

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 1 of 37
		Document Code:	



**The City of Winnipeg**  
**Winnipeg Sewage Treatment Program**

---

**Civil Design Guideline**

Document Code:  
Revision: 003

Approved By: <u>          <i>Linda McCusker</i>          </u> Linda McCusker, Project Director, WSTP	<u>          March 13, 2025          </u> Date
--	---

REVISION REGISTER					
Rev.	Description	Date	By	Checked	Approved
00	Issued as Final	2017-06-06	various	C. Reimer	D. Griffin
001	Revised Site Drainage Design Criteria	2018-10-18	C. Reimer	D.S. Allen	D. Griffin
002	Revision	2022-12-15	Andrew Blanchette	J. Flynn	C. Javra
003	Revision	2024-12-31	Various	Andrew Blanchette	Linda McCusker

## Table of Contents

<b>1</b>	<b>Introduction .....</b>	<b>7</b>
1.1	Scope of the Standard .....	7
1.2	Application .....	7
1.3	Deviations from Standard .....	7
1.4	Acronyms and Abbreviations .....	8
<b>2</b>	<b>General.....</b>	<b>9</b>
2.1	Design Codes and Standards .....	9
2.2	Other City Standards .....	9
2.3	Authority Having Jurisdiction .....	9
2.4	Units.....	10
2.5	Site Co-ordinates .....	10
<b>3</b>	<b>General Site Development Requirements .....</b>	<b>11</b>
3.1	Overall Site Layout .....	11
3.2	Flood Protection .....	11
3.3	Buried Services .....	11
3.4	Fencing.....	11
3.5	Railway Crossing.....	12
3.6	Landscaping .....	12
3.7	Spill Contaminant .....	12
<b>4</b>	<b>Water Main Design Criteria.....</b>	<b>13</b>
4.1	General Requirements .....	13
4.2	Hydraulic Design .....	13
4.2.1	Water Demand Estimation .....	13
4.2.2	Fire Flow Requirements .....	13
4.2.3	Hydraulic Model Analysis .....	13
4.3	Design and Installation Requirements.....	14
4.3.1	Minimum Water Main Size.....	14
4.3.2	Depth of Cover .....	14
4.3.3	Pipe Structural Design.....	14
4.3.4	Fire Hydrants .....	15
4.3.5	Valves .....	15
4.3.6	Water Services .....	15
4.3.7	Materials .....	15
4.3.8	Separation Distances between Water and Sewer Mains .....	15
4.3.9	Connections to Buildings .....	16
4.3.10	Dissimilar Materials and Corrosion Protection .....	16
4.3.11	Thrust Restraint.....	16
4.3.12	Installation of Water Mains .....	16
4.3.13	Abandonment of Existing Water Mains .....	17
<b>5</b>	<b>Wastewater Sewer Main Design Criteria .....</b>	<b>18</b>
5.1	General Requirements .....	18
5.2	Hydraulic Design .....	18

5.3	Design and Installation Requirements.....	18
5.3.1	Depth of Cover .....	18
	Manholes .....	18
5.3.2	18	
5.3.3	Major Yard Pipe Structural Design .....	19
5.3.4	Dissimilar Materials and Corrosion Protection .....	19
5.3.5	Valves - Forcemain.....	20
5.3.6	Connections to Buildings - Forcemain.....	20
5.3.7	Thrust Restraint – Forcemains .....	20
5.3.8	Wastewater Sewer Service Size .....	20
5.3.9	Materials .....	20
5.3.10	Installation of Wastewater Mains.....	20
5.3.11	Deflection Testing of Flexible Sewers .....	21
5.3.12	Abandonment of Existing Wastewater Mains.....	21
5.3.13	CCTV Inspection .....	21
<b>6</b>	<b>Road Design Criteria.....</b>	<b>22</b>
6.1	General Requirements .....	22
6.2	General Road Design .....	22
6.2.1	Road Type and Design Life .....	22
6.2.2	Pavement Structure.....	23
6.2.3	General Roadway Grading Requirements .....	24
6.2.4	Roadway Signage Requirements.....	25
6.2.5	Roadway Clearance Requirements.....	25
6.2.6	Sidewalks .....	25
6.2.7	Parking Lots.....	25
6.2.8	Road Removals/Restorations.....	26
<b>7</b>	<b>Site Drainage Criteria.....</b>	<b>27</b>
7.1	General Requirements .....	27
7.2	Design Criteria.....	27
7.3	Site Design .....	30
7.4	Ditches.....	30
7.5	Culverts.....	30
7.6	Land Drainage Sewer.....	30
7.7	Manholes and Catch Basins.....	31
7.8	Retention and Detention Storage .....	31
7.9	Oil and Sediment Interceptors .....	31
7.10	Flood Protection measures for Sewage Treatment Plants.....	31
<b>8</b>	<b>Civil Design Team Responsibilities .....</b>	<b>33</b>
8.1	General .....	33
8.2	Drawings.....	34
8.2.1	General Requirements .....	34
8.2.2	Drawing List.....	34
8.2.3	Legend.....	34
8.2.4	General Notes Drawing .....	34
8.2.5	Existing Site Plan.....	35
8.2.6	Site Plan .....	35
8.2.7	Site Servicing Plan .....	35
8.2.8	Lot Grading Plan.....	35
8.2.9	Plan and Profile Drawings .....	36

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 5 of 37
		Document Code:	

8.3	Other Documents .....	36
	8.3.1 Traffic Management Plan .....	36
8.4	Design Calculations .....	37
8.5	Civil Servicing Report .....	37



	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 7 of 37
		Document Code:	

# 1 INTRODUCTION

This document identifies the standard design guidelines that are applicable to any civil work within the City of Winnipeg (City) wastewater treatment facilities.

## 1.1 Scope of the Standard

These design requirements will apply to the following facilities:

- Wastewater treatment plants

## 1.2 Application

The scope and intent of this document is to convey general design guidance and expectations regarding civil infrastructure systems. This document does not address specifics related to design type, selection, and configuration; however, the indicated guidelines are presented without knowledge of the specific site civil infrastructure implementation. It is not within the scope of this document to provide detailed design direction, and it will be the responsibility of the respective civil designers to fully develop the civil design details with general conformance to the concepts presented herein. This standard shall not be construed as comprehensive engineering design requirements or negate the requirement for professional engineering involvement. Any design must be executed under the responsibility and seal of the respective engineer in each instance, and must be performed in conformance with all applicable codes and standards, as well as good engineering practice.

Existing facilities do not necessarily comply with this standard. The expectations regarding the application of this standard to maintenance and minor upgrades at existing facilities must be assessed on a case-by-case basis; however general guidelines for application are presented as follows:

- All new buildings and sites are expected to comply with this standard.
- All major upgrades to a building or site are expected to comply with this standard; however, in some cases, compromise with the configuration of the existing facility design may be required.
- All minor upgrades should utilize this standard as far as practical for new work; however, in some cases, compromise with the configuration of the existing facility design may be required.

## 1.3 Deviations from Standard

It is expected that there will be occasional situations where the design engineer will propose a deviation from this design guideline. The rationale for potential deviations from the design guideline may include:

- Evolution of technology,
- Updates to standards and regulations,
- Practical limitations due to existing on-site conditions, or
- Significant cost benefits to the City due to specific project constraints.

**For each proposed deviation from this standard, fully complete a *WSTP Standards Deviation Form* and submit to the City Project Manager for approval. Do not proceed with the proposed deviation unless approval is received from the City Project Manager.**

## 1.4 Acronyms and Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standard Institute
ASTM	American Society for Testing Materials
AWWA	American Water Works Association
CNR	Canadian National Railway's
CPKS	Canadian Pacific Kansas City Railway's
CSA	Canadian Standards Association
MSL	metres above sea level
MUTCDC	Manual of Uniform Traffic Control Devices for Canada
NAD 83	North American Datum 1983
NBC	National Building Code
NFPA	National Fire Protection Association
NEWPCC	North End Sewage Treatment Plant
SEWPCC	South End Sewage Treatment Plant
SI units	International System of Units
TAC	Transportation Association of Canada
TC-E10	Transport Canada's Grade Crossing Standards
UTM	Universal Transverse Mercator
WEWPCC	West End Sewage Treatment Plant
WSTP	Winnipeg Sewage Treatment Program
WWD	Water and Waste Department

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 9 of 37
		Document Code:	

## 2 GENERAL

### 2.1 Design Codes and Standards

The requirements of the latest issue of the following codes, standards and regulations shall apply to civil design:

- National Building Code of Canada with Manitoba Amendments (NBC);
- Geometric Design for Canadian Roads, Transportation Association of Canada (TAC);
- AASHTO Guide for Design of Pavement Structures;
- Manual of Uniform Traffic Control Devices for Canada (MUTCDC);
- Water Supply for Public Fire Protection, Fire Underwriters Survey (FUS);
- Canadian Standards Association (CSA);
- American National Standard Institute (ANSI);
- American Water Works Association (AWWA);
- National Fire Protection Association (NFPA);
- Transport Canada's Grade Crossing Standards (TC-E10); and
- Pipe and Wire Crossing CPR Right of Way Approval Guide.

### 2.2 Other City Standards

While not exclusive, ensure that the following City Standards are adhered to:

- City of Winnipeg "Criteria for Storm Water Management";
- City of Winnipeg Transportation Standards Manual;
- 2015 City of Winnipeg Accessibility Design Standard;
- City of Winnipeg Standard Construction Specifications;
- City of Winnipeg Listings of Approved Products;
- Water and Waste Department Identification Standard;
- MacLaren Drainage Criteria Manual for the City of Winnipeg;
- Culvert and Drainage Inlet/Outlet Safety Guidelines;
- City of Winnipeg Water and Waste Department WWD CAD/GIS Standards (August 2016);
- Manual for the production of Construction Drawings for the City of Winnipeg, Works and Operations Division (November 1984);

### 2.3 Authority Having Jurisdiction

1. National Building Codes: The City of Winnipeg Property, Planning and Development Department, such as: Building Permits, Occupancy Permits, Internal building Fire Protection systems etc.
2. Non-National Building Codes: The City of Winnipeg Water and Waste Department, (water services, sewer services, land drainage, and flood protection etc.)

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 10 of 37
		Document Code:	

## 2.4 Units

All drawings and documentation shall use the International System of Units (SI units). Imperial units will be provided in parenthesis after the metric unit, where requested or appropriate. Specific requirements are as follows:

1. All building dimensions are to be in millimeters; and
2. All elevations are to be in meters, in the format EL. ###.### (example EL. 273.520).

## 2.5 Site Co-ordinates

All site co-ordinates shall be provided in Universal Transverse Mercator (UTM) Zone 14 North mapping projection. North American Datum 1983 (NAD 83) co-ordinates using Province of Manitoba 1990 realization, consistent with City of Winnipeg co-ordinates

Vertical datum shall be as per metres above sea level (MSL) (example EL.273.500), and co-ordinated with on-site monumentation.

Co-ordinates shall be site calibrated to on-site monumentation, where provided. Site-specific Combined Scale Factor shall be provided.

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 11 of 37
		Document Code:	

### 3 GENERAL SITE DEVELOPMENT REQUIREMENTS

#### 3.1 Overall Site Layout

1. Provide an overall site layout design considering all civil and building works, as well as requirements of other disciplines.
  - 1.1 Include all inter-building electrical and control services.
  - 1.2 Include all inter-building mechanical services.
2. Coordinate site layout requirements to include both current and future site development requirements.
3. Coordinate the site arrangement to minimize fill and/or excavation costs while maintaining efficiency of project construction, operation, and maintenance.
4. Ensure oil and chemical storage areas are designed to contain spills.

#### 3.2 Flood Protection

1. Unless otherwise indicated by the City, design flood protection systems to protect all facilities as follows:
  - 1.1 The North End Sewage Treatment Plant (NEWPCC) shall be designed based on 700-year flood protection level of 229.83 m.
  - 1.2 The South End Sewage Treatment Plant (SEWPCC) shall be designed based on 1997 FPL + 0.61m flood protection level (1997 water level + 0.61m + 0.61m) of 232.56 m.
  - 1.3 The West End Sewage Treatment Plant (WEWPCC) shall be designed based on 700-year flood protection level of 234.1 m.

*Note: The process hydraulic requirements with respect to flood levels may be different.*

#### 3.3 Buried Services

1. Ensure that all buried infrastructure is accurately updated in the City's GIS based upon the completed installation.
2. All non-conductive underground piping shall be provided with durable electrical trace wires such that they can be easily traced in the future.

#### 3.4 Fencing

1. Design a permanent perimeter fence around the entire facility.
2. Except where architectural fencing is required or otherwise noted, permanent perimeter fencing shall be chain-link fencing, in accordance with CW 3550-R3.
  - 2.1 Fencing shall have a height of 3 m (10 feet) plus top guard unless matching into existing fence (approval required from City Project Manager).
  - 2.2 Fencing shall have a top guard consisting of 600 mm tall outrigger at a 45-degree angle, facing outward with 3 strands of 13.5-gauge barbed wire.

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 12 of 37
		Document Code:	

3. Gates:
  - 3.1 Provide gates on all access roads.
  - 3.2 Gates must provide an opening to the full width of the access road.
  - 3.3 Gates must be able to be secured (locked) in either an open or closed position.
  - 3.4 Gates which are expected to be open and closed more than twenty times per week shall be electric actuated. Include controls including pushbuttons, RFID, or wireless controls as appropriate for the application.
4. Design temporary fencing for construction areas.

### 3.5 Railway Crossing

1. Proposed utility crossings under Canadian Pacific Kansas City Railway's (CPKS) track and parallelisms within CPKS's right of way will require a formal application submission complete with 11x17 drawing containing all information as outlined in CPKS's "*Pipe and Wire Crossing CPR Right of Way Approval Guide*".
2. Proposed utility crossings under Canadian National Railway's (CNR) track and parallelisms within CNR's right of way will require a formal application submission as outlined in CNR's "A Guide to the Pipe and Wire Process".
3. Proposed road crossings over CPKS / CNR's track will be subject to a crossing safety review by CPKS as per the most recent version of Transport Canada's Grade Crossing Standards.

### 3.6 Landscaping

1. Design landscaping for all new and modified areas of the facility.
2. Provide low maintenance landscaping. Where shrubs are provided, they shall be drought-resistant.
3. Include aesthetic landscaping in public accessible areas of the facility (i.e. next to Administration Building).
4. Removal of trees and shrubs shall be according to the City of Winnipeg Standard Construction Specifications CW 3010 "Clearing and Grubbing".
5. When designing sodding it shall be in accordance with City of Winnipeg Standard Construction Specifications CW 3510 "Sodding".

### 3.7 Spill Contaminant

1. Design must include grading of pavement to provide containment in the in areas where chemical is being delivered in a liquid state. Appropriate valves must also be included on the land drainage system to isolate land drainage piping during chemical delivery.
2. Provide containment around chemical storage tanks, sized as per codes or 110% of the largest tank, whichever is greater.
3. Provide containment around chemical delivery areas, sized as per codes or 110% of the largest delivery vehicle, whichever is greater.

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 13 of 37
		Document Code:	

## 4 WATER MAIN DESIGN CRITERIA

### 4.1 General Requirements

1. These requirements apply to potable water mains from the municipal water supply.
2. Provide new water mains to service new structures (where service is required). Ensure water service to modified structures is suitable for the required service in those structures.
3. Provide location and size of water meters internal to building as required.
4. Provide backflow protection as required by the City Water By-Law 107/2015.
5. Geo-coordinates for all hydrant and valve locations shall be submitted as part of the As-Built / Record Drawings.
6. The water distribution system shall be designed to provide full redundancy for critical buildings and facilities. WWD shall have final determination on what is a critical building or facility.
7. No dead-end water mains shall be accepted. New water mains shall have a minimum of two independent connection to the existing municipal water supply.

### 4.2 Hydraulic Design

#### 4.2.1 Water Demand Estimation

1. Where actual water demands are known they shall be used for the design. Where actual demands are unknown, estimates can be derived from literature values; references must be included with design assumptions.

#### 4.2.2 Fire Flow Requirements

1. The required fire flow shall be determined using the method set by the Fire Underwriters Survey (FUS), found within Part II of the 2020 "Water Supply for Public Fire Protection" document. This document is available from the FUS website.
2. The maximum available fire flow to be considered from a single fire hydrant is:
  - <75m to structure, 95 L/s maximum capacity
  - >75 m and <150 m to structure, 65 L/s maximum capacity

#### 4.2.3 Hydraulic Model Analysis

1. Proposed water mains shall be modeled to demonstrate that adequate flows and pressures can be supported.
2. Contact the City of Winnipeg Water and Waste Department for pressure and flow curves at requested feed points to facilitate hydraulic modeling analysis. A preliminary water network will be required to prepare this information.
3. A Hazen-Williams roughness coefficient of 130 shall be used for all hydraulic analysis unless otherwise indicated by the City. If including existing water mains on site, the City will provide roughness coefficients based on the material and age of the pipe. Physical flow testing may be required to verify assumptions.

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 14 of 37
		Document Code:	

4. The minimum allowable distribution system pressure, measured at design ground elevation, is as follows:
  - 275 kPa (40 psi) during PHD; and
  - 207 kPa (30 psi) with any one isolatable segment of the feeder main network out of service during PHD. This analysis will not be need for every project; the City will identify the need at the time that flow curves are provided.

The model results from the PHD scenario(s) shall be presented in a table for each model node.

5. The minimum allowable distribution system pressure during MDD + fire flow is 140 kPa (20 psi), measured at design ground elevation. Available fire flow hydraulic model simulations shall:
  - include nodes at 'critical' locations in the development area, e.g. highest required fire flows, longest distances between junctions, and/or highest elevation; and
  - determine the maximum available flow at each node while maintaining a minimum system pressure of 140 kPa (20 psi).

The model results from the MDD + fire flow scenario shall be presented in a table for each model node.

## 4.3 Design and Installation Requirements

### 4.3.1 Minimum Water Main Size

1. The minimum water main sized for fire protection and water distribution on the sewage treatment plant site shall be 250 mm, unless otherwise approved.

### 4.3.2 Depth of Cover

1. Minimum ground cover for water mains shall be 2.5 m.
2. Where it is not possible to achieve 2.5 m of cover, water main and water service shall be insulated according to the City of Winnipeg standard detail SD-018 "Water Main and Water Service Insulation".

### 4.3.3 Pipe Structural Design

1. All water main piping shall be designed for the following pressures:
  - 1.1 As specified in the City of Winnipeg Standard Construction Specifications – Underground Works Approved Products List
2. All piping shall be designed for:
  - 2.1 Earth dead loads and surcharge loads;
  - 2.2 Live Loads minimum CAASHTO (HS20/HS25 design vehicles);
  - 2.3 Construction loads should be considered where appropriate; and
  - 2.4 Combination pressure, live and dead loads as required by the appropriate AWWA and or/CSA Standard.
3. Water Main Pipes shall conform to the City of Winnipeg Standard Construction Specifications, Division 3 Approved Products for Underground Works, unless otherwise approved.

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 15 of 37
		Document Code:	

#### **4.3.4 Fire Hydrants**

1. Hydrants shall conform to the City of Winnipeg Standard Construction Specifications, Division 3 Approved Products for Underground Works.
2. Hydrants installation shall conform to City of Winnipeg Standard Construction Specifications CW 2110 – “Water Mains”.
3. Fire hydrants shall be installed:
  - at a spacing to provide the minimum required fire flows as per Section 4.2.2;
  - within the maximum allowable distance from each structure as required by the Manitoba Building Code; and
  - at a maximum spacing of 90 m along the water main.

#### **4.3.5 Valves**

1. Water main valves shall have a size equal to the nominal size of the water main.
2. Water main valves shall be installed such that.
  - no more than two fire hydrants are within an isolatable water main segment;
  - A maximum of four valves are required to be operated to isolate a section of water main.
3. A minimum of two valves are required at every water main tee. A minimum of three valves are required at every water main cross.
4. Valve direction to close shall match the existing valves on site.

#### **4.3.6 Water Services**

1. Minimum size of fire services shall be 150 mm and installed in accordance with City of Winnipeg Standard Construction Specifications CW 2110 “Water Mains”.
2. Sizes of domestic water service pipes shall be determined based on the fixture or appliance numbers. The minimum size of domestic water services shall be 25 mm.
3. Valves for fire and combined fire-domestic services shall be installed 1 m from the City water main.

#### **4.3.7 Materials**

1. Materials for pipes, joints and fittings shall be in accordance with “Approved Products for Underground Use within the City of Winnipeg” where specified.
2. Bedding and backfill materials shall be according to the City of Winnipeg Standard Construction Specification CW 2030 “Excavation Bedding and Backfill” as a minimum, or as required by structural pipe design.

#### **4.3.8 Separation Distances between Water and Sewer Mains**

1. Horizontal Separation:
  - 1.1 The minimum horizontal separation between the outside of water main pipe and outside of any gravity sewer pipe shall be 3.0 m.

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 16 of 37
		Document Code:	

2. Crossings:

- 2.1 Water mains crossing existing or new gravity sewer pipes should be designed such that water mains will cross over sewer pipes whenever possible. In cases where the water main will cross below wastewater or land drainage sewer pipes, one full length of water pipe shall be located so both joints will be as far from the sewer pipe as possible. Minimum vertical separation between the outside of water main pipe and outside of any gravity sewer pipe shall be 500 mm.

#### **4.3.9 Connections to Buildings**

1. Piping connections to buildings and rigid structures shall be designed to prevent shear and settlement using appropriate means including but not limited to:
  - 1.1 flexible ball joints,
  - 1.2 grade beams, and
  - 1.3 non-shrink foundation materials.

#### **4.3.10 Dissimilar Materials and Corrosion Protection**

1. All dissimilar metallic components shall be provided with non-metallic electrical isolation components.
2. Galvanic anodes shall be provided where required by the City Standard Construction Specifications.
3. Corrosion systems shall be designed for soil electrical resistivity of 150 ohm-cm.

#### **4.3.11 Thrust Restraint**

1. Thrust Restraint for water mains less than 600 mm in diameter shall be as per City of Winnipeg Specification CW 2110 – “Water Mains”.
2. Thrust Restraint for mains greater than 600 mm in diameter shall be designed for appropriate thrust forces and allowable soil bearing pressures as recommended by a Geotechnical Engineer.
3. Where suitable soils for reaction blocking are not available or have potential to be disturbed, provide thrust restraint by means of joint restraint devices. Provide design criteria and minimum restraint lengths on construction drawings. Permanent metallic restraint devices shall be protected from corrosion.

#### **4.3.12 Installation of Water Mains**

1. The following items shall be specified in accordance with the City of Winnipeg Standard Construction Specifications:
  - bedding and backfill in accordance with CW 2030,
  - hydrostatic leakage testing and disinfection of water mains and water services in accordance with CW 2125.

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 17 of 37
		Document Code:	

### **4.3.13 Abandonment of Existing Water Mains**

1. Abandonment of existing water mains shall be according to the City of Winnipeg Specification CW 2110 "Water Mains" within the limits shown on the drawings.
2. Sections of abandoned water mains within excavation limits (including existing water mains and previously abandoned water mains) shall be removed.
3. The ends of remaining water main sections shall be plugged and abandoned according to CW 2110.

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 18 of 37
		Document Code:	

## 5 WASTEWATER SEWER MAIN DESIGN CRITERIA

### 5.1 General Requirements

1. These requirements apply to collection, interceptor, forcemain and transmission wastewater mains.
2. Provide new sewer mains to service new structures (where service is required). Ensure sewer service to modified structures is suitable for the required service in those structures.
3. Geo-coordinates for all manhole, junction and connection locations shall be submitted as part of the as-built/record drawings.
4. Ensure that sanitary sewers are drained into or upstream of the headworks facility.

### 5.2 Hydraulic Design

1. Where actual wastewater flows are known they shall be used for the design. Where actual flows are unknown, estimates can be derived from literature values; references must be included with design assumptions.
2. Wastewater design flow rate shall include peak domestic inflows, extraneous inflow and infiltration, processing wastewater flows, and wash down flows.
  - 2.1 Extraneous flow contributions shall include:
    - Groundwater infiltration – 2,200 L/day
    - Manhole Inflow – 12 L/min/manhole. If number of manholes is unknown, a minimum density of 1.0 manhole per hectare may be used for design.
3. Hydraulic calculations shall use the Manning Formula to determine pipe capacity. A Manning 'n' value of 0.013 shall be used for design.
4. Wastewater sewer mains shall have a minimum diameter of 250 mm.
5. A minimum velocity of 0.6 m/s shall be achieved with the pipe flowing full for 250 mm wastewater sewer mains. A minimum velocity of 0.6 m/s shall be achieved under PDWF conditions for 300 mm or greater wastewater sewer mains. The velocity under PDWF conditions shall be shown in the design calculations for all wastewater sewer mains.
6. The maximum velocity in wastewater sewer main shall be 3.0 m/s under PWWF conditions for all pipe sizes.

### 5.3 Design and Installation Requirements

#### 5.3.1 Depth of Cover

1. The minimum permissible depth of cover shall be 2.4 m measured from the crown of the wastewater sewer to centre line of finished grade.

#### 5.3.2 Manholes

1. For collection systems, manholes shall be spaced a maximum of 120 m apart.
2. For interceptor sewers, manholes shall be spaced a maximum of 200 m, or as otherwise approved.

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 19 of 37
		Document Code:	

3. Manholes shall be located at all wastewater sewer main junctions, termination points, changes in alignment, grade, or pipe size. If manholes are located within pavement they shall be located at high points in the finished grade.

### **5.3.3 Major Yard Pipe Structural Design**

1. Flexible pipe design shall consider prism load for earth load.
2. Rigid pipe design shall consider construction constraints, adjacent and parallel pipelines and structures. Where trench widths cannot be assured, consider use of embankment loading, as described in ASCE 15 Standard Practice for Direct Design of Buried Precast Pipe Using Standard Installation (SIDDI) Type 3 installation and minimum vertical arching factor of 1.40.
3. For reinforced concrete pipe in deep fills, consider use of Direct Design as per latest version of ASCE 15 Standard Practice for Direct Design of Buried Precast Pipe Using Standard Installation (SIDDI).
4. Minimum excavation widths to ensure proper embedment compaction and safety shall be selected.
5. As a minimum, live loads shall be based on CSA CL625 design vehicle. Construction loads shall also be considered where appropriate, including potential crane staging, earth moving and other temporary and transient loads that may be present.
6. Forcemains shall consider cyclical pressure loading as per appropriate AWWA standards.
7. Sewer pipes shall conform to the City of Winnipeg Standard Construction Specifications, Division 3 Approved Products for Underground Works, unless otherwise approved. All forcemains and pressure piping shall be designed for the following pressures:
  - 7.1 Maximum working pressure as required by force main design;
  - 7.2 Minimum transient allowance of 40% of maximum working pressure; and
  - 7.3 Minimum test pressure of 1.25 times the maximum design operating pressure or as approved by City.

### **5.3.4 Dissimilar Materials and Corrosion Protection**

1. Gravity wastewater sewer pipe material selection and design shall consider:
  - 1.1 Hydrogen sulfide gas corrosion;
    - 1.1.1 When utilizing concrete pipes in areas with high hydrogen sulfide level, evaluate the use of HDPE or PVC liners and provide recommendations accordingly; and
  - 1.2 CSA S1 soil sulphate exposure.
2. Forcemain pipe material selection and design shall consider:
  - 2.1 All dissimilar metallic components shall be provided with non-metallic electrical isolation components;
  - 2.2 Galvanic anodes shall be provided where required by City construction specifications; and
  - 2.3 Corrosion systems for metallic mains and components shall be designed for site specific soil electrical resistivity. Winnipeg soils typically have a soil resistivity in the range of 200 – 1200 ohm-cm.

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 20 of 37
		Document Code:	

### **5.3.5 Valves - Forcemain**

1. Maximum distance between valves shall consider operational and maintenance requirements. Mains with multiple flow paths should consider isolation for operation and maintenance. The engineer shall propose a valve and configuration acceptable to the City.

### **5.3.6 Connections to Buildings - Forcemain**

1. Forcemain piping connections to buildings and rigid structures shall be designed to prevent shear and settlement using appropriate means including but not limited to;
  - 1.1 Flexible ball joints,
  - 1.2 Grade beams, and
  - 1.3 Non-shrink foundation materials.

### **5.3.7 Thrust Restraint – Forcemains**

1. Thrust Restraint for mains less than 600 mm in diameter shall be as per City of Winnipeg Specification CW 2110.
2. Thrust Restraint for mains greater than 600 mm in diameter shall be designed for appropriate thrust forces and allowable soil bearing pressures as recommended by a Geotechnical Engineer.
3. Where suitable soils for reaction blocking are not available or have potential to be disturbed, provide thrust restraint by means of joint restraint devices. Provide design criteria and minimum restraint lengths on construction drawings. Permanent metallic restraint devices shall be protected from corrosion.

### **5.3.8 Wastewater Sewer Service Size**

1. Minimum size of service shall be 150 mm at a minimum grade of 1.0% and installed in accordance with City of Winnipeg Standard Construction Specifications CW 2130 “Gravity Sewers”.
2. Wastewater services shall not connect directly to manholes.
3. Sizes of wastewater service pipelines shall be determined based on the fixture or appliance number.

### **5.3.9 Materials**

1. Materials for pipes, joints and fittings shall be in accordance with “Approved Products for Underground Use within the City of Winnipeg” where available.
2. Bedding and backfill materials shall be according to the City of Winnipeg Standard Construction Specification CW 2030 “Excavation Bedding and Backfill” as a minimum, or as required by structural pipe design.

### **5.3.10 Installation of Wastewater Mains**

1. The following items shall be specified in accordance with the City of Winnipeg Standard Construction Specifications:
  - bedding and backfill, and

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 21 of 37
		Document Code:	

- pressure/leak testing for forcemain.

### **5.3.11 Deflection Testing of Flexible Sewers**

1. Deflection testing of flexible sewers shall be completed in accordance with City of Winnipeg Construction Specification CW 2130 "Gravity Sewers".
2. Further to CW 2130, deflection testing of flexible gravity sewers, testing shall not occur until a minimum of 30 days of completion of backfilling.

### **5.3.12 Abandonment of Existing Wastewater Mains**

1. Abandonment of existing water mains shall be according to CW 2130 "Gravity Sewers" within the limits shown on the drawings.

### **5.3.13 CCTV Inspection**

1. Perform video inspection of sewers in accordance with CW 2145.

## 6 ROAD DESIGN CRITERIA

### 6.1 General Requirements

1. Provide a comprehensive design for all roads and parking lots required for the facility.
2. Include in the design:
  - 2.1 all permanent roadways and parking lots; and
  - 2.2 all temporary construction access roads, laydown areas and contractor parking lots.
3. Horizontal and vertical alignments for roads shall be designed according to the more stringent Guideline of either the TAC or City of Winnipeg standards. Design speed shall be 40 km/h for construction access road. Horizontal alignment for temporary construction roads shall be developed.
4. All roadway geometry shall meet the most stringent of TAC, City of Winnipeg Transportation Standards Manual or City of Winnipeg Standard Construction Specifications Surface Works Standard Details.
5. Perform simulations to evaluate truck movements around the facility to verify roadway geometry.
  - 5.1 Standard of acceptance is AutoTURN simulation.
6. Avoid mixing vehicle and pedestrian traffic.
7. Provide a traffic management plan for construction and operation, as per Section 8.3.1.

### 6.2 General Road Design

#### 6.2.1 Road Type and Design Life

1. Selection of road type shall be as per Table 6-1.

**Table 6-1 : Sewage Treatment Plant Road Type Selection**

Location	Road Type	Pavement Material	Design Speed	Min. Pavement Width	Design Vehicle
Main Plant Entrance to Administration Building	Primary	Concrete	40 km/h	7.5 m	WB-20
Connection to municipal roads	Primary	Concrete	40 km/h	7.5 m	WB-20
Interior plant roads	Primary	Concrete	40 km/h	7.5 m	WB-20
Interior plant roads	Secondary	Concrete or Asphalt	30 km/h	7.5 m	HSU
Approaches to Buildings	Secondary	Concrete or Asphalt	30 km/h	7.5 m	HSU
Other	Gravel	Gravel	30 km/h	6.0 m	HSU
Construction Roads	Gravel	Gravel	30 km/h	6.0 m	As required

2. Posted speeds for roadways are intended to be 10 km/h less than design speed.

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 23 of 37
		Document Code:	

3. Primary roads shall be designed and constructed as concrete pavement with a minimum 30-year design life.
4. Secondary roads shall be designed and constructed as asphalt or concrete pavement with a minimum 20-year design life for asphalt pavement and 30-year design life for concrete pavement.
5. There shall be two classifications of roadway type, Urban and Rural. Each shall be designed as follows:
  - 5.1 All urban roadways shall be designed and constructed with a Mountable Curb (COW detail SD-201 for concrete pavement) or Mountable Curb and Gutter (for asphalt pavement). The exception shall be at all containment areas where Barrier Curb shall be constructed. All administration buildings and public areas with accessibility requirements shall have curb ramp constructed. Drainage shall be accommodated along gutters and shall be collected in drainage inlets with either catch pits or catch basins. Boulevards shall be graded flush to the top of the curb along the roadway edges.
  - 5.2 All rural roadways shall be constructed with an embankment 0.9 m above surrounding existing ground, side slopes to a ditch, ditch width and ditch back slope. Ditch widths and depths shall be designed to accommodate the specified storm events.

## 6.2.2 Pavement Structure

1. Concrete or asphalt pavement surface thickness (concrete or asphalt) and pavement structure shall be determined according to the AASHTO Guide for Design of Pavement Structures based on the traffic movement data obtained from the City of Winnipeg. Base/Sub-base materials should be in accordance with City of Winnipeg Standard Construction Specifications CW 3110 and City Approved Products for these materials
2. Minimum pavement structure requirements for Primary Roads:
  - 2.1 200 mm reinforced Portland cement concrete pavement;
  - 2.2 100 mm of compacted Granular A base course material;
  - 2.3 325 mm of 50 mm compacted Granular A crushed sub-base material;
  - 2.4 Geogrid
  - 2.5 Separation/filtration geotextile; and
3. Minimum pavement structure requirements for Secondary Roads (Asphalt)
  - 3.1 50 mm of Asphaltic concrete pavement Type IA;
  - 3.2 75 mm of Asphaltic concrete pavement Type III;
  - 3.3 100 mm of compacted Granular B base course material;
  - 3.4 125 mm of 50 mm compacted Granular B crushed subbase material;
  - 3.5 225 mm of 100 mm compacted Granular B crushed subbase material;
  - 3.6 Geogrid as per City of Winnipeg Standard Construction Specifications CW 3135;
  - 3.7 Separation/filtration geotextile as per City of Winnipeg Standard Construction Specifications CW 3130.
4. Minimum pavement structure requirements for Secondary Roads (Concrete)
  - 4.1 150 mm reinforced Portland cement concrete pavement;
  - 4.2 100 mm compacted Granular B base course material;

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 24 of 37
		Document Code:	

- 4.3 300 mm of 50 mm compacted Granular B crushed sub-base material;
- 4.4 Geogrid
- 4.5 Separation/filtration geotextile; and
- 5. Minimum pavement structure requirements for Gravel Roads
  - 5.1 75 mm compacted Granular A base course material;
  - 5.2 150 mm of 50 mm compacted Granular A crushed sub-base material;
  - 5.3 300 mm of 100 mm compacted Granular A crushed sub-base material;
  - 5.4 Geogrid
  - 5.5 Separation/filtration geotextile; and
  - 5.6 Gravel road structure may need to be evaluated on a case by case basis depending on its use.
- 6. All Portland Cement Concrete pavements shall be constructed with a longitudinal centreline joint and transverse joints as per the COW Standard Construction Specifications. All joints shall have either tie bars (tied joint) or dowels (moving joint) as per COW Standard Construction Specifications for the thickness of pavement in question.
- 7. All manholes or catch basins within pavement limits shall have isolations constructed, as per the COW Standard Construction Specifications.
- 8. At an urban site all roadways will be constructed using the Urban Classification with the exception of gravel roadways.
- 9. At rural sites all roadways will be constructed using both the Urban and Rural Classifications as directed by the City of Winnipeg.
- 10. Where asphalt or gravel pavement is permitted, provide concrete pavement where accessible parking is provided or where fully loaded transport vehicles are parked for extended periods.
- 11. Where gravel cross-section is permitted, consider the use of dust control systems where dust from road traffic may impact operations or adjacent private properties.
- 12. Separation/filtration geotextile as per City of Winnipeg Standard Construction Specifications CW 3130 "Supply and Installation of Geotextile Fabrics".
- 13. Geogrid as per City of Winnipeg Standard Construction Specifications CW 3135 "Supply and Installation of Geogrid".

### **6.2.3 General Roadway Grading Requirements**

- 1. All urban roadways will have a minimum longitudinal gutter gradient of 0.50% with a maximum grade differential at low or high points of 2.0%. Low or high points with a longitudinal grade differential of greater than 2.0% shall have a vertical curve incorporated into the design. The vertical curve K value will be in accordance with the design speed for the road and TAC guidelines.
- 2. Minimum longitudinal gutter gradient around radii or on Cul-de-Sacs shall be 0.75%.
- 3. All urban roadways shall have a minimum transverse crossfall of 2.0%.
- 4. All rural roadways shall be constructed with a 2.0% crossfall for paved roadways and 4.0% for gravel surface roadways.
- 5. All rural roadways shall have a minimum 0.50 m shoulder rounding allowance, minimum 4:1 side slope, and 3:1 back slope.

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 25 of 37
		Document Code:	

6. Minimum longitudinal grades for ditches shall be 1.0% or in extreme cases of very long ditches 0.75%.

### **6.2.4 Roadway Signage Requirements**

1. All roadway signage shall be designed in accordance with the Manual of Uniform Traffic Control Devices for Canada (MUTCDC).
2. All roadway signage installation locations shall be designed in accordance with the MUTCDC.
3. Stop/Yield signs shall be provided on the secondary road at intersections with Primary Roads and on the Gravel roads at intersections with Secondary Roads.
4. Speed limit signs shall be provided on all Primary Roads and shall be considered to be 10 km/h less than the applicable design speed.
5. All pavement striping for Primary Roads shall be installed in accordance with MUTCDC.

### **6.2.5 Roadway Clearance Requirements**

1. Lateral clearance requirements from edge of roadway to physical obstructions including but not limited to; poles, trees and buildings, shall be in accordance with the Clear Zone requirements from TAC for the applicable design speed of each type of roadway.

### **6.2.6 Sidewalks**

1. Design sidewalks for all pathways between buildings routinely utilized by Operations personnel.
2. All sidewalks shall be concrete.
3. Concrete sidewalks shall be minimum 1.5 m wide with 100 mm thick slab according to the COW detail SD-228A. Thickness of Granular B sub-base course shall be 150 mm.

### **6.2.7 Parking Lots**

1. Parking lot pavement type:
  - 1.1 Administration and Workshop areas (all sizes): concrete.
  - 1.2 Parking lots for greater than ten vehicles: asphalt or concrete.
2. Layout:
  - 2.1 Minimum parking stall width: 2.8 m
  - 2.2 Minimum parking stall length/depth: 6.1 m
  - 2.3 Minimum parking aisle width: 7.0 m
3. Parking lot shall include number of barrier free parking stalls according to the City of Winnipeg Accessibility Design Standard. This is expected to only be applicable for the Administration Buildings and public areas of the wastewater treatment plants.
4. Minimum requirements for concrete parking lot pavement:
  - 4.1 Pavement surface: 150 mm Reinforced Portland cement Concrete Pavement;
  - 4.2 Base course: 100 mm of Granular B base course material; and
  - 4.3 Sub-base course: 325 mm of 50 mm crushed Granular B sub-base material;

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 26 of 37
		Document Code:	

- 4.4 Geogrid; and
- 4.5 Separation/filtration geotextile.
- 4.6 Minimum slope for concrete pavement 1%.
- 5. Minimum requirements for asphalt parking lot pavement:
  - 5.1 Pavement Surface: 100 mm of asphalt Type IA; Base Course: 100 mm of Granular B base course material;
  - 5.2 Sub-base Course: 375 mm of 50mm crushed sub-base material;
  - 5.3 Geogrid; and
  - 5.4 Separation/filtration geotextile.
  - 5.5 Minimum slope for asphalt pavement 1%.
- 6. All parking lots shall have yellow parking stall pavement markings and accessible parking stalls shall have markings in accordance with City of Winnipeg codes and by-laws.
- 7. All concrete parking lot pavements shall have joints constructed as per City of Winnipeg Standard Construction Specifications.
- 8. All manholes/catch basins in concrete parking lots shall have isolations constructed in accordance with City of Winnipeg Standard Construction Specifications.

### **6.2.8 Road Removals/Restorations**

- 1. Removal of concrete pavement and concrete curbs shall be performed according to the City of Winnipeg Standard Construction Specifications CW 3110 "Sub-Grade, Sub-Base and Base Course Construction" and CW 3230 "Full-Depth Patching of Existing Pavement Slabs and Joints".
- 2. Removal of gravel roads shall be performed according to the City of Winnipeg Standard Construction Specifications CW 3110 "Sub-Grade, Sub-Base and Base Course Construction".

## 7 SITE DRAINAGE CRITERIA

### 7.1 General Requirements

1. Provide a comprehensive site drainage design.
  - 1.1 The general site grading will establish a working surface for operating and construction areas, provide positive drainage from buildings and structures, and provide adequate soil coverage for underground utilities.
2. On-site drainage will be accomplished through gravity flow whenever possible. The surface drainage system will consist of gentle, uniform slopes.
3. The NEWPCC shall meet the urban area drainage design criteria; the SEWPCC and the WWPCC shall follow the rural area drainage design criteria.
4. The site will be graded away from structures with an appropriate slope for drainage. Minimum standard of acceptance is 2% uniform slope. The 100-Year event shall not pond against the building structure.
5. For modifications to existing sites with existing drainage infrastructure, review the ability of the existing system to accommodate additional flow. If the existing system cannot accommodate additional flow and this was not noted within the project scope, discuss the deficiencies with the City. Provide solutions to the City, which may include additional stormwater storage or upgrades to existing infrastructure.
6. Design temporary facilities for site and excavation drainage during construction.

### 7.2 Design Criteria

1. Hydrologic Methodology
 

Stormwater analysis must be completed using either the Rational Method, or Stormwater Modeling analysis. Use of any other methodology will not be permitted unless otherwise authorized by the City.

Use of Rational Method analysis shall be limited to:

  - Systems with catchment areas less than 100 ha.

Stormwater Modeling analysis is preferred for all analysis, and will be required for:

  - Systems with catchment areas larger than 100 ha.
  - Systems with detention or retention basins.
  - Regional drainage analysis
2. Rainfall Return Period
  - 2.1 Land drainage infrastructure must be designed to the rainfall return period shown in Table 7-1

**Table 7-1 : Design Rainfall Return Period**

<b>Infrastructure</b>	<b>Rainfall Return Period</b>
Sewers	The greater of 5 year or what is required under the pavement drainage criteria.
Ditches	25 year (summer)
Onsite Storage	25 year (summer)
Stormwater Detention/Retention Basins	100 year (summer) or May 2010

1. Tailwater Return Period
  - 1.1 Contact the City of Winnipeg (wwd-landdevelopmentrequests@winnipeg.ca) for tailwater design conditions.
2. Design Rainfall
  - 2.1 Rainfall intensity values shall be calculated based on the intensity – duration formula below:

$$i = a / (t_c + b)^c$$

where: i = rainfall intensity in mm/hr

$t_c$  = time of concentration in minutes.

- 2.2 City of Winnipeg design rainfall (IDF) coefficients are listed in Table 7-2.

**Table 7-2 : IDF Coefficients**

<b>Design Rainfall</b>	<b>a</b>	<b>b</b>	<b>c</b>
5 Year	1199	8	0.828
25 Year	1842	9	0.842
100 Year	2318	8	0.856

- 2.3 Design Rainstorms
  - 2.3.1 Artificial rainfall hyetographs shall be based on the “Chicago” design rainstorm developed from the above IDF parameters for summer and spring design storms. The hyetograph for the 2010 May extreme rainfall design storm is based on measured rainfall data.
3. Hydrologic Parameters
  - 3.1 Drainage Limits
    - 3.1.1 All runoff entering the area must be accommodated by the design, including any form third party lands (existing drainage patterns must be maintained)
  - 3.2 Runoff Coefficients and Imperviousness
    - 3.2.1 Runoff coefficients and imperviousness shall be used as shown in Table 7-3.

**Table 7-3 : Runoff Coefficient "C" Values**

Surface Type	C Value	Imperviousness (%)
Forest and Bush	0.15	10
Natural grassland	0.15	10
Grass Boulevards and Lawns	0.15	10
Pavement, Gravel	0.65	60
Pavement, Asphalt or Concrete	0.95	100
Roofs	0.95	100

- 3.3 Time of Concentration
- 3.3.1 For developed areas, time of concentration shall be a maximum of 10 minutes, or as otherwise provided by the City of Winnipeg.
- 3.3.2 For undeveloped rural areas, the designer shall calculate time of concentration using a method suitable for the site.
- 3.4 Conveyance Elements
- 3.4.1 The following conveyance parameters shall be used for analysis:

**Table 7-4 : Manning's Coefficient for Conveyance Elements (Pipes, Channels)**

Conveyance Type	Conveyance Material	Manning's Roughness Coefficient
Pipe	Concrete or plastic, smooth wall	0.013
	Metal or plastic, corrugated wall	0.024
Pavement or Gutters	Concrete, asphalt	0.015
	Gravel	0.020
Channels	All – subject to actual drain conditions	0.035 (minimum)

4. Infiltration into Pervious Surfaces
- 4.1 The following Infiltration parameters shall be used for analysis:
- Methodology: Horton Method
  - Initial infiltration rate: 75 mm/hr
  - Ultimate infiltration rate: 3.0 mm/hr
  - Decay constant: 4.1 /hr
  - Drying time: 7 days
5. Depression Storage
- 5.1 The following depression storage depths shall be used for analysis:
- Impervious Surfaces 2.0 mm
  - Pervious Surfaces 5.0 mm

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 30 of 37
		Document Code:	

### 7.3 Site Design

1. Site design criteria must conform to the Sewer By-law (106/2018) and the Lot Grading By-Law (7294/98).
2. Where restriction is required to limit the amount of flow leaving a catch basin lead, flow restriction shall be achieved by a permanent device such as grouting a smaller restricted pipe into the catch basin lead invert at the manhole. Orifice plates, or any removable restriction device will not be allowed. Refer to Standard Construction Specification SD-025B.
3. Maximum depth and extent of ponding shall not exceed 0.3 m of depth on paved surfaces for the 25-year MacLaren City's design rainfall.

### 7.4 Ditches

1. New ditches will be built and existing ditches shall be regarded or filled according to the City of Winnipeg Standard Construction Specifications CW 3170 "Earthwork and Grading" and CW 3110 "Sub-Grade, Sub-Base and Base Course Construction".
2. Ditches shall be designed that the side slopes are not steeper than 4 to 1, minimum bottom width of 1.0 m and minimum longitudinal slope of 0.1%.
3. Ditch sides and bottom surfaces shall be covered with erosion control blanket to promote establishment of vegetation.
4. The ditch and culvert system shall be designed such that the anticipated water level shall not exceed the channel banks for the design event.

### 7.5 Culverts

1. Culvert and drainage inlet/outlet structures shall be designed based on the City of Winnipeg's Culvert and Drainage Inlet/Outlet Safety Guidelines.
2. New culverts will be built and existing culverts shall be removed according to the City of Winnipeg Standard Construction Specifications CW 3610 "Installation of Culverts".
3. Minimum culvert size shall be 450 mm.
4. Designs shall conform to the requirements in the "Culvert and Drainage Inlet/Outlet Safety Guidelines".

### 7.6 Land Drainage Sewer

1. LDS installation shall be in accordance with the City of Winnipeg Standard Construction Specifications CW 2130.
2. Maximum hydraulic grade line (HGL) must remain at least 0.3 m below ground level during the Rainfall Return Period design basis.
3. LDS pipes shall be designed with a minimum full flowing velocity of 0.9 m/s.
4. The minimum LDS diameter shall be 300 mm; minimum catch basin lead size shall be 250 mm.
5. Minimum depth of cover for LDS pipes shall be 1.50 m from pipe crown to finished grade.

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 31 of 37
		Document Code:	

## 7.7 Manholes and Catch Basins

1. Manholes and Catch Basins installation shall be accordance with the City of Winnipeg Standard Construction Specifications CW 2130.
2. Manholes are required at all changes in pipe size, alignment deflections greater than 30 degrees, changes in grade and upstream ends of land drainage sewers;
3. The maximum LDS manhole spacing shall be:
  - 120 m, for sewers less than 750 mm in diameter; and
  - 150 m, for sewers 750 mm in diameter and larger.
4. Catch basins shall be installed:
  - at sag low points within pavements; and
  - as required in 'on-grade' situations on continuous roadway slopes to manage flow encroachment into travel lanes.
5. Catch basin leads shall have a minimum diameter of 250 mm. A catch basin lead shall service only one catch basin. Maximum catch basin lead length shall be 30 m. If a longer lead is required, then a 1200 mm catch basin manhole shall be substituted in place of a standard catch basin.
6. Construct manholes, catch basins and catch pits in accordance with the Standard Construction Specifications.

## 7.8 Retention and Detention Storage

1. All retention and detention facilities shall be naturalized and meet the City of Winnipeg Criteria for Stormwater Management.
  - 1.1 Maximum design water level rise in 25-year design rainfall is 1.8 m for industrial or open space.
2. Stormwater retention basin shoreline revetment shall be in accordance with City of Winnipeg Standard Construction Specifications CW 2165 and detail drawing SD-026.

## 7.9 Oil and Sediment Interceptors

1. Oil and sediment separators shall be provided in accordance with the City of Winnipeg Sewer By-law.

## 7.10 Flood Protection measures for Sewage Treatment Plants

1. Contact the Department for design requirements for gate chambers, dual flap gates, and temporary dewatering pumping arrangements and rates, etc. (wwd-floodprotection@winnipeg.ca)



	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 33 of 37
		Document Code:	

## 8 CIVIL DESIGN TEAM RESPONSIBILITIES

### 8.1 General

1. Responsibility for deliverables
  - 1.1 All drawings and other deliverables related to a design are the responsibility of the civil designer / engineer.
2. Ensure all civil design deliverables are sealed by a qualified professional civil engineer registered in the Province of Manitoba.
3. Completeness of drawings:
  - 3.1 All drawings shall be comprehensive in nature to allow for effective use in construction.
4. Update of existing drawings:
  - 4.1 If the project is an addition, expansion, upgrade or modification to an existing site or facility, existing drawings may require up-dating. Coordinate with the City to understand the specific requirements. Typical requirements include.
    - Update existing site plans.
5. Design reviews:
  - 5.1 Issue the design documents to the City for review at appropriate intervals in accordance with the City's expectations.
  - 5.2 Detailed drawings and specifications (hard copy and electronic format) at the 33%, 66% and 90% working drawings stages, or other design review milestones approved by the City.
  - 5.3 Incorporate all WSTP comments into the design. Where a WSTP comment is not accepted by the design team, provide a complete response, including rationale, to the City Project Manager.
6. As-Built Drawings:
  - 6.1 All design deliverables shall be updated to "as-built" status at the end of the project. The "As-Built Drawing" documents shall incorporate contractor mark-ups, inspections performed by the design team, Change Orders, RFIs, Field Instructions, and other communication between the Contractor and Design Team.
  - 6.2 Unless otherwise specified by the City and agreed to by the Design Team, as-built drawings are not required to be sealed (Otherwise known as record drawings).
  - 6.3 Record drawings for all underground utilities and services.
7. External, 3<sup>rd</sup> Party Consultants:
  - 7.1 Expertise and assistance may be required, from external 3<sup>rd</sup> party specialized consultants, outside of the primary civil design team.
  - 7.2 The design team shall be responsible for monitoring the activities and progress of each 3<sup>rd</sup> party consultant.
  - 7.3 It is the responsibility of the design engineer to ensure that the deliverables follow all City standards and guidelines.
8. Site Visits:
  - 8.1 The design team is responsible for ensuring that a sufficient number of site visits occur to facilitate the understanding of specific field conditions or status of existing facilities and buildings.

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 34 of 37
		Document Code:	

## 9. Demolition Requirements

- 9.1 It is generally required that the civil designer / engineer is responsible for associated demolition works required to implement the scope of work. Clearly indicate all demolition requirements on the drawings and in the specifications.
- 9.2 Where demolition requirements are significant, create dedicated demolition drawings.

## 8.2 Drawings

Provide a comprehensive set of drawings to detail the civil construction requirements. The drawings indicated in this section are minimum requirements for new construction, unless otherwise approved by the City. All drawings shall meet or exceed City of Winnipeg Water and Waste Department WWD CAD/GIS Standards (August 2016) and the Manual for the production of Construction Drawings for the City of Winnipeg, Works and Operations Division (November 1984).

### 8.2.1 General Requirements

1. All civil drawings are to be produced on a standard ANSI D size drawing.
2. All civil drawings shall be to scale.
3. All dimensions required for construction shall be shown.
4. Indicate north direction on all plan drawings.
5. Provide scale bars on drawings to allow for simplified scale takeoff on the drawings.
6. Differentiate new work from existing work via bold lines.

### 8.2.2 Drawing List

1. Provide a drawing list that identifies all individual drawings/pages within a drawing set. The drawing list shall include:
  - 1.1 Index for each drawing
  - 1.2 City drawing number for each drawing
  - 1.3 Consultant/designer drawing number for each drawing (if applicable)
  - 1.4 Title/description of each drawing

### 8.2.3 Legend

1. Provide a legend drawing showing the symbols and abbreviations utilized. Ensure that the legend is consistent with the City's practices and other disciplines.

### 8.2.4 General Notes Drawing

1. Provide a general note drawing.
2. Content
  - 2.1 Include general construction notes.
  - 2.2 Provide key design criteria

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 35 of 37
		Document Code:	

### 8.2.5 Existing Site Plan

1. Provide a detailed site plan of the existing facility, prior to construction.
2. Contents shall include:
  - 2.1 All existing surface topography and spot elevations
  - 2.2 All existing underground plant
  - 2.3 All existing legal boundaries
  - 2.4 Label all existing buildings/facilities
  - 2.5 All existing underground utilities
3. Format:
  - 3.1 Scale:
    - 3.1.1 Maximum: 1:500

### 8.2.6 Site Plan

1. Provide an overall site plan showing all buildings and major services.
2. Contents shall be in accordance with the current City of Winnipeg Development Permit Application Checklist for Commercial and Multi-unit Residential "Site and Landscape Plan Checklist" (<https://legacy.winnipeg.ca/ppd/Documents/Permits/Development-Permit-Application-Checklist-Commercial-Multi-Unit-Residential.pdf>).
3. Format:
  - 3.1 Scale:
    - 3.1.1 Maximum: 1:500

### 8.2.7 Site Servicing Plan

1. Provide detailed plans showing all piping in the yard.
2. Contents shall be in accordance with the current City of Winnipeg Development Permit Application Checklist for Commercial and Multi-unit Residential "Site Servicing Plan Checklist" (<https://legacy.winnipeg.ca/ppd/Documents/Permits/Development-Permit-Application-Checklist-Commercial-Multi-Unit-Residential.pdf>).
3. Format:
  - 3.1 Scale:
    - 3.1.1 Maximum: 1:500

### 8.2.8 Lot Grading Plan

1. Provide detailed yard grading plan including all slopes and elevations.
2. Contents shall be in accordance with the current City of Winnipeg Development Permit Application Checklist for Commercial and Multi-unit Residential "Lot Grading Plan Checklist" (<https://legacy.winnipeg.ca/ppd/Documents/Permits/Development-Permit-Application-Checklist-Commercial-Multi-Unit-Residential.pdf>).
3. Format:
  - 3.1 Scale:
    - 3.1.1 Maximum: 1:500

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 36 of 37
		Document Code:	

## 8.2.9 Plan and Profile Drawings

1. Provide a comprehensive set of drawings to detail the plan and profile of all buried services and surface grades and roadwork.
2. Format:
  - 2.1 Scale:
    - 2.1.1 Maximum plan view: 1:250
    - 2.1.2 Maximum profile view: 1:10

## 8.3 Other Documents

### 8.3.1 Traffic Management Plan

1. Provide a traffic management plan for all facility upgrades where traffic is affected. The traffic management plan shall be developed to maintain the safe and efficient passage of vehicular and pedestrian traffic on existing roadways and sidewalks within and adjacent to the site.
2. Ensure that safe and efficient emergency vehicle access is maintained to the site at all times.
3. Construction and operations traffic shall be considered during the roadway and parking design and the overall approach shall consolidate construction traffic to minimize impacts to existing plant operation. This includes employee traffic and parking, surrounding environments and deliveries and pickups required for normal plant operations.
4. Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out work or haul materials or equipment. All traffic controls to be in accordance with the latest edition of the City of Winnipeg Manual of Temporary Traffic Control on City Streets (herein after called The Manual).
5. Do not close any lanes of City streets or control areas outside the wastewater treatment facility without approval of the City of Winnipeg Public Works Department.
6. When construction activities disrupt the normal flow of public traffic, provide and maintain flag persons, traffic signals, barricades and flares, lights and lanterns as required to direct the flow of equipment used in performance of the Work and to protect public traffic in accordance with "The Manual".
7. Where applicable ensure that all traffic disruptions and plans are updated to the City of Winnipeg Waze traffic information program managed by the City of Winnipeg's Transportation Management Centre (TMC).
8. If it is necessary to haul materials over roads that are not designated as truck routes, the Contractor shall be responsible for obtaining written acceptance from the AHJ and/or the City of Winnipeg Public Works Department for use of proposed haul routes within their respective jurisdictions.
9. If a new access road is required for construction purposes, the Contractor shall obtain necessary permits and approvals in consultation with the City of Winnipeg Public Works Department or appropriate Government Authority having jurisdiction.
10. Plan for pedestrian and vehicular traffic control to be compatible with construction operations employed in each construction area. If existing parking facilities will be

	<b>WSTP Civil Design Guideline</b>	Revision: 003	Page 37 of 37
		Document Code:	

disrupted by the work; provide temporary parking facilities so as not to obstruct the construction zone and the flow of the vehicular and pedestrian traffic.

11. Incorporate construction sequencing and operations within the traffic management plan.
12. Include procedures for pedestrian and vehicular traffic routing and protection in immediate construction area and surrounding area during working and nonworking hours.
13. When deemed necessary due to construction activities, provide well graded detours or temporary roads to facilitate passage of traffic around restricted area. Provide and maintain signs and lights and maintain roadway. Reduce the length of detours to the degree possible.
14. Provide and maintain reasonable road access and egress to all facilities in vicinity of the Work unless other reasonable means of road access exist.
15. Contractor parking will be permitted on-site provided it does not disrupt existing site operations, employee traffic or parking, and the performance of the Work.
16. Provide and maintain dust control in the construction areas and along any approved traffic diversion route or temporary parking area.
17. Keep the travelled way free of mud and debris. Materials spilled on, or dropped along, or across any roadway, both within and outside the contract limits, shall be removed immediately.
18. Do not proceed with construction of any portion of the work until relevant plans for traffic control measures have been presented and the implementation of those measures have been reviewed and approved.

## 8.4 Design Calculations

1. Provide detailed design calculations in accordance with the relevant codes and authorized local and national bodies taking into account the most unfavorable conditions. Design calculations shall be submitted with the design drawings as part of the review cycle to allow for parallel review. At minimum, the following calculations shall be submitted to the City for review.
2. Submit draft design calculations to the City when the design calculation is performed, such that the calculation can be referenced during the review stage.
3. Provide final calculations, updated to include any modifications during design and construction, as part of the final as-built/record package.

## 8.5 Civil Servicing Report

1. Provide civil servicing report including design briefs, outline specifications, calculations, design criteria and associated figures and appendix for water distribution system, wastewater collection system and land drainage study.