DESIGN GUIDELINES

SANITARY FLOW GENERATION FOR NEIGHBOURHOOD DESIGN REPORT (NDR), WATER CONSUMPTION AND FIRE FLOW FOR HYDRAULIC NETWORK ANALYSIS (HNA)

AUGUST 2024

TERMS OF USE

The “Design Guidelines” is made available for use by developers and consultants in the City of Edmonton effective as of August 01, 2024 and is based on the most recent water use trends observed in the City of Edmonton. The “Design Guidelines” align with the zoning types introduced in the City of Edmonton Zoning Bylaw 20001. Should any user have questions as to the intent or accuracy of guidelines, the user is advised to seek clarification by sending an email to boundaryconditions@epcor.com.

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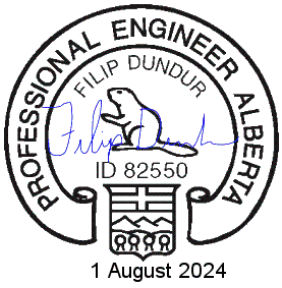 1 August 2024 Filip Dundur, P.Eng. Manager, Water Pipe Strategies
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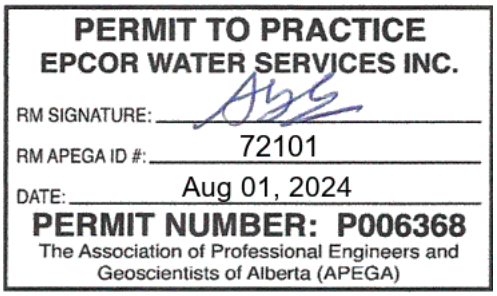 Abhishek Bhargava, P.Eng. Senior Manager, Pipe Strategies

The following is a list of revisions in the Design Guidelines.

Section	Description (Change)	Date
1.1.1	Reduction in residential sanitary flow generation for all new and infill development	August 2024
1.6	Reduction in Inflow and Infiltration (I&I) allowance for all new and infill development	August 2024
1.6	No separate inflow allowance for maintenance hole in sag location subject to certain conditions	August 2024
1.6	Allowance for foundation drain added	August 2024
1.7	No concurrent addition of peak dry weather flow as generated by population and land use in determination of peak design flow	August 2024
2.0	Restructure the HNA section to make requirements more concise. State only minimum report requirements to give consutlants the ability to present outcomes how they see fit. Change the report naming to provide consultants with opportunities to submit planning reports without hydraulic analyisis if it is not deemed necessary.	August 2024
Table 2.1	Align ICI demand assumptions with this document. Clarify demand scenario pressure critieria to align with current practice. Include reference to AWWA C900 for maximum pipe velocity to align with current practice	August 2024
Table 2.2	Align fire flow requirements to Addendum #1 Volume 4: ZBR Fire Protection Updates	August 2024

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1.0 SANITARY SEWER DESIGN FLOW

This section outlines the design criteria to assist the developers and the consultants in preparation of Neighbourhood Design Report or any subsequent amendments. The section applies to the design of sanitary sewage conveyance systems for all new and infill developments. The emphasis of this section is on those criteria that determine the size and profile of sanitary sewers. Refer to Volume 3-03 Section 1.0 for other design considerations such as alignments and the detailed design of appurtenances.

1.1 Estimating Sanitary Flows

1.1.1 Residential sanitary flow (population-generated)

The peak sanitary sewage flow for a residential population shall be determined by the following formula:

$$Q_{PDW} = \frac{G \times P \times PF}{86400}$$

where: Q_{PDW} = the peak dry weather flow rate (L/s)

and: G = the per capita daily sewage flow generation

G (L/day/person)	Context
160	For design of all new and infill developments
220	For analysis of an existing sewage network OR contact EPCOR Water Services (For lower value) at boundaryconditions@epcor.com

and: PF = a "peaking factor" determined as follows:

The peaking factor (PF) shall be the larger of 1.5 or :

$$PF = 2.6P_{pf}^{-0.1}$$

where P_{pf} = the design contributing population in 1,000's

1.1.2 For the design of sanitary sewers to serve small numbers of properties, such as a single typical subdivision, ***Table 1.1*** at the end of this section can be used as a guide to establish population (P) by zoning. Refer to the City of Edmonton Neighbourhood Structure Plan (NSP) Terms of Reference for determining people per unit by land use. For larger areas comprising several typical subdivisions or more, trunk sewers and pump stations are to be sized to accommodate average population densities as proposed in preceding statutory plans (General Municipal Plan, Area and Neighbourhood Structure Plans).

1.1.3 Commercial, institutional and industrial sanitary flow generation

For detailed system design, the average sanitary sewage flow from commercial, institutional and industrial land use areas is to be estimated on the basis of, in order of preference:

- Average daily flow generation computed using rates per business type, as set out in ***Table 1.2*** and ***Table 1.3*** at the end of this section;
- Average daily per area flow generation in accordance with proposed ultimate zoning, as set out in ***Table 1.4*** at the end of this section;
- Projected flows justified by the designer with specific and reliable information relating the projected land uses to flow generation characteristics;
- For high water consumption land uses, refer to Section **1.4**.

1.2 Average Flow Generation Estimates for Planning

For system planning purposes, when specific land uses and zoning are unknown and the requirements of ***Section 1.1*** cannot be defined, the recommended lower limits for estimation of average flow generation, to be used for preliminary planning unless the use of other values is justified with more

specific or reliable information, are as follows:

- Commercial and institutional land uses: The lower limit for average flow generation shall be 20 m³/day/ha;
- Industrial land uses: The lower limit for average flow generation shall be 8 m³/day/ha.

1.3 Determination of Peak Dry Weather Flow Rates

Peak dry weather flow rates for specific design for non-residential areas are to be determined by application of a peaking factor (PF), related to the average flow rate (Q_{AVG} in L/s) in accordance with the following expression to a maximum value of 25.0 and a minimum value of 2.5:

$$PF = 10Q_{AVG}^{-0.45}$$

1.4 High-Water-Consumption Land Uses

The foregoing guidelines do not apply to high-water-consumption land uses, for instance heavy industry, meat packing plants and breweries. Detailed analysis of the design requirements specific to each development proposal is required in such cases. Please contact EPCOR Water Services at boundaryconditions@epcor.com for further guidance.

1.5 Residential Components of Commercial Developments

Where proposed commercial developments include discretionary residential components, the sanitary flow generation from the residential component shall be determined in accordance with ***Section 1.1.1*** and is to be included in the determination of the total generation for the development.

1.6 Extraneous Flow Allowance - All Land Uses

In computing the total peak flow rates for design of sanitary sewers, the designer shall include allowances as specified below to account for flow from extraneous sources.

- General Inflow/Infiltration Allowance

A general allowance of I&I L/s/ha shall be applied, irrespective of land use classification, to account for wet-weather inflow to maintenance holes and for infiltration into pipes and maintenance holes.

I&I (L/s/ha)	Context
0.14	For design of all new and infill developments
0.28	For analysis of an existing sewage network OR contact EPCOR Water Services (For lower value) at boundaryconditions@epcor.com

- Inflow Allowance – Maintenance holes in Sag Locations

No separate allowance for inflow to maintenance holes located in street sags is required (for design of all new and infill developments). Instead, following is required:

  - All such maintenance holes cover shall have one pick hole only. Open pick hole to be sealed with HDPE plug and silicon (Type 6D – Refer Vol 3-06: DR-06-18-13)
  - Seal or line the top 1.5m section of the maintenance hole (from bottom of the maintenance hole frame)
  - Add prefix ‘SAG’ to such maintenance holes on the design drawings

- Foundation Drain (Weeping Tile) Allowances

Connection of foundation drains (weeping tile) to sanitary sewer systems is not permitted. Therefore, for new development areas a specific allowance for foundation drain flow to sanitary sewers is not required. However, the designer is required to include an allowance of 0.6 L/s/ha[1] for foundation drain flow when computing sanitary design flows from areas developed prior to 1990 where such connections may be present.

[1] *From RWMB Wastewater Collection System Master Plan*

1.7 Total Design Peak Flow Rates for Sanitary Sewers

Scenario	Sum of		
#1	Peak dry weather flow rates as generated by population	Average dry weather flow rates as generated by land use	All extraneous flows
#2	Peak dry weather flow rates as generated by population	----	
#3	----	Peak dry weather flow rates as generated by land use	

1.8 Tables of Sanitary Design Factors

Table 1.1: Residential Unit Density by Zoning

Zone[1]	Description	Zoning Bylaw Modifier[2]	(Net) Units/ha
RS	Small Scale Residential Zone		35
RSF	Small Scale Flex Residential Zone		42
RSM	Small-Medium Scale Transition Residential Zone		42
RM	Medium Scale Residential Zone	h16	80
		h23	125
		h28	225
RL	Large Scale Residential Zone	h50	300
		h65	325

[1] Refer to the NSP Terms of Reference for people per unit by land use.
[2] Modifiers are categories that restrict the maximum allowable height in each zone. For example, the h16 modifier means that developments under that designation have a maximum allowable height of 16 meters.

Table 1.2: Sanitary Flow Generation Design Rates by Business Type

Business Type	Flow Generation Per Business (m^3/day)[1]
Commercial Services	
Automotive Servicing Oil changes, lubrication, and general repair	2
Family Services and Places of Assembly Child care services, funeral homes, places of assembly and temporary shelters	3
Medical Services Clinics, dentists and rehabilitation services	3
Offices Administrative activities such financial services, insurance, general consulting, contracting offices, government offices and research and development offices	4
Other Services	
Public Safety Services Police, fire services and ambulance dispatches	7
Accommodations	
Hotels	50
Motels	30
Nursing Care Facilities	50
Continuing Care and Homes for the Elderly	20
Education	
Elementary and Junior Grade Schools	5
Senior Grade Schools	20
Industrial Services	
Small Manufacturing and Machining Businesses related to the manufacturing of physical materials such as machine shops, structure fabrication and metal works	3
Warehousing, Storage, Commercial Sales and Logistics Dedicated towards the storage of bulk goods such as refrigerated and general warehousing, freighting services, courier and shipping services, and industrial sales	4
Retail Services (Shopping Centers/Districts)	
Car Washes, Food Services, Gas Bars, Personal Care Services and Retail Shopping Outlets	See Table 1.4.1
High Water Use Facilities	
Events and Attractions	Contact EPCOR
High-rise Towers	
Hospitals	
Secondary Education Institutions and Buildings	
Sports and Recreation Facilities	
Other High Water Users (heavy industry, meat packing plants and breweries)	

[1] *Flow generation per business is based on 2019 water use records. If it is expected that the business will have unique uses or is uniquely sized, EPCOR can be contacted for further guidance at boundaryconditions@epcor.com.*

Table 1.3: Sanitary Flow Generation Design Rates by Business Type for Retail Services Common to Neighborhood Shopping Centers

Neighborhood Shopping Centers (developments of 2 to 15 ha in approximate size)				
Neighborhood Shopping Center	Business Type			Flow Generation Per Business (m^3/day)[1]
	Anchor Stores	Building Footprint	Large > 1.0 ha	22
			Small 0.5-1.0 ha	15
	Mid-size General Retail *(0.2 – 0.5 ha Building Footprint)*			4
	Small Retail & Personal Services			2
	Sit Down Restaurant & General Food Service			10
	Take Out Restaurant			8
	Gas Bar Only			2
	Carwash			23

[1] *Flow generation per business is based on 2019 water use records. If it is expected that the business will have unique uses or is uniquely sized, EPCOR can be contacted for further guidance at boundaryconditions@epcor.com*

Table 1.4: Commercial/Institutional and Industrial Sanitary Flow Generation Factors by Zoning

Land Use	Zone	Typical Lot Area (ha)[1]	Flow Generation (m^3/day/ha)[1,2,3]
Industrial	IM	0.3-1.5	10
	IH	0.3-2.0	10
	BE	0.3-1.5	10
Commercial	CG	0.3-2.0	40
	CB		
	CN	0.03-0.4	40
Mixed Use	Mixed Use (MU, MUN)	0.03-0.2	60

[1] *Contact EPCOR at boundaryconditions@epcor.com for assistance with atypical lot sizes and for assistance with high consumption land uses.*
[2] *Where water use for residential purposes is anticipated, flow generation is to be determined based on population and may be additive to other use generation.*
[3] *Flow generation is for Net Area that is assumed to be 80% of Gross Area*.

2.0 HYDRAULIC NETWORK ANALYSIS (HNA)

In general, a hydraulic network analysis (HNA) is required for any new development for which a hydraulic analysis has not been previously approved, or for any development that significantly alters the servicing scheme such that a previously approved hydraulic network analysis is no longer applicable. A report, authenticated and validated by a registered engineering professional, shall be submitted to boundaryconditions@epcor.com for review for each of the below:

2.1 High-Level Water Network Planning

High-level water network planning includes planning at a neighbourhood level and larger. Area Structure Plan (ASP) and Neighbourhood Structure Plan (NSP) level planning are the responsibility of the developer along with any associated analysis required by EPCOR Water Services (EWS).

Water Planning Report (WPR)

A Water Planning Report (WPR) is required to propose a water network to meet Table 2.1 and 2.2 where ASP and/or NSP are proposed or amended. A Water Planning Report (WPR) requires hydraulic analysis to be completed to support the water network and the report must be reviewed and supported by EWS prior to support of ASP and NSP Land Development Applications (LDA).

Every submission of a WPR must include, at minimum, the following:

- A digital version of a report, authenticated and validated by a registered engineering professional
- Hydraulic grade line(s) at existing water network connection points, provided by boundaryconditions@epcor.com, used to complete the analysis
- Analysis of the following based on Table 2.1 and 2.2:
    - Average Day Demand (ADD)
    - Maximum Day Demand (MDD)
    - Peak Hour Demand (PHD)
    - Maximum Day Demand plus Fire Flow
- Digital files of the hydraulic model used for the report
    - The water network in .shp, or equivalent format, in NAD83 3TM 114 GRID containing water main diameter, roughness and length.
    - Node data in a .dbf, or equivalent format, containing elevations and demands at each node.
    - Alternate formats can be discussed by contacting boundaryconditions@epcor.com
- Hydraulic modelling output tables are not required within the report, but must be provided upon request.
- Water Main diameter within every identified roadway within the structure plan that requires water infrastructure
- Location and assessment of water infrastructure appurtenances (check valves, pressure reducing valves, pump stations and reservoirs) as required
- Ground elevations consistent with Area Master Plans (AMPs) for ASP and Neighbourhood Design Reports (NDR) for NSP:
    - Highest and lowest ground elevations within the development boundary identified and analyzed for customer servicing
    - Lowest ground elevation, like creek crossings, where pipe pressure may exceed typical water main material specifications
- Water demands consistent with Table 2.1
- Staging or identifying how development will grow/expand
- Proposed Land Use

2.2 Local-level Water Network Planning

Local-level development includes proposed development planning that leads to detailed design. Examples can include, but not limited to, greenfield subdivision circulations and block-level infill.

Water Servicing Report (WSR)

A Water Servicing Report (WSR) is a comprehensive report showing the proposed water network for providing servicing and required fire protection meeting Table 2.1 and 2.2 along with the rest of Volume 4 of the City of Edmonton Design and Construction standards.

Every submission of a WSR must include, at minimum, the following:

- A digital version of a report, authenticated and validated by a registered engineering professional
- A statement confirming proposed water infrastructure meets Table 2.1 and 2.2 or discusses mitigations in detail
- A detailed map showing proposed water main sizing, existing infrastructure as required
- Any pertinent water infrastructure appurtenances (check valve, pressure reducing valve, etc.) as required
- Identifying lots being serviced and total number of lots
- Proposed Land Zoning

Greenfield Subdivision WSRs also require the following:

- A WSR is required to be accepted by EWS prior to support of any Subdivision LDA which proposes new water infrastructure.
- Confirmation that proposed network aligns with applicable WPR
- Phasing plans, if applicable, including infrastructure required to support each phase
- If hydraulic modelling is completed as part of the WSR, output tables are not required within the report but must be provided upon request.

Table 2.1: Water Servicing Guidelines for Hydraulic Network Analysis

Parameter	Value
Residential Average Day Demand (ADD)	220 L/c/d
Residential Maximum Day Demand (MDD)	330 L/c/d
Residential Peak Hour Demand (PHD)	660 L/c/d
Industrial/Commercial/Institutional (ICI) Demand	Section 1.8
Minimum Ultimate Servicing Pressure (PHD)	280 kPa
Minimum Interim Servicing Pressure (MDD)	280 kPa
Minimum Residential Fire Sprinklers Pressure (MDD)	350 kPa
Maximum Servicing Pressure (ADD)	550 kPa
Maximum Allowable Pressure in Distribution System (ADD)	700 kPa
Maximum Hazen-William's Coefficient	120
Maximum PVC Pipe Velocity	AWWA C900

Table 2.2: Fire Protection Guidelines for Hydraulic Network Analysis*

Parameter	Value
Minimum MDD+Fire Flow Pressure	140 kPa
Fire Flow for Single Family Residential (RS, RSF, RR)	100 L/s
Fire Flow for Mid-Value Multi Family Residential (RSM, MUN, CN, CG, CB, IM, A, PS, PSN, PU, UF)	180 L/s
Fire Flow for High-Value Multi Family Residential (RM, RL, MU, BE, IH, UI, AJ)	300 L/s
Fire Flow for NA	33 L/s
Fire flow for all other Zoning	FUS**

**Based on "Fire Flows for Zoning Bylaw Renewal – A Status Quo Approach, 2023"*
***"Water Supply for Public Fire Protection, A Guide to Recommended Practice in Canada, 2020" Part 2*