. Existing intersection configurations and road geometry, including:
    a) Intersection configuration;
    b) Vertical grades of intersections;
    c) Intersection sight distances;
    d) Stopping sight distances;
    e) Signal timings; and
    f) Major developments currently using the intersection.

Proposed Road Network Geometry

At the Outline Plan stage, both the internal and external road networks should be analyzed, in order to confirm that the post-construction condition will have adequate capacity for the anticipated traffic volumes generated by the development, and the appropriate road standards are being used. The following should be assessed to ensure conformance with TAC Guidelines for the internal roads and at any connections to external roads:

1. Internal road network proposed Road Allowance Widths, pavement and walkway widths, etc.
2. Separation of intersections
3. Provision or need of turning Lanes, acceleration/deceleration lanes, etc.
4. Separation of major private accesses (i.e. commercial driveways), or groups of private accesses from major intersections (such as a separation distance between the collector road entrance to the development and the first residential driveway, for example).
5. Sightlines, stopping and sight distances etc.
6. Any proposed upgrades to affected external areas (i.e. acceleration/deceleration lanes on the arterial road at the development entrance, signalization of an adjacent intersection, etc.)
7. Location of any proposed trail crossings of the road network

Existing Traffic Conditions

1. Turning movement counts (AADT, PM peak, and AM peak);
2. Existing AADT's on roadway;
3. Annual, 5 year, and 10 year historical traffic growth rates on roadway / intersection;
4. Vehicle composition (% vehicle type) on roadway / intersection.

Traffic Projections

1. Existing / background traffic review;
2. Build Year
    a) AM and PM peak projected background traffic;
    b) Projected AM and PM development traffic (site generated, pass by / internal trips, and total trips);
    c) Combined (background + development) AM and PM peak traffic.
3. Staging Years
    a) AM and PM peak projected background traffic;

b) Projected AM and PM development traffic (site generated, pass by / internal trips, and total trips);

c) Combined (background + development) AM and PM peak traffic.

4. 20 Year Horizon (Post-Buildout)

a) AM and PM peak projected background traffic;

b) Projected AM and PM development traffic (site generated, pass by / internal trips, and total trips);

c) Combined (background + development) AM and PM peak traffic.

Trip Generation Rates

Traffic Volumes generated by the proposed development shall be estimated using the latest edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual, unless local & more reliable trip generation data is available.

Traffic volumes shall be based on the full build-out condition and/or maximum land use intensity allowed under the existing zoning bylaw regulations, unless otherwise approved by the City Engineer.

Adjustments to trip generation rates and generated traffic volumes to account for internal traffic, pass-by traffic and increased modal splits are permitted. All assumptions for Trip Distribution and Trip Assignments shall be clearly documented, justified, and approved by the City Engineer.

A summary table should be provided in the report identifying the categories and quantities of land uses, with the corresponding trip generation rates or equations and the resulting number of trips.

Analysis

1. Capacity Analysis for internal road network as well as external connections.

a) Delay per vehicle (seconds) by intersection, turning movement, and peak period;

b) Level of service (LOS) by intersection, turning movements, & peak period; (minimum LOS “D”).

c) Left-turn / right-turn warrants;

d) Vehicle Volume to Capacity Ratio (V / C) (Please note critical ratio is 0.85)

e) Confirmation that there are enough connections to the external road network from the development

f) Estimated 95th percentile queue length to be used to determine required storage length.

The City accepts both the Highway Capacity Manual (HCM) and Canadian Capacity Guide (CCG) methodologies of intersection analysis. Specific software package Synchro 7.0 or higher is required.

Existing signal timing plans must be used. Modification may be considered as a measure to address capacity or level of service deficiencies, at the discretion of the City Engineer.

A summary table should be provided in the text of the report, but full documentation is to be provided in the appendix.

2. Signal Warrant Analysis

The Canadian Traffic Signal Warrant Procedure from the Manual of Uniform Traffic Control Devices for Canada (MUTCD) shall be used when determining the warrants for signalized intersections. The 80-point system, which does not include collision warrants, is typically used. The 100-point system is occasionally used in large urban centers. Sound engineering judgment is required in determining which point system to use.

Analysis should be conducted to recommend traffic signal timing and phases. All analysis worksheets should be included in the appendix of the Transportation Design Report.

3. Illumination Warrant Analysis

All intersections must be assessed to determine the requirement for full lighting, partial lighting, delineation lighting, or no lighting. Lighting warrants shall be determined based on Alberta Transportation's Highway Lighting Guide.

All warrant calculations and analysis worksheets shall be included in the Appendix of the Transportation Design Report.

4. Pedestrian Warrant Analysis

The Canadian Traffic Signal Warrant Procedure from the Manual of Uniform Traffic Control Devices shall be referred to for pedestrian crossing requirements.

All warrant calculations and analysis worksheets shall be included in the Appendix

5. Operational Analysis

The operational analysis is a critical phase of the study that should not be overlooked. Once the traffic analysis has been completed and the recommended intersection improvements have been determined, it is necessary to ensure that the design vehicle is capable of safely maneuvering the intersection without interfering with other traffic movements.

Intersection plans should be provided illustrating that the design vehicle can safely maneuver the intersection. If the design vehicle is unable to properly make a specific turning movement with respect to the development, recommended revisions to the intersection layout are required.

6. Safety Analysis

Potential safety or operational concerns associated with the following, as applicable, should be identified:

- Weaving, Merging, Queuing
- Conflicts with pedestrians, cyclists, heavy vehicles, and transit
- Corner clearances

- Sight Distances
- Access conflicts

7. Collision Analysis

Where the development is adjacent to an area identified concerns, existing collision data should be reviewed and an assessment of the impact of the proposed development provided. This information may be helpful to minimize any potential concerns through the designs or location of access points.

8. Transportation Demand Management (TDM) Plan
   - Improvements to facilities and infrastructure to encourage alternative transportation options
   - City staff will determine need for the TDM Plan.

Conclusion and Recommendations

The Transportation Design Report should summarize the findings of the various analyses conducted, including potential issues, and clearly outline the recommendations including:

1. Required Intersection Improvements;
2. Pedestrian Mitigation;
3. Illumination;
4. Signalization; and
5. Right-of-way requirements.

Other Considerations

1. Discussion of conformance to or deviation from City guidelines, Master Plans, Studies or previous Design reports including all existing and approved developments, including justifications for deviations
2. Assessment should include pedestrian and cyclist networks, provision for transit and noise attenuation requirements.

Appendices

Appendices must include ALL Synchro outputs for existing, future and background conditions. These outputs shall be submitted in both digital and hardcopy formats.

4. SUPPLEMENTARY REPORT SUBMISSION REQUIREMENTS

4.1 GEOTECHNICAL REPORTS

4.1.1 General

The Developer shall engage the services of a qualified geotechnical engineer to prepare a report prior to commencing detailed subdivision design. The report shall evaluate soil characteristics and existing groundwater conditions and be based on test holes drilled at a maximum spacing of 150 m throughout the Development. Test holes must be 6.0 m deep or at least 1.0 m deeper than the deepest utility or anticipated basement excavation. Standard piezometers shall be installed in each test hole.

4.1.2 Required Testing

The minimum number of tests required for this report is as follows:

1. Soil moisture contents at 1 m intervals throughout each borehole,
2. For each test hole, plotted existing moisture content, liquid limit, plastic limit, estimated dry unit weight, optimum moisture content, and unconfined compressive strength of each soil encountered. Samples are to be identified as Disturbed or Undisturbed. With uniform soil conditions, a sufficient amount of sampling will be required to determine the consistency across the site and over the profile of the bore hole.
3. A sufficient number of soil sulphate tests to represent the various soil types throughout the Development,
4. A sufficient number of California Bearing Ratio (CBR) tests to represent the road subgrade soils throughout the Development,
5. Sieve analysis for each predominant soil type,
6. Standard penetration tests for determination of in-situ relative soil density and consistency of the various soil strata,
7. Measurement of groundwater table and analysis of its influence with respect to the design of roadways, utility trenches, and foundations. Groundwater readings shall be provided on completion of drilling, 1 day after drilling, 7 days after drilling, 14 days after drilling, 1 month after drilling, and once a month thereafter for 5 additional months.

4.1.3 Final Report

Three copies of the report shall be submitted to The City's Engineering Services Department, including the following information:

1. Test hole location plan and soil classification logs for each test hole (Unified Classification System) with geodetic surface elevation and depth to stabilized water table level,
2. Results of the tests noted above,
3. Water table contour map with seasonally adjusted water table shown at 0.50 m intervals,
4. Recommendations on suitability off site for the proposed development based on final elevations proposed for the site,
5. Comments on the soil bearing capacity and recommended setbacks from escarpments for various types of building foundations,
6. Condition of retaining walls (s) (if any) existing on the site or engineered design for any proposed retaining structures.
7. Recommendations with regard to trench excavation and backfill specifications, and road pavement structure requirements. Pavement designs shall be based on a 20 year design life for in situ conditions and projected traffic volumes ESAL's and other design criteria as outlined in Section 14 of these Guidelines.

4.2 ENVIRONMENTAL

Please note that the City intends to revise this section in 2016 in order to separate dialogue on Biophysical Assessments and Environmental Site Assessments, and to clarify expectations and create a formal outline for the conduction and submission of Biophysical Assessments. The following is an un-edited version of the 2009 comments on Environmental studies.

1. An Environmental Site Assessment or Environmental Impact Assessment is required for all sites where environmental issues are of concern.
2. An Environmental Site Assessment (ESA) is required for any situation where contamination on or adjacent to the subject site poses a current or future environmental concern to the Public. The level of ESA required will vary depending on circumstance as follows:
   a) Phase 1 ESA – Site Reconnaissance and Historical Review.
   b) Phase 2 ESA – Site Investigation and Assessment.
   c) Phase 3 ESA –Planning and Implementation of Remediation.
3. The Environmental Report for development of a site shall include but not be limited to the following:
   a) A definition of the scope of the assessment and the assessment criteria to be used for the study site.
   b) A detailed discussion of the site assessment, including a review of the chemical or biophysical data with respect to the assessment criteria.

c) A clear and concise summary of the conclusions of the study and/or recommendations for further investigation/ remediation.

d) A complete package of supporting documentation and appendices including, but not limited to plans, photographs, aerial photographs, borehole logs, test results, checklists, etc.

e) A statement of limitations for the report.

4. Environmental Reports will be reviewed to the satisfaction of The City and its appointed review agencies which may include Alberta Environment or other approved agents. The level of work required will be dependent on the situation and findings. In general:

   a) Phase 1 ESA's are to be prepared in accordance with accepted guidelines, practices, and procedures that include, but are not limited to those outlined in the Canadian Standards Association Publication (1993) titled —Phase 1 Environmental Site Assessment - Z768-94‖.

   b) If the Phase 1 ESA indicates an environmental issue, a Phase 2 ESA shall be prepared to detail the existence, type, concentration, and extent of on and off- site contamination. This report shall be prepared in accordance with accepted guidelines, practices, and procedures that include but are not limited to those outlined in the Canadian Standards Association Publication (1998) titled Phase 2 Environmental Site Assessment

   c) If the Phase 2 ESA indicates that there is a requirement for remediation or risk management, then a Phase 3 ESA program and documentation will be required. The report(s) shall document how the site will be remedied or risk managed to a level suitable for the intended development. Final confirmation testing and reporting will be required to verify remediation has taken place.

4.3 HYDROGEOLOGICAL REPORT

A hydrogeological investigation will be required if the geotechnical report shows the depth to established ground water is less than 3.0 m from the existing surface and/or proposed grade.

1. This report to include information from test holes spaced on a grid of approximately 150 m, complete with standpipe piezometers at monitoring wells.
2. The report shall determine the stabilized ground water elevation and anticipated seasonally high ground water elevation.
3. The report shall further determine the hydraulic conductivity in the upper 3 meters of the soil profile and the ground water flow direction.
4. The report shall also make recommendations for footing elevations relative to the ground water elevations and methods to control or mitigate detrimental influences to building foundations and infrastructure.

4.4 HISTORICAL RESOURCES OVERVIEWS (HRO'S) AND HISTORICAL RESOURCES IMPACT ASSESSMENTS (HRIA'S)

Most of Alberta's historic resources fall into one of three categories: historic buildings and other structures, archaeological sites (buried artifacts and other evidence that tell us about human life in the past) and palaeontological sites (fossilized remains of plants and animals). The need to preserve and study historic resources has long been recognized and was officially reflected in the passage of the Alberta Heritage Act in 1973 (now the Historical Resources Act, R.S.A. 2000, c. H-9. The Act is administered by Alberta Community Development (ACD).

4.4.1 Historic Resources Overview

ACD requires the submission of a Historical Resources Overview Assessment for each project—large or small—that impacts lands on the Listing. Although this seems like just another hoop to jump through, it can save the developer time and money. The purpose of the overview is to determine the relationship between the proposed development and the existing historical resources or high potential areas. If it can be demonstrated that the development will avoid all impacts to historically sensitive areas, HRO clearance can be obtained without doing a Historical Resources Impact Assessment (HRIA).

Scope of Work

An HRO involves the evaluation and reporting of existing information collected through a record review of provincially designated historic buildings, archaeological sites and palaeontological sites. The current public and restricted versions of the Listing of Significant Sites and Areas (ATPRC 2007) is also to be consulted. The HRO includes a review of aerial photographs, relevant geological, topographic and physiographic information.

An HRO does not include sampling or testing for historical resources. Any further detailed inspections require a permitted Historical Resources Impact Assessment (HRIA).

4.4.2 Historic Resources Impact Assessment

Historic resources are susceptible to the effects of time and, especially, to damage caused by the activities of modern society. In recognizing their non-renewable nature, Section 37 of the Historical Resources Act provides the framework for Historic Resources Impact Assessments (HRIAs) and mitigation studies. When, in the opinion of the Minister of Alberta Culture and Community Spirit, an activity will or will likely result in the alteration, damage or destruction of an historic resource, the person or company undertaking the activity can be required to:

- Conduct an HRIA on lands that may be affected by the activity,
- Submit to Alberta Culture and Community Spirit a report discussing the results of the HRIA,
- Avoid any historic resources endangered by activity, or
- Mitigate potential impacts by undertaking comprehensive studies.

HRIAs and mitigation studies are paid for by the developer undertaking or proposing to undertake the activity. Professional private-sector historians, archaeologists and palaeontologists perform the required work. Culture and Community Spirit regulates archaeological and palaeontological fieldwork through a permit system. All decision-making in regard to the management of historic resources rests with Alberta Culture and Community Spirit.

4.5 SLOPE STABILITY REPORT

4.5.1 General

Please note that the City of Grande Prairie commissioned a Top-of-Bank Policy Framework study, and intends to expand and clarify the requirements listed in this section in 2016. In the meantime, for detailed scoping of slope stability studies or for details on design standards for development adjacent to slopes, please contact Development Engineering.

1. A Slope Stability Geotechnical Report is required for all developments proposed adjacent to a natural slope greater than 3.0 meters in height.
2. Test holes shall be drilled to a sufficient depth below the base of the slope to evaluate soil conditions for potential deep failure. The number of test holes required shall be determined by geotechnical engineer.
3. At least two stand pipe piezometers are to be installed to determine the stabilized ground water levels.
4. Geotechnical Report requirements to be applied, relative to the intended land use shall include the following:
    a) The assessment of the Factor of Safety (Fs) for the existing slope or the proposed design slope profile.
    b) The assessment of a safe set-back or buffer zone back from the crest or away from the toe of the slope.
5. It is the responsibility of the Developer and/or builder to ensure that all development conditions identified in the Slope Stability Geotechnical Report are complied with

4.5.2 Slope Stability Geotechnical Report Requirements

1. As a minimum, the scope of the report should provide setback limits or development recommendations based on the recommended Factor of Safety. The minimum recommended setback shall be shown on the final development plan.
2. The basis for the presented conclusions shall be clearly defined and the selected method of analysis shall be adequate relative to the ground conditions, project type and size, and public interests.
3. The Geotechnical Report requirements must consider the following issues, as well as other site-specific issues identified by the Geotechnical Engineer.
    a) Property lines and setbacks as per the Zoning By-law.
    b) Stability limit, established with respect to most probable adverse groundwater and loading conditions.
    c) Top of embankment or escarpment.
    d) Toe of slope (Note: Where the development at the toe of the slope is proposed, the report is to address the effect and extent of slope failure on the subject land and the adjacent properties and the protection of same).
    e) Erosion control and other mitigation measures (e.g. drainage works, grading, etc.) close to the slope crest.
    f) Appropriate recommendations pertaining to revegetation, dewatering, and slope reconfiguration (e.g. cutting, filling, regrading, retaining walls, etc.).
    g) Building location and foundation design.
    h) The effect of surcharges due to the proposed structures, retaining walls, and future site grading.

4.5.3 Verification

1. The Developer shall retain the Geotechnical Engineer to review the final drawings and confirm, in writing, that the plans are in accordance with the recommendations made in the Geotechnical Slope Stability Report. This documentation is required before the Foundation and/or Building Permit will be issued.
2. The Developer shall retain the Geotechnical Engineer to inspect slope and site improvements during and after completion of the work.
3. The Geotechnical Engineer shall certify, in writing, that construction procedures were conducted in accordance with design recommendations and that the completed work complies with the recommendations made in the Geotechnical Report.

4.6 FLOOD STUDY REPORT

Developments proposed adjacent to large bodies of water will require an investigation of surface water disposition as well as a determination of the high water levels for:

1. The 1:10 and 1:100 year flood levels.
2. Recommendations for development adjacent to the flood level, buffers zone requirements, erosion and bank protections, etc. for each flood event.

As per policy statements in the City of Grande Prairie Municipal Development Plan, no permanent habitable development shall be permitted with the 1:100 year flood plain of any river, stream or lake shore.

4.7 PARKS AND LANDSCAPING DESIGN REPORT

A Conceptual Parks and Landscaping Report is to be provided to illustrate how the municipal reserve parcels will be developed, in particular the Neighbourhood Park Site(s) identified in the Outline Plan.

The report and the plans contained within it should show/discuss the following:

1. Areas of existing wetlands, trees, and vegetation to be removed or retained.
2. Identify topographic features and drainage patterns for all municipal reserve parcels,
3. Proposed trail system, including connection to the trail system in adjacent developments and existing/future planned City trail network
4. Roadways where collector tree planting is required,
5. Proposed development plan for the Neighbourhood Park site(s), including site amenities (e.g. school parcel, sports fields, playground apparatus, etc.), detention pond, water levels and structures, trails, site grading, etc.
6. Identify park categories
7. Provide preliminary park concept plans for each park site, identify park sizes and configurations to ensure setbacks from property lines and other features (e.g. Storm water management facilities, roadways, and utilities) can be achieved
8. Identify proposed type and size of recreation facilities (i.e. rinks, fields, furniture and fixtures, fencing, barricades, signage etc.)
9. Phasing to address staged development from a parks amenities
10. Discussion of the neighbourhood population and analysis of how the park amenities are of adequate capacity to meet the future neighbourhood demand post development.

11. Preliminary tree/shrub bed locations in parks,
12. Special landscaping features that are being considered for incorporation in the development area.
13. Street furniture, rink hydrants, etc.
14. All existing and proposed easements.

Detailed landscaping and parks design criteria are included in Sections 16 and 17 of this document respectively.

4.8 RIPARIAN SETBACKS

Riparian setback design is governed by the Riparian Setback Matrix Model (RSMM) approved by Council in 2012. This model is to be utilized as a basis for establishing development setbacks and Environmental Reserves in and adjacent to riparian areas. The framework is available on the City of Grande Prairie website.

An assessment of the RSMM output is required for all developments adjacent to riparian areas unless otherwise approved by the Municipal Engineer. In cases where multiple setback guidelines exist (riparian, top of bank, etc.), all scenarios are to be calculated with the most severe scenario governing the final design.

SECTION 6 – ENVIRONMENTAL CONSIDERATIONS

Construction of municipal improvements could result in many potential environmental impacts. The City of Grande Prairie endeavours to reduce its environmental impact as much as possible, and as a result, expects its consultants, contractors, and developers to do the same. This section shall outline the City's expectations as well as legislation from higher tiers of government that may affect construction on Capital Projects and Private Developments within the City.

1. REFERENCE MATERIAL

The following reference materials (current editions) have been used in preparing this Section of the Design Guidelines and should be referred to for further detail:

- Alberta Transportation - Design Guidelines for Erosion and Sediment Control for Highways.
- Alberta Transportation – Field Guide for Erosion and Sediment Control for Highways. Alberta Transportation - Fish Habitat Manual
- Alberta Transportation - Navigable Waters Protection Act Manual The City of Calgary - Guidelines for Erosion and Sediment Control
- The City of Calgary – Field Manual for Erosion and Sediment Control The City of Edmonton - Erosion and Sediment Control Guidelines
- The City of Edmonton - Erosion and Sediment Control Guidelines Field Manual
- Alberta Transportation / City of Edmonton / City of Calgary – Environmental Construction Operations (ECO) Plan Framework.

2. REGULATORY REQUIREMENTS

Erosion from land surfaces can contribute large quantities of sediment to watercourses. There are a number of federal and provincial acts and regulations governing activities that cause, or can cause harm to the environment, including construction projects that result in erosion and/or sedimentation. Regulatory agencies also publish codes of practice, guidelines and standards that set out requirements for undertaking certain types of activities. Most legislation and other types of regulatory tools make reference to preventing the release of harmful or deleterious substances, including silt, to the environment.

The Federal Department of Fisheries and Oceans (DFO) operates in Alberta to enforce relevant federal legislation. Alberta Environment enforces relevant provincial legislation in collaboration with DFO enforcement of federal legislation.

Please note that the following Regulations are excerpts from living documents under active revision. The onus remains with the Developer and/or his Consultant to refer to the original source on the Justice Laws Website (Government of Canada), Alberta Provincial websites and the City of Grande Prairie website in order to have the most current version of the cited clauses.

2.1 FEDERAL LEGISLATION

2.1.1 Navigable Water Protection Act

The Navigable Water Protection Act, R.S.C.1985, c. N-22 applies to in-stream work involving construction or placement in, on, over, under, through or across any navigable water. “Navigable waters” includes a canal and any other water created or altered as a result of construction of any work. Section 22 of the Act states:

“No person shall throw or deposit or cause, suffer or permit to be thrown or deposited any stone, gravel, earth, cinders, ashes or other material or rubbish that is liable to sink to the bottom in any water, any part of which is navigable or that flows into any navigable water, where there are not at least a minimum depth of 36 metres of water at all times, but nothing in this section shall be construed so as to permit the throwing or depositing of any substance in any part of a navigable water if it is prohibited by or under any other federal Act.”

Section 21 of the Act also prohibits depositing of “sawdust, edgings, slabs, bark or like rubbish of any description whatsoever” in any navigable water.

2.1.2 Fisheries Act

The Fisheries Act, R.S.C. 1985, c. F-14, Sections 34 to 42 exists to protect fish and fish habitat. 36(3) of the Act states, in part:

“No person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water”.

Silt is amongst the most common types of deleterious substances.

Section 38(5) of the Act states:

"If there occurs a deposit of a deleterious substance in water frequented by fish that is not authorized under this Act, or if there is a serious and imminent danger of such an occurrence, and detriment to fish habitat or fish or to the use by humans of fish results or may reasonably be expected to result from the occurrence, then every person shall without delay notify an inspector, a fishery officer or an authority prescribed by the regulations if the person at any material time

(a) owns or has the charge, management or control of

(i) the deleterious substance, or

(ii) the work, undertaking or activity that resulted in the deposit or the danger of the deposit;

Or

(b) causes or contributes to the occurrence or the danger of the occurrence."

Furthermore, Sections 35(1) and 35(2) state as follows:

1) No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery.

2) A person may carry on a work, undertaking or activity without contravening subsection (1) if

(a) the work, undertaking or activity is a prescribed work, undertaking or activity, or is carried on in or around prescribed Canadian fisheries waters, and the work, undertaking or activity is carried on in accordance with the prescribed conditions;

(b) the carrying on of the work, undertaking or activity is authorized by the Minister and the work, undertaking or activity is carried on in accordance with the conditions established by the Minister;

(c) the carrying on of the work, undertaking or activity is authorized by a prescribed person or entity and the work, undertaking or activity is carried on in accordance with the prescribed conditions;

(d) the serious harm is produced as a result of doing anything that is authorized, otherwise permitted or required under this Act; or

(e) the work, undertaking or activity is carried on in accordance with the regulations.

The Fisheries Act is enforced by the Department of Fisheries and Oceans (DFO). Under administrative agreement with DFO, Alberta Environment acquired certain responsibility for enforcement of Section 36 and related provisions. DFO operates in the Province of

Alberta to enforce relevant federal regulations in collaboration with Alberta Environment on enforcement of provincial regulations.

2.1.3 Migratory Birds Convention Act

The purpose of the Migratory Birds Convention Act, R.S.C.1994, c. 22 and the Migratory Birds Regulations, C.R.C., c. 1035 (Regulations is to protect migratory birds and migratory bird habitat. The Act and Regulations apply to various types of birds, as follows:

- Migratory game birds, including ducks, geese, swan, cranes, shorebirds and pigeons,
- Migratory insectivorous birds, including chickadees, hummingbirds, robins, swallows and woodpeckers,
- Other migratory non-game birds, including gulls, herons and loons,

A complete list of birds is included in the Schedule (Section 2) of the Act. It is prohibited to deposit or permit to be deposited oil, oil wastes or any other substances harmful to migratory birds in any waters or any area frequented by migratory birds.

2.1.4 Canadian Environmental Protection Act

The Canadian Environmental Protection Act, R.S.C.1999, c. 33 (CEPA), targets pollution prevention and protection of the environment, human life and health from the risks associated with toxic substances. Under section 64, a substance is “toxic” if it is entering or may enter the environment in a quantity or concentration or under conditions that:

- Have or may have an immediate or long-term harmful effect on the environment or its biological diversity,
- Constitute or may constitute a danger to the environment on which life depends,

or

- Constitutes or may constitute a danger in Canada to human life or health.

When a substance is declared toxic, it is placed on the Toxic Substances List in Schedule 1 of CEPA. “Respirable Particulate Matter” (PM) that is less than or equal to 10 microns is a toxic substance under CEPA. Wood burning, crop residue fires and road dust can contribute to PM in the air. Under sections 95 to 99, where a toxic substance is released into the environment, any person who owns or has the charge, management or control of a substance, or causes or contributes to the release or increases the likelihood of the release, must report the release and take measures to prevent the release and remedy/mitigate the effects.

2.2 PROVINCIAL LEGISLATION

There are multiple pieces of Provincial Legislation which govern the environment. Below, a select few key pieces of legislation have been provided outlined; however, it is not to be taken as an exhaustive list. All relevant legislation must be followed regardless of if it appears in this manual.

2.2.1 Environmental Protection and Enhancement Act (EPEA)

The Act is the primary act in Alberta through which regulatory requirements for air, water, land, and biodiversity are managed. The Act supports and promotes the protection, enhancement and wise use of the environment by designating proposed activities for which an approval or registration is required.

The Environmental Protection and Enhancement Act can be viewed in its entirety on the Alberta Government website.

Link to the Environmental Protection and Enhancement Act (verified on Dec 09, 2020)

http://www.qp.alberta.ca/570.cfm?frm_isbn=9780779820146&search_by=link

2.2.2 Water Act

The Act supports and promotes the conservation and management of water, through the use and allocation of water in Alberta. It requires the establishment of a water management framework and sets out requirements for the preparation of water management plans. The Act addresses: Albertans' rights to divert water and describes the priority of water rights among users; the types of instruments available for diversion and use of water and the associated processes for decision-making; and the range of enforcement measures available to ensure the goals of the Act are met.

The Water Act can be viewed in its entirety on the Alberta Government website.

Link to the Water Act (verified on Dec 09, 2020)

http://www.qp.alberta.ca/570.cfm?frm_isbn=9780779805570&search_by=link

2.2.3 Public Lands Act

The Act establishes the role of the Alberta government in managing public land. It sets out mechanisms by which rights in public land may be transferred by lease or sale. It provides for and defines the powers of the Minister and the Lieutenant Governor in Council with respect to establishing regulations to govern use and allocation of public land. The Act and its regulations also control public land use through the establishment of public land use zones, recreation areas and trails. The Act provides for appropriate use and management of public land and for the classification of the public land base in Alberta.

The Public Lands Act can be viewed in its entirety on the Alberta Government website.

Link to the Public Lands Act (verified on Dec 09, 2020)

http://www.qp.alberta.ca/570.cfm?frm_isbn=9780779818792&search_by=link

2.2.4 Soil Conservation Act

The Soil Conservation Act describes the requirement for landholders to prevent soil loss or deterioration from taking place or to stop loss or deterioration from continuing. The Act delegates authority to local municipalities and outlines the powers and duties of the designated officers. It also outlines the process, procedures and governance for appeals under the Act. Offences related to, and penalties for, contravention of the Act are described.

The Soil Conservation Act can be viewed in its entirety on the Alberta Government website.

Link to the Soil Conservation Act (verified on Dec 09, 2020)

http://www.qp.alberta.ca/570.cfm?frm_isbn=9780779753468&search_by=link

2.3 MUNICIPAL LEGISLATION

There are multiple pieces of Municipal Legislation which govern the environment in addition to the Provincial Legislation. A few key pieces are outlined below; however, it is

not to be taken as an exhaustive list. All relevant legislation must be followed regardless of of it appears in this manual.

2.3.1 Drainage By-Law C-1241

The most current version of the City of Grande Prairie Drainage By-law can be found in its entirety on the City of Grande Prairie website.

2.3.2 The Use of Public Lands Bylaw (C-1078)

The Use of Public Lands Bylaw outlines the authorized and unauthorized use of lands. The details of the bylaw can be found on the City of Grande Prairie website.

2.4 CONTINUATION OF A CONTRAVENTION

Where a contravention is committed or continued on more than one day, each day is considered a separate offence.

2.5 RELEASE OF INFORMATION

The Environmental Protection and Enhancement Act and the Release Reporting Regulation deal with the release of substances into the environment and set out what must be reported, when, how and to whom reports must be made. Additionally, individual approvals and Codes of Practice may have requirements for the reporting of contraventions of the terms and conditions of the approval or the sections of the Code of Practice.

Where the incident, release or contravention triggers a requirement to immediately report, then this report should be made to the Environmental Service Response Centre as follows:

Verbal Reports can be phoned to **780-422-4505** or **1-800-222-6514** (on a 24 hour basis).

A reference number will be provided at the time of the verbal report to confirm that the report of the release was made.

Written reports can be faxed to **780-427-3178**; or mailed to Environmental Service Response Centre, Alberta Environment, 6th floor, Oxbridge Place, 9820-106 Street, Edmonton, Alberta T5K 2J6.

2.6 DUE DILIGENCE

Most environmental legislation provides for “due diligence” (defined simply as “the exercise of reasonable care”) as a defense to the majority of environment offences. By ensuring due diligence is exercised, the responsible party may prevent the occurrence of a violation altogether.

3. INTRODUCTION OF AN ENVIRONMENTAL CONSTRUCTION OPERATIONS (ECO) PLAN

Section 2 of this manual describes the erosion and sedimentation control expectations the Design Consultant is to include in the Engineering Drawing Set, however, prior to construction, the Contractor shall submit for the City to review and accept, an Environmental Construction Operations (ECO) Plan. The ECO Plan shall conform to the requirements set out in the document titled “Environmental Construction Operations (ECO) Plan Framework”, published by the City of Edmonton and the City of Calgary.

This ECO Plan Framework document is available on the Alberta Transportation website at: ECO Plan Framework Municipal Version 2020 Edition

https://www.calgary.ca/content/dam/www/uep/esm/documents/esm-documents/2020_

ECO Plan Checklist Municipal Version 2020 Edition

https://www.calgary.ca/content/dam/www/uep/esm/documents/esm-documents/ECO_Plan_Checklist_Municipal_Version_2020.pdf

3.1 GOALS AND OBJECTIVES

Much broader than simply erosion and sedimentation control, the ECO Plan shall demonstrate that the Contractor has considered, and is prepared to mitigate, negative impacts on the environment, has obtained the appropriate approvals/permits, and has a plan for waste management and emergency responses.

3.2 RESPONSIBILITIES

All Private Development projects requiring a Servicing Agreement and all City construction projects must prepare an ECO Plan.

4. BEST MANAGEMENT PRACTICES (BMPS) FOR EROSION AND SEDIMENTATION CONTROL

4.1 GENERAL

Best Management Practices (BMPs) for erosion and sedimentation control are various methods that have been proven to work on past construction sites when they are properly planned and constructed. These measures reduce erosion potential by stabilizing exposed soil or reducing surface runoff flow velocity. There are generally two types of erosion control BMPs that can be used in conjunction with the minimum requirements. They are as follows:

a) Source control BMPs for the protection of exposed surfaces; and

b) Conveyance BMPs for control of runoff.

These measures reduce off-site sedimentation potential by promoting sedimentation before surface water flows leave the construction site. There are generally two types of BMPs that can be used in conjunction with the minimum requirements of an erosion control plan. They are as follows:

a) Filtering and Entrapment BMPs; and

b) Impoundment BMPs

It is the Consultant's responsibility to ensure that BMPs are appropriate for the site conditions.

4.2 EROSION AND SEDIMENT CONTROL BMPS

This clause provides general information on BMPs that may be used in the City of Grande Prairie. Additional information can be found in the references noted in Clause 2. The following list includes BMPs that would be most likely used in an urban setting. Non-inclusion of BMPs in this list does not mean that a BMP is not acceptable in Grande Prairie. The Consultant is to use flexibility and good judgment to select BMPs appropriate for the site and situation.

4.2.1 Permanent Best Management Practices

Permanent BMPs to be incorporated in the final site stormwater plan may include:

a) Stormwater ponds

b) Armouring

c) Vegetation

d) Constructed wetlands

e) Sediment (Grit) Separation Stormwater Treatment Units.

For permanent erosion and sediment control (ESC) installations:

a) Make sure the proper vegetation is being used in each situation.

b) Pond and pipe situations are designed to overflow, therefore plan for the pond overflow situation. Know where the overflow will go and provide the required surface armour.

4.2.2 Erosion Control BMPs

Erosion control BMPs protect the soil surface and prevent soil particles from being detached by rain and wind. These tend to be the least expensive and most effective BMPs. Erosion control treats soil as a resource with value and works to keep it in place. Erosion control BMPs are the first line of defense against erosion and sedimentation. Temporary BMPs are intended to address temporary conditions, be easily removed or be biodegradable. The following list includes some of the current erosion control BMPs. Other erosion control BMPs may also be considered.

a) Preservation of existing vegetation

b) Construction sequence scheduling

c) Just-in-time grading

d) Slope treatments

e) Seeding

f) Mulches

g) Hydroseeding and hydromulching

h) Erosion control netting

i) Erosion control blankets

j) Rip-rap

4.2.3 Temporary Sediment Control BMPs

Sedimentation control BMPs help collect sediment on the site in selected locations and minimize the sediment transfer off the site. Sedimentation controls are generally passive systems that rely on filtering or settling of soil particles out of the water or air. Sedimentation controls treat soil as a waste product and works to remove it from the transport system. Sedimentation control BMPs are the last line of defense against erosion and Sedimentation. The following list includes some of the current sediment control BMPs. Other erosion control BMPs may also be considered.

a) Sediment basins

b) Sediment traps

c) Sediment barriers

d) Inlet protection measures
e) Stabilized construction entrance
f) Dust control
g) Brush/rock filter berms
h) Dewatering

It should be noted that good maintenance practices will help to minimize erosion and sediment concerns, and should be considered when preparing the construction schedule. While some may be impractical under certain conditions, others should be considered based on suitability, practicality and cost effectiveness.

- Stockpiles should be located away from watercourses, environmentally sensitive areas, drainage courses, and existing adjacent developments. The stockpiles should be stabilized against erosion immediately following stripping operations. Stabilization can include, but is not limited to establishment of a cover crop or hydro seed matrix consisting of seed, fiber bond and tackifier.

- All construction traffic should leave the site at a designated point or points. Gravelling or paving (where practical) of frequently used access roads will help ensure that minimal material such as mud is tracked off-site. The access road should consist of a bed of non-erodible material (i.e. gravel) of sufficient length to ensure that a minimum of material (mud) is tracked off-site onto adjacent municipal roadways. Internal haul roads and/or track packs can also be designated and maintained to help reduce off-site tracking.

- When storm sewers have been installed or are existing, measures should be undertaken to ensure sediment and debris does not get into the municipal storm sewer system. Both catch basins and manholes should be protected. This may be accomplished by sealing the openings, setting up sumps or weirs inside the structure, or by providing appropriate inlet protection (filter fences, sediment traps, etc.). A temporary drainage system should be used with appropriate velocity controls and temporary storage areas for sediment control. This will ensure that sediment and debris do not get into the municipal storm sewer system and into the downstream waterways. Diligent efforts must be taken to ensure that the temporary drainage system does not flood adjacent properties.

- Where on-site or downstream detention facilities are provided, use can be made of a quality control facility (through placing temporary weirs or check dams) for sediment control during construction. **All temporary and permanent detention facilities must be constructed prior to the installation of any services to the site or the commencement of earth moving operations.**

Dust control measures should be implemented to prevent wind transport of dust from disturbed soil surfaces. This may be accomplished several ways:

- Vegetate, hydro seed, or mulch areas that won't receive vehicular traffic,
- Construct windbreaks or screens,
- Site may be sprinkled with water or a chemical dust suppressant to control dust (care must be taken to prevent tracking of mud that may result), or
- A combination of the above noted methods.
- All accumulated sediment and debris should be removed as required. Once construction activities are complete, all related materials and temporary structures must be removed and properly disposed of.

4.3 BMP INSTALLATION

The sequence of BMP installation must minimize erosion and sedimentation. The following should be considered:

a) Established methods may not meet the objective of preventing erosion and sedimentation.
b) If the contractor can demonstrate that substitute materials can provide the same level of protection, then alternative methods may be considered.
c) Consider the proposed approach and methods in light of achieving the desired goal as well as the economics.

The Consultant and the Contractor should consider the following when designing, installing and maintaining the BMPs:

a) Time the grading work to avoid rainy periods where possible (typically mid-June to early August)
b) Leave as much undisturbed vegetation as possible
c) Minimize the duration of soil disturbance
d) Disturb and then restore small areas rather than fewer large areas
e) Protect soil stockpiles from eroding and trap sediment
f) Break up slope lengths, reduce slope steepness, and control flow concentrations
g) Emphasize erosion control by vegetating, mulching or stabilizing disturbed areas quickly

h) Direct runoff away from disturbed areas

i) Design and construct drainage channels and outlets to handle concentrated flows until permanent structures and vegetation are functional

j) Use sufficiently sized temporary sediment basins, traps, etc.

k) Inspect and maintain control measures, especially before and after storms

l) Install backup BMPs upstream of critical areas and have materials available for

m) Emergencies

n) Keep good records

BMPs will not work properly unless they are installed properly and in accordance with specifications and the manufacturer's recommendations. Regular inspection and maintenance of BMPs is required to keep them fully functional. Deficiencies in quality control can make the ESC situation worse and lead to disastrous failures.

4.4 HAZARDOUS MATERIALS AND WASTE MANAGEMENT

The City of Grande Prairie is conscious of the impacts of contamination, whether actual or potential, due to spills of fuel, chemicals / pesticides / herbicides, or the excavation or exposure of soils that do not meet tolerances for levels of regulated substances. As such, the City expects the consultants, developers, landowners, and contractors to practice due diligence in preventing, reporting, and mitigating any contamination due to their activities.

Hazardous materials shall always be stored appropriately, handled carefully, and disposed of properly, according to the legislation in place. Waste shall always be disposed of in an approved disposal facility rated for the material being disposed of and/or the contaminants present in the waste.

Any spills shall be reported to the appropriate authorities immediately so that remediation and/or mitigation can occur.

Refer to the ECO Plan Framework document for additional dialogue on the handling of hazardous materials and waste management.

4.5 ENVIRONMENTAL EMERGENCY RESPONSE

Contractors working within the City of Grande Prairie on either private development projects requiring a Servicing Agreement or capital construction projects must have a plan in place for emergency responses. An emergency response plan must be developed for

all potential emergencies that could negatively impact the environment, such as but not limited to spills, discovery of contaminated soils, erosion or sediment releases, vehicle overturns, etc. The emergency response plans are to be included in the ECO Plan.

SECTION 7 – SITE CLEARING AND GRADING GUIDELINES

1. GENERAL

Accordingly, the Developer should not do any fieldwork, including site clearing, stripping and/or grading prior to execution of a Development Permit or a Servicing Agreement.

The Clearing and Grading Plan(s) for a development phase should conform to the grading plan prepared for the Servicing Study, as detailed in Section 5, and as accepted by the Lot Grading Department.

The Municipal Engineer should approve the Clearing and Grading Plan, including the location of topsoil stockpiles, prior to any work being undertaken. Any work done without written approval is at the Developers sole risk and must be addressed at Servicing Agreement stage.

The Developer shall implement erosion and sediment control measures in the Clearing and Grading Plan as outlined in Section 6.

- All site contractors should obtain and have on site copies of the following documents:
- Approved Clearing and Grading Plan(s),
- Approved Erosion and Sediment Control Plan, and
- Alberta Transportation – Field Guide for Erosion and Sediment Control for Highways.

1. REGULATORY REQUIREMENTS

Federal, Provincial and Municipal regulatory requirements for clearing and grading are included in Section 6 – Erosion and Sediment Control Measures; Clause 3.

2. SUBMISSIONS FOR A CLEARING AND GRADING PLAN

The Developer shall identify the owners of all lands adjacent to the clearing and grading area that may be affected by the clearing and grading operations.

The Developer shall provide written documentation (letters and/or agreements) from the affected property owners giving permission to access such lands, including City owned lands, used for back-sloping, drainage or other purposes.

Cross sections may be required to provide more information on the impact of the proposed clearing, stripping and grading on adjacent properties. The cross-section(s) should show the existing grade of the site, proposed grade for the site, grade of adjacent sites, and grade of adjacent City, County and/or Provincial roads. Datum points are required to ensure accuracy.

2. SPECIAL CONDITIONS

2.1 RESTRICTIONS, NOTICES AND SITE PREPARATION

Prior to the commencement of site clearing and grading, the Developer shall:

- notify the Municipal Engineer 48 hours in advance and arrange a site meeting with the Consultant and the Contractor,
- erect fencing and provide other measures to ensure that the clearing and grading operation does not encroach into environmental reserves and other restricted areas,
- no grading, filling or excavation is permitted within utility and road right of ways, under any overhead utility lines, or over any underground utilities, unless prior written authorization has been received from the utility agencies concerned
- where the Developer proposes to establish a haul route which crosses an existing roadway, the Developer shall apply for a Crossing Agreement as outlined in Section 1,
- when possible, clearing and grading should take place outside of the nestling/fledgling time period. If work is to occur during the nestling/fledgling time period, information regarding any restrictions should be noted in the Contract Specifications.

2.2 ENVIRONMENT PROTECTION

All work associated with clearing and grading the work shall be completed in accordance with the Contract Specifications.

2.3 PLANT PROTECTION

The Developer shall protect trees and plants on site and on adjacent properties where indicated on the Drawings. Refer to the Construction Manual for tree protection requirements.

2.4 WEED AND VEGETATIVE GROWTH CONTROL

The Developer shall be responsible for controlling noxious weeds and excessive vegetation growth within the clearing and grading area.

2.5 UTILITY RIGHT OF WAYS (EASEMENTS)

Following the installation of water mains, sanitary sewer mains, storm sewer mains and service connections, the Developer shall provide an unobstructed working right of way for the installation of the electrical distribution system, street lighting, gas mains and telecommunication facilities (telephone and cable television). The utility right of ways and boulevards shall be graded to within 150 mm of final grade, for not less that 2 m on each side of the alignment of the utility alignments.

3. TOPSOIL STOCKPILES AND DISPOSAL

3.1 GENERAL

The Developer shall strip and stockpile topsoil within the Development as necessary to facilitate development of the lands.

Where a Development is located adjacent to an Expressway and/or Arterial Roadway, the Developer shall construct or complete the construction of the sound attenuation berm to the design cross sections illustrated in Section 20, utilizing waste excavation material and/or surplus topsoil.

The Developer shall dispose of all topsoil that is surplus to the requirements of the Developer's Lands.

3.2 TOPSOIL (LOAM) STOCKPILES

The amount of topsoil stockpiled on Municipal Reserve parcels shall be restricted to the quantity required to complete the topsoil replacement on the Park Site(s), any other Municipal Reserve parcels within the Development area, and the adjacent arterial roadway berms. Stockpile side slopes shall be no steeper than 3:1 for safety purposes and to allow for weed control.

All topsoil that is set aside for later use on residential lots shall be stockpiled on a non-reserve parcel elsewhere in the Development area as approved by the Municipal Engineer.

Surplus topsoil shall not be stockpiled within undeveloped road right of ways. The stripped loam shall be stockpiled in approved locations as shown on the Drawings. The stockpiles shall be neat in appearance, free from any hazardous conditions and treated to prevent erosion from wind and rainfall.

The loam pile(s) shall be removed as development progresses. All loam piles, with the exception of the loam pile on the Neighbourhood School/Park and/or Neighbourhood Park site, must be removed prior to the last phase of development of the Developer's Lands.

4. STORMWATER MANAGEMENT FACILITIES

4.1 GENERAL

Construction of stormwater management storage facilities (detention ponds, retention ponds and/or constructed wetlands), including any storm sewer mains required to drain the stormwater management storage facilities, require approvals. If a stormwater management storage facility is to be constructed as part of the clearing, stripping and grading work, Alberta Environmental Protection Act approval must be received prior to any grading work proceeding. The approved Servicing Study Drawings can be used for the submission to Alberta Environment for the permit application.

4.2 CONTROL OF DRAINAGE

The Developer shall, at no expense to the City, before during and after the clearing and grading of the area, implement the drainage control measures for the control and disposal of all stormwater (rainwater or snow melt) in and from the lands which may be cut off from its natural drainage route by the development, but not limited to, inlet protection to any adjacent storm sewer system.

5. EROSION AND SEDIMENT CONTROL MEASURES

5.1 GENERAL

It is recommended the Developer shall prepare Erosion and Sediment Control Plans as detailed in Section 6.

The Developer of the lands being stripped and graded shall employ appropriate measures to control dust, particularly in the vicinity of existing roadways and dwellings, to ensure traffic safety and to minimize dust nuisance complaints from the public

Failure to implement and comply with the ESC plan can result in legal action as outlined in the Navigable Water Protection Act, Fisheries Act, Environmental Protection and Enhancement Act and the Water Act.

5.2 EROSION AND SEDIMENT CONTROL PLAN MODIFICATIONS

The Developer shall submit any modifications to the ESC plans that may be necessary from time to time for various reasons, but not limited to, portions of the Lands becoming developed, or adjacent lands becoming developed, or drainage and erosion control facilities that may require rerouting or redesigning.

6. REHABILITATION OF ADJACENT LANDS

Where clearing and grading operations have encroached on adjacent lands, the Developer, at its sole expense, and to the satisfaction of the Engineer, shall rehabilitate in a timely manner, any off-site areas or operations, storm water runoff, soil erosion, soil instability, sedimentation, dust or other problems which may arise from the clearing and grading operation.

7. DEEP FILLS GEOTECHNICAL REPORT

A “Deep Fills” report, completed by a Professional Engineer, is required when the constructed depth of fill is 1.2 metres. The report shall make general recommendations for different types of building foundations.

8. CONSTRUCTION COMPLETION AND FINAL CERTIFICATES

8.1 GENERAL

Issuance of Construction Completion and Acceptance Certificates (CCC’s) and Final Completion and Acceptance Certificates (FAC’s) shall be subject to the following conditions being met.

8.2 MAINTENANCE

The Developer shall promptly correct, at his own expense, all defects, damages, and deficiencies in the erosion and sediment control measures, whether related to materials, workmanship, operation, vandalism, or otherwise.

8.3 MAINTENANCE PERIOD

- The Developer shall maintain temporary erosion and sediment control measures until the graded area is fully serviced and developed. Construction Completion Certificates and Final Acceptance Certificates will not be issued for temporary erosion and sediment control measures.
- The Developer shall maintain permanent erosion and sediment control measures for a period of at least two years after the issuance of the Construction Completion Certificate and until a Final Acceptance Certificate is issued by the Engineer.

SECTION 8 – DRIVEWAY STANDARDS

1. GENERAL

This section will provide Municipal Engineers and developers with standards and guidelines that will manage driveways, while simultaneously preserving the flow of traffic on the City roads in terms of safety, capacity and speed.

This section only applies to multi-family, commercial and industrial driveways. The requirements for residential driveways can be found in the Land Use Bylaw.

It should be noted that Figure 8.2 is referenced throughout Section 8 and contains important visual definitions of dimensions described within this section.

2. DRIVEWAY APPLICATION PROCESS

Driveway crossings require an application and a permit. The application process typically involves a series of steps that applicants must follow to obtain an Engineering Permit. These steps can include concept reviews, pre-application meetings and traffic impact studies.

Prior to constructing a driveway, the driveway plan needs to be approved by the City. After the approval, an Engineering Permit must be obtained. The Engineering Permit form can be obtained from Engineering Services or online on the City's website.

3. SITE PLANS

The site plan should show what the finished project will look like and should provide the following information:

a) Address and adjacent street name(s)

b) Property lines and adjacent street curbs

c) The width of the driveway at the throat and at the flare

d) The distance to all adjacent driveways

e) Location of the driveway in relation to property lines or intersection (for corner lots)

f) Location of all infrastructure (manholes, hydrants, streetlights, catch basins, etc.)

g) Location of all City trees on the boulevard

h) North arrow

i) Truck turning movement templates (when required)

Figure 8.1 Sample Site Plan [Nov 2019]

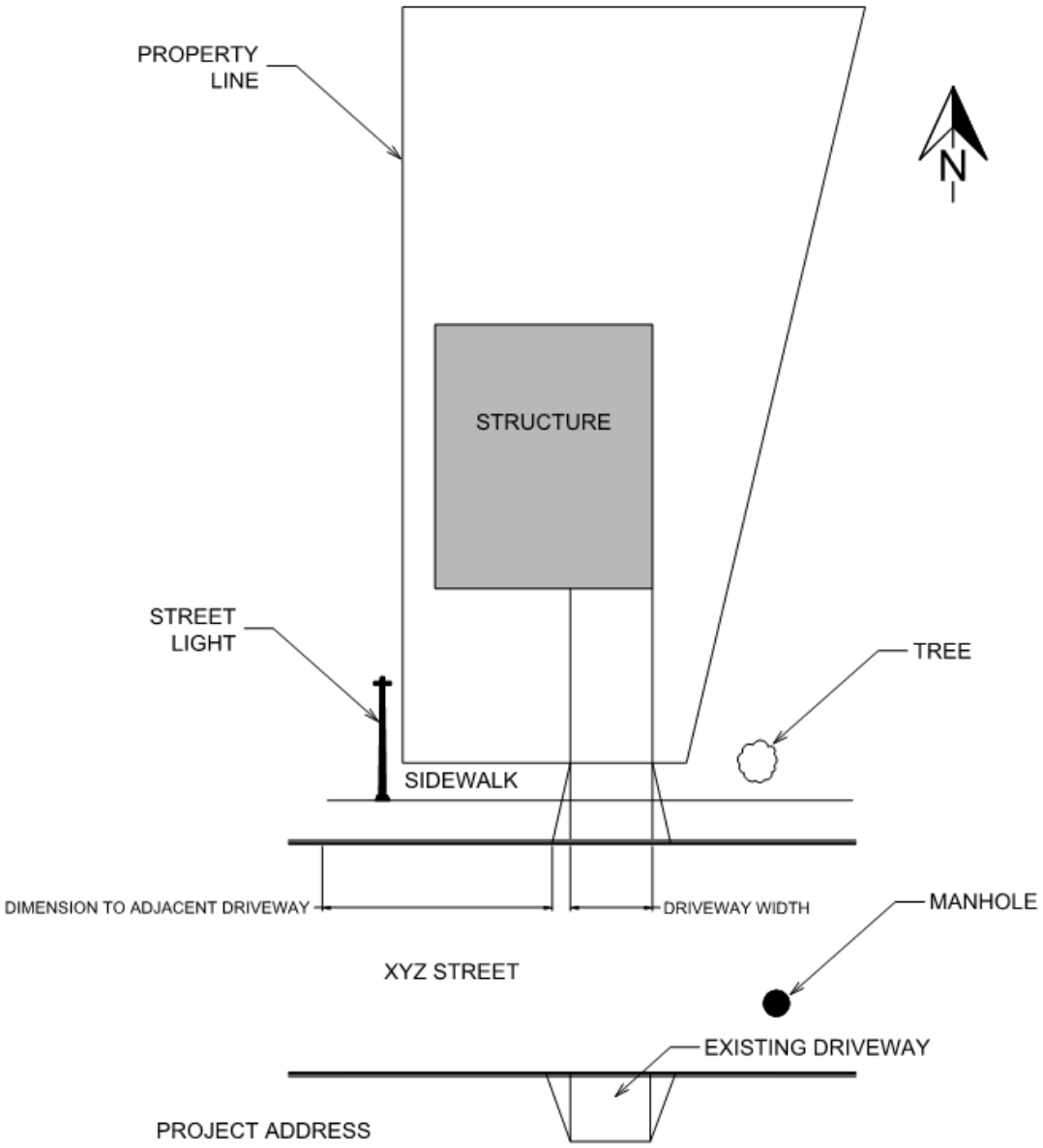
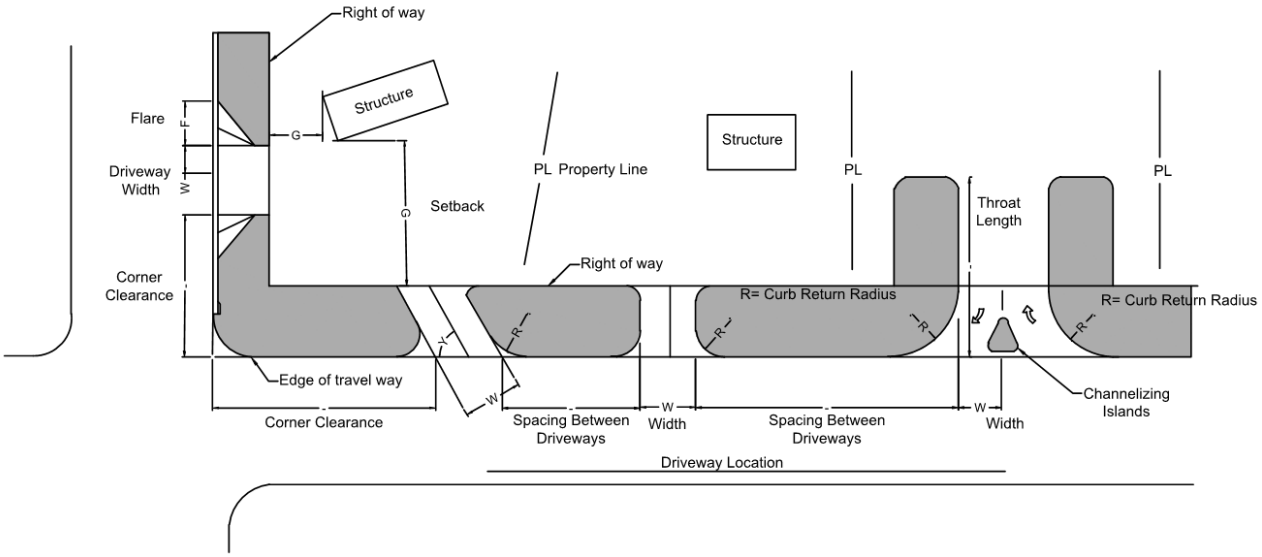


Figure 8.2 Driveway Dimensions [Nov 2019]



4. GENERAL DESIGN PRINCIPLES

Driveway design should be based on the following: design speed of the roadway, driveway traffic volume, entry and exit movements (e.g. one-way, two-way, right-in / right-out), available ROW, and design vehicle. In preparing the site plan, the following shall be provided/given consideration:

Driveways shall be designed to allow safe and efficient movement of vehicles to and from the intersecting street.

Construction shall be in accordance with the City's Construction Manual.

Driveways providing access onto major roads may be denied if an alternative access is available, or if the Municipal Engineer identifies potential safety issues.

It is preferred that new driveways be aligned with existing opposing driveways or be offset to the left of the existing opposing driveway in order to minimize left turn conflicts on the street.

Driveway(s) shall be located on the street with the lower functional classification unless it creates significantly more traffic conflicts and impacts to traffic flow.

All dimensions in this section refer to distances from (or along) face of curb. In the absence of a curb the measurement is considered to be from (or along) the edge of pavement.

Driveway angles are measured between the driveway centreline and one edge of the roadway.

A variance from these guidelines may be permitted depending on site-specific conditions, and shall require approval from the Municipal Engineer.

5. NUMBER OF DRIVEWAYS

Normally only one driveway shall be permitted for every multifamily, commercial, and industrial property. The City may permit an additional driveway if both sufficient frontage exists and extenuating circumstances justify a second driveway. Factors considered in permitting additional driveway(s) will include:

a) Density and type of land use

b) Classification of the adjacent roadway

c) The location and operating activity of existing driveways or local connections

The threshold frontages for additional driveways are outlined in the table below:

Table 8.1 Maximum Number of Driveways

Maximum Number of Driveways for Lot Frontage (metres)			
1 Driveway	2 Driveways	3 Driveways	4 Driveways
0 -15	16 - 50	51 - 50	> 150

6. DRIVEWAY'S WIDTH (W) AND RADIUS (R)

The right-turn radius and access width should be designed to accommodate the largest design vehicle expected to use the access. Driveway width should be restrictive enough to discourage erratic manoeuvres, control the location and angle of conflict points, and limit entry/exit to the intended number of lanes of operation.

6.1 DRIVEWAY WIDTH, W

Driveway width shall be measured at the throat and shall adhere to the table below:

Table 8.2 Driveway Width and Land Uses

Driveway Width for Different Land Uses					
Width for Two-Way Driveways (metres)			Width for One-Way Driveways (metres)		
Multi-Family Residential	Commercial	Industrial	Multi-Family Residential	Commercial	Industrial
3.0 - 7.3	6.7 - 12.0	9.0 - 15	3.0 - 4.3	4.5 - 7.5	5.0 - 9.0

Notes:

a) When driveway width is over 11m, pavement markings or channelization should be considered to help guide the driver to the appropriate portion of the driveway.

b) Minimum driveway widths are normally used with radii at or near the upper end of the range.

c) Maximum driveway widths may be considered where more than one traffic lane (per direction) is required.

6.2 THE RETURN RADIUS (R) OR AMOUNT OF FLARE (F)

The curb return or amount of flare of the curbing connecting the edge or throat of a driveway with the edge of the nearest travel lane is critical in driveway design. The right-turn radius and the access width should be designed to accommodate the largest design vehicle to use the access. The radius of the curb is related to the turning path of a vehicle making a right turn to or from the site, and the width of the driveway.

Flared driveways shall be used on curbed roadways where driveway traffic does not exceed 600 trips per day or 60 trips per hour. Radial return designs shall be used on all flush shoulder roadways and on curbed roadways with driveway traffic greater than 600 trips per day.

Table 8.3 Curb Return Radius

Curb Return Radius (R) for Different Land Uses		
Radius (metres)		
Residential (Medium or High Density)	Commercial[a]	Industrial[a]
6.0 - 9.0	9.0 - 12.0	9.0 - 15

Notes:

a) In flush shoulder roadways, a radius of up to 22 m may be considered.

b) Note that parking lanes and bike lanes can add to the effective radius of the driveway.

7. ANGLE OF DRIVEWAY

The angle of the driveway (Y) influences safety and operation of the driveway. Driveways should generally be at right angle (or within 15^{o} of right angle) to the main roadway. However, other angles may be considered where a right angle is not feasible and must be approved by the Municipal Engineer.

Table 8.4 Driveway Radius for Different Land Uses

Radius(metres)		
Residential (Medium or High Density)	Commercial	Industrial
6.0 - 9.0	9.0 - 12.0	9.0 - 15

8. THROAT LENGTH

Throat length is the distance needed into the site to transition vehicles to the internal circulation system of the site. It is an access controlled portion of the driveway entrance that helps delineate the driveway and provides space to store entering and exiting vehicles.

It is preferred that the driveway length is estimated using any industry standard methodology or by following TAC Guidelines. As a minimum, the required distance for the throat length will be related to the number of parking spaces provided on site, and it is outlined in the table below:

Table 8.5 Throat Length

Facility Size	Minimum (metres)
Parking space ≤ 50	8
Parking space ≥ 50 to ≤ 199	15
Parking space ≥ 200	20
Signalized large shopping centre development access (shopping mall, big box centre, etc.)	65

9. DRIVEWAY LOCATION AND SPACING

The following general design requirements shall apply to the driveway's location:

a) At a minimum, the upstream corner clearance should be longer than the longest expected queue at the adjacent intersection.

b) High speed, high volume roadways require longer corner clearances.

c) Typically, all elements of a driveway, including the radii should be within a property frontage.

d) On major roadways, the corner clearance should be at least as long as the stopping sight distance so that vehicles turning corners can make safe stops when encountering entering traffic.

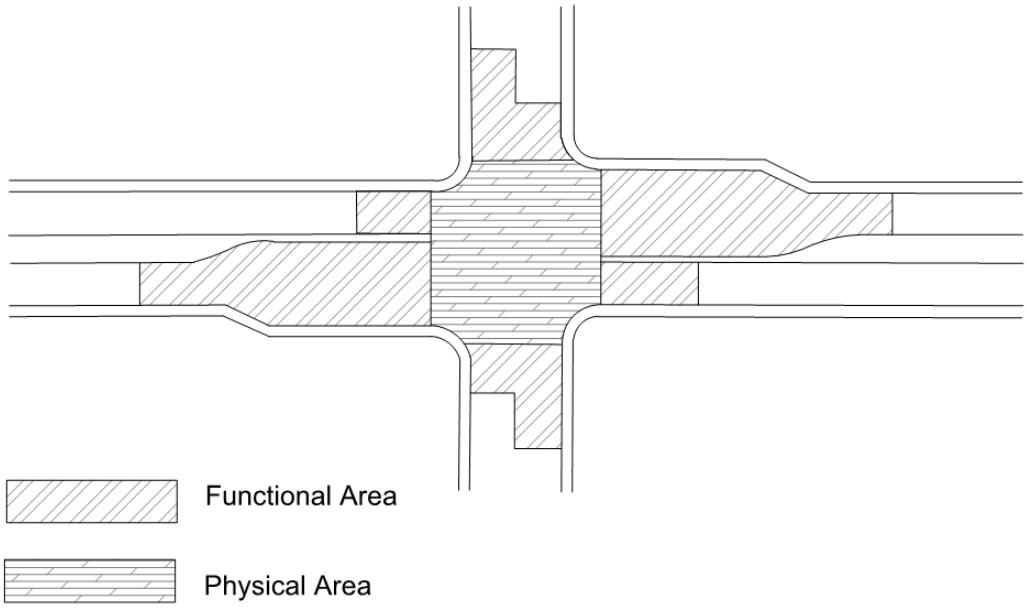
e) Where a development is bordered by two roads of different classifications, access should be to the lower classification.

f) Driveways should not be located in the intersection functional area. Figure 8.3 below. Intersection functional area is a function of corner clearance and storage requirements.

g) Driveways should be located at least 1.0m from surface hardware (streetlight, hydrants, trees, etc.)

h) In addition to the minimum standards in this section and or in the current version of the TAC Manual, the City reserves the right to impose any additional requirements it deems necessary for public safety.

Figure 8.3 Functional Area of an Intersection [Nov 2019]



9.1 MINIMUM CORNER CLEARANCE AND SPACING

In most instances, the guidance on minimum corner clearance and spacing between driveways provided in the latest version of the TAC Geometric Design Guide for Canadian Roads is relevant to the City of Grande Prairie.

9.1.1 CRITERIA FOR DETERMINING THE MINIMUM CORNER CLEARANCE ON MAJOR ROADS/TRAFFIC SIGNAL CONTROLLED INTERSECTIONS

9.1.1.1 GENERAL

Driveways in proximity to major roads require comprehensive plans and adequate attention. Applicants are encouraged to contact the City for concept reviews prior to submitting their application.

9.1.1.2 MINIMUM CORNER CLEARANCE CRITERIA

This subsection provides a framework for City staff and developers to determine the minimum corner clearance. The corner clearances in upstream and downstream of an intersection are controlled by the functional area of an intersection. The required minimum corner clearance shall be determined based on Figure 8.4 and the tables below:

Figure 8.4 Corner Clearance

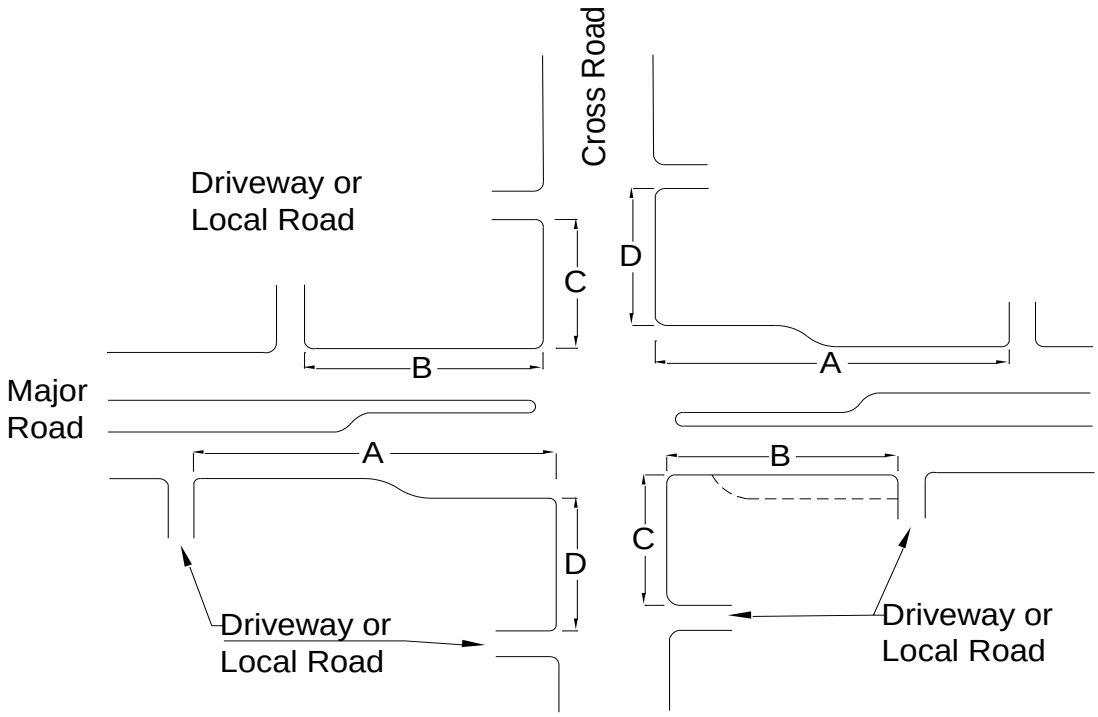


Table 8.6 Corner Clearance Determinants

Location	Determinant of Corner Clearance
A. Upstream on major road	Functional distance of approach to the intersection (See Table 8.7)
B. Downstream on major road	Functional distance of the access connection - Minimum stopping sight distance (See Table 8.8)
C. Upstream on minor cross road	Maximum length of queue
D. Downstream on minor cross road	Allowance for drivers to clear the major road-minor road intersection (See Table 8.9)

Table 8.7 Functional Distance of Approach to Intersection, A

Design Speed (km/h)	A, (metres)
50	70 + S[1]
60	110 + S[1]
70	130 + S[1]
80	150 + S[1]

1. S is the storage or queue length at an acceptable probability for storing all vehicles.

Table 8.8 Minimum Stopping Sight Distance, B

Design Speed (km/h)	B, (metres)
40	50
50	65
60	85
70	105
80	130
100	185
110	220

Table 8.9 Minimum Distance to Allow Vehicles to Clear from a Major/Minor Road Intersection, D

Radius (metres)	Minimum Suggested Corner Clearance, D (metres)
15 m and no channelization	36
15 m with channelization	60
23 m with channelization	70
30 m with channelization	85

In situations where the minimum corner clearance cannot be met, directional prohibitions: right-in and right-out, or right-in, or right-out may be implemented and/or required.

9.2 SPACING BETWEEN DRIVEWAYS

The goal is to provide sufficient distance from one driveway to the next so that drivers can perceive and react to the conditions at each potential conflict point in succession. Spacing should be keyed to the roadway function or access class, operating speed, and development density.

Table 8.10 Spacing Between Driveways

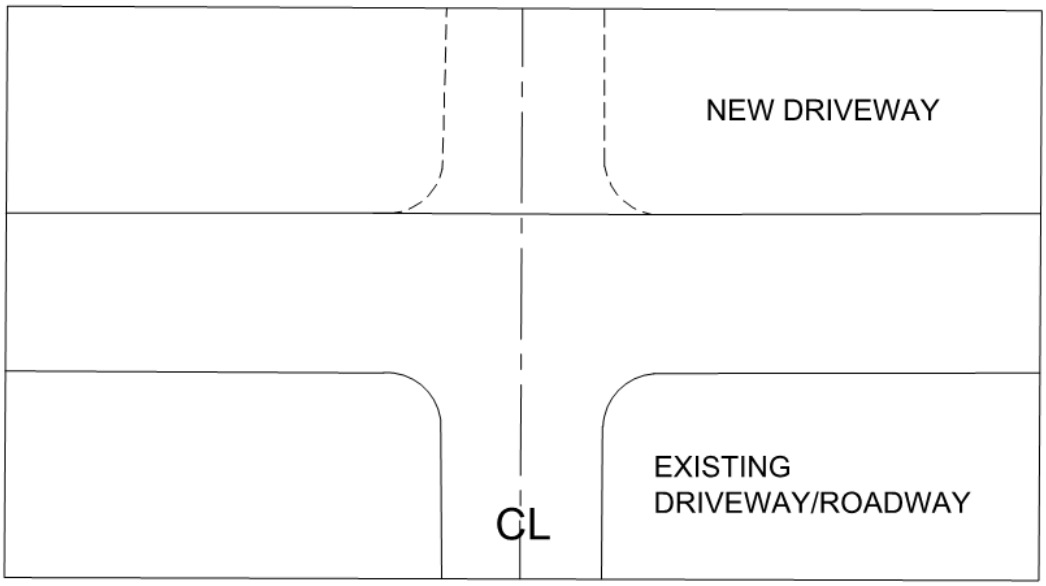
Type of Driveway	Minimum Spacing, m
Commercial/Industrial	30*

*Applies to road with posted speeds less than 60 km/hr and driveways that have traffic volumes of less than or equal to 100 peak hour trip or less than 750 vehicles per day. In situations where the lot width is less than the spacing, the lot's driveway shall be positioned as far away as possible.

9.2.1 SPACING BETWEEN DRIVEWAYS ON OPPOSITE SIDES OF UNDIVIDED ROADS

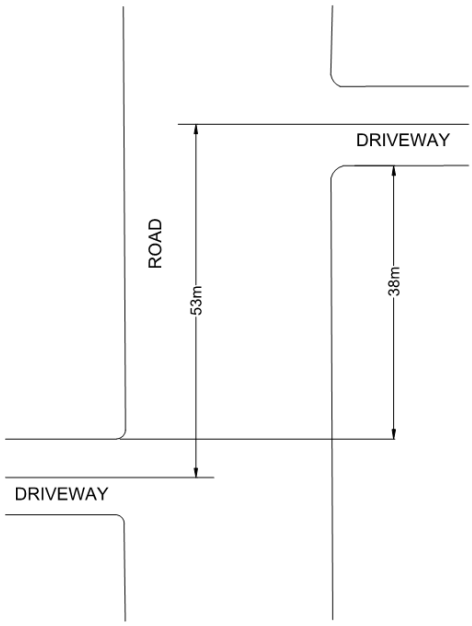
Where appropriate and feasible, the centreline of a new driveway on a road should align with the centreline of any opposing driveway or road as shown in Figure 8.5.

Figure 8.5 Recommended Driveway Alignment [Nov 2019]



Where it is inappropriate or infeasible to align the centrelines, the minimum offset distance in Figure 8.6 is desirable.

Figure 8.6 Minimum Offset Distance [Nov 2019]



10. WHEN ENGINEERING STUDIES OR TRAFFIC IMPACT ANALYSIS IS REQUIRED

In rare instances, engineering studies or analyses will be used to assist in the evaluation of future accesses to the City's roads. The engineering study will determine the safety, mobility, and operational impacts the access will have on the transportation network. A Traffic Impact Analysis will be required to be carried out when one or more of the following circumstances apply:

a) When a proposed development will generate 100 or more additional (new) peak direction (inbound or outbound) trips to or from a site during the adjacent roadway's peak hour or the proposed development's peak hour;

b) When a proposed development will generate will generate trips exceeding 750 vehicles per day;

c) Where there is a localized safety or capacity deficiency;

d) Where the proposed driveway will require a deceleration;

e) Where the proposed driveway does not meet the minimum spacing and or corner clearance requirements;

f) When there are any sight distance or physical obstructions that will result in a safety problem;

g) Where the proposed will affect existing or other proposed driveways/accesses/intersections;

h) Where the development will affect the ability of adjacent/existing/planned roadway system to handle the increased traffic, or the feasibility of improving the roadway system to handle increased traffic; and

i) When deemed necessary by the Municipal Engineer.

The applicant is encouraged to meet the Municipal Engineer to discuss and define the specific requirements for the studies or analysis. Refer to Section 5 and Section 18 of the Design Manual for TIA Guidelines.

11. REFERENCE MATERIALS

The following reference materials have been used in preparing this driveway standard. Applications are strongly encouraged to rely on the current editions of the following sources for access designs:

a) Access Management Manual, Transportation Research Board of the National Academies, 2003.

b) Geometric Design Guide for Canadian Roads, Transportation Association Of Canada

c) The AASHTO “Green Book” (A Policy on Geometric Design of Highways and Streets)

d) V. G. Stover and F. J. Koepke, Transportation and Land Development, Institute of Transportation Engineers, 2nd edition, 2002.

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SECTION 12 – STORM DRAINAGE SYSTEM

1. GENERAL

The storm sewers shall be designed as a separate system and consider both the minor and major drainage. There shall be of sufficient capacity to carry storm sewer runoff from the ultimate catchment identified in the Storm Drainage Master Plan or the Area Basin study if one exists. The design must also account for the interception, conveyance and storage requirements as necessary to accommodate runoff flows from undeveloped contributory areas for the indefinite future or for an interim period until development of those areas occurs.

Control shall be provided to minimize sediment discharge into the storm sewers. This shall be in the form of properly graded and surfaced streets and lanes, landscaping, sediment control structures at pond and pond inlets, or other means where appropriate.

The design of this municipal improvement shall be undertaken in such a manner as to be compliant with the construction specification in the City of Grande Prairie Construction Manual.

The storm system must be approved by the Municipal Engineer and Alberta Environment.

As a guideline for raw land, a predevelopment flow of 5 l/s per hectare is to be used, or alternatively, a watershed study can be undertaken to determine the appropriate flow rate.

2. MINOR SYSTEM

2.1 COMPOSITION AND CONTROL

The minor system comprises piping, manholes, catchbasins, street gutters and outfall structures that function as a conveyance system to rapidly carry away runoff from snowmelt and rainfall events. The minor system should discharge to an adequate receiving body of water (river, stream, lake or pond) without sustaining any surface ponding, excessive surface flows, downstream erosion, or flooding for events up to and including a 1-in-5-year return period. Where required by the Municipal Engineer, high value commercial areas shall have their minor systems designed to accommodate the 1-in-10-year return period.

When designing a storm system, pipe runs downstream of stormwater management facilities are to be upsized by 25% to allow for increased emergency drawdown capacity, some piped emergency overflow, and to allow for catchment boundary revisions at the time of detailed design.

Detention facilities shall be designed as part of both the minor and major drainage systems. They must control the peak runoff conditions for events up to and including the 1-in-100- year return period.

2.2 RAINFALL INTENSITY – DURATION – FREQUENCY

The following formulas define the Intensity-Duration-Frequency Curves (IDF Curves) utilized for the City of Grande Prairie. The curves have been formulated based on data from several different rainfall data sources including the City of Grande Prairie rain gauges with data being compiled from 1961 to 2017. A tabulated form for the IDF curves is included in Appendix A.4 of this section.

Table 12.1 IDF Formulas

2018 IDF Formulas (1961 – 2017 Data)	
Return Period	**Average Intensity (mm/hr.)**
2 year	$271.3 (t + 2.35)^{-0.713}$
5 year	$393.6 (t + 1.64)^{-0.714}$
10 year	$477.6 (t + 1.38)^{-0.714}$
25 year	$585.1 (t + 1.18)^{-0.715}$
50 year	$672.3 (t + 1.12)^{-0.718}$
100 year	$753.0 (t + 1.04)^{-0.718}$
1000 year**	$1030.8 (t + 0.92)^{-0.722}$

t = time (minutes)

** Use with discretion

These IDF formulas shall be used for all new storm basins. For established basins, the design flows shall be based on existing pipe capacities.

2.3 STORM CATCHMENT CALCULATIONS

Computer modelling shall be utilized to design all storm sewer systems except in cases where it can be clearly demonstrated to the satisfaction of the City Engineer that the use of a computer model would be impractical, and only for areas less than 65 ha. The Rational Method may be utilized in these instances, or may be utilized to validate computer modelling results.

Models shall integrate both the minor drainage system (i.e. storm sewers) and the major drainage systems (i.e. surface flow) to ensure that the system is adequately stress-tested under surcharged conditions (i.e. larger than 1:5 year rainfall event). Computer models must be used to determine design flows and the sizing of systems which contain non-pipe

stormwater management facilities (e.g. detention ponds) or systems that include a significant amount of undeveloped land.

In all analyses, the parameters used, the drainage boundaries, the pipe network and its connectivity shall be clearly identified on the overall plan in the Detailed Engineering Drawings, computer printouts and a design summary report.

The City utilizes DHI's Mike Urban software. Other modelling software options include CHI PCSWMM, Innovyze's XPSWMM, EPA SWMM and AutoDesk Storm & Sanitary Analysis.

In the event that the use of the Rational Method is deemed acceptable by the City, the following criteria shall be used in the design of the minor storm sewer system:

$$Q = (C * i * A)/360$$

Where: Q = the design peak flow rate in cubic metres per second (m^3/s)

i = the intensity of rainfall in millimetres per hour corresponding to the time of concentration (mm/h)

A = the contributing area in hectares (ha)

C = the runoff coefficient

The five-year and the one-hundred-year rainfall intensities used shall be as calculated using the formulas in Table 12.1. Runoff coefficients shall be according to Table 12.2.

For developed areas, the weighted average of pervious and impervious area runoff coefficients shall be estimated from the following equation:

$$C = \frac{C_p A_p + C_i A_i}{A_p + A_i}$$

where the subscripts 'p' and 'i' indicate the pervious and impervious surfaces, respectively.

For planning of new areas, the minimum "C" value for various land uses are summarized in the table below.

Table 12.2 Runoff Coefficients

Land Use or Surface Characteristics	Rainfall Event Return Period		
	5 Years	10 Years	100 Years
Residential	0.50	0.5	0.60
Apartments[1]	0.70	0.70	0.80
Downtown Commercial[1]	0.85	0.90	0.90
Neighbourhood Commercial[1]	0.70	0.70	0.80
Light Industrial[2]	0.60	0.70	0.70
Lawns, Parks, Playgrounds	0.20	0.25	0.30
Undeveloped Land (Farmland)	0.10	0.15	0.20
Paved Streets	0.90	0.95	0.95
Gravel Streets	0.25	0.35	0.65

1. Where specific land surfaces are known for Apartment and Commercial areas, the runoff coefficient may be determined based on the surface characteristics for the ultimate development conditions.

2. Runoff coefficients for industrial land use must be estimated based on ultimate land use condition

Note: Values are the recommended minimum for use in the Rational Method.

Table 12.3 Imperviousness

Land use / Surface Cover Type	Minimum Percent Impervious
Single Family Residential	50%
Multi-Family Residential	65%
Medium-Rise Apartment	90%
Neighbourhood Commercial	80%
Downtown / Large Commercial	90%
Industrial	70%
Public Park	10%
Predominantly Grassed Areas	10%
Schools	30%
Asphalt, Concrete, Rooftop	100%

The duration of rainfall used to determine the intensity is equal to the time of concentration. The time of concertation (T_C) for runoff flow is the time required for runoff to become established and reach the design location from the furthest point within the contributing area. Tc is defined as follows:

$$T_C = Inlet\ Time + Travel\ Time$$

Inlet time is the time for flow to reach from the extreme limits of the catchment to the first point of inflow into the defined conveyance system. Design inlet times are provided within Table 12.4. In the event that an inlet time as provided below does not meet the requirements of a development, a calculation of the inlet time can be submitted for the review and consideration for approval by the Municipal Engineer. In the event that the Municipal Engineer accepts an alternative inlet time, the travel time must still be calculated by the Developers Engineer and the above formula is still to be utilized.

The maximum inlet times are as follows:

- 10 minutes for catchments 8 ha and larger with imperviousness of less than 50%
- 8 minutes for catchments smaller than 8 ha with imperviousness of less than 50%
- 7 minutes for catchments 8 ha and larger with imperviousness of 50% or more
- 5 minutes for catchments smaller than 8 ha with imperviousness of 50% or more

Travel Time is the time required for flow to travel within the conveyance system from the point of inflow to the design location.

The following design storms are to be utilized for the design of drainage systems:

- 4-hour Chicago Distribution (Table A.1)
- 12 hour Huff Distribution (1st Quartile) (Table A.3)
- 24-hour Huff Distribution (1st Quartile) (Table A.4)
- 24-hour Chicago Distribution (Table A.2)

2.4 SITE DRAINAGE

2.4.1 Release to Storm Drainage System

No Person shall release, or allow to be released, any prohibited material into the storm drainage system. The following may be released into the Storm Drainage System:

a) foundation drainage;

b) water from a portable swimming pool, decorative pond or fountain, having a capacity of three (3) cubic meters (3000 litres) or less;

c) water from irrigating or otherwise watering a lawn, garden and trees or other landscaping; or

d) water from washing of single-family or semi-detached homes with potable water;

e) water resulting from extinguishing fires;

f) water in accordance with a permit or written approval from the Director; and

g) water in accordance with an approval pursuant to Section 12.

All discharges to the City's storm drainage system shall conform to the City's Drainage By-law.

2.4.2 Roof Drainage

Roof drainage from residential, apartments, commercial and industrial buildings shall discharge to grassed or pervious drainage areas.

Roof drainage from apartment buildings, commercial areas, and industrial areas may discharge to a private storm sewer system that is connected to the City's storm sewer system through an approved storm service connection conforming to the City's Drainage By-law C-1241 and subsequent amendments.

2.4.3 Weeping Tile Connections

Weeping tile from residential, apartments, commercial and industrial buildings shall discharge to grassed or pervious drainage areas.

Weeping tile from one family and two family dwellings may discharge to the City's storm sewer system when a storm service connection has been provided to that dwelling and the dwelling has a sump pump system in accordance with Standard Detail 20.23.

Weeping Tile from apartment buildings, commercial areas, and industrial areas may discharge to a private storm sewer system that is connected to the City's storm sewer system through an approved storm service connection conforming to the City's Drainage Bylaw.

2.4.4 Service Connections

All developments are required to provide a detailed site grading plan identifying storm drainage patterns, on-site detention, storm sewers, manholes and catchbasins.

Calculations for storm sewer and detention sizing must be provided for sites with private storm sewers and detention.

For all new developments a storm sewer and storm service stubs shall be provided to each lot created for multi-family residential, commercial and industrial development.

For all new single family and duplex developments a storm sewer and storm service stub shall be provided when the seasonally corrected ground water level is within 3.5m of the centerline of the road design grades. It is at the Municipal Engineers discretion to waive this requirement.

2.4.5 Service Connection Design Criteria

The storm service stub size is to be determined based on the following, depending on the capacity of the downstream storm sewer system:

Redevelopment Areas

Where the new service is being connected to an existing main in an older area of the City, the allowable capacity for the development will be based on the following formula:

$$Allowable\ Flow = \frac{Site\ Area}{Upstream\ Catchment\ Area} * Capacity\ of\ the\ System$$

New Development Areas

Where the new service is being connected to an existing main in a recently developed area of the City, the allowable capacity for the development will be determined using the 1:5 year rainfall IDF curve and the appropriate run-off coefficient.

2.4.6 Service Connection Installation

Residential lots

Storm services shall be a 150mm in diameter with a 150 mm – 100 mm reducer at the property / easement line to allow for 100mm connections. The storm service shall have a plug in it and be insulated if less than 1.8 m cover.

Storm services shall be installed at the same location as the sanitary services at the property / easement line as per the typical service detail.

Multi-Family Residential, Commercial and Industrial Lots

Storm services shall be based on allowable capacity for the development determined by downstream capacity.

Where the development is located in an area that does not have offsite detention facilities to provide flood control for events up to the 1:100 year storm event or downstream capacity constraints exist, the site should be designed with onsite detention to accommodate storage volumes for events up to the 1:100 year event. The maximum allowable discharge from the site shall be limited to a predevelopment flow of 5 l/s per hectare.

Please note that the minimum allowable orifice restriction size is 50mm in order to reduce the potential for blockage of the orifice by very small debris.

If a large portion of the site is landscaped or ponding volumes are not feasible due to small lot sizes than larger release rates may be permitted at the discretion of the Engineering Services Department.

Calculations for storm sewer and detention sizing must be provided for these sites. Ponding of runoff on roofs, parking lots or landscaped areas to reduce runoff rates must be approved by the Municipal Engineer.

2.5 MINIMUM PIPE SLOPES / VELOCITIES

The minimum velocity shall be 0.6 m/s. Where velocities in excess of 3 m/s are attained, special provisions shall be made to protect against displacement by erosion or impact.

TABLE 12.4 Pipe Minimum Slope

Pipe size	Min. Slope
200 mm	0.40%
300 mm	0.22 %
375 mm	0.15 %
450 mm	0.12 %
525 mm	0.10 %
600 mm	0.10 %

2.6 "N" VALUES

Pipe sizing shall be determined by utilizing the Manning's Formula, using an "n" value of 0.013 for concrete and plastic pipes.

2.7 HYDRAULIC GRADELINE

Storm sewer pipe shall be designed to convey the design flow when all pipes are flowing full, with the hydraulic gradeline occurring at the pipe obvert / crown.

All pipe obvert elevations must match at manhole junctions to carry the hydraulic gradient.

2.8 MAXIMUM SURFACE DRAINAGE

Surface water shall not be permitted to run a distance greater than the following, without provision for interception by the first catchbasin or catchbasin manhole, as the case may be:

Paved Lanes as measured in the center line of the lane:

- 300 metres or the intersection of the curb/gutter of a road, whichever is shorter, for longitudinal grades greater than 1 %,
- 200 metres or the intersection of the curb/gutter of a road, whichever is shorter, for longitudinal grades between 0.8% and 1 %.

Local Roads as measured in a continuous concrete gutter:

- 200 metres with longitudinal grades greater than 1%,
- 150 metres with longitudinal grades between 0.6% and 1%.

Collectors or Arterial road, as measured in a continuous concrete gutter, shall not exceed 120 metres.

On new PUL lots or parks providing overland drainage for adjacent parcels, as measured in the grass swale, the maximum distance shall be 120 metres at a minimum longitudinal grade of 0.8%. Grades <0.8% are acceptable in older subdivisions where a grade ≥0.8% cannot be established due to adjacent development restrictions (e.g. existing concrete or paved driveways, garages, etc.).

The above requirements are a maximum for straight portions of road or utility lot. When the drainage is proposed to be directed around a significant curve or bend the Municipal Engineer may request catchbasins to be placed at a closer spacing to allow for sufficient drainage interception during high runoff or spring thaw events.

In the design of drainage inlets along walkways and utility rights-of-way, the designer must consider the total area that may drain to them and space catch basins and inlets accordingly.

2.9 DRAINAGE INTERCEPTION

Surface water shall be intercepted with an adequate number of catchbasins such that the inlet capacity is sufficient to receive the design stormwater flow. In all cases an analysis of catchbasin grate capability will be required to determine if the system requires a double set of catchbasins to accommodate the volume of water carried over that distance. Catchbasin capacity shall be considered as shown in the Table below, where values are given for sag conditions and on slope conditions based upon inlet grate type.

Table 12.4 Catchbasin Capacities (L/s)

Catchbasin	Flow Condition	
	Continuous Slope	Sump Condition
F33	11	20
F36	10	23
F38, F39	20	38
K1A/F51A	40	80
K2	25	45

Notes:

a) Capacities for F33 and F36 are based on hydraulic studies conducted by the City of Edmonton (Townsend and Moss, 1980). Continuous slope capacity based on gutter flow of 40 L/s (1.4 cfs). Sump capacity is based on 5 cm (2 in) in head.

b) Capacities for others are based on the work of Wilson (1983). Continuous slope capacity based on ratios for F33 and F36 tests. Sump capacity based on 65% of theoretical capacity for 5 cm (2 in) head.

c) Capacities can be considered to be double those shown in the table when assessing the 1-in-100-year event.

The following should be considered when choosing locations for sewer inlets

a) Drainage should not pass through intersections, but rather, sufficient inlet capacity is to be provided to intercept all flow at the uphill side.

b) Inlets required at sags and/or at intersections should be located at the EC or BC of the curb return.

c) Where there is a continuous grade through the curb return at an intersection, stormwater catch basins and catch basin manholes shall be located at the uphill side of the curb return (BC).

d) Design locations for catch basins on residential or other roadways shall be chosen to avoid conflict with driveway crossings wherever possible. Subject to roadway design, drainage locations at property lines are preferred in these instances.

e) Minor runoff event flows from swales or other flow channels draining significant areas of residential development, parks, school sites, municipal reserve, public utility lots, or walkway lots shall not cross sidewalks or walkways. To avoid excessive drainage of water across walks, or ponding of water where flow is obstructed by walks, drainage inlets shall be provided at strategic locations on the upstream side of walks to intercept concentrated drainage flows. Catch basin inlets are to be installed for this purpose and shall be located a minimum of 600 mm from the edge of the walk.

f) Catchbasins and catch basin manholes used to intercept drainage in lanes are to be located generally at the longitudinal centreline of the lane and so as not to be within the typical wheel track area.

g) Catchbasins shall not be located within or directly adjacent to para-ramps. A minimum of 600 mm spacing must exist between the outside edge of the para-ramp assembly and the closest edge of the catchbasin frame.

2.10 MINIMUM GUTTER GRADE

The minimum gutter grade shall be 0.60%, and 0.80% on curves with radii less than or equal to 20m, refer to Section 14 – Roadway Design Standards for more information.

2.11 MAIN DETAIL AND LOCATION

Storm main design will meet the following requirements:

a) The minimum size of storm sewer mains shall be 300mm in diameter.

b) Mains installed for residential lot service connections only may be 200mm in diameter with a minimum grade of 0.40%.

c) Pipe classes shall be determined to withstand subsequent superimposed loading. Approved Class B sand bedding shall be used with all size pipes having water tight joints. CSP pipe is not considered as having water tight joints, and will require Class B crushed gravel bedding.

d) Various factors affecting the pipe class shall be taken into account, and pipe class shall be evaluated as per standard engineering practice, and clearly identified on the Detailed Engineering Drawings.

e) Mains shall be installed to provide a minimum cover to top of pipe of 1.80 m from the final finished surface grade.

f) Mains shall be located within the right-of-way (ROW) in accordance with Section 20, Cross Sections.

g) Storm main(s) shall be separated by a minimum horizontal distance from the water main(s) by

- 2.50 metres measured from the center of each pipe, for pipe diameters of 300 mm or less,
- 2.20 meters measured from outside walls of pipes, for pipe diameter greater than 300 mm.

h) At crossings, storm main(s) shall be separated by a minimum vertical distance from the water main(s) by 500 mm measured from the outside walls of the pipes.

i) At crossings, storm main(s) shall be separated by a minimum vertical distance from the sanitary main(s) by 500 mm measured from the outside walls of the pipes.

2.12 MANHOLE DETAIL AND LOCATION

Manholes shall require:

a) Safety platforms at intermediate levels greater than 6.5m in depth. All barrels and cones shall be provided with bar ladder rungs spaced at 400mm O.C.

b) Manholes shall be located at the upstream end of each line, at all changes in pipe size, grade, material and alignment. Under no circumstances will manholes be permitted in driveways or private property. Due consideration should be given to access by a flusher truck.

c) Storm sewers for weeping tile connections are to be extended 1.5 m past the last house service lead, with the exception of storm mains in cul-de-sacs where service leads may be connected directly to the end of the line manhole provided that the lead enters the manhole less than 0.60 m above the invert of the main.

d) Benching in manholes shall be provided to minimize hydraulic losses. The downstream invert in a manhole shall be a minimum of 30mm lower than the lowest upstream invert. At a change in direction, the drop shall be a least 60mm. If an influent pipe diameter is greater than 525 mm and the bend is greater than 45 degrees or if the outflow pipe velocity exceeds 1.5 m/s, then minor losses shall be considered.

e) Tee riser manholes may be utilized on lines 900 mm in diameter and larger. Tee riser manholes must be bedded in concrete to the spring line of the pipe.

f) Manhole spacing on storm sewers may not exceed 120 m.

g) Manhole spacing on curved sewers shall not exceed 90 m along the curve. Manholes shall be located at the beginning and end of curve.

h) Manhole bases should be reinforced concrete poured-in place, precast slabs, vaults, or precast tees as per the City of Grande Prairie Construction Manual.

i) Manhole frames and covers are not to be located within a sidewalk.

j) Manhole frames and covers (including catchbasin manholes) are not to be installed within 600 mm from the outside edge of the para-ramp assembly and the closest edge of the manhole frame, and are not to be installed within a driveway.

Where drops of 1.0 m or less occur at manholes, the designer is to ensure that free outflow and low backwater conditions will exist in the downstream sewer so that hydraulic jump formation and associated concentrated scouring effects are avoided.

For drops of greater than 1.0 m, a specifically designed drop manhole may be required to address the hydraulic requirements of the change of elevation.

2.13 CURVED SEWERS

Curved sewers will be permitted with the following restrictions:

a) Only to follow curved right-of-ways

b) The sewer shall be laid as a simple curve with a radius equal to or greater than 90 m or the manufacturer's minimum recommended radius, whichever is larger.

c) Manholes shall be located at the beginning and end of the curve.

d) Manholes shall be located at intervals not greater than 90 m along the curve.

e) The main shall run parallel to property line.

f) The minimum grade for sewers on a curve shall be 50% greater than the minimum grade required for straight runs of sewers.

2.14 CATCHBASIN LEAD DETAIL AND LOCATION

Catchbasin leads shall:

a) Be installed only into manholes or catchbasin manholes, as the case may be.

b) Catch basin leads shall be installed to maintain designed hydraulic gradient within the system, and shall be installed matching the obvert of the senior pipe.

c) Have a minimum lead size of 300mm in diameter with a minimum grade of 2.0%.

d) The maximum length of a catchbasin lead shall be 30m.

e) If a lead of over 30m in length is required, a catchbasin manhole shall be installed at the upper end.

f) Catchbasin leads shall have a minimum cover of 1.20 m from the finished road surface to the top of pipe.

2.15 OUTFALL DETAIL AT CREEKS

Obverts of outfall pipes shall be at least 150 mm above the 1-in-5-year flood level in the receiving stream.

Inverts of outfall pipes shall be above the winter ice level. Otherwise, outfall pipes shall be located to avoid damage from moving ice during breakup.

b) Drop structures and energy dissipaters shall be used where necessary to prevent erosion. For all outfalls, it is required that a hydraulic analysis be completed, to ensure

that the exit velocities will not damage natural watercourses. The final exit velocities, where the flow passes from an apron or erosion control medium to the natural channel, shall not exceed 1.0 m/s and may be further limited depending on site specific soil and flow conditions.

c) Facilities shall be provided which will prevent entry or access by children or other unauthorized persons. A grate with vertical bars spaced at no more than 150 mm shall be installed with adequate means for locking in a closed position. Provide for opening or removal of the gate for cleaning or replacing the bars.

d) Outfalls, which are often located in parks, ravines, or on river banks should be made as safe and attractive as is reasonably possible. The appearance of these structures is important and cosmetic treatment or concealment is to be considered as part of the design. Concrete surface treatment is recommended to present a pleasing appearance.

e) The outfall shall require the approval of the Municipal Engineer.

f) The outfall shall be designed in a manner which discourages the passage of fish upstream and into the storm sewer system.

2.16 RURAL RUNOFF OUTLETS

a) Each inlet may be unique and appropriate consideration must be given to provisions for grates, safety, debris interception, sediment catchment and storage and maintenance. Normally a road right-of-way or a public utility lot will be required to permit access to inlets for maintenance purposes.

b) Gratings installed over the ends of rural runoff inlets shall be sized with hydraulic capacity of 200% of the design flow rate to allow for the effects of blockage or fouling of the grate by debris carried by the flow.

3. MAJOR SYSTEM

3.1 COMPOSITION AND CONTROL

The major system comprises the street system, detention facilities, parkland and any other land required to convey runoff from events up to and including a 1-in-100-year return period to the receiving water. The major system shall be evaluated in a manner sufficient to ensure that no flooding that may cause significant property damage (e.g. flooding of buildings) occurs during the 1-in-100-year event.

Detention facilities shall be designed as part of both the minor and major drainage systems, and they must control the peak run-off condition for events up to the 1-in-100-year return period.

3.2 RETURN PERIOD EVENT

The major drainage system shall be assessed with respect to the 1-in-100-year return period event. New developments must also accommodate the major flows from adjacent developments.

3.3 ON-STREET STORAGE AND FLOW-ACROSS CONSIDERATIONS

The grading of streets and the layout of the major drainage system shall be assessed, relative to the following guidelines, during the 1-in-100-year event:

a) Storm water will be contained within City property.

b) No building shall be inundated at its ground line.

c) Continuity of the overland flow routes between adjacent developments shall be maintained.

d) The depth of ponding for all roads should be less than the following:

- Local / Collector Roads - 350mm
- Arterial Roadways - 150mm

e) All ponding areas are to be denoted on the detailed engineering drawings and to adhere to Alberta Environment's standards regarding depth

f) The major overland route and calculated depth of ponding shall be clearly identified on the overall lot grading plan of development.

g) The velocities and depths of flow in the major drainage system shall not exceed the values outlined in the table below:

Table 12.5 Permissible Depths for Submerged Objects

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

Note: Based on a 20kg child and a concrete lined channel. Larger persons may be able to withstand deeper flows.

3.4 INLET / OUTLET CONTROL DEVICES

The outlet from an onsite stormwater management storage system must incorporate appropriate means for the control of outflow and to limit the rate of discharge. The proposed release rates are to be confirmed by detailed modelling of the existing storm sewer system and are to be based on any proposed changes in the release rate to the receiving water body and revisions to the basin boundaries.

Orifice plates or "hydrobrakes" shall be employed as outlet control devices with by-pass system. Controlling flow by restricting pipe diameter and slope should not be approved. Inlet control, utilizing different styles of catchbasin grates is also recommended. Minimum orifice restriction size to be 50mm.

3.4.1 Storm Pond Inlets/Outlets

Pond inlets/outlets should be designed with a minimum 100mm sump, either through being elevated 100mm above the pond bottom, or by providing a plunge pool adjacent to the inlet/outlet. This will assist in reducing resuspension of sediments and provide scour protection.

Design of all outlet structures shall allow for operational flexibility and mitigate any risks of blockage from debris and/or freezing. It should be possible to adjust the rate of flow without physically altering the structure (i.e. removal of orifice plates). The outfall structure should utilize a feature such as a slide gate or similar mechanism to isolate the discharge out of the facility.

The outlet works should include a bypass which allows rapid draw-down of the facility. This bypass should be designed to allow wet facilities to be drained below normal water level. The discharge rate of the bypass should be designed to the full capacity of the downstream system.

Pond outlet control structures must be accessible by land when pond is at high water level.

The designer shall provide an operation and maintenance manual as part of the outlet control structure record drawing submission.

4. STORMWATER MANAGEMENT FACILITY DESIGN

4.1 OVERVIEW

Detention facilities and the entire area that would be submerged by the 1-in-100-year event and the associated freeboard shall be contained on City property. The need for a specific detention facility shall require the approval of the Municipal Engineer. In assessing the need for specific detention facilities, the Developer’s Engineer must consider the impacts of uncontrolled drainage as well as the capital and operating costs of providing control.

Where a detention facility is to have multiple functions, its design shall consider the aesthetic implications of shape, grading and landscape features. The Municipal Engineer should be contacted to provide input during the conceptual stages.

An emergency overflow system shall drain to a receiving stream, if possible, for storms greater than the 1-in-100-year event.

The effects of the maximum pond water levels shall be considered in the design of the minor system and lot grading. The hydraulic gradeline elevations for the minor system piping shall be calculated starting from the maximum ponding level during the 1-in-5- year storm event.

Proposals that rely on third party implementation shall not be accepted.

4.2 BASIS FOR DETAILED DESIGN

4.2.1 Level of Service

Stormwater management facilities shall be designed to satisfy the level of service requirements for major system storage elements as stated above. The requirements for hydraulic performance for stormwater management facilities including storage capacity, outlet restrictions, bypass and drawdown rates and other basic design parameters such as elevations and design water levels are required to be specifically defined and documented in the Storm Design Report for the respective development area.

From design full level, all attempts shall be made to ensure that facilities are able to draw down volume equivalent to runoff from a 1:5 year storm even within 24 hours and they are able to draw down 90% of their live storage within 96 hours. In the event that these levels of service are not achievable, the Municipal Engineer may be presented with the options closest to the design levels of service for further review and a one-off accommodation may be considered.

4.2.2 Geotechnical Considerations

Special geotechnical investigations to address issues related to the design of all constructed wetlands, stormwater management ponds and dry ponds are to be undertaken as a part of the planning and design studies and are a prerequisite to the final design of such facilities.

4.2.3 Aesthetic Considerations

Where a detention facility is to have multiple functions, its design shall consider the aesthetic implications of shape, grading and landscape features. The Municipal Engineer should be contacted to provide input during the conceptual stages.

4.2.4 Staged Construction – Standards for Interim Facilities

When stormwater management storage facilities are to be implemented in stages, the standards applicable to the design and construction of the interim facilities are to be generally in accordance with the standards set out herein for permanent facilities of that type. For example, where an interim dry pond facility is proposed as a preliminary stage in the implementation of a stormwater pond system, it shall be designed and constructed in accordance with the criteria and standards applicable to a permanent pond. Any proposal for application of alternative standards will require special approval.

4.2.5 Storage Alternatives

The review of stormwater management facility alternatives should include the storage methods described in this subsection. The optimum number and location of stormwater management facilities must be determined bearing in mind the major/minor system concept. A combination of the various types of facilities should be considered to select a cost-effective drainage system that minimizes flooding and erosion and maximizes water quality improvement. Constructed wetlands or wet ponds should be used as the final treatment process prior to discharging to the receiving watercourse.

1. Wet Pond - Retention Storage

Retention Storage collects and stores storm runoff for a significant period and releases it after the storm runoff has ended. Retention storage is often associated with “wet reservoirs,” more commonly referred to as “stormwater management lakes” or “wet ponds”. These may accommodate special recreational or aesthetic uses centered on a minimum number of permanent pools.

2. Wetland Pond – Retention Storage

Constructed stormwater wetlands are human-made systems, designed, constructed and operated to emulate natural wetlands or many of their biological processes. They are generally shallow impoundments, planted with emergent rooted vegetation or colonized naturally by volunteer plant species. Water is the primary factor controlling the environment and associated plant and animal life. The water storage, filtering capacity and biological processes in wetlands can improve the quality of stormwater discharge. They may be designed as single or multiple cell compartments to allow redistribution of flows, maintenance of plant communities and flexibility in operation. Multiple cell wetlands may be designed as a series of cells or as parallel cells.

3. Dry Pond - Detention Storage

Detention storage or “dry ponds” have been commonly used for storage in urban drainage works but their use is actively discouraged by the City because of their shortcomings for stormwater quality enhancement. When the inflow is large enough, the proper functioning of flow controls on the outlet from the system restricts the outflow to a rate much less than the inflow and causes the excess to be temporarily detained in the storage element. Dry ponds should only be used at the discretion of the City when constructed wetlands and or wet ponds are not practical, such as under the airport flight paths.

4. Upstream Storage

The storage of water close to the points of rainfall occurrence is referred to as upstream storage. This may be retention or detention storage and usually consists of rooftop ponding, parking lot ponding, property line swale ponding and small ponds in green areas. Although this method lends itself well to planned unit development, it may only be applicable when suitable and effective means are established to ensure that both implementation and long-term operating and maintenance responsibilities are met by property owners.

5. Downstream Storage

Water stored downstream of the area where the rainfall occurs is downstream storage. It may be of either the retention or detention types.

6. Offstream Storage

A minor conveyance system may conduct low flows directly to an outlet, but have restricted outlet capacity or flow control elements that allow only peak flows to be routed to a storm water management facility for storage. This form of storage is usually termed “offstream” or “off-line” storage. The storage may incorporate depressed open areas, reservoirs and low lying recreation fields.

7. Channel Storage (Drainage Parkway)

Slow-flow channels with wide bottoms provide channel storage as an inherent part of their hydraulic characteristics. As the channel fills to transport water it is also storing water.

8. Onstream Storage (Drainage Parkway)

Onstream storage is achieved through the construction of an embankment across a channel so that a storage pond is formed. Spillway considerations are important to pass large floods exceeding the design runoff.

4.3 ENGINEERING DRAWING REQUIREMENTS

The engineering drawings for any SWM facility are to include the following information, in addition to the physical dimensions:

a) The High Water Level (HWL) design event (The design event should be denoted i.e. the 1:100 year and the design rainfall should be noted)

b) Elevations at Normal Water Level (NWL), 5 Year Level and HWL

c) Volumes at NWL, 5 Year Level and HWL

d) Freeboard elevation

e) Freeboard storage volume

f) Pond Bottom elevation

g) Notation including the lowest allowable building opening elevation for lots abutting the pond

h) Contributing basin size in ha

i) Measurements to located submerged inlet(s), outlet(s) and sediment traps referenced to identifiable, permanent features which are not submerged at NWL

j) Depth-Area curve (in both graphical and table format)

k) Depth-Storage curve (in both graphical and table format)

4.4 DESIGN DETAILS FOR WET PONDS

4.4.1 Land Dedication

a) The requirement for dedication of land on which a stormwater management pond is to situated will be in accordance with the City's current practices.

b) The area of land covered by water, subject to flooding to HWL and freeboard will be designated as a "Public Utility Lot", "Road Right-of-Way", or as approved by Council. This designation will also apply to all rights-of-way for access to and protection of inlets, outlets and flow control facilities, and maintenance access routes to the pond.

4.4.2 Minimum Size

The minimum surface area shall be 2 hectares at normal water level. This is to discourage proliferation of large numbers of small ponds with higher maintenance costs and to achieve water quality and treatment objectives.

4.4.3 Side Slopes

a) Side slope requirements are to be generally as shown Standard Detail 20.24.

b) Areas normally or infrequently covered by water, from the design high water level down to a point 1.0 m below the normal water level, shall have a maximum slope of 7 horizontal and 1 vertical. This is to include all overflow areas.

c) A slope of 3 horizontal to 1 vertical shall be used from the 1.0 m depth point (below normal water level) to the pond bottom.

d) Where confined space or extremes of topography dictate, limited areas within overflow areas located on Public Utility proposals to amend the slope requirements will be approved by the Municipal Engineer on a site specific basis.

4.4.4 Depth

The minimum depth from normal water level to pond bottom (beyond the side slope area) shall be 2.0 m and the maximum 2.5 m. Refer to Standard Detail 20.24.

4.4.5 Fluctuation

The maximum water level fluctuation in residential areas during the 1-in-100-year storm event shall be 2.0 m. Refer to Standard Detail 20.24.

4.4.6 Freeboard

The minimum freeboard required is 1.0 m. At the Municipal Engineers discretion in consultation with the Developers Engineer, ponds with surface areas exceeding 2.0 hectares and with less than 1.0 meter water fluctuation during a 1:100, the Municipal Engineer can reduce the required freeboard. d Bottom Material

a) For areas where the ground water table is below NWL, the pond bottom and side slopes are to be composed of impervious material with a suitably low permeability (e.g. with a permeability coefficient in the order of $1x10^{-6}$ cm/s). Intruding silt or sand seams shall be sealed off.

b) For areas where the ground water table is expected to be near or above the NWL, the pond bottom may be of a pervious material as dictated by geotechnical considerations.

4.4.7 Circulation Requirements

Narrow and/or dead bay areas where floating debris may accumulate are to be avoided. Inlets and outlets should be located to maximize detention time and circulation within the pond water body.

4.4.8 Inlet and Outlet Requirements

1. Submergence of Inlets and Outlets

Inlets and outlets are to be fully submerged, with the crown of the pipe at least 1.0 m below normal water level with less than 25 meters of pipe allowed to be flooded.

2. Provision for Free Outfall from Inlets to Wet Pond

The invert elevation of the inlet pipe(s) to the first manhole upstream from the wet pond shall be at or above the normal water level of the pond to avoid deposition of sediments in the inlet to the pond. To avoid backwater effects in the upstream sewers the obvert of the inlet sewer at the first manhole upstream from the pond shall be at or above the pond level for the 1 in 5 year storm. A drop structure upstream from the pond will generally be required to achieve this. Inlet and outlet control calculations are required to verify the mode of operation of the inlets.

3. Separation of Inlets and Outlets

Whenever feasible and at the discretion of the City, the inlet and outlet should be physically separated and be located at the perimeter of the facility. The inlet and outlet should be distanced as far as possible from each other to avoid hydraulic short- circuiting.

4. Sediment Removal Provisions

a) The pond design shall include an approved sedimentation removal process for control of heavy solids that may be washed to the pond during the development of the contributing basin.

b) Sediment basins shall be provided at all inlet locations for use after completion of the subdivision development.

5. Wet Pond Edge Treatment

a) Edge treatment or shore protection is required and shall be compatible with the adjacent land use. The treatment used shall meet the criteria for low maintenance, safety and ease of access to the water's edge.

b) The edge treatment is to cover 1.5 m below and 3.0 m horizontally above the normal water level and shall be adequate to prevent erosion of the pond edge due to wave action.

c) The designer is encouraged to propose alternate edge treatments that exceed this minimum standard. The final selection of edge treatment is subject to the approval of the Municipal Engineer.

6. Landscaping Requirements

Landscaping of areas bounding the pond is to be part of the pond construction requirement, and plans shall be submitted as part of the engineering drawings. This shall include all proposed public lands comprising the pond and all easement areas on private property, including areas from the pond edge treatment to the limit of inundation when the pond is filled to the design high water level. Refer to Standard Detail 20.24. Recommended vegetation establishment is to follow one of the below options:

1. Seed the area utilizing a grass mixture with species as outlined in the table Category 4 – Plant Material Use in Naturalized Areas (Section 16) and designate it a no-mow area. Treat for noxious and prohibited noxious weeds as necessary.
2. Plant the area utilizing any mixture of plants from Category 4 – Plant Material Use in Naturalized Areas (Section 16) along with the associated densities as provided in the Category 4 table. Treat for noxious and prohibited noxious weeds as necessary.

7. Best Management Practices for Design

a) Pond Shape: To avoid reducing the pollutant removal capability and to maximize travel distance, the inflow points of the wet pond should be as far from the outlet as possible. To maximize stormwater contact and residence time in the pool, a length to width ration of 3:1 to 5:1 is recommended.

b) Avoidance of short-circuiting and the promotion of plug flow: To prevent short-circuiting, water is forced to flow, to the extent practical, to all potentially available flow routes, avoiding “dead zones” and maximizing the time water stays in the pond during the active part of a storm. Design features that encourage plug flow and avoid dead zones are:

- Providing a broad surface for water exchange across cells rather than a constricted area.
- Maximize the flow path between inlet and outlet, including the vertical path; also, enhance treatment by increasing residence time. Bafflers or islands can be added within the permanent pool to increase the flow path.

- The ratio of flow path length to width from the inlet to the outlet should be at least 3:1. The flow path length is defined as the distance from the inlet to the outlet, as measured at mid-depth. The width at mid-depth can be found as follows: width = (average top width + average bottom width)/2.
- If there are multiple inlets, the length-to-width should be based on the average flow path length for all inlets

4.5 DESIGN DETAILS FOR CONSTRUCTED WETLAND

A wetland specialist should be consulted throughout the design of the facility and its tributary development to ensure that the water level and water fluctuations will not negatively impact the wetland. Both normal water levels and water fluctuation parameters should be kept as close to natural as possible, unless recommended otherwise by a wetland specialist.

Refer to Standard Detail 20.25.

4.5.1 Land Dedication Requirements for Constructed Wetlands

a) The land requirement for dedication of land on which a storm water management pond is situated will be in accordance with the City's current practices.

b) The area of covered by the wetlands, subject to flooding to the HWL and freeboard will be designated as a Public Utility Lot, Road Right-of-Way or as approved by Council. This designation will also apply to all rights-of-way for access to and protection of inlets, outlets and flow control facilities, and maintenance access routes to the pond.

c) Constructed wetlands should be designed around naturally low topography and features and they should avoid disruption of natural wetlands habitats as much as possible.

4.5.2 Suspended Solids Removal

The minimum design requirements for total suspended solids removal is 85% of particle size 75µm or greater, as recommended by Alberta Environment, April 2001. Constructed wetlands are considered to be the most efficient treatment for sediment control and it is expected that this recommended criteria for reduction of total suspended solids will be achieved.

4.5.3 Wetland Drainage Area

a) A minimum drainage area of 5 ha is required to generate constant or periodic flow to the constructed wetland.

b) The smallest practical drainage area is considered to be 20 ha. For drainage areas between 5 and 20 ha in size, the City may approve the use of constructed wetlands on a site-specific basis.

c) To determine that a permanent pool can be maintained in a constructed wetland, hydrological studies are to be conducted using the size and characteristic of the drainage area.

d) The City prefers that fewer, larger wetlands be constructed rather than a series of smaller constructed wetlands.

d) The Developer is required to implement appropriate sediment controls during development in the drainage area to minimize sediment loading to the forebay and wetland during construction phase of the project and during the staged construction of the stormwater management facility.

4.5.4 Wetland Soil Characteristics

a) For wetland deep water areas, low soil permeability of 10^{-7} m/s is recommended to maintain a permanent pool of water and minimize exfiltration. Compacted sandy clays and silty clay loams may be suitable provided that documented geotechnical testing demonstrates low soil permeability.

b) Wetland vegetative zones can be constructed using soils from recently displaced wetlands, sterilized topsoil, or peat from within the drainage basin or region. A layer of 10 cm to 30 cm soil shall be spread over the vegetation zones of the constructed wetland. Planting will be done in this soil over the 2 years following construction.

c) One year after completion of construction a stable mixture of water tolerant grasses shall be in place.

d) In the spring of the second year following construction of the non-surviving woods plants shall be replaced and the remaining 50% of the woody plants should be planted.

e) Two years after completion of the construction a diverse population of water tolerant grasses, native grasses, wild flowers, and water tolerant woody plants should have taken root.

f) Manipulation of water levels may be used to control plant species and maintain plant diversity.

g) Harvesting emergent vegetation is not recommended.

4.5.5 Upland Vegetation in the Extended Detention Storage Area around the Wetland

a) Requirements for screening the constructed wetlands, between NWL and HWL, from adjacent land uses and for visual aesthetics shall be agreed by the Developer and the City.

b) A strip of a minimum of 2.0 m in width shall extend from the public utility lot boundary towards the constructed wetland NWL. This is to act as a safety bench and to prevent root invasion of adjacent properties by Poplar and Aspen species.

4.5.6 Wetland Water Depth

a) Use a variety of water depths, 0.1 m to 0.6 m with an average permanent water depth of 0.3 m to encourage emergent vegetation.

b) Deep water areas, i.e. greater than 2 m are to be limited to less than 25% of the wetland surface area.

c) Water fluctuation in excess of 1 m above NWL should be infrequent to prevent killing of the vegetation.

4.5.7 Wetland Surface Area

a) The surface area of the constructed wetland shall be a minimum of one hectare at the NWL.

b) The wetland surface area is typically about 3% to 5% of the drainage area.

4.5.8 Wetland Volume

To achieve suspended solids removal for the highest level of protection, it is required to provide 80 m3 of dead storage volume per hectare for a drainage area 35% impervious. For an area 85% impervious, a dead storage volume of 140 m^3 per hectare of drainage is required.

4.5.9 Length to Width Ratio

a) The minimum ratio should provide an effective flow path length at low flow that is three times the relative wetland width in order to increase the residence time.

b) Incoming water should be well distributed throughout the land and be conveyed as sheet flow to optimize treatment.

4.5.10 Forebay

a) A forebay is required at each major inlet to trap suspended solids before stormwater enters the constructed wetland.

b) A major inlet is one that provides greater than 10% of the total storm inflow to the wetland.

c) A forebay is to be between 2.4 m to 3.0 m deep for major inlets.

d) Provide maintenance access at forebays to permit removal of sediments.

e) Runoff leaving the forebay should pass through shallow areas of emergent vegetation.

f) Side slopes shall be a maximum of 7 horizontal and 1 vertical (7H:1V) along accessible areas around open and deep water areas at the forebay.

4.5.11 Permanent Pool at the Outlet

a) The permanent pool requires a depth of 2.4 m to 3.0 m. Size can be variable depending on the wetland's configuration.

b) Side slopes shall be a maximum of 7H: 1V along accessible areas around open and deep water areas at the permanent pool.

4.5.12 Inlet and Outlet

a) Inlets are to discharge to a forebay.

b) A variable water level control structure is required on the outlets for maintenance and water management purposes and to assist with the establishment and management of vegetation. The control structure should be capable of maintaining water levels between 0.5 m below NWL and 0.5 m about NWL. Variable water level control should be obtained through the manipulation of stop logs or similar overflow devices.

c) Inlets and outlets should be located to avoid short-circuiting and maximize the flow path.

d) The maximum depth in the inlet and outlet areas is restricted to 3.0 m.

e) Inlets and outlets are to be fully submerged, with the crown of the pipe at least 1.0 m below NWL. Inlet and outlet pipe inverts are to be a minimum of 100 mm above the bottom.

f) Provide maintenance access to forebay and permanent pool to allow for sediment removal.

g) An emergency overflow system shall drain to an overland route away from private property where possible.

4.5.13 Grading

a) Slopes shall be 5H:1V or flatter to support larger areas of wetland vegetation. Terraced slopes are acceptable.

b) A 2 m wide shallow marsh bench around the wetlands at NWL with a 10H:1V slope and the use of terraced grading is recommended to improve public safety.

c) Side slopes around the accessible deep areas in sediment forebay and permanent pool areas shall be a maximum of 7H:1V.

d) The 2 m wide mow strip shall have a side slope of either 7H:1V at accessible deep water areas or 5H:1V in other areas around the wetland

4.5.14 Floatables, Oil and Grease

To trap floatable materials, oil and grease, inlets and outlets are to be below normal water level.

4.5.15 Maintenance

a) The Developer is required to provide an operations and maintenance manual.

b) Maintenance and warranty period shall be two years from construction completion certificate (CCC) issuance.

c) Removal of accumulated sediment during construction from forebays will be required prior to issuance of the final acceptance certificate (FAC).

d) Sediment traps are to be cleaned during the maintenance period.

e) Sediment removal is required when forebay and permanent pool volumes are reduced by greater than 25%.

f) Replace or adjust plantings and manage noxious species during maintenance period.

g) During the maintenance period, the facility shall be inspected at least twice each year to determine vegetation distribution and the preservation of design depth. These inspection reports shall be submitted when applying for the FAC.

h) In future years, wetland vegetation regeneration should be possible by lowering the water level in the fall season using the control structure.

4.5.16 Monitoring

a) The Developer shall monitor stormwater quality. If required by the City, effluent from the permanent pool shall be sampled and tested for the following parameters: TSS, TP, NH3, BOD and fecal coliforms each during the maintenance period and the date provided to the City.

b) The Developer shall also monitor wetland and upland vegetation and take any corrective action required during the maintenance period.

c) At the end of the maintenance period, before the issuance of the FAC, the Developer shall ensure that at least 75% of the grass cover and 30% of the non-grass emergent vegetation around the wetland's edge has established given normal season conditions. A vegetation survey by a qualified professional shall be submitted to the City.

4.5.17 Access

Access is required to all inlets and outlets for maintenance, operation of water control structures, removal of debris and litter and vegetation management.

4.5.18 Fencing

a) The Developer is required to use natural solutions such as grading and planting strategies to provide safety features for the wetland, inlets and outlets.

b) The Developer shall provide a fence at the public utility lot boundary with openings for maintenance and public access to trails.

4.5.19 Mosquito Control

The Developer shall include design features that minimize mosquitoes in a constructed wetlands facility. Features can include system design and vegetation management that would preclude stagnant backwaters and provide habitat for purple martin, swallows, batfish, dragon flies, bats and other predators.

4.6 DESIGN DETAILS FOR DRY PONDS

4.6.1 Land Dedication for Dry Ponds

a) Dry ponds are to be located within a public utility lot, road right-of-way or as approved by Council that encompass the area subject to inundation at the HWL and freeboard.

b) The area covered by the pond, subject to flooding to the HWL and freeboard will be designated as a Public Utility Lot, Road Right-of-Way or as approved by Council. This designation will also apply to all rights-of-way for access to and protection of inlets, outlets and flow control facilities, and maintenance access routes to the pond.

4.6.2 Frequency of Operation

a) All dry ponds shall be off-line storage areas designed to temporarily detain excess runoff and reduce the peak outflow rates to the downstream system.

b) Designs that propose containment of runoff due to events more frequent than 1 in 2 years are to include special provisions to facilitate clean up, i.e. paved bottom areas.

4.6.3 Depth of Ponding

The maximum HWL live storage depth in a dry pond is 2.0m measured from the invert elevation of the outlet pipe, or measured from the pond bottom elevation at the outlet pipe, whichever is smaller. Refer to Standard Detail 20.26.

4.6.4 Dry Pond Bottom Grading and Drainage

The dry pond shall be graded to properly drain all areas after its operation. The pond bottom shall have a minimum slope of 1%, greater is recommended where feasible. Lateral slopes shall be 2% or greater. French drains or similar may be required where it is anticipated that these slopes will not properly drain the pond bottom, or where dictated by multiple use or special considerations.

4.6.5 Side Slopes

Side slopes subject to inundation upon filling of the dry pond shall have a maximum slope of 5 horizontal to 1 vertical within public property. Where possible, reduced slopes should be used.

4.6.6 Landscaping

Landscaping of dry ponds will be considered part of the construction and plans shall be submitted with the engineering drawings. The minimum requirement for landscaping of dry ponds shall be the establishment of 100% creeping red fescue. See Section 16 – Landscaping.

4.6.7 Inlets and Outlets

a) All inlet and outlet structures associated with dry ponds shall have grates provided over their openings to restrict access and prevent entry into sewers by children or other persons. A maximum clear bar spacing of 150 mm shall be used for gratings.

b) Grated outlet structures are to be designed with a hydraulic capacity of at least twice the required capacity to allow for possible plugging. Further, the arrangement of the structures and the location of the grating shall be such that the velocity of the flow passing through the grating will not exceed 1.0 m/s. Appropriate fencing and guard-

rails are to be provided to restrict access and reduce the hazard presented by headwalls and wingwalls.

c) Whenever feasible at the discretion of the City, the inlet and outlet should be physically separated from the perimeter of the dry pond. The inlet and outlet should be distanced as far as possible from each other to avoid hydraulic short-circuiting.

d) An emergency overflow system shall drain to an overland route away from private property where possible.

4.6.8 Best Management Practices for Dry Ponds

a) Pond shape: To maximize the treatment potential of the pond, the inlet and outlet should be positioned in such a way that short circuiting in the basin is minimized. Ponds that are considerably longer than wide (e.g. length equal to three times width) will likely provide additional detention time for settling and biological treatment.

b) Pond Inlet/Outlet Structures and Pipes: The pond should be designed in such a way that turbulence in the main treatment areas is minimized. For example, inflow points should be designed with energy dissipaters to reduce inflow velocity.

c) Scour Control: Flow-diffusion devices, including plunge pools, directional berms or other specially created dissipation structures, are recommended to reduce the scouring of pond bottom.

4.7 DESIGN DETAIL FOR DRAINAGE PARKWAYS

4.7.1 Land Dedication for Drainage Parkways

Drainage Parkways are to be located within public utility lots, road right-of-way or land as approved by Council that encompass the area subject to inundation at the HWL and freeboard. Adjacent land provided for maintenance access may be Municipal Reserve if providing a recreation use and designated by Council.

4.7.2 Depth of Ponding

Two main water levels should be designed for within a drainage parkway.

a) Frequently flooded level (maximum 0.5m above NWL for a 1:5 year event) and;

b) Infrequently flooded level (maximum 1.5m above NWL for 1:100 year event)

c) Refer to Standard Detail 20.27

4.7.3 Base Width and Slope

The minimum base width is 5.0 m and a low-flow channel to carry the base flow shall be provided. The minimum longitudinal slope is 0.5% and 1.0 % is preferred.

4.7.4 Side Slopes

Side slopes subject to inundation shall have a maximum slope of 5 horizontal to 1 vertical.

4.7.5 Access

A minimum setback of 5 m on one side to construct walkways and provide access for maintenance shall be provided.

4.7.6 Landscaping

Wetland areas shall contain emergent vegetation to enhance water quality, adjacent to the channel. Landscaping will be considered as part of the construction and plans shall be submitted with the engineering drawings. The minimum requirement for landscaping shall be the establishment of 100% creeping red fescue. See Section 16 – Landscaping.

4.7.7 Inlets and Outlets

a) All inlet and outlet structures for drainage parkways should be submerged (under the NWL) and should be designed to resist blockages from debris and vegetation. A maximum bar spacing of 150 mm is recommended for all gratings.

b) Grated outlet structures are to be designed with a hydraulic capacity of at least twice the required capacity to allow for possible plugging. Further, the arrangement of the structures and the location of the grating shall be such that the velocity of the flow passing through the grating will not exceed 1.0 m/s. Appropriate fencing and guard-rails are to be provided to restrict access and reduce the hazard presented by headwalls and wingwalls.

c) Whenever feasible at the discretion of the City, the inlet and outlet should be physically separated from the perimeter of the pond. The inlet and outlet should be distanced as far as possible from each other to avoid hydraulic short-circuiting.

d) An emergency overflow system shall drain to an overland route away from private property where possible.

4.8 RECEIVING WATERS

a) Measures should be incorporated in new development to prevent any increase in the amount of downstream erosion.

b) If a development will cause downstream erosion despite the use of on-site peak runoff rate controls, appropriate measures should be constructed in the downstream areas.

c) Preservation of watercourse aesthetics and wildlife habitat should be considered in erosion and bank stability work.

d) Where drainage parkways discharge to wetlands, the end of the parkway should be designed as a forebay or as a structure which acts as a forebay.

4.9 CULVERTS AND BRIDGES

Culvert and bridge design should consider backwater effects over a range of flows. The design of a hydraulic structure requires assessment of both its nominal design "capacity" and its performance during the 1-in-100-year event.

4.10 TESTING

The design must be conducive to achieving appropriate construction results as detailed in the Construction Manual.

Appendix A

Table A.1 – City of Grande Prairie 4-Hour Chicago Distribution Design Rainfall [mm/hr]

Minutes	Hours	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
5		1.6	2.3	2.8	3.4	3.8	4.3
10		1.7	2.4	3.0	3.6	4.0	4.5
15		1.8	2.6	3.1	3.8	4.2	4.7
20		1.9	2.7	3.3	4.0	4.5	5.0
25		2.0	2.9	3.5	4.2	4.8	5.3
30		2.2	3.1	3.7	4.5	5.1	5.7
35		2.3	3.3	4.0	4.9	5.5	6.1
40		2.5	3.6	4.4	5.3	5.9	6.6
45		2.8	4.0	4.8	5.8	6.5	7.3
50		3.1	4.4	5.3	6.5	7.2	8.1
55		3.5	5.0	6.0	7.3	8.2	9.2
60	1.00	4.1	5.8	7.0	8.5	9.5	10.6
65		5.0	7.0	8.5	10.2	11.5	12.8
70		6.5	9.2	11.0	13.3	14.9	16.6
75		10.0	14.0	16.7	20.1	22.6	25.2
80 **		35.5 (44.3)	52.9 (67.0)	64.9 (82.7)	79.9 (102.4)	91.3 (117.3)	102.7 (132.1)
85 **		53.1 (44.3)	81.1 (67.0)	100.4 (82.7)	124.8 (102.4)	143.2 (117.3)	161.4 (132.1)
90		17.8	24.6	29.3	35.1	39.5	43.9
95		11.4	15.9	18.9	22.8	25.6	28.5
100		8.6	12.1	14.4	17.4	19.5	21.8
105		7.0	9.9	11.8	14.3	16.1	17.9
110		6.0	8.4	10.1	12.3	13.8	15.4
115		5.3	7.4	8.9	10.8	12.1	13.5
120	2.00	4.7	6.7	8.0	9.7	10.9	12.2
125		4.3	6.1	7.3	8.8	9.9	11.1
130		3.9	5.6	6.7	8.1	9.1	10.2
135		3.6	5.2	6.2	7.5	8.5	9.5
140		3.4	4.8	5.8	7.1	7.9	8.8
145		3.2	4.5	5.5	6.6	7.4	8.3
150		3.0	4.3	5.2	6.3	7.0	7.9
155		2.9	4.1	4.9	5.9	6.7	7.5
160		2.7	3.9	4.7	5.7	6.3	7.1
165		2.6	3.7	4.5	5.4	6.1	6.8
170		2.5	3.5	4.3	5.2	5.8	6.5
175		2.4	3.4	4.1	5.0	5.6	6.2
180	3.00	2.3	3.3	4.0	4.8	5.4	6.0
185		2.2	3.1	3.8	4.6	5.2	5.8

Table A.1 (continued) – City of Grande Prairie 4-Hour Chicago Distribution Design Rainfall [mm/hr]

Minutes	Hours	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
190		2.1	3.0	3.7	4.5	5.0	5.6
195		2.1	2.9	3.6	4.3	4.8	5.4
200		2.0	2.8	3.4	4.2	4.7	5.2
205		1.9	2.8	3.3	4.1	4.5	5.1
210		1.9	2.7	3.2	3.9	4.4	4.9
215		1.8	2.6	3.2	3.8	4.3	4.8
220		1.8	2.5	3.1	3.7	4.2	4.7
225		1.7	2.5	3.0	3.6	4.1	4.5
230		1.7	2.4	2.9	3.5	4.0	4.4
235		1.6	2.4	2.9	3.5	3.9	4.3
240	4.00	1.6	2.3	2.8	3.4	3.8	4.2
4-Hour Precipitation Total (mm)		*21.6*	*31.3*	*38.0*	*46.3*	*52.4*	*58.7*
2-Hour Precipitation Total (mm)		*17.6*	*25.5*	*31.0*	*37.9*	*42.9*	*48.1*

** Values in blue are average intensities over peak 10 minutes period.
Yellow highlight is peak 2-hour of Chicago rainfall distribution.

Table A.2 – City of Grande Prairie 24-Hour Chicago Distribution Design Rainfall [mm/hr]

Hours	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.25	0.44	0.63	0.77	0.93	1.04	1.16
0.50	0.45	0.65	0.79	0.95	1.06	1.19
0.75	0.46	0.66	0.81	0.98	1.09	1.22
1.00	0.48	0.68	0.83	1.00	1.11	1.25
1.25	0.49	0.70	0.85	1.03	1.14	1.28
1.50	0.50	0.72	0.87	1.05	1.17	1.31
1.75	0.51	0.74	0.89	1.08	1.21	1.35
2.00	0.53	0.76	0.92	1.12	1.24	1.39
2.25	0.55	0.78	0.95	1.15	1.28	1.43
2.50	0.56	0.81	0.98	1.19	1.32	1.48
2.75	0.58	0.83	1.01	1.23	1.36	1.53
3.00	0.60	0.86	1.05	1.27	1.41	1.58
3.25	0.62	0.89	1.08	1.31	1.46	1.64
3.50	0.65	0.93	1.13	1.37	1.52	1.70
3.75	0.67	0.97	1.17	1.42	1.58	1.77
4.00	0.70	1.01	1.22	1.48	1.65	1.85
4.25	0.74	1.05	1.28	1.55	1.73	1.93
4.50	0.77	1.11	1.34	1.63	1.81	2.03
4.75	0.81	1.16	1.41	1.71	1.91	2.14
5.00	0.86	1.23	1.49	1.81	2.02	2.26
5.25	0.91	1.31	1.58	1.92	2.14	2.40
5.50	0.97	1.40	1.69	2.05	2.29	2.56
5.75	1.05	1.50	1.82	2.20	2.46	2.76
6.00	1.13	1.63	1.97	2.39	2.67	2.99
6.25	1.24	1.78	2.16	2.61	2.92	3.27
6.50	1.38	1.97	2.39	2.90	3.24	3.63
6.75	1.56	2.23	2.70	3.27	3.66	4.10
7.00	1.81	2.58	3.13	3.79	4.24	4.74
7.25	2.18	3.11	3.76	4.56	5.10	5.71
7.50	2.80	4.00	4.83	5.85	6.55	7.33
7.75	4.20	5.95	7.17	8.67	9.73	10.88
8.00	17.34	25.33	30.85	37.77	42.94	48.16
8.25	27.45	40.53	49.56	60.89	69.43	77.95
8.50	7.22	10.12	12.15	14.65	16.46	18.36
8.75	4.74	6.71	8.08	9.77	10.97	12.25
9.00	3.65	5.18	6.26	7.57	8.49	9.50
9.25	3.02	4.29	5.19	6.28	7.04	7.87
9.50	2.59	3.70	4.47	5.42	6.07	6.79

Table A.2 (continued) – City of Grande Prairie 24-Hour Chicago Distribution Design Rainfall [mm/hr]

Hours	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
9.75	2.29	3.27	3.96	4.79	5.37	6.01
10.00	2.06	2.94	3.56	4.32	4.83	5.41
10.25	1.88	2.69	3.25	3.94	4.41	4.94
10.50	1.73	2.48	3.00	3.64	4.07	4.55
10.75	1.61	2.30	2.79	3.38	3.78	4.23
11.00	1.51	2.16	2.61	3.17	3.54	3.96
11.25	1.42	2.03	2.46	2.98	3.33	3.73
11.50	1.34	1.92	2.33	2.82	3.15	3.53
11.75	1.27	1.82	2.21	2.68	2.99	3.35
12.00	1.21	1.74	2.10	2.55	2.85	3.19
12.25	1.16	1.66	2.01	2.44	2.72	3.05
12.50	1.11	1.59	1.93	2.34	2.61	2.92
12.75	1.07	1.53	1.85	2.25	2.51	2.81
13.00	1.03	1.47	1.78	2.16	2.41	2.70
13.25	0.99	1.42	1.72	2.09	2.33	2.61
13.50	0.96	1.37	1.66	2.02	2.25	2.52
13.75	0.93	1.33	1.61	1.95	2.18	2.44
14.00	0.90	1.29	1.56	1.89	2.11	2.36
14.25	0.87	1.25	1.51	1.84	2.05	2.29
14.50	0.85	1.21	1.47	1.78	1.99	2.23
14.75	0.82	1.18	1.43	1.73	1.93	2.17
15.00	0.80	1.15	1.39	1.69	1.88	2.11
15.25	0.78	1.12	1.36	1.65	1.84	2.06
15.50	0.76	1.09	1.32	1.61	1.79	2.00
15.75	0.74	1.07	1.29	1.57	1.75	1.96
16.00	0.73	1.04	1.26	1.53	1.71	1.91
16.25	0.71	1.02	1.24	1.50	1.67	1.87
16.50	0.70	1.00	1.21	1.47	1.63	1.83
16.75	0.68	0.98	1.18	1.44	1.60	1.79
17.00	0.67	0.96	1.16	1.41	1.57	1.75
17.25	0.65	0.94	1.14	1.38	1.54	1.72
17.50	0.64	0.92	1.12	1.35	1.51	1.69
17.75	0.63	0.90	1.09	1.33	1.48	1.65
18.00	0.62	0.89	1.07	1.30	1.45	1.62
18.25	0.61	0.87	1.06	1.28	1.42	1.60
18.50	0.60	0.86	1.04	1.26	1.40	1.57
18.75	0.59	0.84	1.02	1.24	1.38	1.54
19.00	0.58	0.83	1.00	1.22	1.35	1.52
19.25	0.57	0.81	0.99	1.20	1.33	1.49
19.50	0.56	0.80	0.97	1.18	1.31	1.47
19.75	0.55	0.79	0.96	1.16	1.29	1.44

Table A.2 (continued) – City of Grande Prairie 24-Hour Chicago Distribution Design Rainfall [mm/hr]

Hours	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
20.00	0.54	0.78	0.94	1.14	1.27	1.42
20.25	0.53	0.76	0.93	1.12	1.25	1.40
20.50	0.53	0.75	0.91	1.11	1.23	1.38
20.75	0.52	0.74	0.90	1.09	1.22	1.36
21.00	0.51	0.73	0.89	1.08	1.20	1.34
21.25	0.50	0.72	0.88	1.06	1.18	1.32
21.50	0.50	0.71	0.86	1.05	1.17	1.31
21.75	0.49	0.70	0.85	1.03	1.15	1.29
22.00	0.48	0.69	0.84	1.02	1.14	1.27
22.25	0.48	0.69	0.83	1.01	1.12	1.26
22.50	0.47	0.68	0.82	0.99	1.11	1.24
22.75	0.47	0.67	0.81	0.98	1.09	1.22
23.00	0.46	0.66	0.80	0.97	1.08	1.21
23.25	0.46	0.65	0.79	0.96	1.07	1.20
23.50	0.45	0.65	0.78	0.95	1.05	1.18
23.75	0.44	0.64	0.77	0.94	1.04	1.17
24.00	0.44	0.63	0.76	0.93	1.03	1.15
24-hour Precipitation Total (mm)	*36.4*	*52.5*	*63.7*	*77.4*	*87.1*	*97.5*
12-hour Precipitation Total (mm)	*29.8*	*43.0*	*52.2*	*63.5*	*71.6*	*80.2*

Yellow highlight is peak 12-hour of Chicago rainfall distribution.

Table A.3 – City of Grande Prairie 12 Hour Huff (1st quartile) Design Storm [mm/hr]

Hours	mm/hr for 1mm of total precipitation	Accumulated Depth (%)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
0.00	0.0000	0.00%	0.00	0.00	0.00	0.00	0.00	0.00
0.25	0.0725	1.81%	2.16	3.12	3.78	4.60	5.19	5.81
0.50	0.1315	5.10%	3.92	5.65	6.86	8.35	9.42	10.55
0.75	0.1659	9.24%	4.94	7.13	8.66	10.53	11.88	13.30
1.00	0.2031	14.32%	6.05	8.73	10.60	12.90	14.54	16.29
1.25	0.2400	20.31%	7.15	10.32	12.53	15.24	17.18	19.25
1.50	0.2625	26.87%	7.82	11.29	13.70	16.67	18.80	21.05
1.75	0.2792	33.85%	8.32	12.00	14.57	17.73	19.99	22.39
2.00	0.2823	40.90%	8.41	12.14	14.74	17.93	20.22	22.64
2.25	0.2619	47.45%	7.80	11.26	13.67	16.63	18.75	21.00
2.50	0.2402	53.45%	7.16	10.33	12.54	15.25	17.20	19.26
2.75	0.2123	58.75%	6.33	9.13	11.08	13.48	15.20	17.03
3.00	0.1831	63.33%	5.46	7.87	9.56	11.63	13.11	14.69
3.25	0.1563	67.24%	4.66	6.72	8.16	9.92	11.19	12.53
3.50	0.1312	70.51%	3.91	5.64	6.85	8.33	9.40	10.53
3.75	0.1085	73.23%	3.23	4.67	5.67	6.89	7.77	8.70
4.00	0.0937	75.57%	2.79	4.03	4.89	5.95	6.71	7.52
4.25	0.0798	77.56%	2.38	3.43	4.17	5.07	5.71	6.40
4.50	0.0722	79.37%	2.15	3.11	3.77	4.59	5.17	5.79
4.75	0.0672	81.05%	2.00	2.89	3.51	4.27	4.82	5.39
5.00	0.0625	82.61%	1.86	2.69	3.27	3.97	4.48	5.02
5.25	0.0584	84.07%	1.74	2.51	3.05	3.71	4.18	4.68
5.50	0.0542	85.42%	1.62	2.33	2.83	3.44	3.88	4.35
5.75	0.0500	86.67%	1.49	2.15	2.61	3.18	3.58	4.01
6.00	0.0459	87.82%	1.37	1.97	2.39	2.91	3.28	3.68
6.25	0.0426	88.89%	1.27	1.83	2.23	2.71	3.05	3.42
6.50	0.0401	89.89%	1.20	1.73	2.09	2.55	2.87	3.22
6.75	0.0376	90.83%	1.12	1.62	1.96	2.39	2.69	3.02
7.00	0.0351	91.71%	1.05	1.51	1.83	2.23	2.51	2.82
7.25	0.0326	92.52%	0.97	1.40	1.70	2.07	2.34	2.62
7.50	0.0308	93.29%	0.92	1.32	1.61	1.95	2.20	2.47
7.75	0.0291	94.02%	0.87	1.25	1.52	1.85	2.08	2.33
8.00	0.0274	94.70%	0.82	1.18	1.43	1.74	1.96	2.20
8.25	0.0257	95.35%	0.77	1.11	1.34	1.64	1.84	2.07
8.50	0.0241	95.95%	0.72	1.04	1.26	1.53	1.72	1.93
8.75	0.0224	96.51%	0.67	0.96	1.17	1.42	1.61	1.80
9.00	0.0208	97.03%	0.62	0.89	1.08	1.32	1.49	1.66
9.25	0.0191	97.50%	0.57	0.82	1.00	1.21	1.37	1.53

Table A.3 (Continued) – City of Grande Prairie 12 Hour Huff (1st quartile) Design Storm [mm/hr]

Hours	mm/hr for 1mm of total precipitation	Accumulated Depth (%)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
9.50	0.0174	97.94%	0.52	0.75	0.91	1.11	1.25	1.40
9.75	0.0158	98.33%	0.47	0.68	0.82	1.00	1.13	1.26
10.00	0.0141	98.68%	0.42	0.61	0.74	0.89	1.01	1.13
10.25	0.0124	98.99%	0.37	0.53	0.65	0.79	0.89	1.00
10.50	0.0107	99.26%	0.32	0.46	0.56	0.68	0.77	0.86
10.75	0.0091	99.49%	0.27	0.39	0.47	0.58	0.65	0.73
11.00	0.0074	99.68%	0.22	0.32	0.39	0.47	0.53	0.59
11.25	0.0057	99.82%	0.17	0.25	0.30	0.37	0.41	0.46
11.50	0.0041	99.92%	0.12	0.18	0.21	0.26	0.29	0.33
11.75	0.0024	99.98%	0.07	0.10	0.13	0.15	0.17	0.19
12.00	0.0008	100.00%	0.02	0.03	0.04	0.05	0.05	0.06
12-hour Precipitation Total (mm)			29.8	43.0	52.2	63.5	71.6	80.2

Table A.4 – City of Grande Prairie 24 Hour Huff (1st quartile) Design Storm [mm/hr]

Hours	mm/hr for 1mm of total precipitation	Accumulated Depth (%)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
0.00	0.0000	0.00%	0.00	0.00	0.00	0.00	0.00	0.00
0.25	0.0225	0.56%	0.82	1.18	1.43	1.74	1.96	2.19
0.50	0.0500	1.81%	1.82	2.63	3.19	3.87	4.36	4.88
0.75	0.0615	3.35%	2.24	3.23	3.92	4.76	5.36	6.00
1.00	0.0700	5.10%	2.55	3.67	4.46	5.42	6.10	6.82
1.25	0.0784	7.06%	2.85	4.11	4.99	6.07	6.83	7.64
1.50	0.0875	9.24%	3.19	4.59	5.57	6.77	7.62	8.53
1.75	0.0969	11.66%	3.53	5.09	6.17	7.50	8.44	9.45
2.00	0.1063	14.32%	3.87	5.58	6.77	8.22	9.25	10.36
2.25	0.1156	17.21%	4.21	6.07	7.37	8.95	10.07	11.27
2.50	0.1244	20.31%	4.53	6.53	7.92	9.63	10.83	12.13
2.75	0.1292	23.54%	4.70	6.78	8.23	10.00	11.25	12.59
3.00	0.1333	26.87%	4.85	7.00	8.49	10.32	11.61	13.00
3.25	0.1375	30.31%	5.01	7.22	8.76	10.64	11.98	13.41
3.50	0.1417	33.85%	5.16	7.44	9.02	10.97	12.34	13.81
3.75	0.1436	37.44%	5.23	7.54	9.15	11.11	12.51	14.00
4.00	0.1388	40.90%	5.05	7.28	8.84	10.74	12.09	13.53
4.25	0.1335	44.24%	4.86	7.01	8.51	10.34	11.63	13.02
4.50	0.1283	47.45%	4.67	6.74	8.17	9.93	11.18	12.51
4.75	0.1231	50.52%	4.48	6.46	7.84	9.53	10.72	12.00
5.00	0.1171	53.45%	4.26	6.15	7.46	9.06	10.20	11.42
5.25	0.1098	56.19%	4.00	5.76	6.99	8.50	9.56	10.70
5.50	0.1025	58.75%	3.73	5.38	6.53	7.93	8.93	9.99
5.75	0.0952	61.13%	3.47	5.00	6.06	7.37	8.29	9.28
6.00	0.0879	63.33%	3.20	4.62	5.60	6.80	7.66	8.57
6.25	0.0812	65.36%	2.96	4.27	5.18	6.29	7.08	7.92
6.50	0.0750	67.24%	2.73	3.94	4.78	5.80	6.53	7.31
6.75	0.0687	68.95%	2.50	3.61	4.38	5.32	5.99	6.70
7.00	0.0625	70.51%	2.28	3.28	3.98	4.84	5.44	6.09
7.25	0.0564	71.92%	2.05	2.96	3.59	4.36	4.91	5.49
7.50	0.0522	73.23%	1.90	2.74	3.32	4.04	4.54	5.09
7.75	0.0486	74.44%	1.77	2.55	3.10	3.76	4.24	4.74
8.00	0.0451	75.57%	1.64	2.37	2.87	3.49	3.93	4.40
8.25	0.0415	76.61%	1.51	2.18	2.65	3.22	3.62	4.05
8.50	0.0383	77.56%	1.39	2.01	2.44	2.96	3.33	3.73
8.75	0.0367	78.48%	1.34	1.93	2.34	2.84	3.20	3.58
9.00	0.0355	79.37%	1.29	1.86	2.26	2.75	3.09	3.46
9.25	0.0343	80.22%	1.25	1.80	2.18	2.65	2.98	3.34

Table A.4 (Continued) – City of Grande Prairie 24 Hour Huff (1st quartile) Design Storm [mm/hr]

Hours	mm/hr for 1mm of total precipitation	Accumulated Depth (%)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
9.50	0.0330	81.05%	1.20	1.73	2.10	2.55	2.87	3.22
9.75	0.0318	81.84%	1.16	1.67	2.03	2.46	2.77	3.10
10.00	0.0307	82.61%	1.12	1.61	1.96	2.38	2.68	3.00
10.25	0.0297	83.35%	1.08	1.56	1.89	2.30	2.59	2.90
10.50	0.0287	84.07%	1.04	1.51	1.83	2.22	2.50	2.80
10.75	0.0276	84.76%	1.01	1.45	1.76	2.14	2.41	2.69
11.00	0.0266	85.42%	0.97	1.40	1.69	2.06	2.32	2.59
11.25	0.0255	86.06%	0.93	1.34	1.63	1.98	2.22	2.49
11.50	0.0245	86.67%	0.89	1.29	1.56	1.90	2.13	2.39
11.75	0.0235	87.26%	0.85	1.23	1.49	1.82	2.04	2.29
12.00	0.0224	87.82%	0.82	1.18	1.43	1.74	1.95	2.19
12.25	0.0216	88.36%	0.79	1.14	1.38	1.67	1.88	2.11
12.50	0.0210	88.89%	0.76	1.10	1.34	1.63	1.83	2.05
12.75	0.0204	89.40%	0.74	1.07	1.30	1.58	1.77	1.99
13.00	0.0198	89.89%	0.72	1.04	1.26	1.53	1.72	1.93
13.25	0.0191	90.37%	0.70	1.00	1.22	1.48	1.67	1.86
13.50	0.0185	90.83%	0.67	0.97	1.18	1.43	1.61	1.80
13.75	0.0179	91.28%	0.65	0.94	1.14	1.38	1.56	1.74
14.00	0.0172	91.71%	0.63	0.91	1.10	1.34	1.50	1.68
14.25	0.0166	92.12%	0.61	0.87	1.06	1.29	1.45	1.62
14.50	0.0160	92.52%	0.58	0.84	1.02	1.24	1.40	1.56
14.75	0.0156	92.91%	0.57	0.82	0.99	1.21	1.36	1.52
15.00	0.0152	93.29%	0.55	0.80	0.97	1.17	1.32	1.48
15.25	0.0148	93.66%	0.54	0.77	0.94	1.14	1.28	1.44
15.50	0.0143	94.02%	0.52	0.75	0.91	1.11	1.25	1.40
15.75	0.0139	94.37%	0.51	0.73	0.89	1.08	1.21	1.36
16.00	0.0135	94.70%	0.49	0.71	0.86	1.04	1.18	1.32
16.25	0.0131	95.03%	0.48	0.69	0.83	1.01	1.14	1.28
16.50	0.0127	95.35%	0.46	0.66	0.81	0.98	1.10	1.23
16.75	0.0122	95.65%	0.45	0.64	0.78	0.95	1.07	1.19
17.00	0.0118	95.95%	0.43	0.62	0.75	0.92	1.03	1.15
17.25	0.0114	96.23%	0.42	0.60	0.73	0.88	0.99	1.11
17.50	0.0110	96.51%	0.40	0.58	0.70	0.85	0.96	1.07
17.75	0.0106	96.77%	0.39	0.56	0.67	0.82	0.92	1.03
18.00	0.0102	97.03%	0.37	0.53	0.65	0.79	0.89	0.99
18.25	0.0098	97.27%	0.35	0.51	0.62	0.75	0.85	0.95
18.50	0.0093	97.50%	0.34	0.49	0.59	0.72	0.81	0.91
18.75	0.0089	97.73%	0.32	0.47	0.57	0.69	0.78	0.87
19.00	0.0085	97.94%	0.31	0.45	0.54	0.66	0.74	0.83
19.25	0.0081	98.14%	0.29	0.42	0.51	0.63	0.70	0.79
19.50	0.0077	98.33%	0.28	0.40	0.49	0.59	0.67	0.75

Table A.4 (Continued) – City of Grande Prairie 24 Hour Huff (1st quartile) Design Storm [mm/hr]

Hours	mm/hr for 1mm of total precipitation	Accumulated Depth (%)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
19.75	0.0072	98.51%	0.26	0.38	0.46	0.56	0.63	0.71
20.00	0.0068	98.68%	0.25	0.36	0.44	0.53	0.60	0.67
20.25	0.0064	98.84%	0.23	0.34	0.41	0.50	0.56	0.63
20.50	0.0060	98.99%	0.22	0.32	0.38	0.46	0.52	0.59
20.75	0.0056	99.13%	0.20	0.29	0.36	0.43	0.49	0.54
21.00	0.0052	99.26%	0.19	0.27	0.33	0.40	0.45	0.50
21.25	0.0048	99.38%	0.17	0.25	0.30	0.37	0.41	0.46
21.50	0.0043	99.49%	0.16	0.23	0.28	0.34	0.38	0.42
21.75	0.0039	99.59%	0.14	0.21	0.25	0.30	0.34	0.38
22.00	0.0035	99.68%	0.13	0.18	0.22	0.27	0.30	0.34
22.25	0.0031	99.75%	0.11	0.16	0.20	0.24	0.27	0.30
22.50	0.0027	99.82%	0.10	0.14	0.17	0.21	0.23	0.26
22.75	0.0023	99.88%	0.08	0.12	0.14	0.17	0.20	0.22
23.00	0.0018	99.92%	0.07	0.10	0.12	0.14	0.16	0.18
23.25	0.0014	99.96%	0.05	0.07	0.09	0.11	0.12	0.14
23.50	0.0010	99.98%	0.04	0.05	0.06	0.08	0.09	0.10
23.75	0.0006	100.00%	0.02	0.03	0.04	0.05	0.05	0.06
24.00	0.0002	100.00%	0.01	0.01	0.01	0.01	0.01	0.02
24-hour Precipitation Total (mm)			36.4	52.5	63.7	77.4	87.1	97.5

Table A.5 – City of Grande Prairie IDF Curves – Average Rainfall Intensity

Minutes	Hours	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	1000-yr **
5		65.4	101.9	127.2	159.1	183.1	207.0	285.5
6		59.7	92.2	114.6	142.9	164.2	185.5	255.0
7		55.1	84.4	104.7	130.2	149.5	168.6	231.4
8		51.3	78.1	96.6	119.9	137.5	155.0	212.3
9		48.0	72.7	89.8	111.4	127.6	143.7	196.6
10		45.2	68.2	84.1	104.1	119.3	134.3	183.5
11		42.8	64.3	79.2	97.9	112.1	126.2	172.2
12		40.6	60.9	75.0	92.6	105.9	119.1	162.5
13		38.7	57.9	71.2	87.9	100.5	113.0	154.0
14		37.0	55.3	67.9	83.7	95.6	107.5	146.5
15	0.25	35.5	52.9	64.9	79.9	91.3	102.7	139.8
16		34.1	50.7	62.2	76.6	87.5	98.3	133.7
17		32.8	48.7	59.7	73.6	84.0	94.4	128.3
18		31.7	47.0	57.5	70.8	80.8	90.8	123.4
19		30.6	45.3	55.5	68.3	77.9	87.5	118.9
20		29.6	43.8	53.6	65.9	75.2	84.5	114.7
21		28.7	42.4	51.9	63.8	72.8	81.7	110.9
22		27.9	41.1	50.3	61.8	70.5	79.2	107.4
23		27.1	39.9	48.8	60.0	68.4	76.8	104.2
24		26.3	38.8	47.5	58.3	66.4	74.6	101.1
25		25.6	37.8	46.2	56.7	64.6	72.5	98.3
26		25.0	36.8	45.0	55.2	62.9	70.6	95.6
27		24.4	35.9	43.8	53.8	61.3	68.8	93.2
28		23.8	35.0	42.7	52.4	59.7	67.0	90.8
29		23.3	34.2	41.7	51.2	58.3	65.4	88.6
30	0.50	22.7	33.4	40.8	50.0	57.0	63.9	86.5
35		20.5	30.1	36.7	45.0	51.2	57.4	77.7
40		18.8	27.5	33.5	41.0	46.6	52.3	70.7
45	0.75	17.3	25.3	30.9	37.8	42.9	48.2	65.0
50		16.1	23.5	28.7	35.1	39.9	44.7	60.4
55		15.1	22.0	26.8	32.8	37.3	41.8	56.4
60	1.00	14.2	20.8	25.3	30.9	35.1	39.3	53.0
75	1.25	12.2	17.8	21.6	26.4	30.0	33.6	45.2
90	1.50	10.8	15.6	19.0	23.2	26.3	29.5	39.7
105	1.75	9.7	14.0	17.1	20.8	23.6	26.5	35.6
120	2.00	8.8	12.8	15.5	18.9	21.5	24.1	32.3
150	2.50	7.5	10.9	13.3	16.2	18.3	20.5	27.5
180	3.00	6.6	9.6	11.7	14.2	16.1	18.0	24.2
210	3.50	5.9	8.6	10.4	12.7	14.4	16.1	21.6
240	4.00	5.4	7.8	9.5	11.6	13.1	14.7	19.7

Table A.5 (Continued) – City of Grande Prairie IDF Curves – Average Rainfall Intensity

Minutes	Hours	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	1000-yr **
300	5.00	4.6	6.7	8.1	9.9	11.2	12.5	16.7
360	6.00	4.1	5.9	7.1	8.7	9.8	11.0	14.7
420	7.00	3.6	5.3	6.4	7.8	8.8	9.8	13.1
480	8.00	3.3	4.8	5.8	7.1	8.0	8.9	11.9
540	9.00	3.0	4.4	5.3	6.5	7.3	8.2	11.0
600	10.00	2.8	4.1	5.0	6.0	6.8	7.6	10.2
660	11.00	2.6	3.8	4.6	5.6	6.3	7.1	9.5
720	12.00	2.5	3.6	4.3	5.3	6.0	6.7	8.9
780	13.00	2.3	3.4	4.1	5.0	5.6	6.3	8.4
840	14.00	2.2	3.2	3.9	4.7	5.3	6.0	8.0
900	15.00	2.1	3.1	3.7	4.5	5.1	5.7	7.6
960	16.00	2.0	2.9	3.5	4.3	4.9	5.4	7.2
1020	17.00	1.9	2.8	3.4	4.1	4.6	5.2	6.9
1080	18.00	1.9	2.7	3.3	4.0	4.5	5.0	6.6
1140	19.00	1.8	2.6	3.1	3.8	4.3	4.8	6.4
1200	20.00	1.7	2.5	3.0	3.7	4.1	4.6	6.2
1260	21.00	1.7	2.4	2.9	3.5	4.0	4.5	5.9
1320	22.00	1.6	2.3	2.8	3.4	3.9	4.3	5.8
1380	23.00	1.6	2.3	2.7	3.3	3.7	4.2	5.6
1440	24.00	1.5	2.2	2.7	3.2	3.6	4.1	5.4

** Use with discretion

SECTION 13 – UTILITIES

1. GENERAL

1.1 AQUATERA UTILITIES INC

Aquatera is a regional utility corporation that provides the City of Grande Prairie with water and wastewater treatment, garbage collection, and recycling services. For new developments, the Developer is required, as a condition of subdivision or development approval, to construct at their expense, Aquatera water and sewer mains, services and related appurtenances. All water and sewer mains and service connection designs require approval from both the City and Aquatera and must conform to the City's and Aquatera's design standards. In the event of a design standard conflict between Aquatera and City standards, City design standards shall govern. Aquatera's design standards can be found on Aquatera's website:

https://www.aquatera.ca/services/engineering/standards-and-guidelines

1.1.1 City Tree Fitment for Residential Lots

Aquatera Standard Detail 11-01 Typical Joint Party Shallow Lot Servicing Detail is to be used as a starting point for servicing design. However, in instances where the aforementioned detail will not accommodate a City owned tree as per the City of Grande Prairie street cross sections, the water and sanitary services are to be repositioned, under driveways if necessary, in order to accommodate the trees as approved within the City of Grande Prairie Design Manual. The repositioning must still respect the minimum of 3.0 m and maximum of 4.0 m from the property line requirement along with any other proximity requirements to other utilities as per Aquatera or Provincial standards.

1.2 ATCO ELECTRIC

Electrical power service is provided by ATCO Electric Ltd. under a Franchise Agreement. The Developer's Consultant and ATCO Electric shall obtain City approval for the method of installation, including excavation, alignment and backfill requirements.

Whenever overhead power lines exist and are impacted in any way by the proposed development, it is the Developer's responsibility to have the lines installed underground at the Developer's expense. Typically all proposed and existing power lines adjacent to a subdivision are to be buried. Exemptions can be approved by Council through the Outline Plan process. Exemptions considered include overhead power lines in Industrial areas in utility lots or rear easements not visible from high visibility corridors like arterial roads and lines greater than 25 kV.

Information on electrical design and installation can be found on ATCO electric's website:

http://www.atcoelectric.com/#

1.3 ATCO GAS

Gas service is provided by ATCO Gas under a Franchise Agreement. The Developer's Consultant and ATCO Gas shall obtain City approval for the method of installation, including excavation, alignment and backfill requirements.

1.4 COMMUNICATIONS

Communication services are provided by Telus Communications, Eastlink, Bell, CCI Wireless, GP Networks, Crossover Networks Inc., Micro Computers Plus, Nexxcom Technologies and any other service providers that may be available. Every effort was made to have an updated list at the time of publishing.

Wherever possible, power, gas, telephone and cable T.V. lines shall run in a common trench and share surface hardware/furniture.

1.5 RIGHT-OF-WAYS

Where required, the Developer shall provide right-of-ways and easements of sufficient size and location to satisfy shallow utilities (ATCO Electric, ATCO Gas, Eastlink, and Telus Communications).

In general, there are two typical shallow utility alignments in developments:

1. Power, telephone and cable TV are installed in a joint trench within a 4.0 m utility easement, 1.0 m off property line. Gas is installed in a single trench 3.0m off property line; or

2. Gas, power, telephone and cable TV are installed in a joint trench within a 2.6m utility easement, with gas installed 1.6m into private property and electrical / telephone / cable TV installed 1.0m into private property.

Figures of the shallow utility alignments are included in Section 20.

All easements shall be registered in the name of the City of Grande Prairie. In existing alignments, the first option is to overdig an existing line.

Alignments along sideyards of low density residential lots can be problematic for maintenance and may impact development of lot, therefore avoid if possible.

Surface hardware shall be located a minimum of 10m away from major road intersections.

2. COSTS

Any capital contribution that the utility companies may charge for installation of services shall be paid by the Developer.

3. DETAILED DESIGN DRAWINGS

The Developer is required to have an Engineering Consultant prepare a detailed Shallow Utility Plan for each phase of development. The Developer shall make arrangements for the provision of natural gas, power, telephone, and cable television service for each phase of development as follows:

ATCO Gas – Distribution Engineering
Parkland Division
10035 – 105 Street
Edmonton, AB T5J 2V6

Telus Communications Inc. National Access Network Design
4th Floor, 10103 99 Ave
Grande Prairie, AB T8V 0S1

Eastlink Engineering
155 Chain Lake Dr
Unit 19
Halifax, NS B3S 1B3
western-planning@corp.eastlink.ca

ATCO Electric – Customer Service Northwest Region
9717 – 97 Avenue
Grande Prairie, AB T8W 6A4

3.1 REVIEW AND APPROVAL OF DETAILED SHALLOW UTILITIES PLAN

As noted in Section One – Clause 7.2, the Developer is responsible for coordinating the location of the power, gas, telephone and cable TV, including obtaining alignment approvals.

The Developer shall forward the following information to ATCO Gas, EastLink and Telus Communications following ATCO Electric approval of the power distribution and street lighting design.

a) Copies of the roadway and deep utilities plan drawings,

b) Copy of the approved ATCO Electric power distribution, street lighting and surface hardware design drawing.

Following the completion of the design of each service provider's facilities, copies of their alignments and easement requirements will be forwarded to the Developers Engineering Consultant for preparation of Detailed Engineering Drawings. Copies of the approved Shallow Utility Plan will be circulated by the City.

3.2 LOCATION

As noted in Section One – Clause 7.2, the Developer is responsible for coordinating the location of the power, gas, telephone and cable TV, including obtaining alignment approvals.

3.3 DEPTH

Depth of utilities to be buried as specified in Detailed Engineering Drawings.

In general shallow utilities are to be buried below final grade as set out in the City's

Construction Manual Division 33, Utilities,

Refer to Aquatera standards for buried depth of sanitary and water utilities and refer to Section 12 – Storm Drainage System for buried depth of storm utilities.

3.4 STREET LIGHT DAVITS AND FIXTURES

Streetlights shall be “cobras” with galvanized steel davits (posts) and fixtures unless otherwise approved. All new street lighting installations shall use LED lamps. The use of any of the below alternate approved decorative lighting styles (aside from galvanized steel davits and fixtures) must be approved by Engineering.

In March of 2017, Council approved the use of the following LED decorative roadway and pedestrian lighting styles:

a. Utility Postop style

b. GranVille Premier style; and

c. Black powder coating on standard davit arm pole with cobra head

3.5 STREET LIGHT ILLUMINATION

The location and density of street lights shall be such to provide the minimum lighting levels based on guidelines provided by Transportation of Canada (TAC) and Illuminating Engineering Society of North America (IES). Please refer also to the “City of Grande Prairie Street and Park Lighting Standards”.

SECTION 14 – ROADWAY DESIGN STANDARDS

1. GEOMETRIC DESIGN STANDARDS

The following reference materials (current editions) have been used in preparing these Design Guidelines and should be referred to for further detail:

- Geometric Design Guide for Canadian Roads, TAC
- (www.TAC-ATC.ca)
- Metric Curve Tables, TAC
- A Policy on Geometric Design of Highways and Streets, AASHTO
- Turning Vehicle Templates, TAC
- Manual of Uniform Traffic Control Devices for Canada (MUTCD), TAC
- Roadside Design Guide, AASHTO
- (www.transportation.org)
- TAC/ITE Canadian Guide to Neighbourhood Traffic Calming, TAC/ITE

The TAC Manual and TAC Urban Supplement noted above must be adhered to unless otherwise specified in these Design Guidelines or by the Engineer.

Road classification and designation shall be in accordance with the classification system outlined in the Transportation Association of Canada (TAC) Manual of Geometric Design Standards for Canadian Roads and its Urban Supplement.

The following are the general minimum requirements that shall be used in the design.

2. VERTICAL ALIGNMENT

2.1 MINIMUM GRADES

Roadways

The minimum longitudinal surface grade for all road classifications is 0.6%. For curved roadways, cul-de-sacs, and expanded bulb corners, centre line grades should be increased to provide a minimum gutter grade of 0.80%. It is desirable to use slightly steeper grade where possible.

Minimum gutter grades on curb returns shall be 0.8%.

Maximum gutter grades shall not exceed those defined by the Roadway Design Elements tables at the end of this Section.

Lanes and Public Utility Lots

The minimum longitudinal surface grade for paved lanes and public utility lots in new subdivisions is 0.8%. Grades <0.8% are acceptable in older subdivisions where a grade ≥0.8% cannot be established due to adjacent development restrictions (e.g. existing concrete or paved driveways, garages, etc.). Grades <0.60% are not to be used unless approved by the Municipal Engineer.

Paved lanes shall have a centre swale and cross slopes of 2.5%.

Sidewalks and Trails

Sidewalks and trails are to be designed according to the Transportation Association of Canada (TAC) recommended standards. As a general guideline, slopes for trails and walkways should be limited to 8% in order to maintain accessibility.

2.2 APPROACH GRADES

Approach grades from any designation of road, for a distance of 30 m from the nearest projected face of curb of the intersecting road, shall not exceed the following in terms of positive or negative grades:

Table 14.1 – Approaching Road Grades

Approaching Road Designation	Accessing Road Designation		
	Local	Collector	Arterial
Local	3%	2%	1%
Collector	-	2%	1%
Arterial	-	-	1%

2.3 VERTICAL CURVES

Vertical curves shall be provided at points where a grade change takes place in accordance with the following criteria:

1. Length of Vertical Curve, L = KA

Where “K” is the vertical curve calculation factor, and “A” is the algebraic difference between grades (%).

2. Crest "K" Factor based on L > Stopping Site Distance (SSD)

.1 SSD = 0.278tVt + db (TAC Formula 2.5.2)

Where braking distance, db **= 0.039V^2/a**(TAC Formula 2.5.1)

Where Perception and reaction time (t) = 2.5 sec., acceleration rate (a) = 3.4 m/s2, and coefficient of friction, f is as listed in the table below and TAC – Table 1.2.5.2

.2 K (Crest) = SSD2 / 200 (h1-0.5 + h2-0.5)2 (TAC Formula 2.1.24)

All vertical curves shall be designed to meet or exceed the following minimum requirements:

Table 14.2 – Vertical Curve Values

Design Speed	Coefficient of Friction	Stopping Site Distance	Rate of Vertical Curvature (K) (Design)	
(km/h)	f	(m)	Crest (TAC Table 3.3.2)	Sag (TAC Table 3.3.4)
30	0.40	35	2	6
40	0.38	50	4	49
50	0.35	65	7	13
60	0.33	85	11	18
70	0.31	105	17	23
80	0.30	130	26	30
90	0.30	160	39	38
100	0.29	185	52	45
110	0.28	220	74	55
120	0.28	250	95	63
130	0.28	285	124	73

3. HORIZONTAL ALIGNMENT AND INTERSECTION DESIGN ELEMENTS

Horizontal alignment and intersection design elements, including radius of curvature, super elevation, curb return radii, and intersection angles are summarized in the Tables at the end of this Section.

4. CROSS-SECTIONS

Standard roadway cross-section drawings are included in Section 20.

4.1 CROWN AND CROSSFALL

All roads shall be crowned or shall have a crossfall as shown on the Typical Detail Drawings in Section 20. The standard crown or crossfall rate is 2.5%. Crossfalls are not permitted on local or collector roads.

Lanes shall have inverted crowns with 2.5% crossfall.

4.2 CURB, GUTTER, MEDIANS AND SIDEWALKS

Curb and gutter will be required on all roadways with the exception of industrial roadways that may be constructed to a rural cross section. A 0.5 m wide concrete gutter shall be provided on expressways and arterial roadways. A 0.3 m gutter width shall be provided on all other road classifications.

All barrier curbs in heavy industrial districts and adjacent to arterial roadways are to be 190 mm in height. The Municipal Engineer may require 190 mm height barrier curbs in other areas based on traffic types and will be determined at the sole discretion of the Municipal Engineer.

The Consultant is required to provide written recommendations and/or confirmation of the cross-section for all expressways and arterial (divided and undivided) roadways within their project limits.

a) Council adopted a standard practice for median construction March 18, 2013, as follows: stamped coloured concrete when on dangerous good route or high traffic six lane arterial roads;
b) Grass with 1 meter stamped coloured concrete strips on all other arterial roads;
c) Asphalt when the median is temporary and on dangerous good route and high traffic arterial road;
d) Grass when the median is temporary and on all other arterial roads;
e) Or as directed by council.

Reverse gutter may be used where the road cross slopes away from the curb such as on super elevation and for median curbs.

Standard curb and gutter shall be used on arterial roadways, urban industrial roadways, frontage roads, adjacent to school and park areas, and along divided sections of residential roadways unless otherwise required by the Engineer.

Local and collector residential roadways shall have standard curb and gutter along both sides. On roadways where front driveways are permitted, rolled curb and gutter may be used.

Generally, 1.5 meter wide separate sidewalks are required on all roadways. Sidewalks shall be clear of all obstructions, including surface utilities that pose an obstruction to pedestrians. Sidewalk locations shall be in accordance with the roadway cross-section. Specific requirements are subject to review by the Municipal Engineer

Wider sidewalks may be required in areas of high pedestrian activity, as determined by the Municipal Engineer, generally through the Outline Plan processes.

Arterial roadways shall be designed to accommodate a 3.0 m wide separate sidewalk as part of any new or upgrading construction project.

To provide barrier-free access, sidewalk ramps shall be installed at the corner of any intersection which connects to an existing or planned sidewalk or pathway, as part of any new or upgrading construction project. An additional curb ramp shall also be installed on the through street of a three-legged intersection.

4.3 SUB DRAINAGE

The lifespan of the road structure is enhanced by preventing saturation of the roadway aggregate and subgrade. Wick drains are required to be installed directly under the curb and gutter at the lowest point of the subgrade along both sides of the roadway prior to placement of the aggregate subbase. All wick drains must connect to catchbasins or catchbasin manholes as shown in the Construction Specifications.

4.4 SHALLOW UTILITY EASEMENTS

2.6m wide easements shall be required on both sides of residential roadways, where required to provide an alignment for shallow utilities, power, gas, telephone and cable TV. The shallow utilities are typically installed in a joint-use trench as shown on the cross-sections in Section 20.

5. UTILITY CROSSINGS

To protect existing infrastructure from damage due to the installation of major utilities including, but not limited to, water, sanitary, and storm water. These methodologies are only a requirement on existing infrastructure and not on new construction/development.

5.1 ARTERIAL ROADS

When installing any pipe leads or pipe mains for water, sanitary, or storm sewer utilities which run underneath existing Arterial roadways, the preferred method of installation is through boring and jacking of a casing pipe followed by the installation of a carrier pipe.

Where an alternative method of installation is desired, the methodology must be clearly presented and accepted by the Municipal Engineer.

The City reserves the right to require the use of pipe casings, installed by boring and jacking, where it can not be clearly demonstrated that alternative construction methods will adequately protect existing and future roadways.

Drilling reports and/or detailed installation records will be required for the chosen methodology including an agreement to warranty the road surface as required by the Municipal Engineer. The Municipal Engineer will set the conditions of the warranty including but not limited to the length and performance measures to be covered.

All pipes, including casings and carrier pipes, are to be installed perpendicular to the roadway or in a way such as to minimize the distance of roadway which the pipe must travel under.

Open cutting may be permitted in extreme circumstances where no other crossing methods are feasible and will only be allowed upon approval by the Municipal Engineer.

6. PAVEMENT STRUCTURES

6.1 PAVEMENT DESIGN

All roads shall be paved with hot mix or warm mix asphalt. A geotechnical investigation and independent pavement design is required for all developments and shall be based on a minimum 20 year design life for in- situ conditions and projected traffic volumes. The geotechnical report with recommended pavement designs shall be provided by a Professional Engineer recognized by APEGA and employed by a recognized engineering agency, and submitted to the Municipal Engineer for review and approval.

The pavement design shall be performed in such a way that pavement structure recommendations address performance. The City reserves the right to require a structural analysis of the pavement, at the Developer's expense, prior to Final Acceptance Certificate for private development projects.

Typical pavement structure permitted for each road classification is outlined in the following table:

Table 14.3 – Pavement Structure

		Alternate 1			Alternate 2		
Road Classification	**Design Traffic ESAL's (80 kN Axles)**	**Asphaltic Concrete (mm)**	**Granular Base (mm)**	**Granular Sub base (mm)**	**Asphaltic Concrete (mm)**	**Granular Base (mm)**	**Reliability %**
Arterial	4×10^6 *	125	300	350	125	550	85
Industrial Collector	2.7×10^6	125	250	350	125	500	85
Industrial Local	8.6×10^5	100	250	300	100	450	85
Residential Collector	1.35×10^6	100	300	300	100	500	85
Residential Local	9×10^4	75	150	200	75	300	75
Paved Lane	1×10^3	75	300		75	300	75
Gravel Lane	5×10^2		200	250		400	75
Pedestrian Trails	N/A				65	250	

These pavement structures are based on the assumption of a prepared subgrade having a California Bearing Ratio (CBR) of 3.0 in a soaked condition, that the granular base has a CBR of at least 80, and that the granular sub-base has a CBR of at least 20. These conditions are considered representative of the typical level of subgrade support for the City during spring thaw when the subgrade soils will exist in a weakened condition.

Alternative designs that utilize geogrids to increase the subgrade CBR will be considered.

If the geotechnical site investigation at the time of subgrade preparation proves that the prepared subgrade has a California Bearing Ratio (CBR) of greater than 3.0 in a soaked condition, than alternate designs based on the higher CBR value may be provided to the Municipal Engineer for consideration.

The City reserves the right to require the Developer to engage a geotechnical engineering agency to carry out CBR tests on the subgrade prior to paving to confirm adequacy of design. A minimum of three (3) tests per area up to 100m in length, plus one (1) test for every additional 100m of length (or portion thereof), with the test locations taken at representative locations, including the area(s) with the suspected weakest subgrade conditions.

The pavement structures shown in Table 14.3 provide thickness for asphalt, granular base and granular sub-base with an alternate design using only asphalt and a granular base. The granular base layer may consist of aggregates of 20mm, 25mm or 40mm maximum nominal sizes as per City Aggregate Specifications. Any aggregate greater than 40mm will be considered granular sub-base course. If Alternate 2 design is used, the granular base thickness must consist of a minimum 50% of material that meets the 20mm classification.

All pavement design is to follow the AASHTO design method with the following coefficients applying to each structural layer:

Table 14.4 – Structural Layer Coefficients

Material	Layer Coefficient
Asphalt Concrete (ACP)	0.40
Granular Base Course (GBC)	0.14
Granular Sub base Course (GSBC)	0.10

Reclaimed asphalt/concrete 63 minus aggregate may be used in the design structure of the granular course and would be considered granular base course (GBC).

The design parameters used by the designer such as Equivalent Single Axle Loadings (ESAL's), California Bearing Ratio (CBR), etc., are to be outlined to the Municipal Engineer in the report. Table 14.3 summarizes the recommended design ESAL's for collector and local roadways. ESAL's for arterial roadways are to be determined by engineering analysis by the Developer's Engineer and approved by the Municipal Engineer.

The pavement design shall be performed in such a way that pavement structure recommendations are based on the initial (Stage 1) pavement thickness only. Unless otherwise approved by the Municipal Engineer, all roads will be constructed with two stages of construction, with the final lift of asphalt (minimum 40 mm) placed immediately prior to Final Acceptance Certificate eligibility. The 40mm final lift is to be viewed as an overlay with no structural value and not included in the pavement structure design unless the Developer provides a guarantee to the City that the final lift of asphalt will be placed no more than two years after the date of completion of the initial (Stage 1) paving. The

final lift will be treated as an overlay as per the City's Construction Specifications. After placement of the Stage 2 lift, there shall be a minimum One-year maintenance period. Either the One-year Stage 2 maintenance period or the remainder of the Two-year Stage 1 maintenance period shall apply, whichever is longer. This maintenance period applies to the asphalt only, and may be waived at the City Engineer's discretion.

All asphalt lift thicknesses shall conform to Section 32 12 16.13 Table F of the City of Grande Prairie Construction Manual.

Interim gravel surfacing is not permitted on rear paved lanes (alleys) unless approved by the Municipal Engineer. Staged Construction of paved lanes shall be undertaken where underground utilities have been constructed. Initial construction shall be to a gravel lane standard section. After one year of the initial construction, the lane must be rehabilitated, shaped to the proper cross section, and then paved.

No asphalt concrete pavement shall be permitted on Bike / Pedestrian Trails.

6.2 SUBGRADE PREPARATION

The minimum depth of prepared compacted subgrade will be 300 mm. In areas where the water levels are close to the existing surface grades or in areas of poor drainage, there will be the potential for groundwater to be pumped up into the subgrade soils by surface vibrations from construction traffic. In these areas the granular sub base section of the pavement design should be thickened. Increased granular sub base will increase the working platform of free draining course gravel and improve the subgrade support of the design pavement section. A geotechnical firm should be contacted to determine the acceptable depths of granular sub base required to provide adequate support.

The use of cement stabilization may be applied as means of subgrade moisture conditioning but does not add to the subgrade strength and is not considered a structural layer in design calculations. The CBR value will be considered the same as unstabilized soil.

Construction procedures should be designed to minimize disturbance to sensitive subgrades and to protect the integrity of the granular base. If the subgrade has failed during construction, the weakened material will have to be sub cut and replaced with an approved fill material on top of a non-woven filter fabric. At no time should a failed subgrade simply be leveled.

A non-woven geotextile separation strip should be considered for all subgrades consisting of clay or silty clays.

A non-woven filter fabric should be used when the D50 grain size of the fill to subgrade ratio exceeds 25, unless additional gravel is used to account for fines intrusion into the base or sub base material or the subgrade is shown to have sufficient clay content and gradation that it will be stable and not subject to piping, as follows:

$$\frac{D50_{Fill}}{D50_{Subgrade}} > 25$$

Additionally, when the subgrade consists of greater than 60% silt and the D85 grain size is smaller than the apparent opening size of the geotextile, or where the fines (<200 µm) are subject to piping, the use of a 100 to 300 mm thick fine sand sub base should be considered. The sand gradation should be chosen based on rational filter design criteria and the non-woven geotextile chosen to provide separation of the sand from the gravel base course.

Required additional granular thickness, initial lift thickness and the need for any special construction procedures are best determined based on observations at the time of construction.

7. CUL-DE-SACS

Minimum pavement radius for cul-de-sacs is 12 meters to face of curb in residential areas and 15 meters in industrial areas.

Maximum cul-de-sac length without an emergency access shall be 100 m from the entrance at property line of the intersecting road to the beginning of the return radius at the cul-de-sac or for a maximum of 20 single-family housing units. Longer cul-de-sacs shall be designed with an emergency access.

8. REAR LANES AND ALLEYS

Rear lanes and alleys shall have a minimum full paved surface width of 6.0 m within a 10.0 m right-of-way. Where rear lane traffic activity is expected to be high, a wider surfaced width and right-of-way may be required as determined by the Municipal Engineer. Lane

corners shall have intersectional flares or a corner cut lot lines where they form intersections with roads or other lanes.

No asphalt concrete pavement staging shall be required at back lane.

9. EMERGENCY ACCESS DESIGN REQUIREMENTS

The clear unobstructed width of an emergency access right of way shall be a minimum width of 6.0 m with a 3.0 m driving surface. The driving surface for permanent emergency accesses may be concrete, asphalt, paving stone, or turf stone on a properly constructed base.

The emergency access shall be structurally and geometrically designed (e.g. width, turning radii, structure) to safely carry fire-fighting equipment loading to a connecting street or lane.

Avoid placing an emergency access in line with a road segment, so that it does not appear to be an extension of the road.

The overhead clearance through an emergency access shall be a minimum of 5.0 m.

Emergency access roads must be signed at each street or lane intersection as “Emergency Access”, and the signs designed such that they meet the intent of the Alberta Fire Code.

Collapsible bollards must be installed at each street or lane intersection to limit access to traffic other than emergency vehicles. Reflective strips must be installed on the bollards so that they are visible to cyclists and pedestrians at night.

All developments shall have one or more points of access in accordance with the National Fire Protection Association “NFPA 1141: *Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas”*, most recent edition.

For Residential Areas:

Number of households/Units	Number of Access Points
0-100	1
101-600	2
>600	3

For Non-Residential Areas:

Number of Parking Spaces	Number of Access Points
0-1250	1
1251-3000	2
>3000	3

10. DRIVEWAYS

10.1 PRIVATE DRIVEWAYS

All driveways shall be designed to give a minimum of 1.0m clearance from any structure, e.g. hydrants, light standards, service pedestals, manholes, and catch basins, the only exception being Curb Stops in concrete driveways in cul-de-sacs. The driveway locations shall be clearly shown on the overall lot-grading plan and on all plan profiles. All residential driveways must meet TAC Guidelines for separation and clearance from intersections. Driveways should have a minimum design width of 2.74 meters. Driveways must be spaced a minimum distance of 2.0m from the edge of the driveway to the curb return of collector roadway intersections. For additional driveway requirements see Section 8 – Driveways.

11. TEMPORARY ROADS

When it is determined by the Municipal Engineer that a temporary road is required in a new subdivision, the road shall be built in accordance to plans approved by the Municipal Engineer, with all costs borne by the Developer.

11.1 ACCESS ROADS

An access road between a partially developed arterial road and a collector road shall be constructed to the satisfaction of the Municipal Engineer.

A temporary road between a proposed subdivision and an existing local road or collector road which is required as a point of access shall be constructed to one of the following specifications:

- When the road will be used by the residents of the Developer-proposed subdivision, it shall be constructed to the completed stage of a roadway. A temporary road constructed through or flanking a RL lot shall have screen fencing provided to buffer the adjacent development.
- When the temporary road shall be used by construction traffic only, and shall be taken out of service before residential occupancy of the subdivision (following the construction of permanent access points), then the road shall be constructed to the interim gravel stage without curb / gutters. When the temporary road crosses the curbs, gutters, and sidewalks of adjoining roads, provision shall be made to permit regular vehicle movement across the curbs.

11.2 TURNAROUNDS

Where a road terminates at mid-block, and has no provisions for egress, a temporary turnaround shall be constructed. It shall be constructed to the same Granular Base Course structure as the abutting roadway and shall be designed to permit either passenger cars or transit vehicles to perform a 180 degree turn maneuver in one direction, as may be required by the Municipal Engineer. Paving will not be required unless the turnaround is intended to be in use for a prolonged period of time. Turnarounds must be paved prior to FAC if they will continue to be used beyond the issue of the FAC; this will be at the discretion of Municipal Engineer in consultation with Developer.

12. PAVEMENT MARKINGS AND TRAFFIC CONTROL AND STREET NAMES SIGNS

All pavement markings and traffic control signs shall be designed in accordance with the Manual for Uniform Traffic Control Devices (MUTCD) as issued and revised from time to time by the TAC. Signs shall be constructed and installed as per details in the City Construction Manual.

Plans which depict the locations and details of all traffic signs, pavement markings, and street name signs shall be provided to the Municipal Engineer for approval.

Street name signs shall not include numbered suffixes. (i.e. xxnd Street)

13. PAVEMENT MARKINGS AND SIGNAGE DRAWING APPROVAL PROCESS

The Municipal Engineer shall approve pavement markings and traffic control signs. The approval process is as follows:

1. Consultant submits traffic signing and pavement marking drawings to the Municipal Engineer for review. Consultant to revise the drawings in accordance with the Municipal Engineer's comments and resubmit for final review.

2. Street names and street light pole locations may change from initial detailed engineering design; therefore prior to the manufacture and installation of signage, the consultant must confirm both street naming and signage location to ensure accuracy and appropriateness.

3. Upon approval in principle, the Consultant submits reproducible original traffic drawings, which are signed and stamped by the Consultant's Enginer, for acceptance by the by Municipal Engineer.

4. Consultant to arrange for the installation of traffic signs and pavement markings through the use of a private contractor.

14. PAVEMENT MARKINGS

Pavement markings for the various roadway classifications are as follows:

Acceptable Pavement Marking Materials		
Item	***Type of Material***	
Expressways and Arterial Roadways *1*		
1.	*Centre Lines*	*Type 1*
2.	*Edge Lines*	*Type 1*
3.	*Lane Lines*	*Type 1*
4.	*Stop Bars*	*Type 1*
5.	*Crosswalk Lines*	*Type 1*
6.	*Guide Lines*	*Type 1*
7.	*Arrows*	*Type 1*
8.	*Concrete Bridge Decks*	*Paint*
9.	*Asphalt Bridge Decks*	*Type 1*
Collector Roadways		
1.	*Centre Lines*	*Paint*
2.	*Lane Lines*	*Paint*
3.	*Stop Bars*	*Paint*
4.	*Crosswalk Lines*	*Paint*
Local Roadways		
1.	*Centre Lines*	*Paint*
2.	*Stop Bars*	*Paint*
3.	*Crosswalk Lines*	*Paint*
Notes:		
1.	*Expressway and Arterial roadways include any portion of a* ***Collector or Local roadway within 50 m*** *of an intersecting expressway or arterial roadway.*	
2.	*Type 1 permanent pavement marking material - Thermoplastic "Hot In-Laid" material.*	

TABLE 1 - ROADWAY GEOMETRIC DESIGN ELEMENTS

Roadway Designation	Design Elements								
	TAC Design Classification	Daily Service Volume (vpd)	Right Of Way Width	Horizontal Alignment Minimum Radius of Curvature	Minimum Intersection Angle (degrees)	Intersections "Corner Cut-Off Dimensions"			
						Arterial Roadway	Collector Roadway	Local Roadway	Lanes
6 Lane Divided Arterial	UAD 80	10,000 – 30,000	58.5 m	280 m	75	Site Specific (TBD)	10 x 10	N/A	N/A
4 Lane Residential Undivided Arterial	UAU 70	5,000 – 20,000	48 m	200 m	75	Site Specific (TBD)	10 x 10	N/A	N/A
4 Lane Commercial Undivided Arterial	UAU 70	5,000 – 20,000	38 m	200 m	75	Site Specific (TBD)	10 x 10	N/A	N/A
Major Residential Collector (See Note)	UCD 60	3,000 – 8,000	23.6–26.6m or 30m*	185 m NC 135 m RC	75	10 x 10	5 x 5	5 x 5	N/A
Minor Residential Collector (See Note)	UCU 50	1,000 – 3,000	23.6 – 26.6 m	185 m NC 135 m RC	75	10 x 10	5 x 5	5 x 5	N/A
Residential Local (See Note)	ULU 50	<1,000	19.6 m	115 m	75	N/A	5 x 5	5 x 5	2 x 2
Urban Industrial / Commercial Collector	UCU 60	6,000 – 12,000	23.5 – 25 m	185 m	75	10 x 10	10 x 10	10 x 10	N/A
Rural Industrial Local	RLU 50	<3,000	28 m	125 m	75	N/A	10 x 10	10 x 10	5 x 5
Urban Industrial / Commercial Local	ULU 50	<3,000	20 m	125 m	75	N/A	10 x 10	10 x 10	5 x 5
Lanes	20	<500	10 m	Not Permitted	75	N/A	N/A	2 x 2	5 x 5

Notes:

- Environmental capacity of Collector and Local Roadways within residential areas is 5,000 vpd and 1,000 vpd, respectively.
- NC – Normal Crown, RC – Reverse Crown
- Additional Corner Cut-Off dimension may be required at detailed engineering design review; the above is a guideline only.
- All Minimum Radii are at the road Centreline.
- When designing an alignment with Reverse Curves, Minimum Radius is doubled.
- All Industrial Roads are considered equivalent to Collector Roads, therefore Collector Road Standard is to be used.
- * Residential Collectors shall have 30m ROW Width for the first 60m from an intersection with an Arterial Road to allow for turning lanes.

TABLE 2 - ROADWAY DESIGN ELEMENTS

Roadway Designation	Design Elements									
	TAC Design Classification	Horizontal Alignment		Minimum " K" for Vertical Curves	Vertical Alignment			Intersections		
		Rate of Superelevation (As per TAC)			Road Gradient (%)			Curb Return Radii (m)		
		Desirable Rate (m/m)	Maximum Rate (m/m)		Maximum Grade	Desired Maximum Grade	Minimum Grade	Arterial Roadway	Collector Roadway	Local Roadway
Divided Arterial	UAD 80	0.04	0.06	See Section 14 Clause 2.3	6.00	4.00	0.60	Drawing 20-18	15	N/A
Undivided Arterial	UAU 70	0.04	0.06		6.00	4.00	0.60		15	N/A
Major Residential Collector	UCD 60	Normal Crown 0.02	Reverse Crown 0.02		6.00	6.00	0.60	15	12.5	12.5
Minor Residential Collector	UCU 50	Normal Crown 0.02	Reverse Crown 0.02		6.00	5.00	0.60	15	10	10
Residential Local	ULU 50	Normal Crown 0.02	Normal Crown 0.02		7.00	4.00	0.60	N/A	9	9
Rural Industrial Collector	RCU 60	Normal Crown 0.02	Reverse Crown 0.02		6.00	4.00	0.60			
Urban Industrial / Commercial Collector	UCU 60	Normal Crown 0.02	Normal Crown 0.02		6.00	5.00	0.60			
Rural Industrial Local	RLU 50	Normal Crown 0.02	Normal Crown 0.02		6.00	5.00	0.60	N/A		
Urban Industrial / Commercial Local	ULU 50	Normal Crown 0.02	Normal Crown 0.02		6.00	5.00	0.60	N/A		
Urban Frontage (Service) Road	ULU 50	Normal Crown 0.02	Normal Crown 0.02		6.00	6.00	0.60	N/A		
Lanes	20	N/A	N/A		7.00	6.00	0.80	N/A	N/A	N/A

Note: Municipal Engineer can use discretion when reviewing road gradients.

15. Transit/Bus Stops

The following section provides requirements for City of Grande Prairie Transit stops. Private bus stops (including school busses) on City property are recommended to follow the provided guidelines but are not required.

15.1 Transit Stop Locations & Requirements

1. At a 90-degree typical intersection, when the bus movement is straight through the intersection, the head of the stop on the other side of the intersection following the movement through the intersection is to be signed no closer than 25 m from the intersection as measured from the curbline on the perpendicular road
2. At a 90-degree typical intersection, when the bus movement is either a left or right turn through the intersection, the head of the stop on the other side of the intersection following the turning movement is to be signed no closer than 35 m from the intersection as measured from the curbline on the perpendicular road
3. A mid-block stop is to have a clear zone of 45 m
4. At a typical intersection where a right turn cut-off is present (including right turn cut-off & slip-lane), the head of the stop is to be no closer than 70 m from the intersection as measured from the curbline on the traffic island on the perpendicular road
5. Refer to Standard Detail 20.28

15.2 Transit Stop Signage

1. All bus stops are to be signed at the head (front) of the stop and at the rear (tail) of the stop except where the tail of the stop can be formed by the edge of an intersection or where the tail end sign is omitted by the Municipal Engineer
2. Sign contents are to be confirmed with the City of Grande Prairie Transit Department

SECTION 15 - LOT GRADING

1. PURPOSE OF SECTION

The City of Grande Prairie generally requires two (2) types of lot grading plans. A high level lot grading plan is submitted as part of the detailed engineering drawings for any new development, and a detailed lot level plan will be submitted as required to obtain a lot grading permit. Lot level lot grading plans shall be submitted to the City of Grande Prairie in conformance with the most current Lot Grading Bylaw.

This section outlines the requirements and considerations that apply to the detailed design of lot grading and surface drainage plans as required for new development.

2. SURFACE DRAINAGE ON PRIVATE PROPERTY

2.1 LEVEL OF SERVICE

The level of service requirements for lot grading include provision of protection against surface flooding and property damage for the 1 in 100 year return frequency design storm. Refer to Section 12 for further information on stormwater design guidelines and storm events. Through control of surface elevations, designs should be such that maximum flow or ponding surface elevations are 150 mm below the lowest anticipated finished ground elevations at buildings. An overflow route or sufficient ponding volume must be provided at all sags or depressions to provide for this 150 mm freeboard with the recommended maximum depth of ponding is limited to 350 mm.

2.2 INTENT AND APPLICATION OF LOT GRADING PLANS

The establishment of a lot grading plan is one of the principal means for establishing a critical component of the major drainage system and a specific requirement within the detailed Engineering Drawings for a subdivision under the terms of a standard servicing agreement.

The overall site grading plan shall ensure proper drainage of individual private properties and establish an effective surface drainage system for the entire development area. This plan will ensure that appropriate drainage relationships are maintained between all properties within the development and adjacent to the developed area.

The lot grading plan shall be suitable for use as a tool to control surface drainage through the development process and thereafter. The lot grading plan may be enforced by the City, initially to implement the approved grading and then to have the grading maintained by the property owner to prevent or correct obstruction of flow routes and excessive or recurrent ponding of water around buildings.

General considerations in the establishment of lot grading plans.

a) In the design of lot grading plans, the Engineer must achieve a proper relationship and balance between the street elevation, building grade elevation, surrounding development and existing topography.

b) The implications of required noise attenuation berms and other elevation controlling features are to be fully addressed by the Engineer. It is also important to ensure that the lot grading design and the anticipated building designs are complementary. Reverse slope driveways and other features that would likely capture runoff or fail to drain during major rainfall events should be discouraged.

c) The Developer must ensure that builders are informed of any potential problems or restrictions respecting building design and lot grading. The lot grading plan will be used as one of the principle means by which this information is communicated.

3. LOT GRADING REQUIREMENTS

3.1 DETAILS OF GRADING WITHIN LOTS

Refer to Figure 15.1A and Figure 15.1B for typical lot grading details for various standard drainage arrangements for detached residential developments

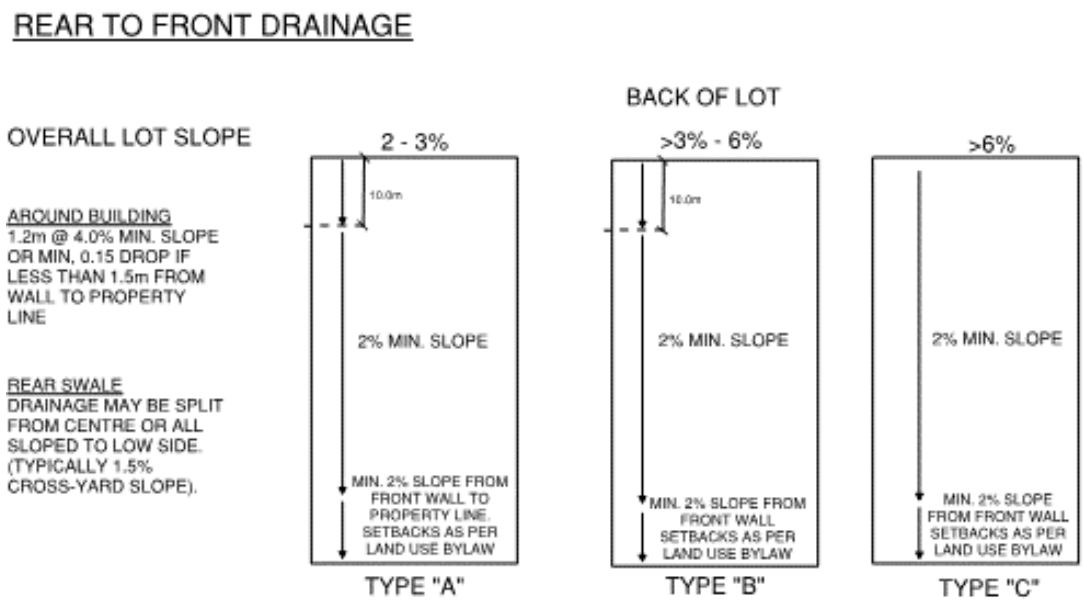


Figure 15.1A – Typical Lot Grading Details – Rear to Front Drainage

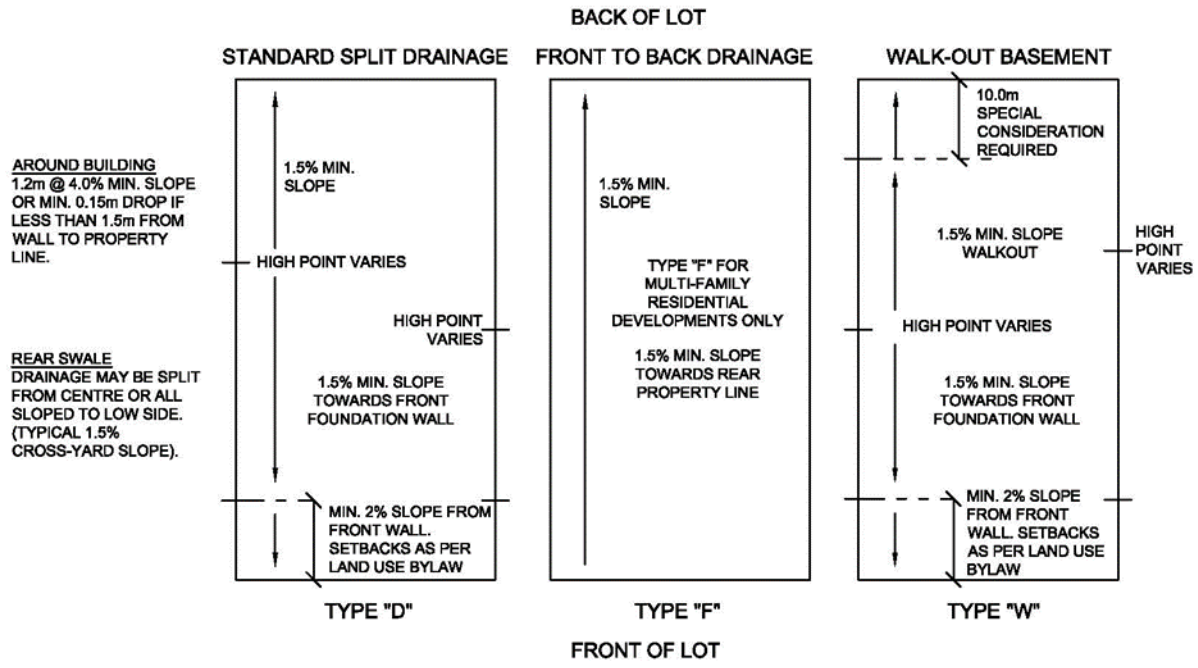


Figure 15.1B – Typical Lot Grading Details – Split / Front-to-Back Drainage

3.2 ESTABLISHMENT OF GRADE ELEVATIONS AT BUILDINGS

The finished grade elevations at buildings are established by following the Alberta Building Codes, Part 9 – Housing and Small Buildings. The Alberta Land Surveyor or Engineer will set the elevation as per the most current Lot Grading Bylaw and amendments.

The relative surface elevations must allow for the slope of the ground adjacent to the building to be at a minimum of 4% for a distance of 1.2 m or to the property line, on all sides of the house, with a slope directing drainage away from the building. The remainder of the lot shall have reasonable slopes in the order of 2.0% from all points within the property boundary at which the drainage may escape.

3.3 OVERALL SLOPES FOR PROPERTY GRADING

Property line elevations are to be established such that lots have a minimum overall slope of 2.0% from the high point to the front or back property lines for split drainage situations, or between the higher and lower, front and rear property lines with through drainage. The minimum grade (2%) should normally be exceeded if topography allows. Boulevard

grading (typically completed on city property) shall also be a minimum 2% slope towards the roadway.

3.4 OVERALL DRAINAGE ARRANGEMENT

a) Lots abutting a public right of way at front and rear.

Split drainage or through drainage (front to rear or front drainage) will be allowed when a lot is located such that there is a road, lane, or public right of way at both the front and back of the lot.

b) Lots not abutting a public right of way at rear

Rear to front drainage is preferred in these subdivisions. Split drainage subdivisions will be permitted if rear to front drainage is not feasible or practical.

In situations where split drainage may be problematic, the use of a swale for interception of split drainage and its conveyance to a public right of way will be permitted.

4. USE OF SWALES

4.1 GENERAL

A swale is a shallow sloped linear depression for conveyance of surface runoff. The use of swales crossing properties for collection of runoff and drainage control is not permitted unless justification is produced and documented to the satisfaction of the Engineer, indicating that no other alternative is feasible.

Drainage swales, whether on municipal or private property (through drainage easements), shall be constructed completely prior to any development of subdivision lots. Drainage swales running between adjacent private lots may be constructed of concrete along their entire length at the request of the Municipal Engineer to ensure lots are graded to the correct elevation.

Design and construction shall comply with City of Grande Prairie construction manual requirements. When drainage swales are utilized to control runoff flows from a large catchment area, confirmation of capacity may be requested by the Municipal Engineer.

4.2 EASEMENT

If the Municipal Engineer approves a swale to provide shared drainage across multiple lots, it shall be covered by a standard easement available from the City of Grande Prairie.

4.3 PRIVATE DEVELOPMENTS

With respect to private subdivision development, under the terms of servicing agreements between a developer and the City, included swales shall be completed as part of the drainage improvements and in accordance with the approved engineering drawings or lot grading plan.

4.4 SWALE REQUIREMENTS

a) Concrete channels will be required when any of the following conditions are met:

- Where there are more than three lots from one side (or six lots from two sides) draining consecutively, the drainage swale must be defined by a concrete gutter along the swale invert through all the consecutive lots.
- A minimum slope of 1.5% cannot be achieved with a grass swale.

Concrete swales shall be constructed as per the City of Grande Prairie Construction Manual or as per the approved Engineering Design.

b) Where swales in easements are to intercept runoff flows and prevent discharge of that flow across downstream properties they are located on one side of a parallel property line on the upstream lot.

c) Swale alignment and routing

- Swales should be aligned as straight as possible and sudden or sharp deflections of greater than 45 degrees are to be avoided.
- In cases where greater deflections cannot be avoided, the minimum radius of curvature of the swale centerline is to be 1.0 m and either the outside edge of the swale gutter is to be super-elevated or appropriate curving is to be provided as necessary to deflect the flow and contain minor event flows within the swale gutter. Major event flows should be contained within the 2.0 m wide swale easement.
- Swales collecting and conveying flows from more than two properties are not to be routed along the side yard of a single family or duplex residential lot.
- Side slopes of drainage swales in private property shall be extensions of the grading slope of the adjacent area being drained and will normally be approximately 2.0%. Landscaped portions of the swale may be provided with grass cover or other appropriate ground cover (plants or material). Concrete swale gutters are usually centered on the swale easement, however they may be

offset from centre to address site specific requirements. A minimum clearance of 200 mm should be provided between the edge of a swale and the nearest property line in order to allow for the placement of fences.

4.5 SWALE LONGITUDINAL SLOPE REQUIREMENTS

a) For swales with a concrete gutter on private property, the minimum design slope is to be 0.75%.

b) For swales without a concrete gutter, a minimum longitudinal slope of 1.5% is required. This will generally apply to swales constructed within condominium multiple residential developments, or serving small number of residential lots where concrete swale gutter is not required.

5. CONTENT OF LOT GRADING PLANS

Generally, two types of lot grading plans are required by the City. A high level lot grading plan is submitted as part of the detailed engineering drawings for any new development, and a detailed lot level plan will be submitted as required to obtain a lot grading permit. Lot level lot grading plans shall be submitted to the City in conformance with the most current Lot Grading Bylaw. Development level lot grading plans required as part of the detailed engineering drawings for development agreements are to include the following information:

a) Legal Description – The legal designation for all existing and proposed lots including lot and block numbers and plan numbers when established.

b) Predevelopment Topography – Existing contours within the subdivision and extending into the adjacent lands, at a maximum 0.5 m interval and flow patterns on adjacent lands.

c) Overall Stormwater Management – the nature and detail of the major conveyance system is to be shown on the lot grading plan, including all major drainage flow directions, ponding areas and the extent and maximum depth of ponding anticipated for a in 100 year return frequency rainfall event. The overall major drainage flow route is to be clearly defined and designated with prominent arrows.

Where significant major system flows are expected to discharge or overflow to a watercourse, ravine or environmental reserve area, the rate and projected frequency of such flows is to be noted on the lot grading plan.

Information shown is generally to include the direction of surface flows on all surfaces, elevations of overflow points from local depressions and details of channel cross sections. Plans shall also indicate all proposed or existing elevations along the boundaries of the subdivision, design elevations at all lot corners, changes of surface slope along property boundaries, and proposed roadway slopes/relevant surface grades.

d) Lot Grading "Type" – The direction of surface drainage for each lot is to be identified to indicate whether split drainage or through drainage required. Proposed surface drainage for abutting future development lands is to be shown to the extent that it will impact on the subject lands. Typical detail diagrams of the various types of lot grading arrangements, which will normally conform to Figures 15.1A and B are to be used, identifying for each lot which typical detail applies. When more than one sheet is required for the lot grading plan, each sheet is to show the typical details which apply.

e) Foundation Details – Provisions for foundation drainage are to be noted on the lot grading plan. This is to include identification of foundation drains to receive the weeping tile flows only, or storm services when needed.

f) Swale Details – When the use of swales has been included in the design, the lot grading plan is to show locations, easement requirements, slopes, cross sections and construction details for the swales.

g) Provisions for Lots Abutting Stormwater Management Facilities – For lots backing onto the stormwater management facilities, the lowest permitted building opening elevations are to be above the ultimate design HWL for the facility by at least 1 m. Building footings shall also be at least 1 m above the NWL of wet storage facilities (ponds). Lot Grading Plans are to include appropriate notation of the requirements to establish building elevations accordingly. This notation and the specific requirements for building elevations and the grading of the property are to be consistent with the geotechnical considerations in the area.

SECTION 16 – LANDSCAPING

1. GENERAL

The design of this municipal improvement shall be undertaken in such a manner as to complement Division 32 in the City's Construction Specifications.

All landscape plans shall be submitted with the Detailed Engineering Drawings as required by the Service Agreement and in accordance with the Outline Plan and City Master Plans. The Municipal Engineer may approve a separately submitted park plan.

Neighbourhood Entrance Features on public lands shall be done in accordance with Policy 611. Neighbourhood Entrance Feature means a permanent sign that displays the name of a residential neighbourhood, commercial or industrial subdivision and which is typically located at the primary entrance to the subdivision, and may also include associated landscaping.

Landscape entry features that are proposed to be located on City property (PUL or Road ROW) will require a separate detailed engineering plan and Maintenance Agreement to be approved by the Municipal Engineer.

All landscaping design and construction is the sole responsibility of the Developer.

2. BOULEVARDS

Boulevards are defined as that portion of the road right of way between the back of curb and the private property line.

Boulevards are to be topsoiled, seeded/sodded; trees/shrubs planted as per plan depending upon types of roadway (see 14.4.1). Timing must be as per specifications in Division 32 in the City's Construction Specifications.

Planting Cross-Section showing all underground utilities within 3.0 m of planting root zones, limits to road base and sub-bases and the limits of the compacted verge base materials in relation to organic soils, mulches and to the root zones of trees and shrubs.

Planting Plan showing all underground utility alignments, with walk, tree and shrub setbacks; proposed planting and spacing; landscaped edging, mulches and free- standing features i.e. signs, gates, pedestals, sculptures, light poles, etc.

The Planting Cross-Section and Planting Plan shall be cross-referenced to the Detailed Engineering Drawings.

3. ROAD MEDIANS, LANDSCAPE ENTRY FEATURE MEDIANS & LANDSCAPE ENTRY FEATURES

Road medians, including such structures as road islands and turnouts, are areas between back of curbs on the intersecting road, generally at 90 degrees, to the subdivision entrance. Road medians shall not be landscaped.

Entry Feature Medians are areas between back of curbs in the median at entries to subdivisions, if the subdivision is so designed. Entry feature medians may be landscaped at the Municipal Engineers approval. In these cases the minimum width of the Entry Feature shall not be less than 4.5m when tree planting is proposed. Refer to Section 4.2 for design requirements.

Landscape Entry Features are areas back of the curb of road islands or turnouts, which contain the landscape feature. Entry Features are to be topsoiled, seeded/sodded, and if so required by the Municipal Engineer, trees/shrubs planted.

4. PATHWAYS/TRAILS (IN PARKS, BOULEVARDS OR WIDER PUBLIC UTILITY LOTS)

Pathways are defined as providing single access from the back of curb or sidewalk adjacent to roadway and terminating at a playground.

Trails will be defined as providing linear access through a park (Municipal Reserve) and/or providing linear access between neighbourhood/subdivision phases via a public utility lot.

For walkways/trails for which the right of way is less than 10 m wide, only topsoiling, paving and seeding/sodding will be required. For walkways/trails for which the right of way is 10 m or greater (that are not in a P.U.L.) topsoiling, paving, seeding/sodding, tree/shrub planting will be required. Refer to Section 4.3 for design requirements.

The Municipal Engineer may determine the need for lighting for all walkways longer than 50 m or those providing a link to School sites. Lighting installations must meet the specifications of Municipal Engineer and ATCO Electric.

5. PUBLIC UTILITY LOTS (PUL'S)

PUL's are defined as areas contained within the legal boundaries of the so designated lots, containing public utilities.

PUL's are to be graded to accommodate surface drainage.

6. STORM WATER MANAGEMENT FACILITIES

Storm water management facilities are defined as the areas contained within the legal boundaries of the so designated facilities, consisting of either retention or detention ponds.

If new, these areas are to be topsoiled, seeded/sodded, and trees/shrubs planted as per approved plans, around the perimeter (refer to 4.5 for design requirements). If existing, extent of landscaping shall be determined by the Municipal Engineer.

7. NATURAL AREAS

Where identified on the Outline Plan, existing Natural areas identified for preservation shall be fenced off with temporary construction fencing and/or silt fencing. Areas damaged during construction, shall require restoration landscaping as determined in consultation with the Developer's Landscape Consultant and the Municipal Engineer.

8. MUNICIPAL RESERVE (MR)

A Municipal Reserve is defined as the areas contained within the legal boundaries of the so designated lands.

Plans are to be submitted to the Municipal Engineer with Detailed Engineering Drawings as required by the Servicing Agreement. Topsoiled areas, seeded or sodded areas and trees or shrubs planted as per plan are to be identified in the drawings. Amenities such as playground play structures within a defined border, site furnishings, walkways/trails, play fields, outdoor lighting, ice rinks, and toboggan hills are to be provided as required. (Refer to Section 17)

The City may accept cash in lieu of additional park development to an amount equal to the cost of the required park development.

9. LANDSCAPE PLAN AND PLAYGROUND PLAN IF APPLICABLE

9.1 MR'S, STORM WATER MANAGEMENT AREAS AND NATURAL AREAS

The Developer shall submit a Landscaping Plan as part of the Detailed Engineering Drawings and detailed cost estimates of the proposed improvements.

This plan shall be drawn to maximum scale of 1:250 and minimum scale of 1:500 and must show existing and proposed utilities, infrastructure and adjacent PUL's. Where specific design details are provided, they shall be at a scale of 1:100.

The plan shall identify areas to be seeded or sodded, location, size, and name of all trees and shrubs (common name and scientific name), location of park signage, planting beds, any walkways, trails, trail lighting, rinks, and berms or toboggan hills, location and type of fencing and any park furniture or playground equipment being installed. Phases of development shall be indicated on the plan, or in writing. The plan shall utilize the Overall Utilities, Road, and Sidewalk Plan as a base. The completed plan may be subject to public review, as determined by the Municipal Engineer.

Detailed cost estimates for the supply and installation of proposed park landscaping, furniture, playground equipment and other park amenities shall be provided and will require the approval of the Municipal Engineer. Individual components shall be shown, and named and/or listed. The Manufacturer's drawing/plan or shop drawings may be acceptable provided they indicate sufficient detail.

No landscaping shall commence until the landscaping plan has been approved by the Municipal Engineer.

In the event the Developer is redeveloping existing facilities or previously serviced lands, the Development Officer may require the landscape plans to be approved by the appropriate City department, in addition to the Municipal Engineer, prior to the issuance of a development permit.

10. BOULEVARDS, ENTRY FEATURES AND WALKWAYS

The following Detailed Engineering Drawings are required drawn to a metric scale of 1:500.

Planting Plan showing all underground utility alignments, with walkway, tree and shrub setbacks; proposed planting and spacing; landscaped edging, mulches and free-standing features i.e. signs, gates, pedestals, sculptures, light poles, etc.

The Planting Plan shall be cross-referenced to the Detailed Engineering Drawings.

11. DESIGN GUIDELINES

11.1 GENERAL

For landscape materials, installation, and testing specifications (i.e. site work, topsoil, seed, trees, shrubs, benches) refer to the appropriate section of the City's Construction Manual.

11.1.1 Setbacks and Spacing

Where possible, trees shall be set back a minimum distance from above and below grade utilities and property lines as specified in this section.

Unless Authorized by the Municipal Engineer, all trees shall be set back a minimum of 3.0 m from back of curb, walk, playground edging, fence or verge except where placing as per the City's Standard Road Cross Sections.

Northwest poplars shall be setback a minimum of 8.0 m to prevent damage to municipal infrastructure from roots. If they are to be planted closer than 8.0 m to infrastructure, an approved root barrier must be installed.

No trees or shrubs are to be planted directly over any underground utilities or underneath any overhead utility lines. For shallow utilities, water, and sewer lines, a 2.0 m setback is required for all underground lines. For overhead power lines, the horizontal setback shall be the spacing requirement of the species as listed under Section 3.2, Plant Selection.

Planting beds will be set back a minimum of 3.0 m from back of curb, walk, playground or edging. Planting beds will either be set back a minimum of 3.0m from fences or will abut directly to the fence.

Trees shall never be planted at the very top of a berm. Trees shall be planted a minimum of one-third of the slope down from the top.

All objects/features in the park shall have a minimum of 3.0 m separation between one another to provide space for mowing equipment, except fences as referenced above.

11.1.2 Planting Beds

All shrubs and container grown stock are to be incorporated into planting beds. Planting beds shall include trees in groups of not less than 3 trees at a minimum size of 15 gallons and shrubs at a minimum size of 2 gallons.

Planting bed & tree layouts are to be designed to facilitate easy maneuverability of large turf maintenance and cutting equipment. (Equipment varies from 3.0 - 6.0 m in width).

Planting beds are to be edged with landscape edging as per Division 32 in the Construction Specifications. Use of landscape fabric is prohibited. All shrubs/groundcovers in planting beds shall be set-back sufficiently to allow a 200 mm edge between its mature spread and the edge of the bed.

Mulch shall be clean and free of weeds and other foreign matter. Wood chip is the preferred mulch substrate. Other mulch types may be acceptable if approved by the Municipal Engineer.

Amend soil in shrub beds with 300 mm of topsoil and 50 mm of peat-moss or composted organic material. Peat-moss / organic compost shall be worked in uniformly to create a shrub bed with a total minimum depth of 350 mm of amended soil.

11.1.3 Topsoils

A minimum of 300 mm of topsoil is required for all areas designated as Municipal Reserve that are intended for park development and for medians that are landscaped as a feature. For all other areas (boulevards, school sites, PUL's), a minimum of 100 mm of topsoil is required.

11.1.4 Fences

Uniform or screen fences, as indicated in Detailed Engineering Drawings, will be positioned wholly on adjacent privately-owned lands. The screen and uniform fencing shall meet City Standards. Fences bounding parks are to be coated chain-link and black in colour. Fences along roadways must follow the standard detail with a colour to be approved in conjunction with the Municipal Engineer.

11.1.5 Testing

Refer to of the appropriate sections of the City's Construction Specifications.

11.2 PLANT SELECTION

All plant materials shall be specified on a Plant Materials List on the approved landscape drawings in both the Common Name (trade name) and Scientific Name (Latin).

No more than 20% of the trees in the planting plan may be of the same species and no more than 30% of the same genus, unless approved by the Municipal Engineer. No more than 20% of the total trees in the planting plan may be *Ulmus spp.* and *Fraxinus spp.* combined.

Tree mix of approximately 40% coniferous and 60% deciduous is to be met within a park setting, unless a proposed deviation is approved by the Municipal Engineer. All trees, shrubs, perennials and grasses must be hardy to at least Canadian Hardiness Zone 3.

60% of deciduous trees shall have a minimum 50 mm caliper and remaining 40% of the trees shall be a minimum of #15 Container Grown Stock. All container stock shall meet Canadian Standards for Nursery Stock.

80% of coniferous trees shall have a minimum 1.8 m height and remaining 20% of the trees shall be a minimum of #15 Container Grown Stock with a minimum height of 1.0 m. All container stock shall meet Canadian Standards for Nursery Stock.

Minimum shrub/perennial size: #2 pot-grown. Shrub height and spread will be between 450 mm and 1200 mm, subject to availability and species.

Smaller caliper sized trees may be approved for planting by the Municipal Engineer in consultation with Parks Operations.

No annual plantings will be approved in planting beds to be maintained by the City of Grande Prairie.

Note: For plant material proposed to be installed directly under ATCO Electric overhead lines: consult ATCO Electric; use only those species acceptable to City of Grande Prairie.

All plant materials shall conform to the measurement specified in the Plant List and Landscape Plan. Plants larger than specified may be used if approved by the Municipal Engineer.

To promote greater urban forest diversity, a minimum of 10% of the total number of trees required in Municipal Reserves designated as Parks must be chosen from the Category 3 Trees list. To assist in sourcing these species, container grown stock from Category 3 may be used in 10 or 15-gallon pot sizes.

11.2.1 Moratoriums and Limitations

1. **BLACK, MANCHURIAN & HYBRID ASH Moratorium**: NO BLACK, MANCHURIAN OR HYBRID ASH SHALL BE PLANTED on City property until further notification by the City of Grande Prairie. This moratorium is in place to prevent the spread of cottony psyllid, a fatal pest that infests these species.
2. **WHITE BARKED BIRCH Moratorium**: Due to presence of a large population of bronze birch borer destroying white barked birch species, there will be no planting of *Betula pendula* (European cutleaf weeping birch), *Betula papyrifera* (Paper birch), *Betula lenta* (Cherry birch), *Betula platyphylla* (Japanese white birch), *Betula alleghaniensis* (Yellow birch), *Betula populifolia* (Gray birch), *Betula neoalaskana* (Alaska birch), *Betula utilis* (Whitebark Himalayan birch), or *Betula dahurica* (Dahurian birch) on City property until further notification by the City of Grande Prairie. *Betula nigra* (River birch), *Betula occidentalis* (Red birch), *Celtis occidentalis* (Hackberry), and *Salix spp.* (Willow) may be substituted. This moratorium is in place to safeguard urban tree inventory diversity.
3. *Ulmus* and *Fraxinus* Limitation*:* no more than 20% of any design may be made up of the two species combined.
4. *Prunus* Limitation: no more than 5% of any boulevard planting may be *Prunus virginiana or Prunus padus.*

11.2.2 CATEGORY 1 TREES – FOR BOULEVARDS AND COLLECTOR ROADS

COMMON NAME	SCIENTIFIC NAME	SITE CONSIDERATIONS / SPECIAL CONDITIONS	MIN. SPACING IN METRES
Acute Leaf Willow	*Salix acutifolia*	Favours moist sites. Plant 8m from infrastructure unless approved root barrier is installed. Excellent in low lying areas that retain surface water (Stormwater Management Facility).	10
American Elm[2]	*Ulmus americana*	None.	10
Brandon Elm[2]	*Ulmus americana* 'Brandon'	None.	8
Bur Oak	*Quercus macrocarpa*	None.	8
Green Ash[2]	*Fraxinus pennsylvanica* and hardy cultivars	Male clones only.	8
Hybrid Poplar	*Populus spp.*	Cultivars must be male clones and hardy to Zone 3. Examples include (but are not limited to): Assiniboine, Okanese, and Prairie Sky. 5m setback from roads, sidewalks, water, and sanitary services unless approved root barrier is installed.	6
Laurel Leaf Willow	*Salix pentandra*	Favours moist sites. Plant 5m from infrastructure unless approved root barrier is installed. Excellent in low lying areas that retain surface water (Stormwater Management Facility).	8
Manitoba Maple	*Acer negundo*	Male clones only.	8
Manitoba Maple 'Baron'	*Acer negundo* 'Baron'	None.	8
Northwest Poplar	*Populus x jackii* 'Northwest'	8m setback from private property lines, roads, sidewalks, and water/sanitary services unless approved root barrier is installed.	10
Siberian Elm[2]	*Ulmus pumila* *Ulmus mandshurica*	None.	8
Silver maple 'Silver Cloud'	*Acer saccharinum* 'Silver Cloud'	Sheltered sites	8
Silver willow	*Salix alba* 'Sericea' or 'Vitellina'	Favours moist sites. Plant 8m from infrastructure unless approved root barrier is installed. Excellent in low lying areas that retain surface water (Stormwater Management Facility).	10
Skyfest Poplar	*Populus deltoides* 'Jefcot'	8m setback from roads, sidewalks, water, and sanitary services unless approved root barrier is installed.	5
Tatarian Maple 'Hot Wings'	*Acer tataricum* 'GarAnn'	None.	5
White Ash[2]	*Fraxinus americana* and hardy cultivars	Male clones only.	8

Amur Chokecherry	*Prunus maackii*	Prefers well drained sites	8
Hawthorn	*Crataegus spp.* and hardy cultivars	Prefers well drained soils. Min. 3m setback from sidewalks/trails	5
Linden	*Tilia spp.* and hardy cultivars		6
Ohio Buckeye	*Aesculus glabra* and hardy cultivars	Min. 3m setback from sidewalks/trails	5
Ornamental Crabapples	*Malus baccata* & hardy hybrids	Well drained sites only, 'Dolgo' not within 4m of sidewalks/trails	6
Princess Kay Plum	*Prunus nigra* 'Princess Kay'		5
Schubert Chokecherry*[1]	*Prunus virginiana* 'Schubert'	Min. 3m setback from sidewalks/trails	7
Colorado Spruce	*Picea pungens* + varieties		6
Jack Pine	*Pinus banksiana*		5
Lodgepole Pine	*Pinus contorta latifolia*		5
Ponderosa pine	*Pinus ponderosa*	Sheltered sites	5
Scots Pine	*Pinus sylvestris*		5
Siberian Larch	*Larix sibirica*		5
Swiss Stone Pine	*Pinus cembra*		5
Tamarack	*Larix laricina*		5
White Spruce	*Picea glauca*		6

*Note: *[1] A maximum of 5% of required trees within boulevards may be *Prunus virginiana* or *Prunus padus*.

*Note: *[2] A maximum of 20% of any boulevard planting may be comprised of *Ulmus spp.* and *Fraxinus spp.* (combined).

****Important Notice: BLACK, MANCHURIAN & HYBRID ASH Moratorium**: NO BLACK, MANCHURIAN OR HYBRID ASH SHALL BE PLANTED on City property until further notification by the City of Grande Prairie. This moratorium is in place to prevent the spread of cottony psyllid, a fatal pest that infests these species.

11.2.3 CATEGORY 2A TREES – FOR MUNICIPAL RESERVES / PARKS (NON-EDIBLE)

Parks and Open space trees may include all Category 1 Trees providing they meet site conditions.			
COMMON NAME	**SCIENTIFIC NAME**	**SITE CONSIDERATIONS / SPECIAL CONDITIONS**	**MIN. SPACING IN METRES**
Amur maple	*Acer ginnala* and hardy cultivars	Sheltered sites	2
Golden Willow	*Salix alba* 'Vitellina'	Prefers moist, sheltered sites. Min. 8m setback from infrastructure	8
Bebb's Willow	*Salix bebbiana*	Prefers moist sites	5
Plains Cottonwood	*Populus deltoides var. occidentalis*	Min. 8m setback from infrastructure	10
Pussy Willow	*Salix discolor*	Prefers moist sites	4
River Birch	*Betula nigra* *Betula occidentalis*	Prefers moist sites	3
Trembling Aspen	*Populus tremuloides*	Min. 8m setback from infrastructure.	3
Fernleaf Caragana	*Caragana arborescens* 'Lobergii'	Prefers well drained sites; drought tolerant	3
Japanese Tree Lilac	*Syringa reticulata* and hardy cultivars	Sheltered side of group planting only	4
Pin Cherry	*Prunus pensylvanica*	Well drained and sheltered sites only	4
Russian Olive	*Elaeagnus angustifolia*	Prefers well drained sites	5
Showy Mtn. Ash	*Sorbus decora*	Prefers well drained sites	6
'Sutherland' Caragana	*Caragana arborescens* 'Sutherland'	Prefers well drained sites; drought tolerant	1
Mountain Pine	*Pinus uncinata*	Min. 8m setback from roads	4
Norway Spruce	*Picea abies*	Min. 8m setback from roads	6
Siberian Fir	*Abies sibirica*	Min. 8m setback from roads	6
White Spruce	*Picea glauca*	Min. 8m setback from roads	6

11.2.4 CATEGORY 2B TREES – FOR MUNICIPAL RESERVES / PARKS (EDIBLE)

COMMON NAME	SCIENTIFIC NAME	SITE CONSIDERATIONS & SPECIAL CONDITIONS	SPACING IN METRES
Evan's Cherry	Prunus 'Evans'	None	3
Dexter Jackson Apple	*Malus* 'Dexter Jackson'	None	4
Gemini Apple	*Malus* 'Jefcoutts'	Avoid Strong Winds	4
Goodland Apple	*Malus* 'Goodland'	Avoid Strong Winds	4
Norkent Apple	*Malus* 'Norkent'	None	4
Odyssey Apple	*Malus* 'Jefsey'	None	4
Prairie Magic Apple	*Malus* 'Jefdale'	Avoid Strong Winds	4
Red Sparkle Apple	*Malus* 'Red Sparkle'	Avoid Strong Winds	4
September Ruby Apple	*Malus* 'September Ruby'	None	4
Brookgold Plum	*Prunus salicina* 'Brookgold'	Avoid Strong Winds	4
Pembina Plum	*Prunus* 'Pembina'	Avoid Strong Winds	4
Waneta Plum	*Prunus* 'Waneta'	Avoid Strong Winds	4
Early Gold Pear	*Pyrus ussuriensis* 'Early Gold'	Avoid Strong Winds	8
Ure Pear	*Pyrus ussuriensis* 'Ure'	Avoid Strong Winds	8

Note: Orchard/Edible bed design and layout must follow Procedure 212.2, Policy 212 (Available on www.cityofgp.com) and Standard Detail 56 06 01.

11.2.5 CATEGORY 3 DIVERSIFIED TREES – FOR USE IN PARK SITES ONLY MUST CHOOSE 10% FROM THIS LIST

COMMON NAME	SCIENTIFIC NAME	SITE CONSIDERATIONS / SPECIAL CONDITIONS	MIN. SPACING IN METRES
Amur Corktree	*Phellodendron amurense*	Sheltered sites	6
Amur Maackia*	*Maackia amurensis*		5
'Lace' Weeping Willow*	*Salix babylonica* 'Lace'	Sheltered sites, wet sites only	6
Muckle Hybrid Plum*	*Prunus x nigrella* 'Muckle'	Sheltered sites, well-drained soils	3
'Majestic Skies' Northern Pin Oak*	*Quercus ellipsoidalis* 'Bailskies'		8
Northern Red Oak*	*Quercus rubra*		9
'Prairie Horizon' Manchurian Alder*	*Alnus hirsuta* 'Harbin'	Moist sites preferred	5
Prairie Radiance Winterberry	*Euonymous bungeana* 'Verona'	Sheltered sites	3
Balsam fir*	*Abies balsamea*	Plant on Sheltered side of group planting, moist, cool site	4

Brandon Cedar*	*Thuja occidentalis* 'Brandon'	Moist, well-drained soil required, deer protection and plant on sheltered side of group planting	1
Eastern White Cedar*	*Thuja occidentalis*	Well drained soil, sheltered site	4
Eastern White Pine*	*Pinus strobus*	Well drained soil, sheltered site	5
Limber Pine*	*Pinus flexilus*	Well drained soil, sheltered site	5
Sub-alpine fir*	*Abies lasiocarpa*	Well drained soil, on north side of evergreen planting	4
'Techny' Cedar	*Thuja occidentalis 'Techny'*	Moist, well-drained soil required, deer protection and plant on sheltered side of group planting	2
Upright juniper*	*Juniperus spp.*	Preferred varieties include but are not limited to 'Wichita Blue', 'Moonglow' and 'Medora'	3

Notes:

* Preferred category 3 trees

Due to the difficulty in sourcing caliper-sized Category 3 trees, potted stock in 10, 15 and 20 gallon sizes are acceptable.

Additional zone (3B) tolerant species may be available that are not listed above. These trees may be approved by the Municipal Engineer in consultation with Parks Operations and accepted on a trial basis for the 2 year maintenance period (CCC-FAC) only.

Category 3 Tree Species may be placed on the Category 1 and/or 2 Tree list after obtaining substantial growth and proven survivability over a period of 10 consecutive growing seasons. Any Category 3 Tree that does not survive the initial trial period (CCC to FAC inspection period) shall be replaced with a zone tolerant Category 1 or 2 Tree.

11.2.6 CATEGORY 4 – PLANT MATERIAL FOR USE IN NATURALIZED AREAS

COMMON NAME	SCIENTIFIC NAME	SITE CONSIDERATIONS / SPECIAL CONDITIONS	SEEDLINGS PER SQUARE METER
Balsam poplar	*Populus balsamifera*	SWMF	1
Trembling Aspen	*Populus tremuloides*	SWMF; Slope stabilization	1
Lodgepole pine	*Pinus contorta* var. *latifolia*	Slope stabilization	1
Jack pine	*Pinus banksiana*	Slope stabilization	1
Limber pine	*Pinus flexilis*	Slope stabilization	1
White spruce	*Picea glauca*	Slope stabilization	1
Black spruce	*Picea mariana*	SWMF	1
Balsam fir	*Abies balsamea*	SWMF	1
Subalpine fir	*Abies lasiocarpa*	SWMF	1
Tamarack	*Larix laricina*	Slope stabilization	1
Hoary willow	*Salix candida*	SWMF	2
Bebb's willow	*Salix bebbiana*	SWMF; slope stabilization	2
Pussy willow	*Salix discolor*	SWMF	2
Sandbar/coyote willow	*Salix exigua*	SWMF	2
Pin cherry	*Prunus pensylvanica*	Slope stabilization; edible	2
Wild plum	*Prunus americana* *Prunus nigra*	Slope stabilization, edible	2
Red osier dogwood	*Cornus stolonifera*	SWMF; slope stabilization	2
Buffaloberry	*Shepherdia canadensis*	Slope stabilization	2
Wolf willow	*Elaeagnus commutata*	Slope stabilization	2
Beaked hazelnut	*Corylus cornuta*	Slope stabilization; edible	2
Green alder	*Alnus crispa*	SWMF	2
Elderberry	*Sambucus racemosa*	SWMF, slope stabilization, wildlife	2
Bog birch	*Betula glandulosa*	SWMF	2
Highbush cranberry	*Viburnum trilobum*	SWMF; slope stabilization	2
Saskatoon	*Amelanchier spp.*	Slope stabilization; edible	2

Wild gooseberry	*Ribes oxyacanthoides*	Slope stabilization; edible	3
Golden currant	*Ribes aureum*	Wildlife, edible	3
Wild black currant	*Ribes americanum*	Edible	3
Shrubby Cinquefoil	*Potentilla fruticosa*	Slope stabilization	3
Prickly rose	*Rosa acicularis*	Slope stabilization	3
Prairie rose	*Rosa arkansana*	Slope stabilization	3
Wood's rose	*Rosa woodsii*	Slope stabilization	3
Bracted Honeysuckle	*Lonicera involucrata*	SWMF	3
Twining Honeysuckle	*Lonicera dioica*	SWMF	3
Juniper	*Juniperus horizontalis* *Juniperus communis*	Slope stabilization; wildlife	3
Western Snowberry	*Symphoricarpos occidentalis*	Slope stabilization	3
Wild raspberry	*Rubus idaeus*	Edible	3
Wild strawberry	*Fragaria vesca* *Fragraria glauca*	Edible	3
Goldenrod	*Solidago spp.*		3
Gumweed	*Grindelia squarrosa*		3
Joe pye weed	*Eupatorium maculatum*	SWMF	3
Blanketflower	*Gaillardia spp.*		3
Black-eyed Susan	*Rudbeckia serotina*		3
Blazing star	*Liatris spp.*		3
Native Aster species	*Aster spp.*	Includes smooth, showy, Lindley's, many-flowered, white prairie and willow asters	3
Fleabane	*Erigeron spp.*		3
Yarrow	*Achillea millefolium*		3
Harebell	*Campanula rotundifolia*		3
Northern bedstraw	*Galium boreale*		3
Milk vetch	*Astragalus spp.*		3

Fireweed	*Epilobium angustifolium*		3
Western red lily	*Lilium philadelphicum*		3
Canada anemone	*Anemone canadensis*		3
Prairie crocus	*Anemone patens*		3
Wild columbine	*Aquilegia canadensis*		3
Three-flowered avens	*Geum triflorum*		3
Wild vetch	*Vicia americana*		3
Wild flax	*Linum lewisii*		3
Crowfoot violet	*Viola pedatifida*		3
Western Canada violet	*Viola rugulosa*		3
Scarlet paintbrush	*Castilleja coccinea*		3
Bunchberry	*Cornus canadensis*		3
Western wild bergamot	*Monarda fistulosa*	SWMF; slope stabilization	3
Wild mint	*Mentha arvensis*	SWMF	3
Western porcupine grass	*Stipa curtiseta*	Refer to Section 32 of Construction Manual for seeding rates	
June grass	*Koeleria macrantha*	Refer to Section 32 of Construction Manual for seeding rates	
Northern wheatgrass	*Agropyron dasystachyum*	Refer to Section 32 of Construction Manual for seeding rates	
Western wheatgrass	*Agropyron smithii*	Refer to Section 32 of Construction Manual for seeding rates	
Awned wheatgrass	*Agropyron trachycaulum var. unilaterale*	Refer to Section 32 of Construction Manual for seeding rates	
Green needlegrass	*Stipa viridula*	Refer to Section 32 of Construction Manual for seeding rates	
Rocky Mountain fescue	*Festuca saximontana*	Refer to Section 32 of Construction Manual for seeding rates	

11.2.7 OPTIONAL CATEGORY A: ORNAMENTAL SHRUBS

COMMON NAME	SCIENTIFIC NAME	SITE CONSIDERATIONS & SPECIAL CONDITIONS	SPACING IN METRES
Dogwood	*Cornus spp.* and hardy varieties	Moist sites preferred	3
Globe Caragana	*Caragana frutex* 'Globosa'		1
Pygmy Caragana	*Caragana pygmaea*		1
Silverberry (Wolf Willow)	*Elaeagnus commutata*		3
Mock Orange	*Philadelphus lewisii* and hardy varieties	Prefers sheltered sites	2
Ninebark	*Physocarpus opulifolius* and hardy varieties		2
Potentilla	*Potentilla fruticose* and hardy varieties		2
Alpine Currant	*Ribes alpinum*		2
Silver Buffaloberry	*Shepherdia argentea*	Min. 15 meters from playgrounds	2
Spirea	*Spiraea spp.* and hardy varieties		
Compact American Cranberry	*Viburnum trilobum* 'Compactum'		2
Arrowwood Viburnum	*Viburnum dentatum* and hardy varieties		
Highbush Cranberry	*Viburnum trilobum*		3
Lilacs	*Syringa spp.*	Non suckering zone tolerant varieties	2-3
Roses	*Rosa spp.* and hardy varieties		2-3
Nannyberry	*Viburnum lentago*		3
Wayfaring Tree	*Viburnum lantana* and hardy varieties		3
Snowball Viburnum	*Viburnum opulus* 'Roseum'		
Barberry	*Berberis spp.* and hardy varieties		1
Beaked Hazelnut	*Corylus cornuta*		2
Cotoneaster	*Cotoneaster lucidus*		1
Broom	*Cytisus spp.* and hardy varieties		2
Shrub Honeysuckle	*Lonicera* spp. and hardy varieties		2
Burning Bush	*Euonymus spp.* and hardy varieties		2
Hydrangeas	*Hydrangea spp.* and hardy varieties	Moist sites; can tolerate partial shade	2
Russian Almond	*Prunus tenella*		2
Shrub willow	*Salix spp.*	Prefers moist sites	3
Elder	*Sambucus spp.* and hardy varieties	Prefers moist sites	3
Sem False Spirea	*Sorbaria sorbifolia* 'Sem'	Prefers moist sites	2
Russian Cypress	*Microbiota decussata* and hardy varieties		2
Green Penguin Scot pine	*Pinus sylvestris* 'Green Penguin'		
Dwarf Scot pine	*Pinus sylvestris* 'Glauca Nana'		
Juniper – Spreading / low growing varieties	*Juniperus sabina* / *Juniperus horizontalis*		2-4
Mugo Pine	*Pinus mugo* and hardy varieties		3
Ohlendorfii spruce	*Picea abies* 'Ohlendorfii'		
Globe cedar	*Thuja occidentalis* 'Woodwardii'		

NOTE:

Additional zone (3B) tolerant shrubs may be available that are not listed above. These shrubs may be approved by the Municipal Engineer in consultation with Parks Operations and accepted on a trial basis for the maintenance period (CCC-FAC) only. In the event the shrubs (those not listed above) do not survive, replacement will be required with proven stock (those species listed above).

11.2.8 OPTIONAL CATEGORY B: EDIBLE SHRUBS

COMMON NAME	SCIENTIFIC NAME	SITE CONSIDERATIONS & SPECIAL CONDITIONS	SPACING IN METRES
Saskatoon	*Amelanchier* spp.	None	3
Aurora Haskap	*Lonicera* 'Aurora'	None	1
Berry Belle Haskap	*Lonicera* 'Berry Belle'	None	1
Berry Blue Haskap	*Lonicera* 'Berry Blue'	None	1
Boreal Beast Haskap	*Lonicera* 'Boreal Beast'	None	2
Boreal Blizzard Haskap	*Lonicera* 'Boreal Blizzard'	None	2
Borealis Haskap	*Lonicera* 'Borealis'	None	1
Cinderella Haskap	*Lonicera* 'Cinderella'	None	1
Honey Bee Haskap	*Lonicera* 'Honey Bee'	None	2
Tundra Haskap	*Lonicera* 'Tundra'	None	1
Carmine Jewel Cherry	*Prunus* 'Carmine Jewel'	None	3
Crimson Passion Cherry	*Prunus* 'Crimson Passion'	None	3
Cupid Cherry	*Prunus* 'Cupid'	None	3
Juliette Cherry	*Prunus* 'Juliette'	None	3
Nanking Cherry	*Prunus tomentosa*	None	2
Romeo Cherry	*Prunus* 'Romeo'	None	3
Valentine Cherry	*Prunus* 'Valentine'	None	3
Raspberry	*Rubus spp.*	Requires edging to keep contained	0.5
Rhubarb	*Rheum* spp.	None	2
Jostaberry	*Ribes josta*	None	2
Consort Black Currant	*Ribes nigrum* 'Consort'	None	1
Captivator Gooseberry	*Ribes* 'Captivator'	None	1
Sea buckthorn	*Hippophae rhamnoides*		
Valiant Grape	*Vitis* 'Valiant'	Climbing structure/fence required	1

Note:

Additional zone (3B) tolerant shrubs species may be available that are not listed above. These shrubs may be approved by the municipal Engineer in consultation with Parks Operations and accepted on a trial basis for the maintenance period (CCC-FAC) only. In the event the shrubs (those not listed above) do not survive, replacement will be required with proven stock (those species listed above).

12. DESIGN REQUIREMENTS

12.1 BOULEVARDS

12.1.1 Collector Roadways

Topsoiling and seeding / sodding shall be required from the back of curb to the property line.

Collector road boulevards adjacent to residential areas shall be designed with:

- minimum 1 tree for each single family lot where lots have direct access to the roadway
- minimum 1 tree for every 8 to 10 lineal meters of the boulevard where access to single and or multifamily lots is provided via a lane or in case of multifamily sites where off street parking is provided.
- minimum of 1 tree for every 8 to 10 lineal meters on flankage of corner lots for all single family lots adjacent to the roadway
- minimum of 1 tree for every 8 to 10 lineal meters when boulevard adjacent to residential properties with rear yards backing onto roadway (aka double fronting lots)
- minimum 1 tree for each every 8 to 10 lineal meters of the boulevard for commercial and industrial lots, excluding driveway crossing.

This requirement may be adjusted at the City Engineers discretion when sight lines at the intersection may be affected.

Boulevards may be designed to include planting beds with trees & shrubs, or trees grouped in clusters. The exception is when there is the potential to create sightline issues impacting vehicle using adjacent accesses.

Walks may be required and if provided, shall be to the satisfaction of the Municipal Engineer.

Furniture may be provided by the Developer and placed at strategic locations within the boulevard, if a walkway is required.

12.1.2 Major Entrance Roadways to Subdivisions

Boulevard tree planting shall be designed to meet the spacing distance noted depending on tree species selected as per the Category 1 Tree List, unless trees are grouped in mulched beds.

Tree and shrub planting design shall give due consideration to the importance of vehicular sightlines and must not impact the efficiency of street lighting or the visibility of street signs.

Screen and uniform fences, if provided by the Developer, shall meet the design and construction specifications of the City of Grande Prairie.

Walks may be required and if provided, shall be approved by the Municipal Engineer.

Furniture may be provided by the Developer and placed at strategic locations within the boulevard or along walkway and shall be approved by the Municipal Engineer.

Lighting, if provided, shall be to the satisfaction of the Municipal Engineer and ATCO Electric.

12.2 LANDSCAPE ENTRY FEATURE MEDIANS AND LANDSCAPE ENTRY FEATURES

All entry feature medians and entry feature designs must be low maintenance.

No trees or shrubs are to be used within entry feature medians less than 4.5 meters wide.

Turf shall not be used within entry feature medians less than 4.5 meters wide.

Tree and shrub planting design shall give due consideration to the importance of vehicular sightlines and street lighting efficiency.

Turf areas shall be designed to minimize mowing requirements. Preference is to use alternative groundcover species.

Paving stone and paving stone header, concrete or other special hard-surfaced verge or walks shall be to the satisfaction of the Municipal Engineer, and must meet the specifications outlined in the City's Construction Specifications.

Lighting, if provided, shall be approved by the Municipal Engineer, and meet ATCO Electric's specifications.

Sewers and other underground utilities shall not be aligned under landscaped road islands and medians to avoid conflicts with landscape improvements.

12.3 WALKWAYS / TRAILS 10 METER WIDE RIGHT OF WAY OR GREATER

There shall be a minimum of four trees per every 35 linear meters of walkway right-of-way. Trees / shrubs as specified under Plant Selection in 3.2 above.

Where possible, tree centres will be set back a minimum distance of 3.0 m from adjacent private property lines and walkways.

Walkways shall maintain adequate year-round sight lines through the walkway-trails for pedestrian safety and security.

Tree groupings should be positioned on either side of the walk, and groupings will be staggered.

Furniture shall be provided by the Developer and placed at strategic locations along the walkway and shall be subject to approval of the Municipal Engineer. (See Section 17, Parks).

Screen and uniform fences if provided by the Developer shall meet the City's specifications and shall be subject to approval of the Municipal Engineer.

Walks may be required within walkway or top-of-bank right-of-ways to the satisfaction of the Municipal Engineer. Walks may be either asphalt or concrete as required by the Municipal Engineer. Walks shall not be in the proximity of underground utilities.

12.4 PUBLIC UTILITY LOTS (PUL)

Rough grading (± 50 mm) is required to obtain 0.8 % grade or greater. Landscaping, generally topsoiling and seeding/sodding, will be delayed by separate agreement until a significant quantity of house construction is completed or house lots are sold. Preference shall be for a no-mow ground cover.

U-Lot Barriers are to meet City Specifications as indicated in the appropriate sections of the City’s Construction Specifications.

12.5 STORM WATER MANAGEMENT FACILITIES

Landscaping is to be provided in areas within and surrounding new storm water management facilities including Dry Ponds (detention ponds) for the temporary storage of water during peak flows, and Wet Ponds (retention ponds) to permanently retain water.

These areas must be graded, topsoiled, seeded or sodded, and landscaped by the Developer to the satisfaction of the Municipal Engineer. A natural look is preferred over a man-made appearance. These areas should be designed to be left unmowed below the 1 in 50 storm event water line, and may be designed to be completely naturalized.

Plant materials will be selected to respect hydrological and soil saturation characteristics of the facility. Approved plant species can be found in Category 4, Section 11.2, Plant Selection.

Public lands within the facility must be planted with a minimum rate of 35 trees / landscaped hectare above the 1 in 50 year storm event water line and designed according to these specifications. If the facility is also designated as Municipal Reserve a minimum rate of 75 trees / landscaped hectare is to be planted to these specifications.

Major storm sewer outlets/inlets shall be grass/groundcover only to provide an open view for safety of pedestrians and dry pond users. Fencing shall be provided where necessary to ensure safety of pedestrians and dry pond users.

A naturalized landscape design may be used in part or in whole for storm water management areas. In this case, 50% of the required trees per landscaped hectare may be substituted with native plant material from Category 4. The substitution rate shall be 10 seedlings per 1 tree.

Walks may be required within walkway or top-of-bank rights-of-way to the satisfaction of the Municipal Engineer. Walks may be either asphalt or concrete as required by the Municipal Engineer.

Furniture / park amenities may be provided by the Developer and placed at strategic locations above the 1:100yr flood line of the dry pond, by walkway as approved by the Municipal Engineer.

Special or unique features, i.e. artificially pumped dry streams, special play courts, bridges and architectural and structural features will be designed and sealed by a Professional Engineer recognized by APEGA and approved by the Municipal Engineer.

12.6 NATURAL AREAS

Existing natural and naturalized areas impacted by the proposed improvements which cannot be protected during construction must be re-naturalized with native plant materials having regard for the surrounding environment, new drainage patterns, soil conditions, and ecological rehabilitation.

In order to create more naturalized spaces within the City and to reduce maintenance costs, the City will allow the use of naturalized seed mixes and plantings in certain areas throughout the City (eg. undeveloped school sites, roadway facing side of noise attenuation berms, stormwater management facilities).

Any project requiring landscaping on City owned lands (or lands destined to become City owned) must consider the use of naturalization and is to consult with the City Parks department and City Engineering department during the design stage of the project.

At this time the City is not prescribing the use of naturalization in any specific area and its use will be determined based on the ability for crews to safely maintain the area in question and the ability for specific vegetation to be supported within the area in question.

The Developer will determine the level of restoration to be completed in consultation with the Municipal Engineer. A Biophysical Inventory prior to construction of the natural area may be required.

The Developer will design an appropriate mix of native trees, shrubs, ground covers and wildflower seed mixes to rehabilitate impacted naturalized areas. The design shall be natural in appearance, not formal or man-made.

The Developer will design any required subsurface drainage, surface drainage and erosion control measures in the rehabilitation area in conjunction with the Developer's Engineer.

The Developer shall, if required, co-ordinate this rehabilitation with other consultants to implement geotechnical, structural and bioengineering principles and recommendations.

The Landscape Plan will identify all plant communities to be established and all other information necessary to implement the proposed improvements.

The Developer will specify all tree, shrub and ground cover sizes. Plant selection shall match natural setting.

Forestry stock, seedlings, deciduous tree whips, and propagated and rooted cuttings are acceptable for 80% of plant material, with remaining 20% consisting of more mature sizes interspersed throughout the plantings.

All plant materials to be nursery stock, or materials transplanted from site.

The Developer's Landscape Consultant is to identify appropriate planting installation specifications and detailing on landscape drawings.

At the approval of the Municipal Engineer approved herbicides may be used to eradicate noxious, prohibited noxious and invasive plants prior to planting of trees and shrubs. Herbicide shall be applied under a licensed applicator.

12.7 MUNICIPAL RESERVE (MR)

See Design Manual, Section 17 - Parks.

12.8 BERMS

See Design Manual, Section 17 - Parks.

13. TESTING

The design must be conducive to achieving appropriate construction results as detailed The appropriate sections in the City's Construction Manual.

SECTION 17 – PARKS

1. GENERAL

Size and location shall be as set out in Area Structure Plans and Outline Plans, and the MR shall meet all City Policies, Bylaws, and the Municipal Government Act. Outline Plans report shall detail MR parcel sizes, configuration, amenities and linkages.

Area Structure Plans shall be developed in accordance with City of Grande Prairie Parks and Open Space Master Plan.

"Playground" refers to the edged "Protective Surfacing Area" and all equipment contained therin.

2. PARK CATEGORIES

2.1 NEIGHBOURHOOD PARK

Neighborhood Parks require a playground and the size shall be determined through the Outline Plan process. These playgrounds shall accommodate users between the ages of eighteen (18) months to twelve (12) years. Neighbourhood Parks shall include but not limited to the following park amenities:

1. Playground border no smaller than 300 sq. m. As park size increases from the minimum of 0.3 ha, playground borders shall cover 10% of the area, to a maximum of 600 sq. m.
2. Play structures/equipment and associated protective surfacing area. These playgrounds shall accommodate users between the ages of eighteen (18) months to twelve (12) years.
3. Parks 0.3 Ha shall have one bench, one picnic table and one litter receptacle located next to the play equipment (not within the play area) and one backless bench located adjacent to rink site.
4. Parks greater than 0.3Ha shall require one additional playground bench, picnic table and litter receptacle for each additional 0.2 ha in size. This means a 0.5 Ha park will have a total of two benches with backs, one bench with no back, two picnic tables and two waste receptacles.
5. Minimum of one (1) Dog Waste Bag Dispenser and regulatory signage installed at/near the street frontage. If a trail passes through the park, one dispenser shall be required at trail entrance on each side of the park.

6. A Grassed Informal Playfield including a specified area to accommodate a seasonal Low Board Rink Site “Neighborhood Rink Site” having a grade between 0.0% - 0.5% slope. (Rink site includes water standpipe, Rink Light and backless bench).
7. Park Trees and Landscape features as per Section 16.
8. Park Signage.
9. Bike Rack, four bikes accommodated for a 0.3 Ha park and six bikes for a 0.5 Ha park.

Construction details are found in Division 31 - Earth Work, 32 - Exterior Improvements, Division 10 - Signs and Division 50 - Specification Drawings.

These parks are typically adjacent to residential units and are distributed throughout the subdivision. Park areas shall have continuous street frontage for a minimum of 10% of the perimeter for easy visibility, so as to monitor activities occurring in the Park and to enhance child security. Parks with a continuous street frontage of less than 10% require the approval of the Municipal Engineer.

Park frontage shall be designed to deter unauthorized vehicular access and will require the installation of vertical faced curbing. Fencing may be required depending on site surroundings and at the discretion of the Municipal Engineer.

2.2 SCHOOL SITES

School sites are typically 5 ha with single elementary or junior high school, and 8 ha with two schools.

It is not uncommon for potential school sites to remain vacant for a number of years. School sites that are not being immediately developed have the option of being designed to be naturalized or no-mow areas. No mow areas are to be landscaped with topsoil and then seeded with 100% creeping red fescue.

If the Parks Design Report requires another set of playground equipment in order to service the neighbourhood and the intention is to locate it on a potential school site, the Developer is to provide the equipment in a suitable area, independent of any equipment that will accompany a future school. In this case, the criteria provided in Subsection 2.3 and 2.4 shall apply as appropriate.

2.3 COMMUNITY PARK

Community Parks are typically located so that more than one neighbourhood may conveniently access them, are easily accessible for pedestrians via walkways, and with on-street parking nearby for vehicles. Community parks are generally at least 3 ha in size.

This category of park requires larger playgrounds, covering 450-1000 sq. m bordered area, suitable for ages 18 months to 12 years inclusive. They shall include but not limited to the following park amenities; Separate Play structures 18 months – 5 years and one for 5 years to 12 years old.

Community Parks shall include but are not limited to the following park amenities:

1. Separate Play structures 18 months – 5 years and one for 5 years to 12 years old and associated protective surfacing area. The total combined (between both playgrounds) bordered area shall be 600 – 800 sq.m. The protective surfacing area must be wheelchair accessible.
2. Minimum two benches, two picnic tables and one litter receptacle located next to play equipment (not within the play area) and one backless bench located adjacent to rink site.
3. Parks greater than 3 ha shall require a minimum of three additional benches, picnic tables and litter receptacles.
4. Minimum of one (1) Dog Waste Bag Dispenser and regulatory signage installed at/near the street frontage. If a trail passes through the park, one additional dispenser shall be required at the trail entrance on each side of the park.
5. A Grassed Informal Playfield including a specified area to accommodate a seasonal Low Board Rink Site having a grade between 0.0% - 0.5% slope. (Rink site includes water standpipe, Rink Light and bench).
6. Park Trees and Landscape features as per Section 16.
7. Bike Rack, minimum six bikes accommodated.

Picnic shelter and toboggan hill are optional. Lighted paved walkways may be required to link with the City of Grande Prairie Trail System.

Community Parks shall have continuous street frontage for a minimum of 20% of the perimeter for easy visibility so as to monitor activities occurring in the Park and to enhance child security. Park frontage shall be designed to deter unauthorized vehicular access and will require the installation of vertical faced curbing.

2.4 REGIONAL PARK

These parks are typically centrally located to several neighbourhoods with access to arterial roads, public transit routes and trail linkages. This category of park shall include, but not be limited to such things as school buildings or municipally owned buildings, a larger playground or two playgrounds, one for preschool (18 months-5yrs) and one for elementary children (5-12 years), covering 600-1000 sq.m in total. The remainder of the site shall include basketball stands/hoops, (in asphalt areas) with official-sized sports fields and posts, (baseball, soccer) and a large rink site with a street light and rink hydrant nearby. Asphalt play surfaces, bicycle parking areas, and paved parking areas shall be provided. Lighted paved walkways may be required to link into the City of Grande Prairie Trail System.

Park areas shall have continuous street frontage for a minimum of 30% of the perimeter for easy visibility so as to monitor activities occurring in the Park and enhance child security. The road curb shall be a vertical face (not a rolled curb) to deter vehicular access. Maintenance free fencing is required adjacent to playgrounds along roads. Requirement for maintenance free fencing adjacent to play fields along arterial and collector roads shall be subject to approval of the Municipal Engineer.

These parks are to be designed in conjunction with School Boards and/or Community User Groups.

2.5 LINEAR PARK / TRAIL SYSTEMS

A linear park / trail system can be part of a Neighborhood and Community Park or be on its own and should include a bench and waste receptacle at a rate of 1 / 300 lineal meters of trail, plus one bench and waste receptacle at trail heads and intersections.

Dog dispenser w/signage shall be provided at the trail heads and the midway distance lineal trail/park systems where they exceed 300 lineal meters.

3. LANDSCAPE PLAN

The Developer shall submit a detailed Landscaping Plan prepared by a qualified Landscape Designer approved by City of Grande Prairie in accordance to Section 2 drawn to a scale of 1:500 with the Detailed Engineering Drawings.

The Developer shall submit Detailed Engineering Drawings of proposed park furniture and playground equipment at a minimum scale of 1:100 along with detailed price quotes for

approval by the Municipal Engineer. Individual components shall be shown, and named and/or listed. Manufacturer's drawings or plans are acceptable.

No landscaping shall commence until the Landscaping Plan has been approved by the Municipal Engineer.

In the event the Developer is redeveloping existing private facilities or previously serviced lands, the Municipal Engineer may require the landscape plans to also be approved by other appropriate City Departments.

Maintenance free fencing is required adjacent to playgrounds along arterial and collector roads. Requirement for maintenance free fencing adjacent to play fields along arterial and collector roads shall be subject to approval of the Municipal Engineer.

4. DESIGN REQUIREMENTS

4.1 GENERAL

For landscape, play equipment and park furnishings materials, installation, and testing specifications (i.e. site work, topsoil, seeding, trees, shrubs, benches) refer to the appropriate section of the City's Construction Manual.

For plant selection and general design guidelines and requirements, see Section 16 Landscape Design.

All parks are to be landscaped, including grading, drainage, topsoil and seeding or sod, and planted with trees/shrubs as per specifications and the approved plan.

Parks shall be designed with a minimum of 125 trees per landscaped hectare. Areas such as official sport fields, parking areas, playgrounds (within protective surfacing area), permanent skating rinks (with boards) and other areas approved by the Municipal Engineer may be excluded from the acreage total for these calculations. Neighbourhood and Community Parks shall require the necessary infrastructure to accommodate the installation of a drip (or similar) irrigation systems to all trees and landscape features/shrub beds. This shall include supply and installation of seasonal meter, backflow preventer, meter vault and system controller. Up to 20% of required trees may be substituted with shrubs and/or perennial flowers. Substitution rates shall be as follows: 5 shrubs or 10 perennials to equal one tree. Shrubs and perennials shall be hardy to Canadian Hardiness Zone 3 or lower, and installed into mulched beds per Construction Manual Specifications.

Within each developing neighborhood (typically quarter section), a minimum of one accessible park shall be provided. Where parks /playground equipment are designed to accommodate persons with disabilities, the site and equipment shall be designed in accordance to Annex H of CSA Z614:20 (Children's play spaces and equipment).

In addition the required number of trees within a municipal reserve, boulevards adjacent to all parks shall be planted with trees as per Landscape Design, Section 16.

Park frontage shall be designed to deter unauthorized vehicular access and will require the installation of vertical faced curbing. A fence may be required, and its requirement is to be determined by the Municipal Engineer. A Park Maintenance Access Gate as shown in the city construction manual standards details shall be installed at locations identified during the engineering drawing / park design review process.

4.2 FURNITURE AND FIXTURES

Furniture shall be provided by the Developer and placed at strategic locations. A minimum of one bench and receptacle shall be located beside each playground, by the edge, in a quiet corner or section of the playground. Furniture and fixtures shall not be placed within playgrounds.

The following set backs are to be respected:

- Benches – a minimum 2.0 m back and a maximum of 5.0 m from pathways and/or outside edge of playground border (from front seat edge).

- Waste Receptacles – a minimum 2.0 m back and a maximum of 5.0 m from pathways and/or outside edge of playground border (from front receptacle edge), and 2.0 m from bench

- Picnic Tables - designed in clusters to be approved by the Municipal Engineer. A minimum 2.0 m back and a maximum of 5.0 m from pathways and/or outside edge of playground border (from back seat edge).

- Rink light, Backless Bench and Hydrant: - 3.0 m away from the designated edge of rink pad. Both the Light and Hydrant shall be installed along the length and within 3 meters of the either side of centreline.

- Walkway or Trail lights: - 2.0 m from edge of any adjacent infrastructure and spacing will be at Municipal Engineers discretion. Material and installation specifications shall be as indicated in the City's Construction Specifications.

5. PLAYGROUND DESIGN

5.1 LOCATION

The location of any play-spaces shall be made in co-operation with the City of Grande Prairie. In general, however, play-spaces for preschool children and school-aged children shall be located separately or adjacent to each other. Play-spaces may be located in residential areas or attached to facilities used by children such as schools and community centres.

Play spaces for pre-schoolers shall be located so that they are readily accessible to young children and their parents. The specific characteristics of the neighbourhood should be taken into consideration when locating a playground, paying particular attention to lighting, access routes, walking distance, public visibility of the playground and take into consideration CPTED (Crime Prevention through Environmental Design) principles.

5.2 NATURAL TOPOGRAPHY

The play space should have good exposure to sunlight, especially in the winter, some shade by deciduous trees, especially in the summer, sheltered from the prevailing westerly winds and positive drainage away from the play space.

Sites with gradients greater than 10%, high noise levels or those over tile septic beds are not acceptable. Dangerous settings (such as high voltage power lines and transformer stations) adjacent to site are also unacceptable.

Vegetation and other landscape elements such as berms or maintenance free fences should be used to create an appropriate setting for play space that is appealing to and useable by children. The play area should have visually defined boundaries.

5.3 LAYOUT

Play structures shall be placed within the playground border, and the border shall be large enough to encompass all required activities for children without interference.

Potential play spaces should be investigated for the presence of any hazardous materials. Spaces for each type of activity shall be well defined.

Walkways shall link activity areas when required by City. Parking for cars and bicycles shall be separate and located near the perimeter of the play space where possible. Bicycle parking areas should still be in view of the play area.

Playgrounds, asphalt pads/basketball, skating rinks and other spaces that are typically associated with generating noise shall be located a minimum of 15 meters from a residential lot line. It is recommended that the areas between these activities and residential lot lines have some form of acoustical screening. This may include but not limited to; placement of coniferous trees and or berms to reduce the sounds of those activities.

All structures and landscaping within the play area shall provide reasonable opportunity for surveillance of the children at play in all portions of the playground. Masses of solid screening shall be avoided. Screening and walls that offer opportunities for frequent visual penetration and surveillance are desirable. All playground and park design shall be reviewed incorporating sound CPTED (Crime Prevention through Environmental Design) principles

Playground borders shall have a minimum setback of 20 meters from the roadside curbs. In instances where park space is encircled on three (3) or more sides by roadway, the minimum setback may be reduced to 15 metres. Any variances shall require the approval of the municipal engineer.

5.4 PLAYGROUND PROTECTIVE SURFACING AREAS

The City of Grande Prairie requires a minimum depth of 300 mm for Protective Surfacing Areas when utilising acceptable loose-fill material under and around all play structures. Play equipment shall be designed to accommodate this minimum depth. The depth of protective surfacing in these areas must meet a Critical Fall Height of 3 meters. All Protective Surfacing Material within the playground shall meet the minimum CSA Z- 614 Standards (most current edition) for energy absorbency. Test methods specified in ASTM F 1292 and CEN EN 1177 are the acceptable method for testing for the energy absorbency of protective surfacing material.

The City of Grande Prairie will accept the following Protective Surfacing Materials;

1. Specified Play Sand (Construction Manual),
2. Certified “Engineered Wood Fibre” (available through Playground Manufacturer / Equipment Supplier) or
3. Unitary Synthetic Materials (tiles or pour-in-place).

Pea Gravel and Recycled/Shredded Tire rubber loose fill are not acceptable protective surfacing material within playgrounds owned and operated by the City of Grande Prairie.

A total of 70 sq. m. shall be provided for “Free Play” in addition to the required protective surfacing zone under/around play equipment. The “Free Play” areas shall be identified on the plan including total square meters provided.

5.5 PLAY STRUCTURES AND MINIMUM EQUIPMENT REQUIREMENTS

Various designs, themes and layouts are subject to approval by the City. All Playgrounds shall include play equipment suitable for children ages 18 months to 12 years inclusive. Use of a playground designer or Certified Canadian Playground Inspector is required and can usually be provided by playground equipment suppliers. This area shall be edged as per the Standard detail for Playground Edging for sand or engineered wood fibre safety surfaces. No border is needed for pour-in-place or tile surfaces.

Neighbourhood Park Playgrounds

Playground installations shall include a minimum of 15 different play events. Neighbourhood parks with parcels size greater than 0.6 Ha are required to accommodate more playground users and a minimum of 20 play events and playground border increased accordingly.

Community Park Playgrounds

Playgrounds shall include two separate structures, one structure for 18 months to 5 years and one structure for children 5-12 yrs. Community Parks are required to accommodate a minimum of 50 children / 25 play events.

Minimum Equipment Requirements

The City of Grande Prairie requires the following minimum forms of play activities (Play Events) on the following types of structures:

Composite or functionally linked Play Structures shall include the following Play Events:

a) Upper Body Equipment (Jr. & Sr.) (e.g. Horizontal ladders, chinning bars, parallel bars, ring ladders, sliding poles, track rides),
b) Vertical Climbing Apparatus (e.g. Rock wall-access, Cargo net, Ships ladder, etc.),
c) 2 Slides – Jr (max deck height of 1.2m) and Sr. Slide (deck height >1.2m),
d) Interactive Play Panels (e.g. Tic-tac-toe, Sign Language/Alphabet, Eye-spy),
e) Imaginative Play Area (e.g. Store-fronts, Theatre, Sand Table),
f) Balance and Agility components (e.g. balance beam, stepping stones/pods, log rollers).

g) Independent Play Structures / Accessories may include but not limited to the following:
h) Teeter Totter / See-saw,
i) Spring toys / Rocking Equipment (Spring/rocking toys should be located adjacent to the age appropriate play areas),
j) Free Standing Rock Climbing Walls (max critical fall height of 3 metres),
k) Spinning seats and other equipment rotating on vertical access.
l) Climbing Net Structures
m) A Single Bay Rotating Swings
n) Steering Wheels, “Talk Tubes” and other similar interactive accessories

Notes:

a) Swings - All Neighbourhood Park playgrounds shall provide a minimum of “2- Bay To-Fro” swing with 2 bucket seats (18 months to 5yrs) and 2 belt swings (5- 12yrs). Community Parks shall have a “4- Bay To-Fro Swing” with 4 bucket seats (18 months to 5yrs) and 4 belt swings (5-12yrs). The top rail for a To-fro swing shall not exceed 3m in height.
b) Fully Enclosed “Tube” slides and “Crawl Tunnels” are not permitted on play structures owned and operated by the City.
c) Roof / Shade Structures and Decorative Ornamentation attached to composite or independent play structure are not permitted. Roof/shade structures that are an integral part of a play structure are permitted per CSA Z.614.
d) All slides shall be oriented in a south-east, east, north-east, north or northwest facing direction. This does not apply to spiral-shaped slides. No metal slides are permitted.

Accessible Parks and equipment may be designated by the Municipal Engineer and identified at time of Outline Planning Stage and Parks Design Reports dependent on the location of the park and users.

All designs shall be in compliance with CSA Z.614 standards for the spacing of play equipment and the size of the safety area around it. All structural components including vertical supports and decks shall be constructed of metal. Play equipment shall be of metal, plastic or composite material. No wood shall be permitted on the equipment.

5.6 FENCING

Fencing shall meet the requirements of 3 above.

5.7 OUTDOOR RINKS

Outdoor rinks must be a minimum size of 15 m x 23 m, with larger sizes being any multiple of 4.3 m.

Permanent rinks with boards shall be a minimum size of 21 m x 42 m and meet the City's Construction specifications.

Areas that will be used for Neighbourhood Rink program shall be graded at 0% - 0.5% slopes, and all other adjacent land shall drain away from them. The Engineering Consultant shall survey the rink and provide elevations confirming appropriate drainage at time of CCC.

All rinks shall be illuminated with a light standard (Single Davit Cobra-head) as approved by the Municipal Engineer and ATCO Electric complete with a photocell and timing device. The Timing device shall be installed on the pole at a height of 6 meters above finished grade. The light shall be centred along the length of the rink. Developer shall be required to install appropriate metering device and protection to meet the standards of ATCO Electric.

Rink hydrants and lines are to be provided by the Developer, and are to be installed prior to topsoil/walkway placement. Rink hydrants shall conform to Aquatera Construction requirements.

5.8 LANDSCAPE BERMS

Low, undulating and well-spaced berms containing some landscaping may be included into the site design along the street frontage and within neighbourhood or community park sites.

Maximum height of a berm used for only visual attractiveness shall be 3 m with a minimum width at the top of 2 m and a maximum width of 4 m. See Drawing 20.21. These berms shall not be adjacent to playgrounds.

5.9 TOBOGGAN HILLS

Maximum height of toboggan hills shall be 6 m, with a minimum width at the top of 4 m. See Drawing 20.22.

If any hill can be expected to be used for tobogganing, there should be no obstructions including, but not limited to, roads, trees, plants, benches, waste receptacles, fences, power boxes, lights or play equipment present on the slope or at the foot of the hill for a minimum distance of 18 m.

Whenever possible, top soiling and seeding or sodding of hills and berms should be delayed until the spring following construction to allow for settlement of the soil.

5.10 INFORMAL PLAYING FIELDS

Informal playing fields for kite flying, baseball, soccer, etc. are to be open level grassed areas.

They shall be unobstructed by trees, overhead lines, fences, berms or other structures. The boundaries of informal playing fields shall be defined by trees, berms and/or walkways. As well, shaded viewing/resting areas shall be provided.

All structures and landscaping in the area shall provide reasonable opportunity for Surveillance of the children at play in all portions of the playing fields. Masses of solid screening shall be avoided. Screening and walls that offer opportunities for frequent visual penetration and surveillance are preferred.

Minimum size shall be 384 m^2 within Neighbourhood Parks and maximum size shall be 2800 sq. m. within Community Parks. In a Neighbourhood Park, the Informal Playfield may be combined with the area designated for rink site. The size of playing field must be relative to size of park, and larger ones must accommodate junior soccer (40 m x 70 m). These dimensions will also accommodate junior baseball field dimensions (40 m x 40 m). A 5-metre setback between designated sports fields and residential properties or roads is required for all fields. Goal posts and backstops are excluded from these fields.

5.11 FORMAL SPORTS FIELDS

Formal sports fields shall meet official field sizes and shall include the sports of softball or baseball, and soccer. They shall be uninterrupted by trees, overhead lines, fences, berms or other structures. The boundaries shall be defined by trees, berms and/or walkways. Shaded viewing/resting areas shall be provided.

The field's orientation to the sun shall be appropriate to the sport and the time of day that the field is most often used. The fields shall not overlap.

Acoustical screening shall be provided by the use of berms and be located at a distance from residences that shall dissipate the sounds of children at play.

Soccer Field: On elementary school sites, one soccer field 100m x 60 m with soccer goal posts to be developed. On junior high and middle school sites, a combined soccer/football field 100m x 60 m, complete with 18.3 metre end zones and combination goal posts to be developed. A 20-metre setback between sports fields and residential properties or roads is required for all fields.

Ball Diamond: One ball diamond and backstop, with an outfield distance of 91.5 metres is required. A setback of approximately 20 metres shall be provided along the diamond perimeter.

In some locations as determined by topography, existing vegetation or special constraints other sizes may be considered subject to the approval of the Municipal Engineer.

SECTION 18 – INFILL DEVELOPMENT STANDARDS

INTRODUCTION

The City of Grande Prairie considers infill to be defined as any new development that is sited on vacant or undeveloped land within an existing community, and that is enclosed by other types of development. These vacant lots may or may not be serviced adequately for intended lot use; all proper site investigations should be completed prior to any development being contemplated.

1. GENERAL

In order for an infill site to be considered eligible for Development, the following minimum requirements must be in place:

a) Correct lot boundaries for proposed use – a subdivision application may be necessary to update parcel

b) Appropriately sized utilities (storm, water, and sanitary) must be stubbed onto private property

c) Road network must be able to adequately service the development's proposed use

d) Connectivity to the pedestrian network is ensured

e) Site conditions suitable for development

These conditions will be confirmed through (but not limited to) the following site investigations as necessary:

a) Traffic Impact Assessment

b) Geotechnical Investigation

c) Site Servicing Design (Storm, Water, Sanitary)

d) Environmental (Environmental Site Assessment, Biophysical Impact Assessment, or others as dictated by site conditions)

e) Historical Resources Overview and Historical Resources Impact Assessments

f) Slope Stability Report

If any of the investigations determine that upgrades to Public Lands are required to reach an acceptable level of service, the land developer may be required to enter into a Servicing Agreement (Section 1 of this Manual) in order to complete this work.

2. TRAFFIC IMPACT ASSESSMENTS

Traffic Impact Assessments (TIAs) for infill or lot-level developments are similar to Transportation Design Reports but often include a much narrower scope. Scope is determined on a site-specific basis.

TIAs for infill developments are usually requested through the review and approval process for rezoning and development permit applications, although other instances may indicate the need for study of the resultant traffic impacts.

The primary purpose of a TIA is to provide reliable guidance on short and long range planning of site access, assist developers and the City in making critical land use and site planning decisions with regard to the road network system.

2.1 WHEN REQUIRED

TIAs are required whenever one or more of the following conditions are met:

a) The development is expected to generate 100 total (or more) new vehicular peak hour trips

b) The application involves an amendment to the Land Use Bylaw

c) The development is expected to require improvements to the municipal transportation network

d) The development incorporates direct vehicular access onto an arterial road

e) The development's previous transportation impact assessment is out of date

f) The development will occur in a sensitive area or was not captured in a local land-use plan (i.e. Outline Plan) or transportation plan (i.e. Functional Study).

g) At the judgement or discretion of city staff

2.2 CONSTRUCTION

Developers and consultants are strongly encouraged to consult with the City of Grande Prairie Engineering staff as early as possible in the application process to determine the expectation of the Traffic Impact Assessment. Benefits of pre-consultation include:

- Identifying transportation concerns that may affect the land use, density, site plan, building location and other specific concerns.
- Confirming the Traffic Impact Assessment scope
- Assessing the requirements for future consultation with City staff and/or other agencies for gathering and sharing information.

In addition to the City of Grande Prairie requirements, the adjacent municipal and provincial roadway authorities may require additional information or analysis to satisfy their requirement for a development/redevelopment proposal. The consultant should contact these roadway authorities, where applicable, to determine these requirements.

Typical topics to discuss during a project consultation meeting in order to earmark challenges for the study include:

a) The size of the site location and its study area.

b) The available transportation data required (i.e. traffic data, collision assessment, signal timing plan, etc.)

c) The impact of adjacent developments (approved and unapproved background traffic data)

d) Applicable City policies, standards and guidelines

e) Expected transportation improvements/infrastructure upgrades

f) Development Phasing

g) Trip generation rates and trip distribution

h) Expected impacts of the subject development on the public road network

i) Report format

j) Any other assumptions / concerns

An approved scope of work is valid for a maximum of six (6) months. Consultation with City staff will determine if a change of scope is required (e.g. if the proposed project remains unchanged).

Generally, a Traffic Impact Assessment (TIA) will be considered valid for a period of one year. The City may accept a TIA that is up to two years old if the developers' consultant provides an update report that is signed and stamped by a Traffic Engineer or at the discretion of City Engineering. Major changes within the study area may reduce the "life" of the document if they were not considered in the impact assessment. A new study will be required in the event that the timing of succeeding development approvals exceeds five (5) years.

2.3 DATA COLLECTION

Traffic and pedestrian data are the foundation for most of a Traffic Impact Assessment. Some traffic data is available through the Traffic Engineering Branch for a fee. Contact the City Engineer for more information on availability and associated cost for obtaining this data.

The applicant is responsible for providing both electronic and hard copies of all raw data collected for the Traffic Impact Assessment in order to substantiate the assumptions made for the study.

Data to be considered for the study includes but should not be limited to:

a) Traffic Counts including date/times of count and method used (please note that counts used shall be maximum 2 years old)
b) Gap and Queue Studies
c) Average Annual weekday traffic counts (AWDT)
d) Collision records
e) Transit information
f) Pedestrian and cyclist traffic
g) Existing signal timings
h) Conformance with any existing Functional Studies, Master Plans, Transportation Design Reports, etc.

2.4 REPORT OUTLINE

The following outline is intended to be modular and scaled up or down in scope as the specifics of the project may require. For example, if no significant traffic volume impacts are expected, but a new access to a major road is required, only a Geometric Analysis would be requested.

In general, a Traffic Impact Assessment report should include the following sections:

Background Information

1. Proposed development, including the name of the development / developer, location, type, size, and staging.
2. Description of the Study Area, including a key map and site plan.
3. Horizon Years, Intended Phasing and Peak Period identification

Existing Infrastructure Condition and Road Geometry

1. Existing roadway infrastructure conditions, including:
   a. Pavement width;
   b. Pavement markings;
   c. Right-of-way width;
   d. Vertical alignment;
   e. Horizontal alignment;

f. Posted speed limits;
g. Locations of speed limit changes;
h. Existing access vicinities;
i. Existing illumination;
j. Existing pedestrian / active transportation network
k. Traffic control type; and
l. Traffic Operation Signage

2. Existing intersection configurations and road geometry, including:
   a. Intersection configuration;
   b. Vertical grades of intersections;
   c. Intersection sight distances;
   d. Decision sight distances and departure sight distances;
   e. Signal timings; and
   f. Major developments currently using the intersection, which are already approved

3. Existing Traffic Conditions
   a. Turning movement counts (AWDT, PM peak, and AM peak);
   b. Existing AWDT's on roadway;
   c. Annual, historical traffic growth rates
   d. Vehicle composition (% large or heavy vehicles) on roadway

Traffic Projections

1. Existing / background traffic review;
   a. Background traffic
   b. Other approved developments
   c. Identified transportation network improvements

2. Base year (opening year of proposed development)
   a. AM and PM peak projected background traffic;
   b. Projected AM and PM development traffic (site generated, pass by / internal trips, and total trips);
   c. Combined (background + development) AM and PM peak traffic.

3. Staging years (if multi-phased development)
   a. AM and PM peak projected background traffic;
   b. Projected AM and PM development traffic (site generated, pass by / internal trips, and total trips);
   c. Combined (background + development) AM and PM peak traffic.
   d. Long-term forecast (typically 20 years from base year but this may be reduced to ten years on small developments (single phase) or in locations where

surrounding lands are fully developed with any adjustments or accommodations made at the sole discretion of the City Engineering department

e. AM and PM peak projected background traffic;
f. Projected AM and PM development traffic (site generated, pass by / internal trips, and total trips);
g. Combined (background + development) AM and PM peak traffic.

Trip Generation Rates

Traffic Volumes generated by the proposed development shall be estimated using the latest edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual, unless local & more reliable tip generation data is available.

Traffic volumes shall be based on the full build-out condition and/or maximum land use intensity allowed under the existing zoning bylaw regulations, unless otherwise approved by the City Engineer.

All assumptions for Trip Distribution and Trip Assignments shall be clearly documented and justified, and approved by the City Engineer.

A summary table should be provided in the report identifying the categories and quantities of land uses, with the corresponding trip generation rates or equations and the resulting number of trips.

Analysis

1. Capacity Analysis for external connections (and internal road network if applicable).
   a. The City accepts both the Highway Capacity Manual (HCM) and Canadian Capacity Guide (CCG) methodologies of intersection analysis. Specific software package Synchro 10.0 or higher.
   b. Delay per vehicle (seconds) by intersection, turning movement, and peak period;
   c. Level of service (LOS) by intersection, turning movements, & peak period; (minimum LOS “D”).
   d. Left-turn / right-turn warrants;
   e. Vehicle Volume to Capacity Ratio (V / C) (Please note critical ratio is 0.85)
   f. Estimated 95th percentile queue length to be used to determine required storage length.
   g. Existing signal timing plans must be used. Modification to signal timings may be considered as a measure to address capacity or level of service deficiencies, at the discretion of the City Engineer.
   h. A summary table should be provided in the text of the report, but full documentation is to be provided in the appendix.

2. Geometric Analysis

The following should be assessed to ensure conformance with TAC Guidelines:

a. Separation of accesses from intersections
b. Provision or need of turning Lanes, acceleration/deceleration lanes, etc.
c. Separation of major private accesses (i.e. commercial driveways), or groups of private accesses from major intersections (such as a separation distance between the collector road entrance to the development and the first residential driveway, for example).
d. Sightlines, decision sight distances etc. Sight distance requirements shall be determined based on Decision Sight Distance and Departure Sight Distance as identified in the TAC Geometric Design Guide.
e. Any proposed upgrades to affected external areas (i.e. acceleration/deceleration lanes at the development entrance, signalization of an adjacent intersection, etc.)
f. Location of any proposed trail crossings of the road network

2. Signal Warrant Analysis

The Canadian Traffic Signal Warrant Procedure from the Manual of Uniform Traffic Control Devices for Canada (MUTCD) shall be used when determining the warrants for signalized intersections.

Analysis should be conducted to recommend traffic signal timing and phases. All analysis worksheets should be included in the appendix of the TIA.

3. Illumination Warrant Analysis

All accesses/intersections must be assessed to determine the requirement for full lighting, partial lighting, delineation lighting, or no lighting. Lighting warrants shall be determined based on Alberta Transportation's Highway Lighting Guide.

All warrant calculations and analysis worksheets shall be included in the Appendix of the TIA.

4. Pedestrian Warrant Analysis

The Canadian Traffic Signal Warrant Procedure from the Manual of Uniform Traffic Control Devices shall be referred to for pedestrian crossing requirements.

All warrant calculations and analysis worksheets shall be included in the Appendix of the TIA.

5. Operational Analysis

The operational analysis is a critical component of the TIA to ensure that the design vehicle is capable of safely maneuvering the intersection without interfering with other traffic movements.

Intersection plans should be provided illustrating that the design vehicle can safely manoeuver the intersection. If the design vehicle is unable to properly make a specific turning movement with respect to the development, recommended revisions to the intersection layout are required.

6. Safety Analysis

Potential safety or operational concerns associated with the following, as applicable, should be identified:

- Weaving, Merging, Queuing
- Conflicts with pedestrians, cyclists, heavy vehicles, and transit
- Corner clearances
- Sight Distances
- Access conflicts

7. Collision Analysis

Where the development is adjacent to an area with identified concerns, existing collision data should be reviewed and an assessment of the impact of the proposed development provided. This information may be helpful to minimize any potential concerns through the designs or location of access points.

8. Parking Review

The proposed parking supply should be compared to the minimum requirements as per the City of Grande Prairie Land Use By-law C1260. Rationale and analysis for the supplying parking greater or lower than the specified requirements shall in identified. Shared Parking assessment should be included when necessary.

Other Considerations

- Discussion of conformance to or deviation from City guidelines, Master Plans, Studies or previous Design reports including all existing and approved developments, including justifications for deviations
- Assessment should include pedestrian and cyclist networks, provision for transit and noise attenuation requirements.

Conclusion and Recommendations

The TIA should summarize the findings of the various analyses conducted, including potential issues, and clearly outline the recommendations including:

- Required Intersection Improvements;
- Pedestrian Mitigation;
- Illumination;
- Signalization; and
- Right-of-way requirements.

Appendices

Appendices must include ALL Synchro outputs for existing and future conditions. These outputs shall be submitted in both digital and hardcopy formats.

SECTION 19 – TRAFFIC SIGNALIZATION

1. GENERAL

Plans shall be provided to the City's Traffic Engineer which shows:

a. Above Ground Installations

b. Below Ground Installations

c. Pole Elevations

d. Tables and Schedules which consist of the following
   i. Signal Phasing Diagram
   ii. Initial Controller Timings
   iii. Detector Schedule
   iv. Cabling Schedule
   v. Equipment List
   vi. Pole Schedule
   vii. Shop Drawings

e. Standard Drawings

f. Specifications (see Division 34)

All traffic control devices and pavement markings shall be designed and installed in accordance with the "Manual Uniform Traffic Control Devices for Canada".

Emergency pre-emption is required for all intersections. The pre-emption priority is as follows:

i. Rail
ii. Emergency Vehicles
iii. Log haul road
iv. Other

All detection must be done by an approved video detection system.

If backup power is deemed necessary, cabinets must have a power back up system sufficient for 4 hours of regular use.

All work must be done in accordance with construction specifications Section 34.

2. PEDESTRIAN TIMINGS

2.1 MINIMUM WALK

- Downtown
  a) Walk indication will equal the difference between the through movement green time and the calculated Walk Clearance
  b) 5 s minimum
  c) Can be adjusted in situations of high pedestrian traffic and/or reduced mobility

2.2 WALK CLEARANCE

a) Walk distance shall be measured from curb to curb at the midpoint of the marked crosswalk
b) Walk clearance interval will be calculated by dividing the Walk Distance by the Walk Speed
c) Walk Speeds
   a. 1.2 m/s – default speed
   b. 1.0 m/s – in areas with significant senior or elementary school student pedestrians

3. VEHICLE TIMINGS

3.1 THROUGH MOVEMENTS

3.1.1 Minimum Green

a) Minimum Green 7.0 s

3.1.2 Amber

Minimum amber times, by posted speeds:
a. ≤ 50 km/h: 3.0 s
b. 60 km/h: 3.5 s
c. 70 km/h: 4.0 s
d. 80 km/h: 4.5 s

3.1.3 All Red

Minimum All Red time – 2.0 s

All red time may be increased as deemed necessary based on intersection conditions.

3.2 PROTECTED LEFT SIGNALS (PERMISSIVE OR PROHIBITED)

3.2.1 Minimum Green

a) Seven seconds

3.2.2 Amber

a) Is a minimum of 3.0 s

3.2.3 All Red

a) Provide an all red of for a minimum of 3.0 s.

4. OTHER SIGNAL TIMING PARAMETERS

a) Advance warning signal times (to be developed)

b) Emergency vehicle pre-emption timings (to be developed as part of the ITS project, with GPS pre-emption may be distance based)

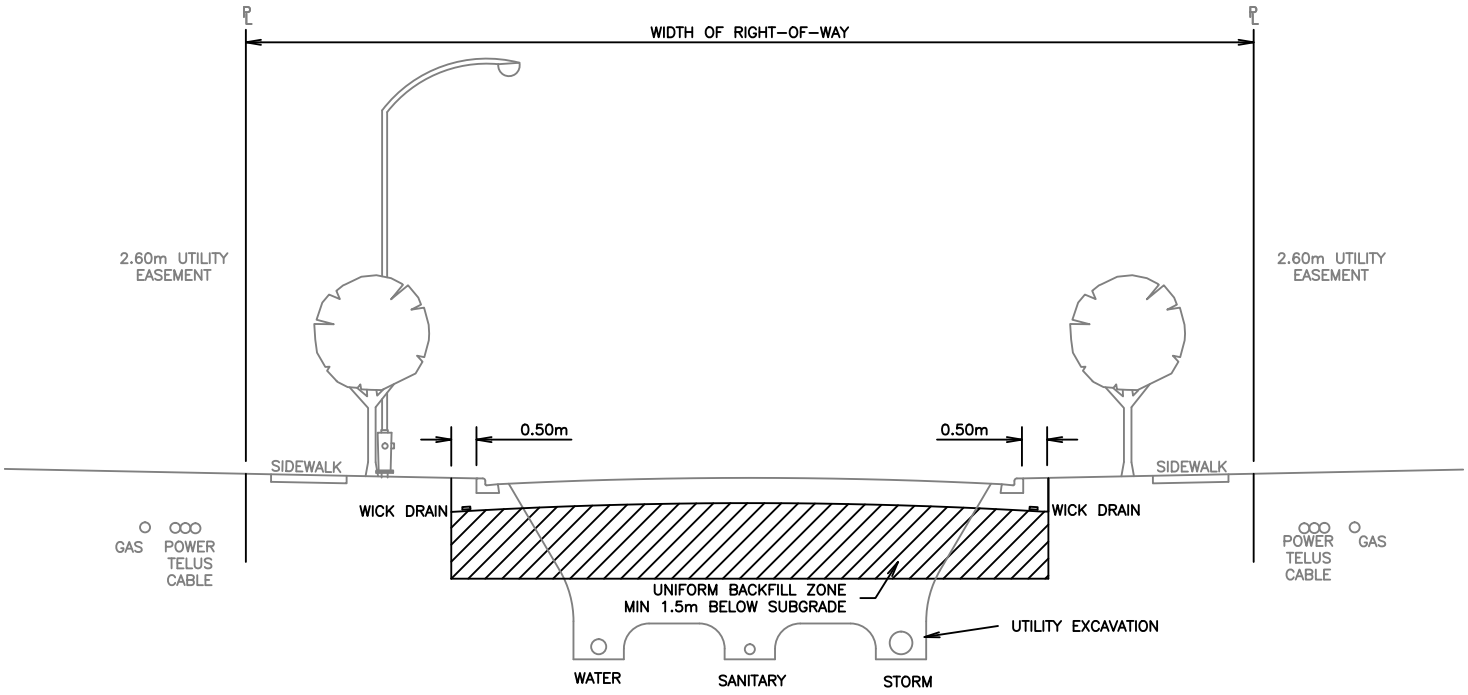
c) Timings of traffic signals adjacent to schools (to be developed)

SECTION 20 – DESIGN DRAWINGS

Table of Contents

For information related to the following historic sections, please refer to the Aquatera Design and Construction Manual which can be found on their website.

Section 08 - Water Distribution System
Section 09 – Sanitary Sewer System
Section 10 – Sanitary Lift Stations
Section 11 – Sanitary Sewer and Water Connections



REVISIONS		
DATE	DETAILS	BY

UNIFORM BACKFILL DETAIL

APPROVED BY KD	AUTHORIZED BY K. DONNELLY		STANDARD DETAIL 20.02
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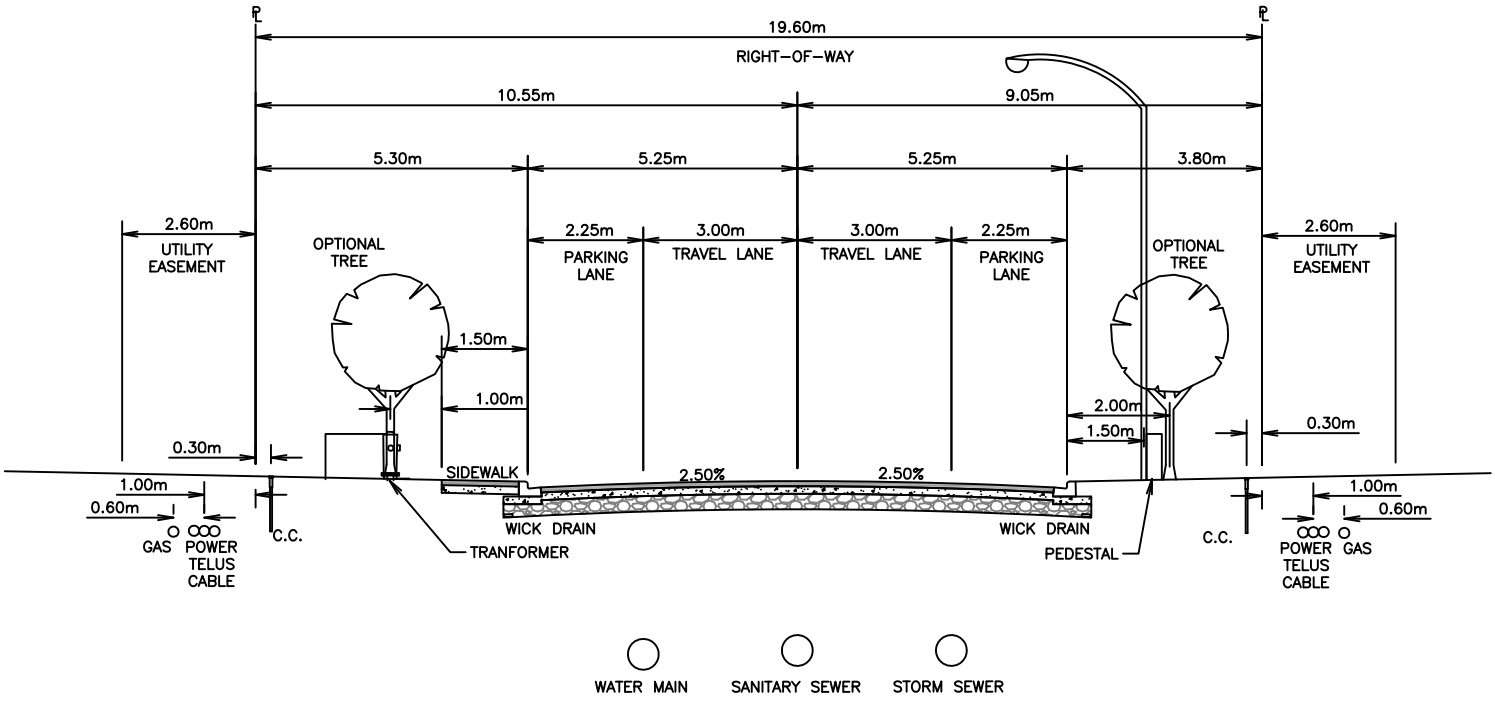
DRAWN BY B. SHERVEY	SCALE N.T.S.	DATE 12/01/18	FILE NUMBER C11066



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RESIDENTIAL LOCAL ROADWAYS

STANDARD DETAIL 20.03

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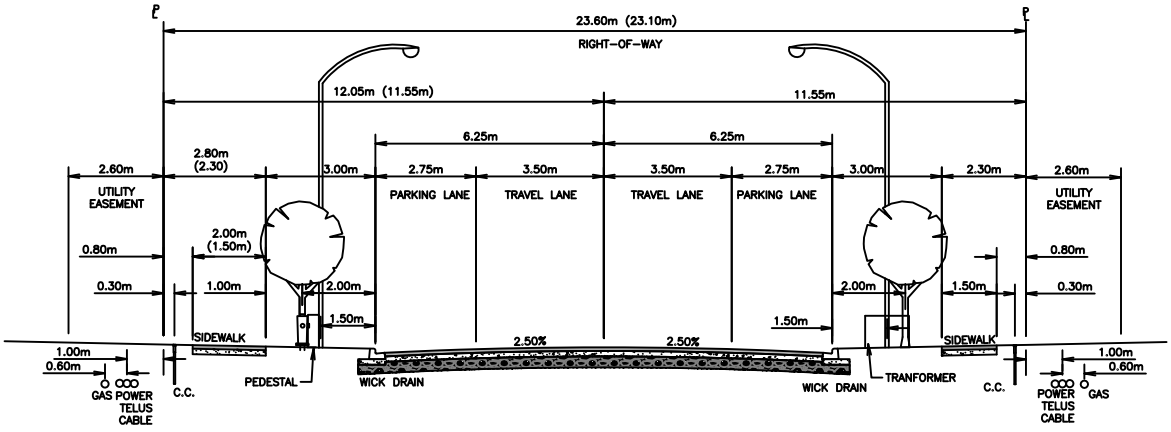
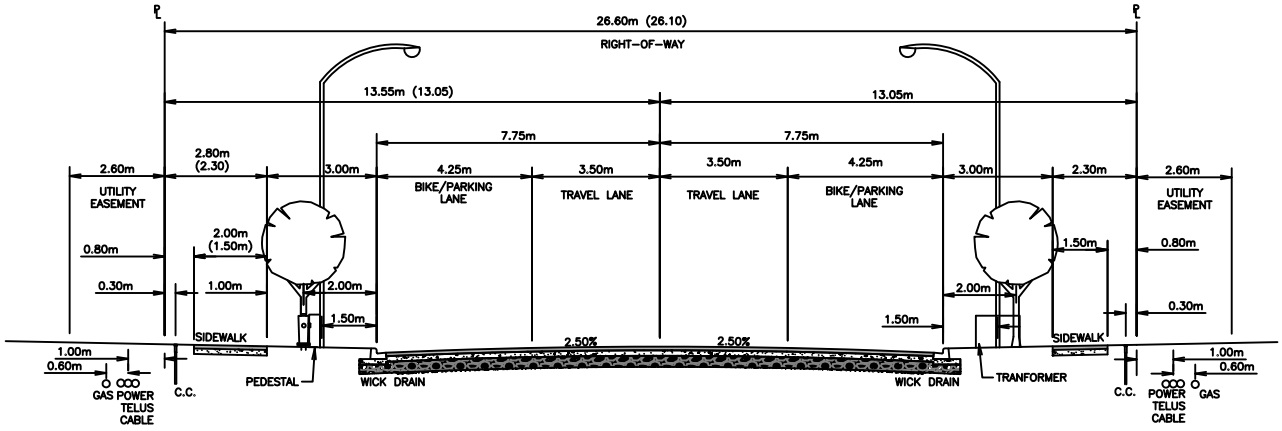


RESIDENTIAL COLLECTOR



RESIDENTIAL COLLECTOR WITH BIKE LANES

REVISIONS		
DATE	DETAILS	BY

THE CITY OF GRANDE prairie

RESIDENTIAL COLLECTOR ROADWAYS

STANDARD DETAIL 20.04

APPROVED BY KD	AUTHORIZED BY K. DONNELLY	
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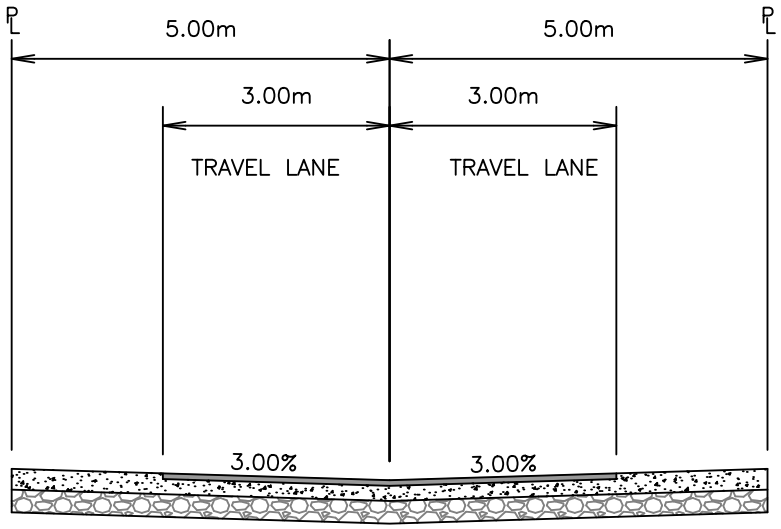

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DATE	DETAILS	BY

RESIDENTIAL REAR LANE

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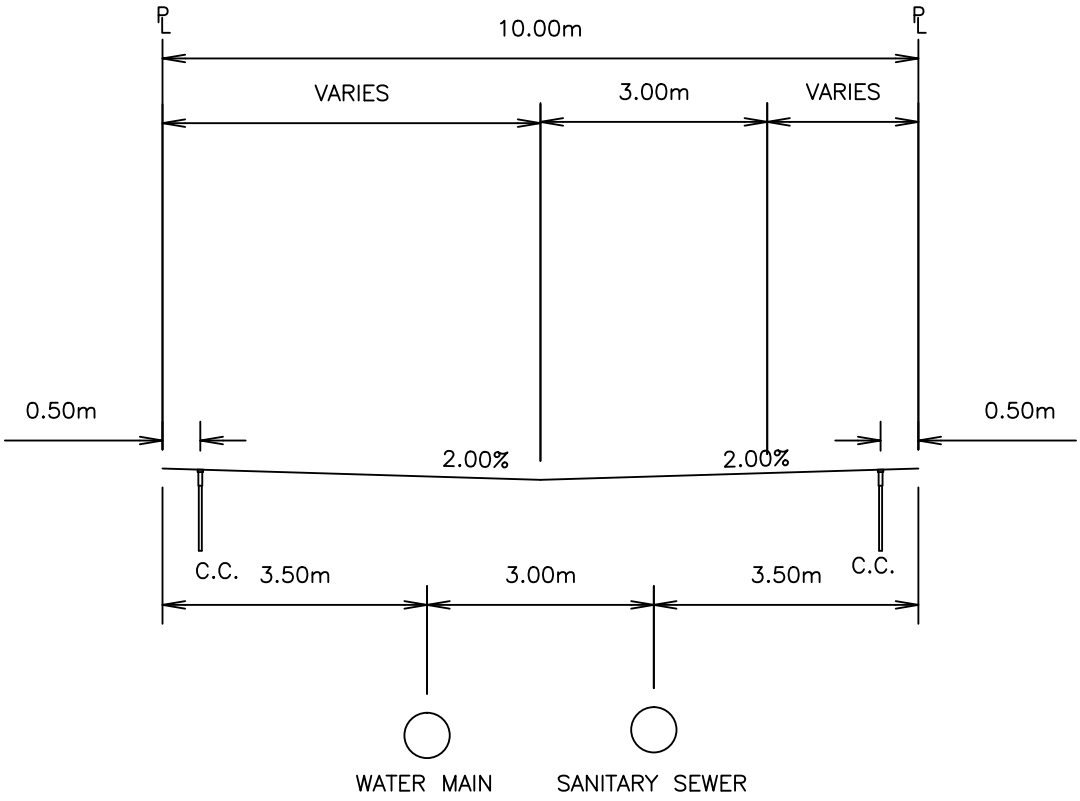

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DATE	DETAILS	BY

GRANDE prairie

RESIDENTIAL PUBLIC UTILITY LOT (TWO SERVICES)

APPROVED BY KD	AUTHORIZED BY K. DONNELLY	
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STANDARD DETAIL 20.06

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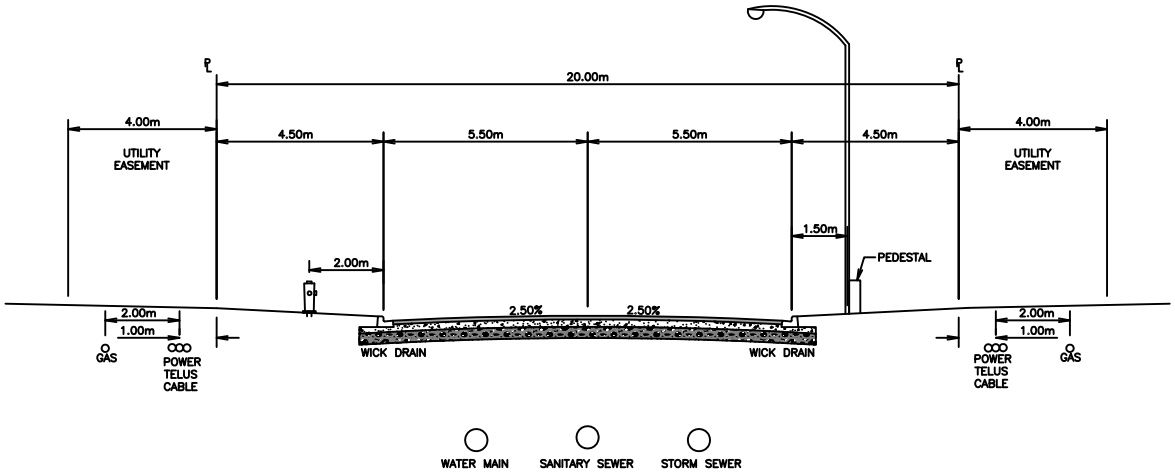
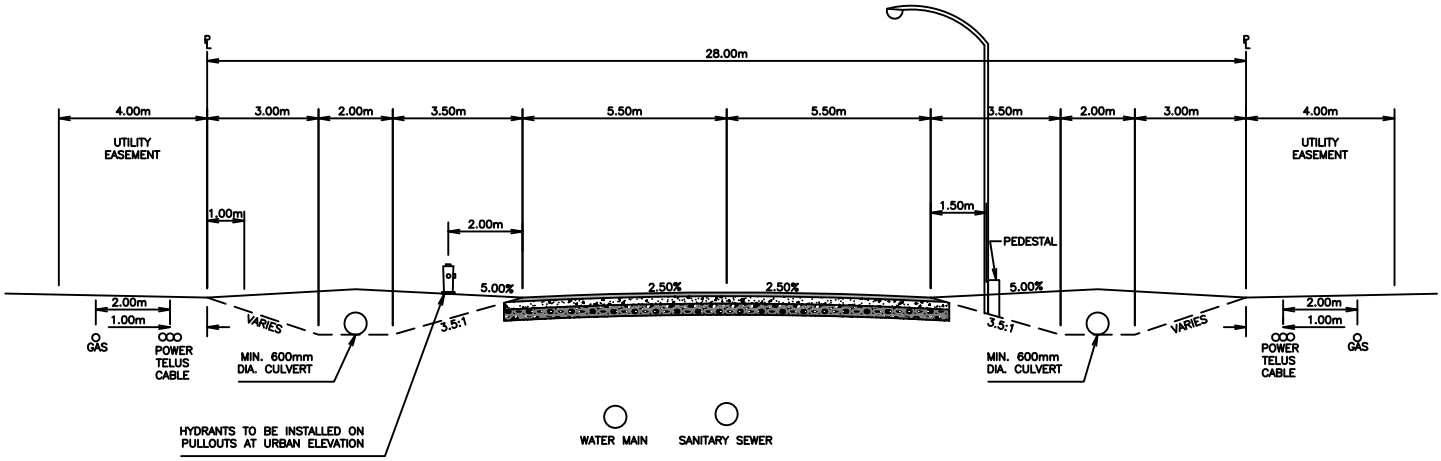


URBAN LOCAL INDUSTRIAL
(NO PARKING)



RURAL LOCAL HEAVY INDUSTRIAL
(NO PARKING)

REVISIONS		
DATE	DETAILS	BY

THE CITY OF GRANDE prairie

LOCAL INDUSTRIAL ROADWAYS

APPROVED BY KD	AUTHORIZED BY K. DONNELLY	
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DRAWN BY B. SHERVEY	SCALE N.T.S.	DATE 12/01/18

STANDARD DETAIL
20.07

FILE NUMBER
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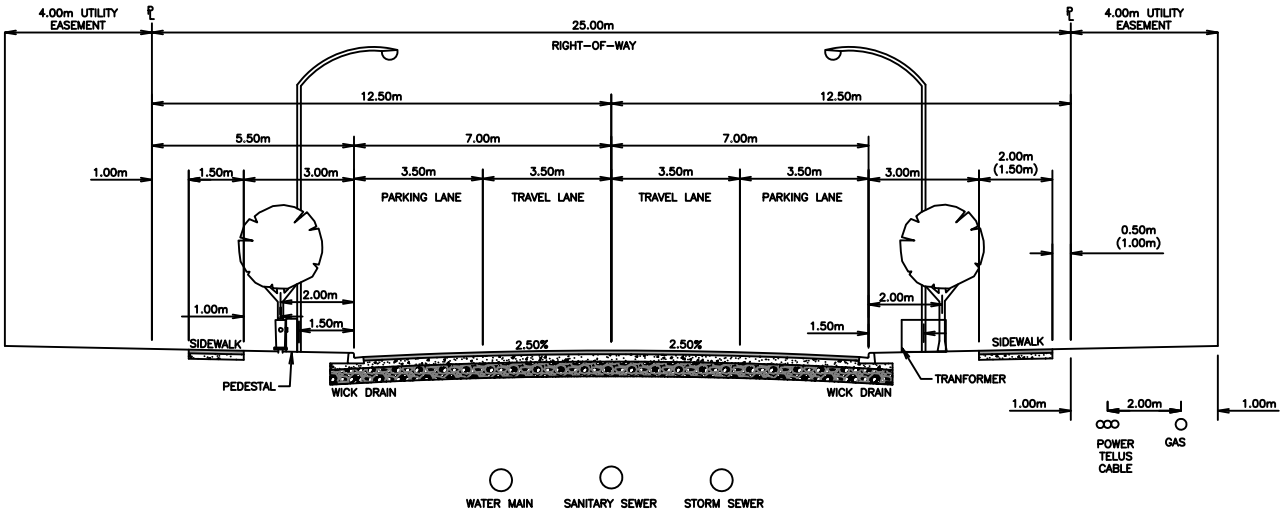
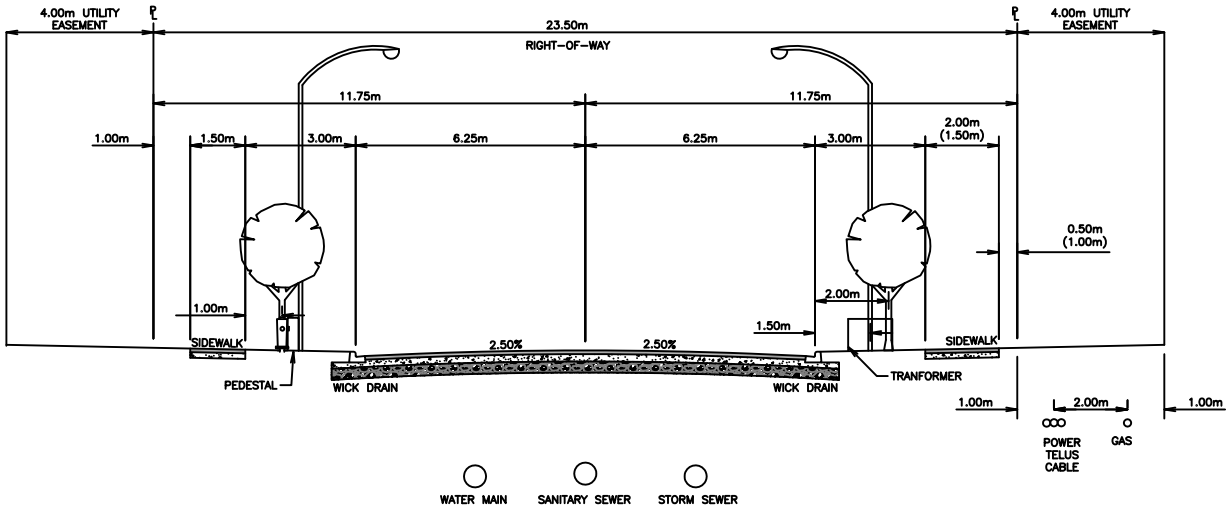


COMMERCIAL COLLECTOR



INDUSTRIAL/COMMERCIAL COLLECTOR
(NO PARKING)

REVISIONS		
DATE	DETAILS	BY

THE CITY OF GRANDE prairie

COMMERCIAL / INDUSTRIAL COLLECTOR ROADWAYS

APPROVED BY KD	AUTHORIZED BY K. DONNELLY	
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STANDARD DETAIL
20.08

FILE NUMBER
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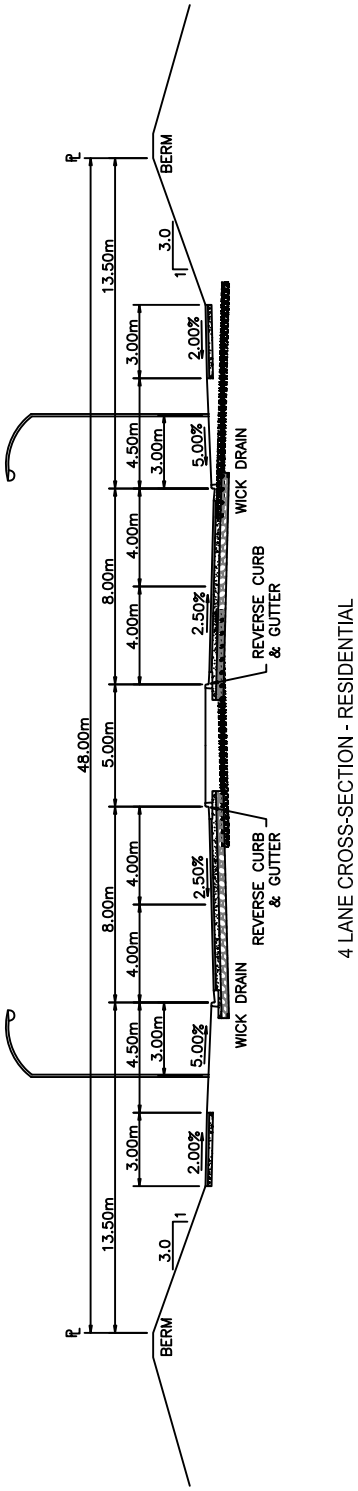

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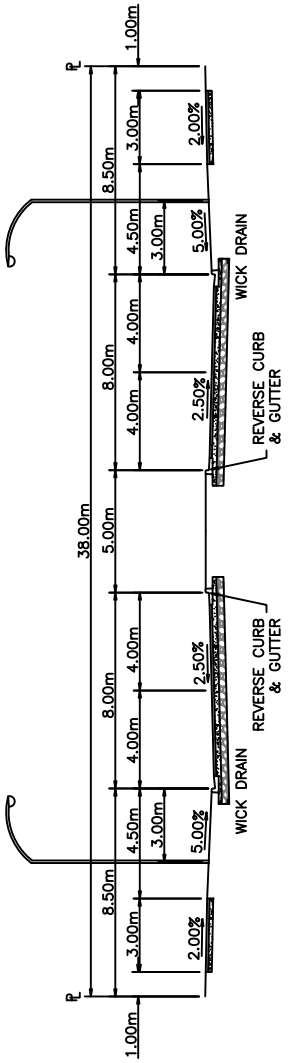

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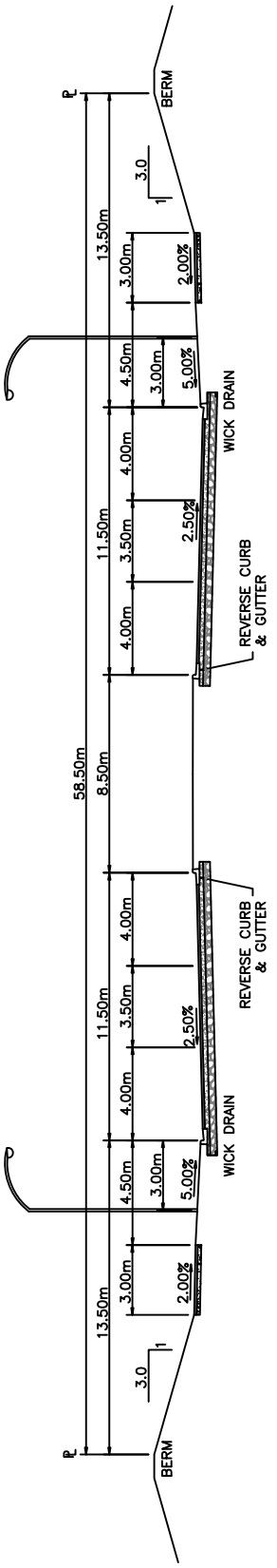

6 LANE CROSS-SECTION

REVISIONS		
DATE	DETAILS	BY

THE CITY OF GRANDE prairie

DIVIDED ARTERIAL ROADWAY

APPROVED BY KD	AUTHORIZED BY K. DONNELLY		STANDARD DETAIL 20.09
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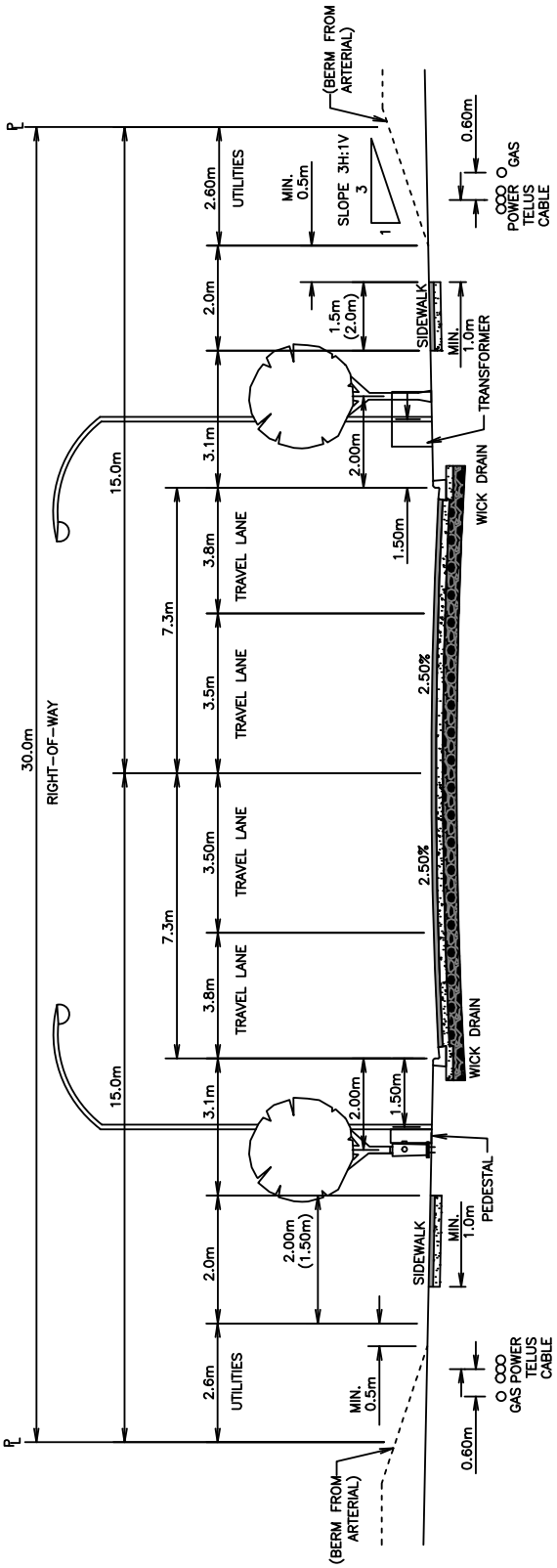
DRAWN BY B. SHERVEY	SCALE N.T.S.	DATE 12/01/18	FILE NUMBER C11073



RESIDENTIAL COLLECTOR
ENTRANCE SECTION
(UTILITIES CONTAINED WITHIN ROAD ALLOWANCE)

REVISIONS		
DATE	DETAILS	BY

GRANDE prairie

RESIDENTIAL COLLECTOR ROADWAYS

APPROVED BY: -	AUTHORIZED BY: -		STANDARD DETAIL: 20.10
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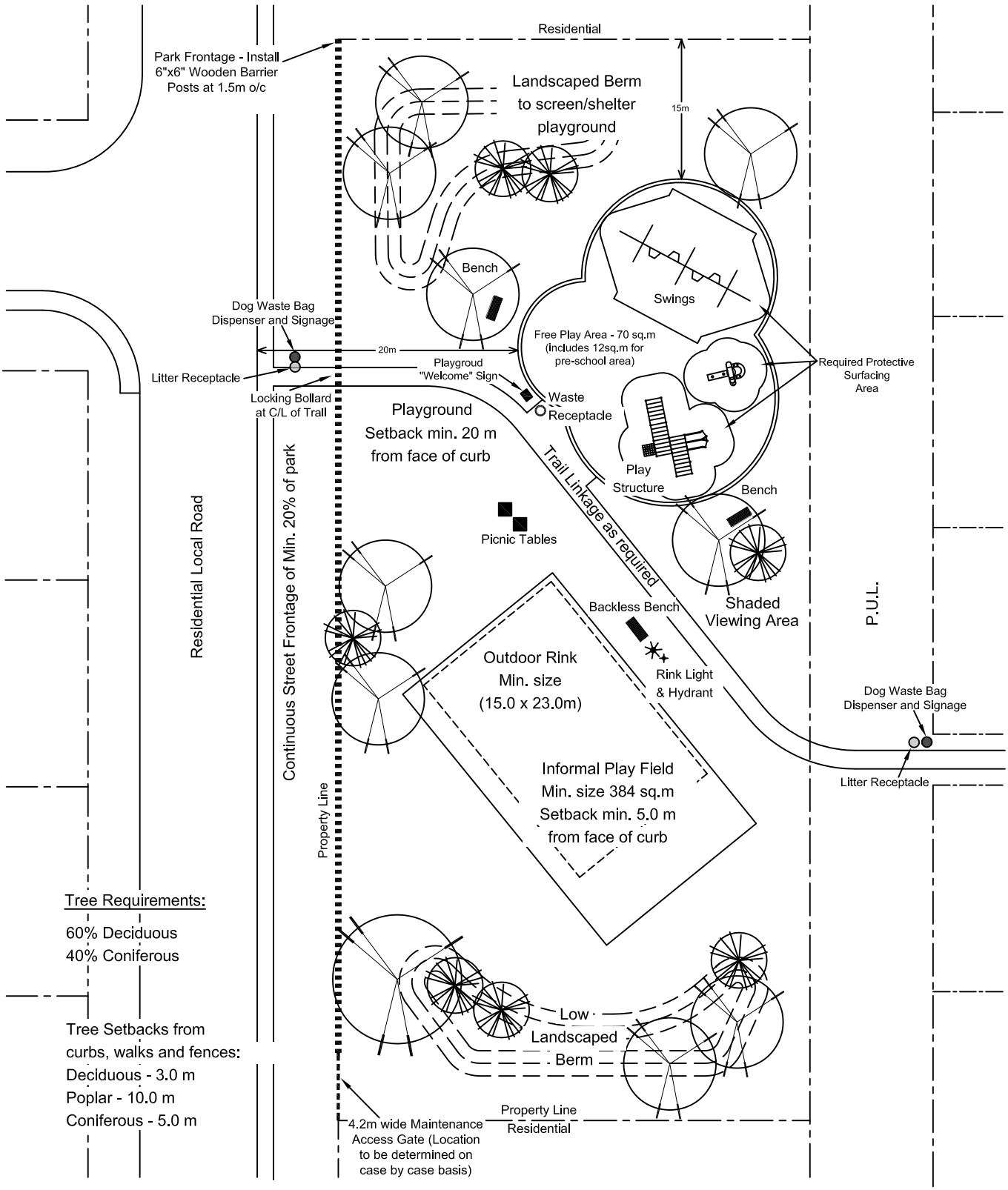

REVISIONS		
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THE CITY OF GRANDE prairie

NEIGHBOURHOOD PARK (GENERAL LAYOUT DETAIL)

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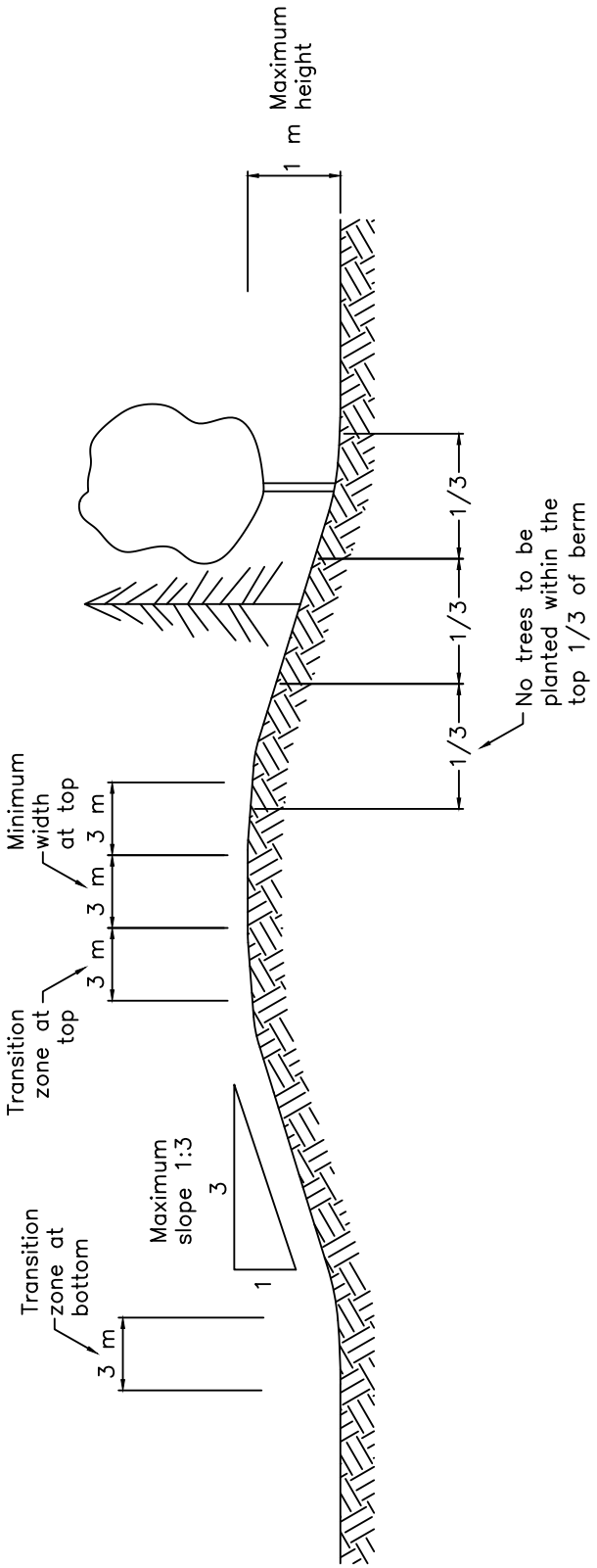

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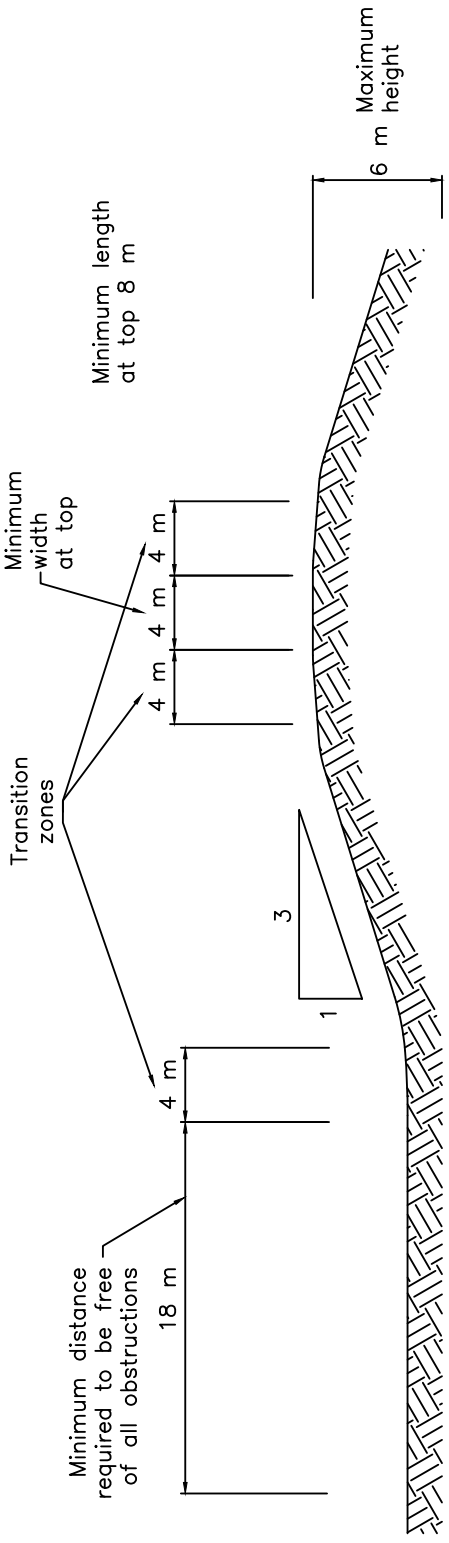
GRANDE prairie

BERMS: LANDSCAPED (PARK DESIGN DETAIL)

APPROVED BY KD	AUTHORIZED BY K. DONNELLY		STANDARD DETAIL 20.21
CHECKED BY KD			
DRAWN BY B. SHERVEY	SCALE N.T.S.	DATE 12/01/18	FILE NUMBER C11075

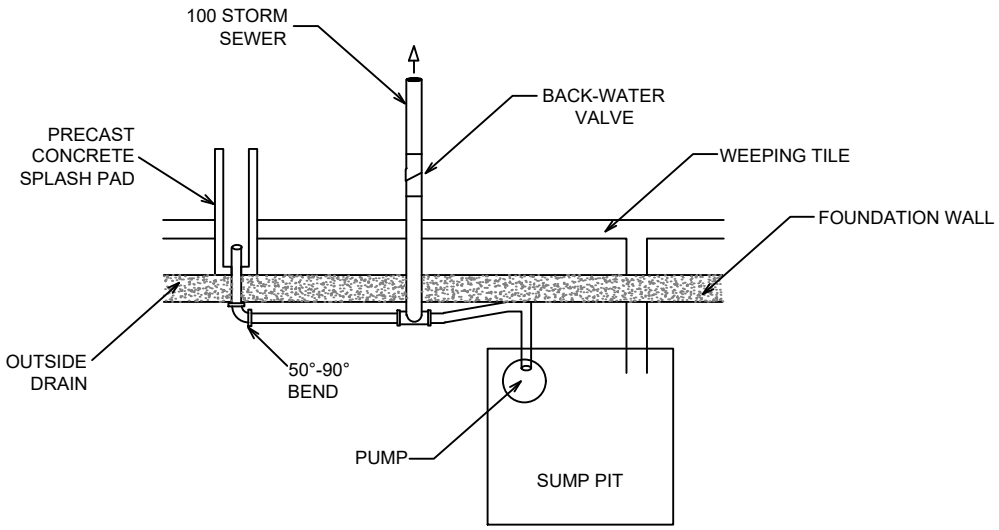


REVISIONS		
DATE	DETAILS	BY

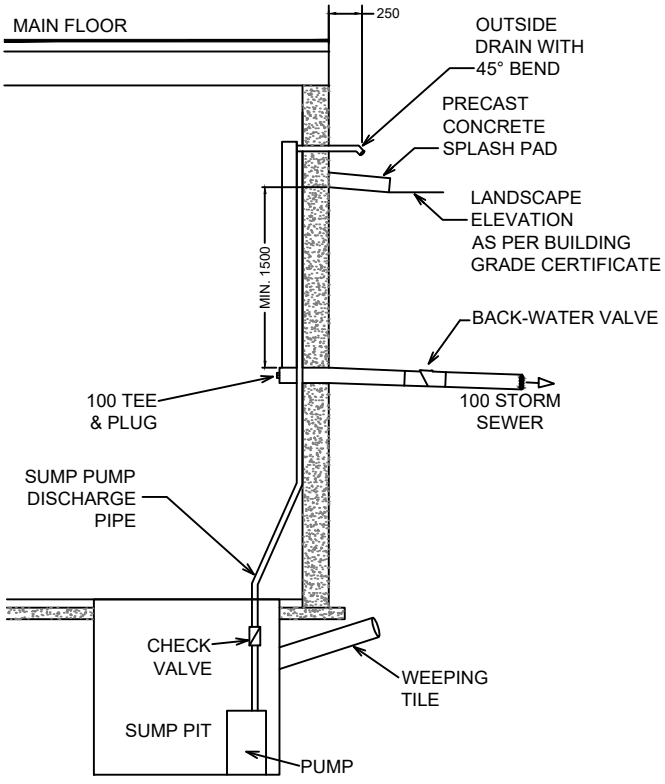
GRANDE prairie

BERMS: TOBOGGAN HILLS (PARK DESIGN DETAIL)

APPROVED BY KD	AUTHORIZED BY K. DONNELLY		STANDARD DETAIL 20.22
CHECKED BY KD			
DRAWN BY B. SHERVEY	SCALE N.T.S.	DATE 12/01/18	FILE NUMBER C11076



TOP VIEW



SECTION VIEW

NOTE:
1. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED
2. BACK-WATER VALVE PROTECTING BASEMENT PLUMBING CLOSES DUE TO SEWER BACK-UP
3. SUMP PIT FILLS, PUMP IS AUTOMATICALLY TURNED ON AND WEEPING TILE WATER IS DISCHARGED TO THE OUTSIDE SPLASH PAD

REVISIONS		
DATE	DETAILS	BY
-	-	-

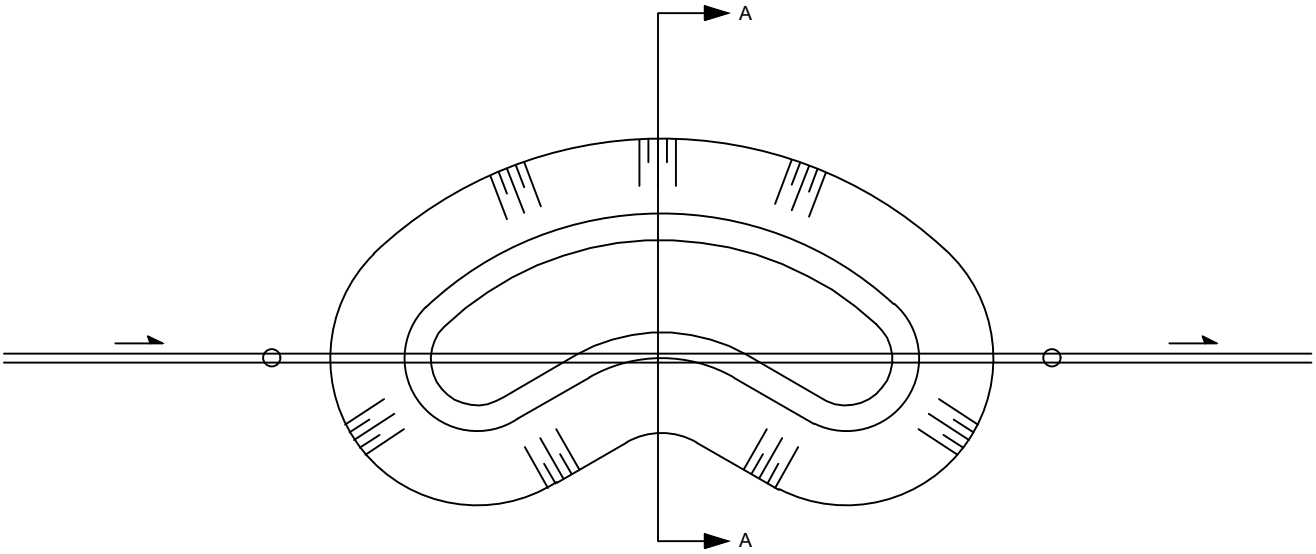
THE CITY OF GRANDE prairie

RESIDENTIAL LOT STORM SERVICE CONNECTIONS

STANDARD DETAIL 20.23

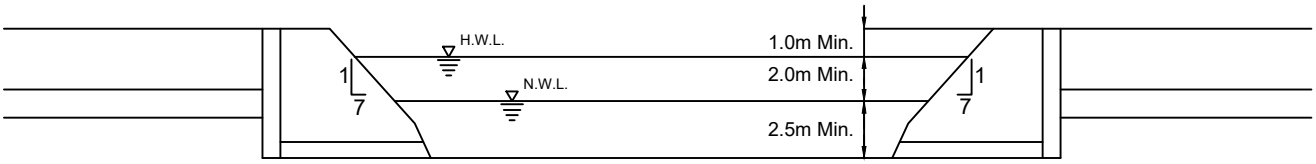
APPROVED BY: -	AUTHORIZED BY: ENGINEERING SERVICES	
CHECKED BY: -		
DRAWN BY: A. DOOLEY	SCALE: N.T.S.	DATE: 19/09/23

FILE NUMBER: C19031



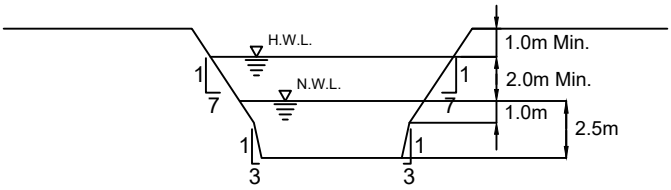
PLAN VIEW

N.T.S.



PROFILE

N.T.S.



SECTION A-A

N.T.S.

REVISIONS		
DATE	DETAILS	BY
-	-	-

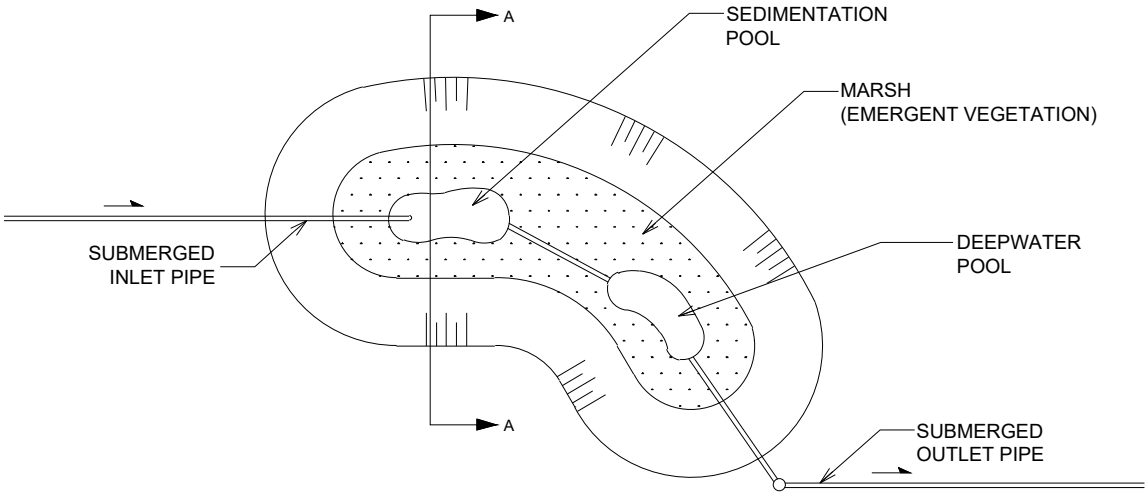
THE CITY OF GRANDE prairie

Wet Pond Concept

APPROVED BY -	AUTHORIZED BY ENGINEERING SERVICES	
CHECKED BY -		
DRAWN BY A. DOOLEY	SCALE N.T.S.	DATE 19/09/23

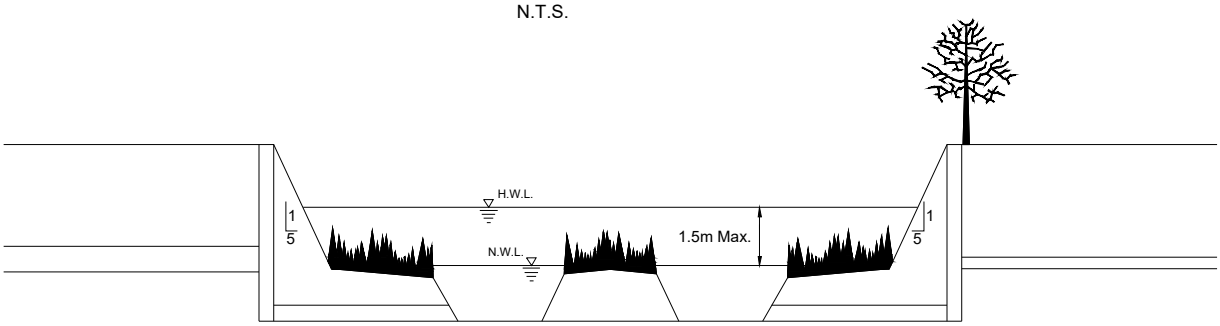
STANDARD DETAIL
20.24

FILE NUMBER
C19032



PLAN VIEW

N.T.S.



PROFILE

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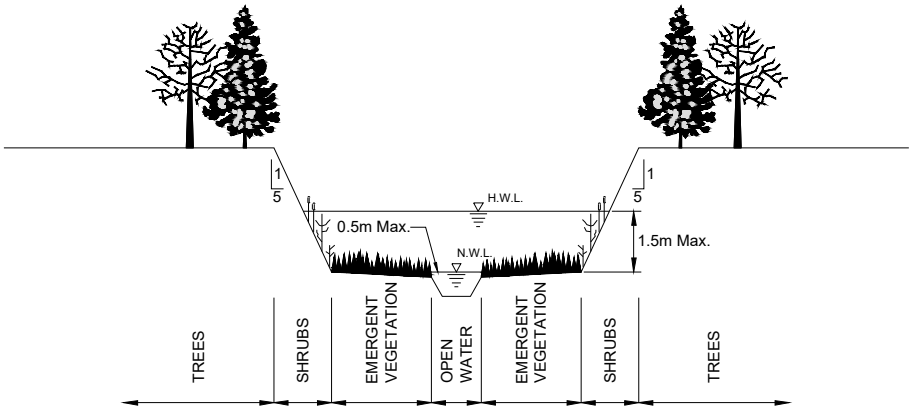


SECTION A-A

N.T.S.

REVISIONS		
DATE	DETAILS	BY
-	-	-

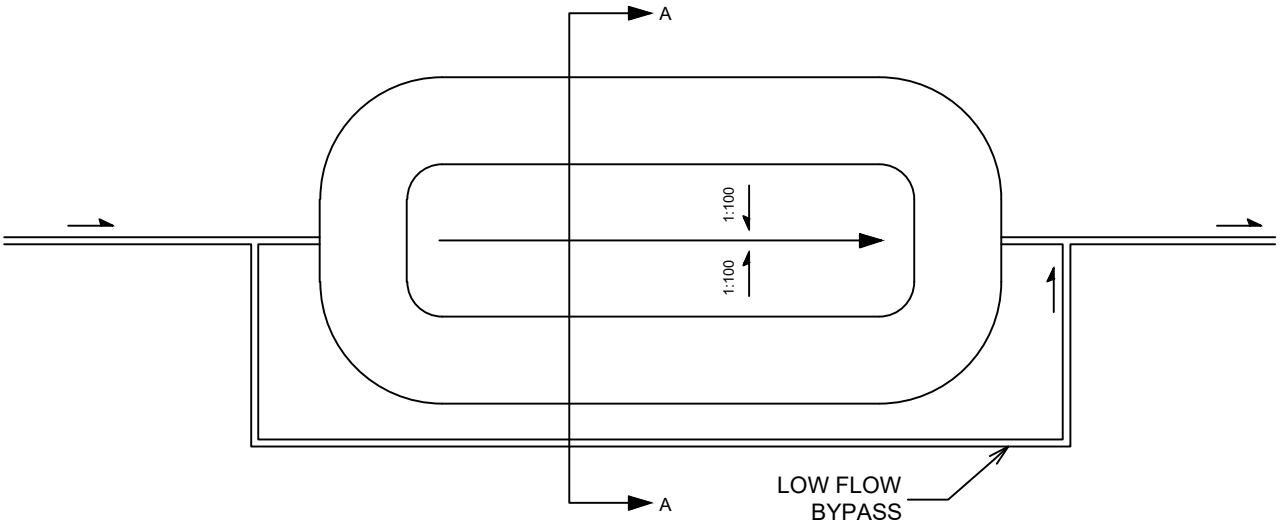
THE CITY OF GRANDE prairie

Wetland Concept

APPROVED BY: -	AUTHORIZED BY: ENGINEERING SERVICES	
CHECKED BY: -		
DRAWN BY: A. DOOLEY	SCALE: N.T.S.	DATE: 19/09/23

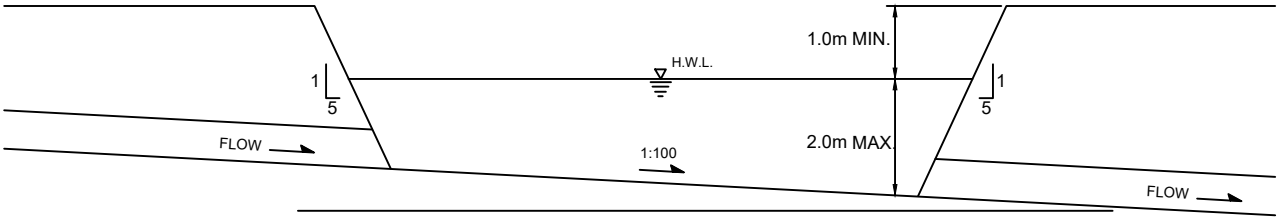
STANDARD DETAIL: 20.25

FILE NUMBER: C19033



PLAN VIEW

N.T.S.



PROFILE

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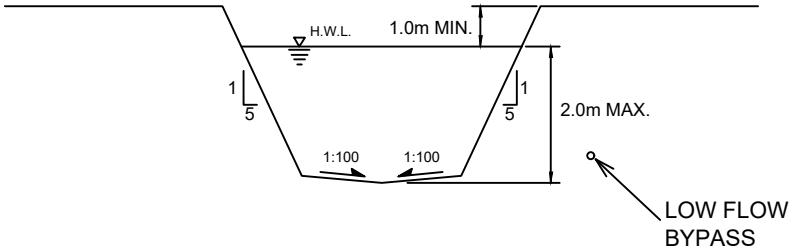


SECTION A-A

N.T.S.

REVISIONS		
DATE	DETAILS	BY
-	-	-

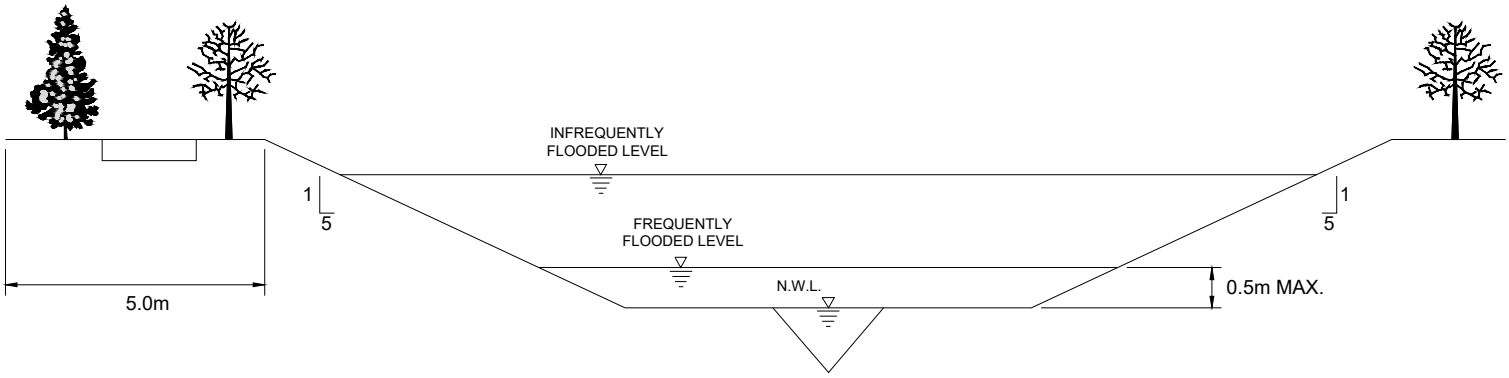
THE CITY OF GRANDE prairie

Dry Pond Concept

APPROVED BY: -	AUTHORIZED BY: ENGINEERING SERVICES	
CHECKED BY: -		
DRAWN BY: A. DOOLEY	SCALE: N.T.S.	DATE: 19/09/23

STANDARD DETAIL
20.26

FILE NUMBER
C19034



REVISIONS		
DATE	DETAILS	BY
-	-	-

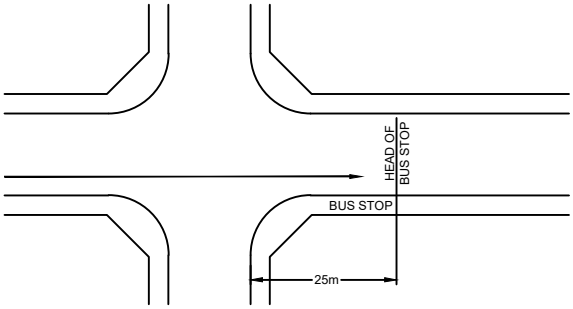
THE CITY OF GRANDE prairie

Drainage Parkway Concept

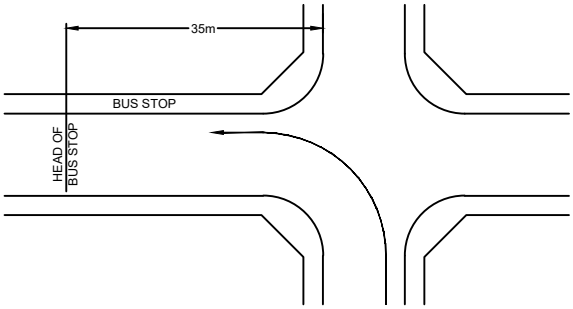
APPROVED BY -	AUTHORIZED BY ENGINEERING SERVICES		STANDARD DETAIL 20.27
CHECKED BY -			
DRAWN BY A. DOOLEY	SCALE N.T.S.	DATE 19/09/23	FILE NUMBER C19035

BUS GOES STRAIGHT THROUGH

NOTE:
1. Mid-Block Bus Stops require a minimum bus stop zone length of 45m for a standard bus

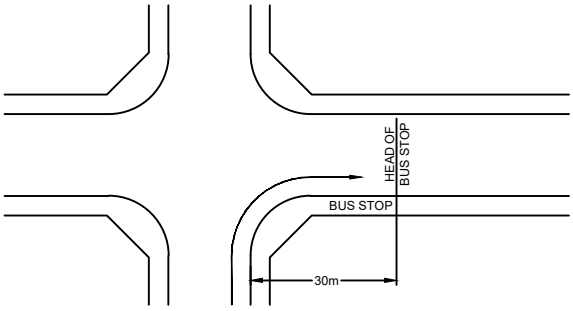


BUS MAKES A LEFT TURN

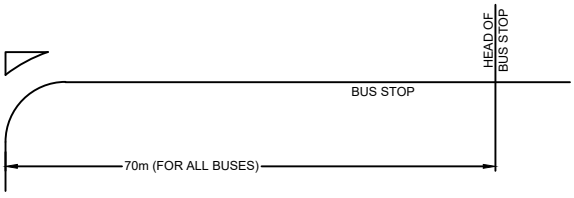


BUS MAKES A RIGHT TURN

NOTE:
1. Installation of a right turn cut-off depends on intersection geometrics.



RIGHT TURN CUT-OFF



REVISIONS		
DATE	DETAILS	BY
-	-	-

THE CITY OF GRANDE prairie

BUS STOP LOCATIONS AT 90° INTERSECTIONS

APPROVED BY -	AUTHORIZED BY ENGINEERING SERVICES		STANDARD DETAIL 20.28
CHECKED BY -			
DRAWN BY A. DOOLEY	SCALE N.T.S.	DATE 20/11/13	FILE NUMBER C20062