



# GENERAL PREFACE

DESIGN AND CONSTRUCTION MANUAL

## Vertical Municipal Infrastructure Standards



# REVISION TRACKING

## General Preface

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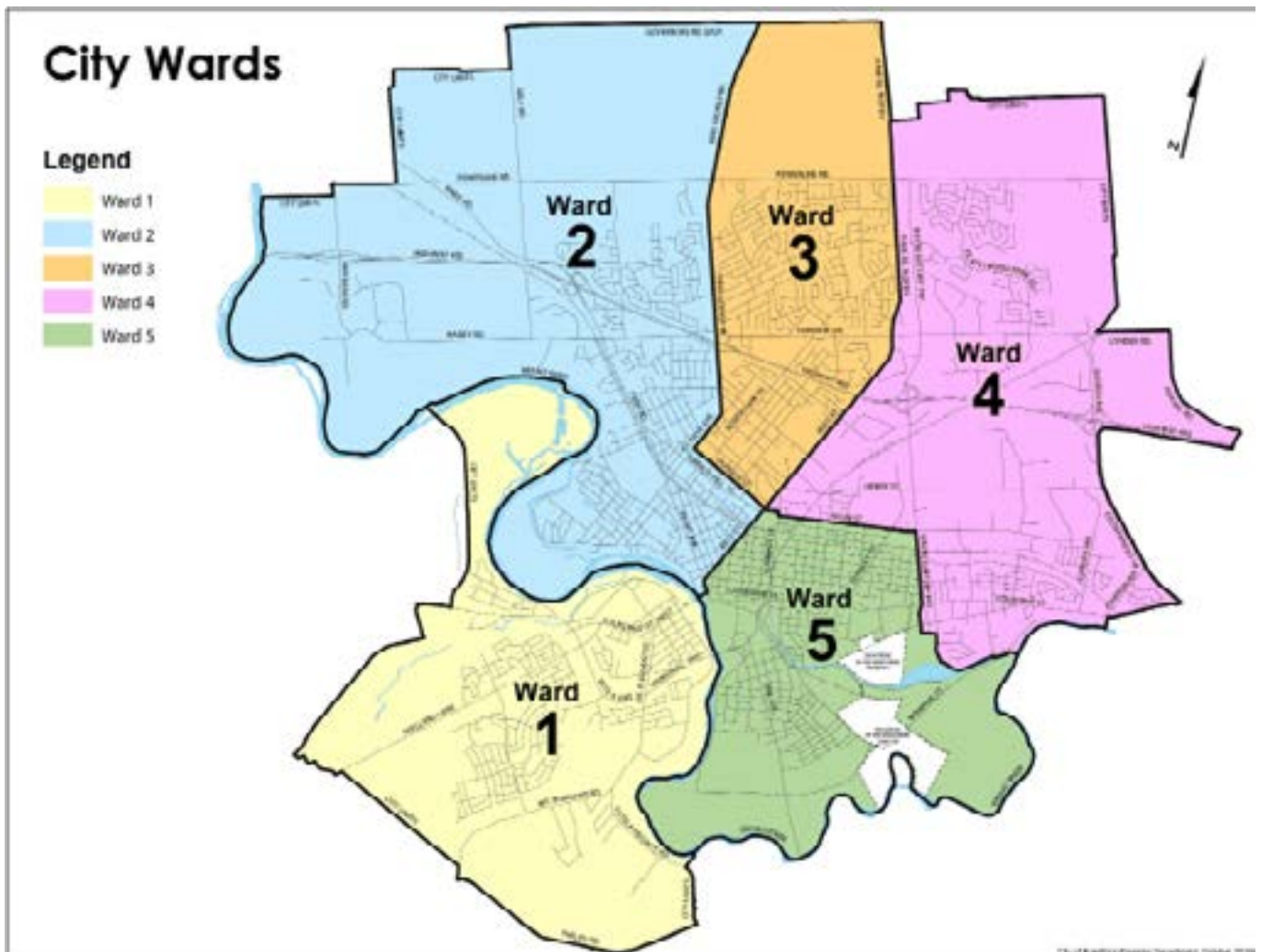
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## 1.0 PREAMBLE

The City of Brantford, situated on both sides of the picturesque Grand River, is located in the heart of southwestern Ontario. The City is a single-tier municipal government that is fully independent with access to major highways and surrounded by the County of Brant and neighbouring Six Nations of the Grand River.

The City is responsible for water treatment, transmission and distribution, storage facilities, pumping stations, wastewater treatment, sanitary sewers, forcemains, wastewater pumping stations, road networks, storm sewers, drainage ditches, culverts, and stormwater management ponds.

As the City is responsible for the ongoing management, operation, maintenance, planning, and growth of its municipal infrastructure, consistency is essential in the quality of design. These guidelines have been developed to achieve an accurate representation of the expectations and visions for the City moving forward.



## 2.0 DEFINITIONS AND ABBREVIATIONS

The following are definitions for terms and abbreviations used throughout the manual.

TERM	DEFINITION
ACI	American Concrete Institute
ANSI	American National Standards Institute
AODA	Accessibility for Ontarians with Disabilities Act
APL	Approved Products List
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
BAS	Building Automation System
BEP	Best Efficiency Point
BOM	Bill of Material
CCTV	Closed-circuit Television
CI	Chlorine Institute
City	The Corporation of the City of Brantford and all entities owned by it
CGSB	Canadian General Standards Board
Contractor	Any person, persons, or corporation undertaking the installation of municipal infrastructure and services in the City.
CPTED	Crime Prevention Through Environmental Design
CSA	Canadian Standards Association
CSI	Construction Specifications Institute
DC	Direct-current
DO	Dissolved Oxygen
DRAP	Design Review Advisory Panel (standard review)
DWWP	Drinking Water Works Permit
ECA	Environmental Compliance Approval
EEMAC	Electrical and Electronic Manufacturers Association of Canada
EPA	Environmental Protection Agency
ESA	Electrical Safety Authority
FAT	Factory Acceptance Testing
FDR	Final Design Report
FRP	Fiberglass-reinforced Plastic
GHS	Global Harmonized System
GRCA	Grand River Conservation Authority
HAZOP	Hazard and Operability
HI	Hydraulic Institute
H <sub>2</sub> S	Hydrogen Sulfide
HVAC	Heating, Ventilation, and Air Conditioning

## 2.0 DEFINITIONS AND ABBREVIATIONS (CONT'D)

TERM	DEFINITION
I&I	Inflow and Infiltration
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IFC	Issued for Construction
IFT	Issued for Tender
IIoT	Industrial Internet of Things
ISEA	International Safety Equipment Association
ISO	International Organization for Standardization
LCC	Life Cycle Cost/Costing
LCP	Local Control Panel
LED	Light-emitting Diode
LEL	Lower Explosive Limit
LID	Low Impact Development
MCC	Motor Control Centre
MDWL	Municipal Drinking Water License
MECP	Ministry of the Environment, Conservation, and Parks
MNRF	Ministry of Natural Resources and Forestry
MTO	Ministry of Transportation of Ontario
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
OBC	Ontario Building Code
OHSA	Ontario Occupational Health and Safety Act
OMAFRA	Ontario Ministry of Agriculture, Food and Rural Affairs
P&ID	Piping and Instrumentation Diagram
PCN	Process Control Narrative
PDR	Preliminary Design Report
PEO	Professional Engineers of Ontario
PLC	Programmable Logic Controller
POE	Power over Ethernet
POR	Preferred Operating Range
PRAP	Product Review Advisory Panel
Proponent	User of this manual
PTTW	Permit to Take Water

## 2.0 DEFINITIONS AND ABBREVIATIONS (CONT'D)

TERM	DEFINITION
RAS	Return Activated Sludge
RMF	Residue Management Facility
RPZ	Reduced Pressure Zone
SAT	Site Acceptance Testing
SCADA	Supervisory Control and Data Acquisition
SOPs	Standard Operating Procedures
TDGA	Transportation of Dangerous Goods Act
TSSA	Technical Standards and Safety Authority
UPS	Uninterruptible Power Supply
UTM	Universal Transverse Mercator
UV	Ultra Violet
VFD	Variable Frequency Drive
WAS	Waste Activated Sludge
WEF	Water Environment Federation
WHIMS	Workplace Hazardous Materials Information System
WTP	Water Treatment Plant
WWPS	Wastewater Pumping Station
WWTP	Wastewater Treatment Plant

### 3.0 INTRODUCTION

This manual is intended to provide the Proponent with a common reference to ensure the consistent application of design practices of vertical municipal infrastructure within the City. The information in this manual is provided to aid in the design of new water and wastewater vertical infrastructure and the retrofit of existing infrastructure. It is the City's objective that where the opportunity arises to modify or upgrade an existing facility, these guidelines are considered and applied whenever feasible.

Vertical municipal infrastructure covered in this manual includes the following:

- **Water:** Water treatment, pumping stations, reservoirs, elevated tanks, and bulk water fill stations;
- **Wastewater:** Wastewater pumping stations, septage receiving stations, wastewater treatment, and biosolids management; and,
- **Stormwater:** Stormwater pumping stations.

Linear infrastructure, including roads and transportation, watermains, gravity sewers, forcemains, storm sewers, and utilities, is covered under the Linear Municipal Infrastructure Standards.

**The key guiding principles of this manual are intended to:**

- Provide a comprehensive set of guidelines to aid in the consistent design and construction of new assets and retrofits of vertical municipal infrastructure;
- Integrate industry standards and best practices;
- Encourage consistent approaches for design in the City;
- Prioritize the health and safety of the public; and,
- Reduce impacts to the natural environment and protect natural resources.



The use of this manual does not absolve the Proponent from their professional obligations in applying sound engineering principles and industry best practices for solutions that are practical, reliable, economical, efficient, innovative, safe, and easy to operate and maintain while providing the best life cycle outcome for the City.

This manual neither supersedes nor replaces industry standards, regulations, and legislation governing the design and construction of vertical municipal infrastructure. The Proponent shall be fully familiar with all applicable legislative requirements as they relate to the subject infrastructure.

This manual will be reviewed and updated periodically to stay current with design guidelines and industry best practices as well as remain in compliance with regulatory requirements. It is the responsibility of the Proponent to ensure that they are using the most recent version of this manual.

The information provided is not intended to hinder innovation; rather, the information herein is rooted in meeting performance requirements over the life cycle of the infrastructure. The Proponent is encouraged to propose innovative solutions.

### 4.0 REFERENCE DOCUMENTS

The vertical infrastructure must be designed in accordance with the most recent version of applicable codes and regulations, industry standards and best practices, and the City's published guidelines and manuals. These include but are not limited to the following:



## 4.1 *Federal Codes and Regulations*

- National Building Code of Canada
- National Fire Code of Canada
- National Plumbing Code of Canada
- Canadian Electrical Code
- Guidelines for Canadian Drinking Water Quality, Health Canada
- Canada Wastewater Systems Effluent Regulations

## 4.2 *Provincial Codes, Regulations, and Guidelines*

- Ontario Building Code
- Ontario Electrical Safety Code
- Ontario Clean Water Act
- Ontario Safe Drinking Water Act and associated regulations
- Ontario Water Resources Act
- Ontario Nutrient Management Act
- Ontario Environmental Assessment Act
- Ontario Environmental Protection Act
- Ontario Occupational Health and Safety Act
- Ontario Accessibility for Ontarians with Disabilities Act
- Ontario Provincial Standards Specifications and Drawings
- Ontario Design Guidelines for Drinking-Water Systems
- Procedure for Disinfection of Drinking Water in Ontario
- Ontario Design Guidelines for Sewage Works
- Low Impact Development (LID) Stormwater Management Guidance Manual
- Guidelines for Environmental Protection Measures at Chemical and Waste Storage Facilities
- Water and Energy Conservation Guidance Manual for Sewage Works

- Environmental Noise Guideline - Stationary and Transportation Sources- Approval and Planning (NPC-300) Guidelines for Environmental Protection Measures at Chemical and Waste Storage Facilities
- Guidelines for Environmental Protection Measures at Chemical and Waste Storage Facilities
- Ontario Underground Infrastructure Notification Systems Act
- Provincial Guidelines for Utilization of Biosolids and Other Wastes on Agricultural Land

## 4.3 *City of Brantford Plans, Guidelines, and Standards*

- City of Brantford Master Servicing Plan
- City of Brantford Transportation Master Plan
- City of Brantford Official Plan
- City of Brantford By-laws
- City of Brantford Site Plan Manual
- City of Brantford Facility Accessibility Design Standards
- City of Brantford Design and Construction Manual Linear Municipal Infrastructure Standards
- City of Brantford SCADA Standards
- City of Brantford Corporate Energy Management Plan

## 4.4 *Industry Guidelines, Standards, and Best Practices*

- National Sanitation Foundation Standards
- American Water Works Association Standards
- National Fire Protection Association Standards
- Technical Standards and Safety Authority Standards (Ontario)
- Institute of Electrical and Electronic Engineers Standards
- The Instrumentation Systems and Automation Society Standards
- Hydraulic Institute Standards

## 4.4 Industry Guidelines, Standards and Best Practices (Cont'd)

- Canadian Standards Association Guidelines and Standards
- Chlorine Institute Guidelines
- American Society of Heating, Refrigerating and Air-Conditioning Engineers Standards
- National Electrical Manufacturers Association Standards
- Guide to Cost Predictability in Construction: An Analysis of Issues Affecting the Accuracy of Construction Cost Estimates, prepared by the Joint Federal Government/ Industry Cost Predictability Taskforce

## 5.0 PROPOSED DESIGN CHANGES AND DEVIATIONS

As this manual is intended to be updated as needed on a regular basis, Proponents shall submit any suggested changes via the Proposed Design Standard Change Form provided in the Appendices section of the manual.

In situations where it is not technically feasible to apply a particular design requirement, exercise judgment and identify all deviations from the guidelines as part of the design process in the Standard Deviation Form. Provide justification and demonstrate that any proposed deviation is consistent with sound engineering practice. The City will consider all deviation requests. However, the City reserves the right to enforce the standards herein.

## 6.0 USE OF THE MANUAL

This manual is divided into the following sections which are intended to be used in conjunction with one another:

- **General Preface:** Introduction to the manual, reference documents, and key design concepts
- **Common Elements:** Submission requirements and design guidelines for civil, landscape, architectural, structural, process mechanical, building mechanical, electrical, security and safety systems, standby power systems, and instrumentation and control systems applicable facilities

- **Water:** Design guidelines specific to water treatment, high lift pumping stations, reservoirs, elevated tanks, booster pumping stations, and bulk water fill stations
- **Wastewater:** Design guidelines specific to wastewater pumping stations, septage receiving, and wastewater treatment systems including biosolids management
- **Stormwater:** Design guidelines for stormwater pumping stations

## 7.0 KEY DESIGN CONCEPTS

### 7.1 Health and Safety

Ensure that the design complies with all applicable health and safety acts and regulations, including the Occupational Health and Safety Act (OHSA). Take reasonable measures to ensure that the design is safe for operations and maintenance staff. For example,

- Eliminate or minimize the need for confined space entries;
- Provide non-slip surface finish in all walkway areas to reduce the risk of falls;
- Provide secondary fall protection grating for all openings;
- Provide permanent fall protection appurtenances at all confined space entry points (for example, floor sockets for portable davits);
- Provide adequate separation between electrical equipment and sources of water (for example, pumps, piping, and valves); and,
- Keep control panel equipment (120 V and less) separate from motor starters (600 V or higher).

### 7.2 Redundancy

Allow for equipment and redundancy in system components to prevent single points of failure that would compromise either the overall function of the process or the minimum level of service. Design systems to permit servicing of each piece of equipment or sub-component without impacting the overall intended process.

### 7.3 Standardization

Consider standardization in consultation with the City during the design process. It should be emphasized that standardization does not mean sole-sourcing an item to a specific vendor. Rather, standardization means that multiple units of the same item should all be of the same type, size, and make to facilitate efficient operation and maintenance.

### 7.4 Cost Estimation

When evaluating alternative technologies or process equipment, consider the overall life cycle cost (LCC) along with the initial capital cost of an asset. Provide documentation of LCC analysis for all major capital assets and overall design.

All capital construction cost estimates must follow the requirements set in the *Guide to Cost Predictability in Construction*.

### 7.5 Energy Efficiency

Recognize the energy impact of the proposed designs and prioritize the specification and design of products and equipment that optimize energy consumption. Review the City's Corporate Energy Management Plan and ensure that the proposed works are in line with the City's goals and objectives.

### 7.6 Standard Operating Procedures

Review all relevant Standard Operating Procedures (SOPs) that may impact design decisions to ensure that the proposed design is consistent with the City's current practices. Inform the City of the updates required for existing SOPs if one or more SOPs need to be updated due to the unique nature of the proposed design.

## 8.0 APPROVED PRODUCTS LIST AND REVIEW PROCESS

### 8.1 Approved Products List

An approved products list (APL) is provided as an appendix to the Vertical Municipal Infrastructure Standards. The APL is intended for reference by Proponents who are specifying products as part of a project, or by other Proponents who are providing services or performing work for the City.

It should be noted that inclusion of a product on the APL does not constitute acceptance by the City that the product meets the design criteria for every project.

The APL identifies specific brands or suppliers of products the City has deemed will meet the requirements of this manual. The absence of a particular brand, product, or supplier from the APL does not necessarily imply that it does not meet the requirements. In addition, the APL is not to be construed as an endorsement of a given product, nor does the APL guarantee adequate performance of a given product relative to specific Contract requirements.

The APL shall in no way absolve the Proponent from their responsibility to ensure the right products are specified for their design.

### 8.2 Product Review Advisory Panel

A Product Review Advisory Panel (PRAP) is responsible for the selection, review, and approval of new product applications for equipment used in water, wastewater, and stormwater facilities within the City. The APL will be updated as required to ensure products and suppliers are current and reflect the existing needs of the City's infrastructure.

