Report

MUNICIPALITY OF NORTH Cowichan

Date	March 11, 2025	File:	
Subject	Subdivision Control Bylaw Amendment Bylaw No. 3986 for first three readings		

PURPOSE

To introduce Subdivision Control Bylaw Amendment Bylaw No. 3986, which proposes to update the Water and Sanitary Design Standards.

BACKGROUND

Engineering's Business Plan includes projects to update North Cowichan's three water systems and three sanitary system models. The project involves migrating the models to new software, updating the models to reflect existing conditions, calibrating the models, updating the design criteria for future connections based on the calibration data, and developing a build-out model based on land uses in the 2022 Official Community Plan (OCP). The said models can then be used:

1) to understand what the residual capacity is in North Cowichan's systems;
2) to model the impact of land development applications on North Cowichan's systems to determine what, if any, upgrades might be triggered and the size of those upgrades;
3) to determine what upgrades should be considered as development-driven and to what degree, for the purposes of updating relevant Development Cost Charge (DCC) bylaws; and,
4) for general long-term capital planning and budgeting.

This report focuses on the development of new design criteria. The current design criteria are from 1993 and need updating to reflect better the current state of North Cowichan's water and sanitary systems. Factors that can affect the design criteria are as follows:

1) Significant changes in land development patterns, particularly increased density, can reduce per capita water consumption rates and sanitary inflow and infiltration (I&I) rates;
2) Increased density that is achieved through the construction of large, multi-storey wood-framed structures can dramatically increase the size of infrastructure to meet fire flow requirements;
3) As the age of a system changes, the water leakage and sanitary I&I rates can change significantly; and,
4) Conservation measures, such as measures introduced to reduce lawn watering or the prevalence of low-flow toilets, can reduce water consumption and sewage generation rates.

The proposed design criteria would be used to design infrastructure and assess the load placed on North Cowichan's water and sanitary systems by new development. The key design criteria are:

1) Water:
    a) Per capita water consumption rates for residential uses.
    b) Persons per unit area for calculating institutional, commercial, and industrial water consumption rates.
    c) Fire flow requirements.

2) Sanitary:
    a) Per capita sewage generation rates.
    b) Sewage generation rate peaking factors.
    c) Persons per unit area for calculating institutional, commercial, and industrial sewage generation rates.
    d) Inflow and infiltration rates.

In order to utilize the design standards to develop the build-out model, staff undertook a separate population study to determine what the district can expect to see in terms of the various archetypes (building forms) and the number of persons per unit (PPU) within each archetype. The PPU, based on a given archetype and a given zoning or OCP land use designation, allows for calculating the number of persons expected to reside within a given area. That then allows for calculating the expected water demand or sewage load at any location in the district. Professional judgment is used to determine the future population that might reside in a given area. There are several sources of uncertainty or challenges in establishing the level of accuracy of various parameters that go into setting the standards. For example:

1) There is some uncertainty when factoring in future institutional, commercial, and industrial loads. These introduce some uncertainty when calculating the net load on the water and sanitary systems, as the actual load that transpires when an application is submitted may be significantly higher or lower than what was assumed for a given parcel of land.
2) Developers may make submissions for high-density multi-family structures that move towards smaller units. This can have the effect of skewing the PPU counts and result in unexpectedly higher loads than assumed at the time that the modelling was done to size future infrastructure.
3) Bill 44 introduces significant uncertainty by essentially allowing developers to quadruple the number of housing units, and hence people, on qualifying parcels of land. This can dramatically affect sanitary servicing in particular.

For these reasons, incorporating some safety factors into the design standards is necessary to manage the risk of potentially higher loads than anticipated. This reality also underscores the need to regularly reassess the building forms, persons per unit, population projections, infrastructure modelling, and DCC rates.

DISCUSSION

Existing bulk meter data and water meter data were used to develop the proposed design rates. Per capita water consumption and sewage generation rates could be determined in concert with the estimated connected population or land area. Those rates were then compared to other municipalities, and broadly accepted engineering guidelines were used to set the new design standards.

The following tables compare the proposed water and sewer design rates to the district's existing bylaw, the Master Municipal Construction Document Design Guidelines (MMCD), and a variety of other Vancouver Island municipalities. In addition to the comparators provided below, several other municipalities use the MMCD guidelines as their design criteria, including the City of Victoria, the Town of Lake Cowichan, and the Capital Regional District.

Water

While several factors govern the sizing of water infrastructure, the most significant factor is required fire flow. To put this in perspective, the maximum day demand for the entire South End Water System is around 170 L/s. The required fire flow for industrial areas is 225 L/s. So, while the Maximum Day Demand (MDD) is an important factor in the design of the water systems, fire flow is the most impactful in the sizing of pipes and is somewhat impactful in reservoir sizing. MDD is somewhat impactful for reservoir sizing, and most impactful in the sizing of pumps, except for fire pumps, which are governed entirely by fire flow requirements.

Table 1 shows the proposed design Average Day Demand (ADD), MDD water consumption rates, and some comparators. The selected rates were checked against the observed rates. Based on the comparators, the proposed rates are in the middle of the range. There are many reasons other municipalities may have higher or lower bylaw rates (i.e. age of bylaw, locally observed conditions, metered versus unmetered systems, etc.).

The proposed rates are based on the MMCD rates. These are in line with most municipalities. Adopting the proposed residential water consumption rates results in a **30% reduction in the load** on the water systems versus the current rates based on MDD and peak hour demand.

Table 1 Proposed design residential water consumption rates versus the current bylaw, MMCD, and other municipalities.

Parameter	Proposed	Current Bylaw	MMCD	City of Duncan	City of Nanaimo	District of Saanich	City of Courtenay	City of Parksville
ADD	**450**	**682**	**300**	**-**	**455**	**300**	**635**	**518**
MDD	**960**	**1,364**	**600**	**1,400**	**1,135**	**600**	**2,100**	**1,319**
PHD	**1,470**	**2,046**	**900**	**2,100**	**1,820**	**1,350**	**3,000**	**1,910**

Notes

###	Value is LOWER than proposed design value.
###	Value is within 10% of the proposed design value.
###	Value is HIGHER than proposed design value.

Table 2 shows the proposed design persons per unit area for Institutional, Commercial, and Industrial (ICI) for calculating water consumption rates along with some comparators. The current bylaw requires that ICI water consumption be determined on a case-by-case basis. This will remain the case when assessing land development applications, as ICI rates can differ significantly depending on the nature of an application. However, for the purposes of assessing future needs so that the DCC bylaw rates can be calculated, the above rates in Table 2 will be used. The proposed design rates are based on MMCD, which is the **industry standard**, and are **not expected to vary the load** on the system versus the current rates.

Table 2 Proposed design ICI water consumption rates versus the current bylaw, MMCD, and other municipalities.

Parameter	Proposed	Current Bylaw	MMCD	City of Duncan	City of Nanaimo	District of Saanich	City of Courtenay	City of Parksville
Commercial	**90 c/ha**	-	90 c/ha	30 c/ha*	36 c/ha	90 c/ha	90 c/ha	90 c/ha
Institutional	**50 c/ha**	-	50 c/ha	30 c/ha*	36 c/ha	50 c/ha	50 c/ha	50 c/ha
Industrial	**90 c/ha**	-	90 c/ha	30 c/ha*	36 c/ha	90 c/ha	90 c/ha	36 c/ha

Notes
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***Based on a rate of 40,000 L/ha/day for ICI demands and a rate of 1,400 L/c/d for residential MDD.**

Table 3 shows the proposed Required Fire Flow (RFF) rates along with some comparators. The proposed design RFF rates align with MMCD rates, which are industry standard, with the exception of multi-family residential, where the required fire flow was increased to account for the medium to higher density wood-frame residential buildings proposed in many of the land development applications being submitted. It is staff's understanding that the MMCD standards for multi-family residential need updating to account for multi-storey, multi-family **wood frame structures**. Staff engaged a consulting firm that specializes in the calculation of fire flows for such structures, and they have confirmed that **the minimum fire flow recommended for multi-family residential should be 120 L/s**. The proposed commercial and institutional fire flows align with MMCD, the industry standard. They are similar to or lower than the other comparators; however, the municipalities with the higher ranges for commercial and institutional fire flows have these ranges to account for specific zoning designations with known higher fire flow requirements.

Table 3 Proposed design RFF rates versus the current bylaw, MMCD, and other municipalities.

Landuse	Proposed	Current Bylaw	MMCD	City of Duncan	City of Nanaimo	District of Saanich	City of Courtenay	City of Parksville
Single Family Residential	**60**	45 - 60	60	60	75	60 - 83	60	75
Multi-Family Residential	**120**	90	90	120	110 - 240	83 - 200	90	150
Commercial	**150**	110 - 225	150	150	105 - 300	150 - 300	150	250
Institutional	**150**	90	150	150	105 - 300	100 - 240	150	250
Industrial	**225**	110 - 225	225	190	225 - 300	225	225	200

Notes
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With respect to fire flows, staff recommend using the lower end of the range for multi-family residential because it reduces the quantity of water mains requiring upgrading, thereby resulting in a lower water DCC charge than would otherwise be the case. If the higher fire flow is used, developers have no choice but to pay the higher DCC rate. By establishing a lower fire flow standard, the developer can invest in fire hazard reduction measures within their buildings to reduce the fire flow demand **without the burden of a DCC rate that is set to a higher fire flow**.

Sanitary

Table 4 shows the proposed design sanitary criteria and some comparators. The proposed Average Dry Weather Flowrate (ADWF) rate is based on the MMCD rate for metered water systems, which agreed well with observed rates in North Cowichan's systems. Metered water systems tend to produce lower sanitary flow rates. North Cowichan is 100% metered. The proposed design ADWF, Harmon Peaking Factor, and I&I rates reduce the residential load on the sanitary system by approximately 28% for low-density developments and by 54% for higher-density **developments**. The proposed design rates for institutional, commercial and industrial uses are based on the industry standard and are **not expected to vary the load** on the system versus the current rates.

Table 4 Proposed sanitary design criteria versus the current bylaw, MMCD, and other municipalities.

Parameter	Proposed	Current Bylaw	MMCD	City of Duncan	City of Nanaimo	District of Saanich	City of Courtenay	City of Parksville
ADWF (L/c/d)	**240**	**380**	**240 - 360**	**360**	**230**	**360**	**360**	**300**
I&I (L/ha/d)	**22,500**	**5,615**	**11,200**	**8,640**	**25,000**	**11,232**	**11,200**	**12,500**
Peaking Factor	**Harmon**	Babbitt	Harmon	2.5	Harmon	Harmon	Harmon	$6.75P^{-0.11}$
Commercial	**75 c/ha**	-	**75 c/ha**	-	**90 c/ha**	*	**75 c/ha**	**90 c/ha**
Institutional	**50 c/ha**	-	**50 c/ha**	-	**50 c/ha**	*	**50 c/ha**	**50 c/ha**
Industrial	**90 c/ha**	-	**90 c/ha**	-	**36 c/ha**	*	**90 c/ha**	**36 c/ha**

Notes

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***Average daily sewage flows for other land uses shall be as per the *Sewage Disposal Regulation of the Health Act* or some other criteria acceptable to the Director of Engineering Services.**

The observed I&I rates are based on an extensive I&I study of all three sanitary systems undertaken by North Cowichan from 2006 to 2011. The proposed design I&I rate is based on the observed I&I rates from the I&I studies and allows for poor construction and/or the aging of infrastructure while also factoring expected improved performance from new piping materials.

The proposed design peaking factor is the Harmon peaking factor used by most B.C. municipalities with a few exceptions. The Harmon peaking factor formula is as follows:

$PF_{Harmon} = 1 + 14 / (4 + P^{0.5})$

P Population in thousands.

The Babbit peaking factor, specified in the current engineering standards, tends to generate overly conservative peak flows for smaller sanitary catchment areas (Figure 1 compares the Harmon and Babbit peaking factors for varying number of persons in a study area). The Harmon peaking factor was considered more reasonable, particularly given that the proposed design ADWF and I&I rates already have some conservativeness built into them.

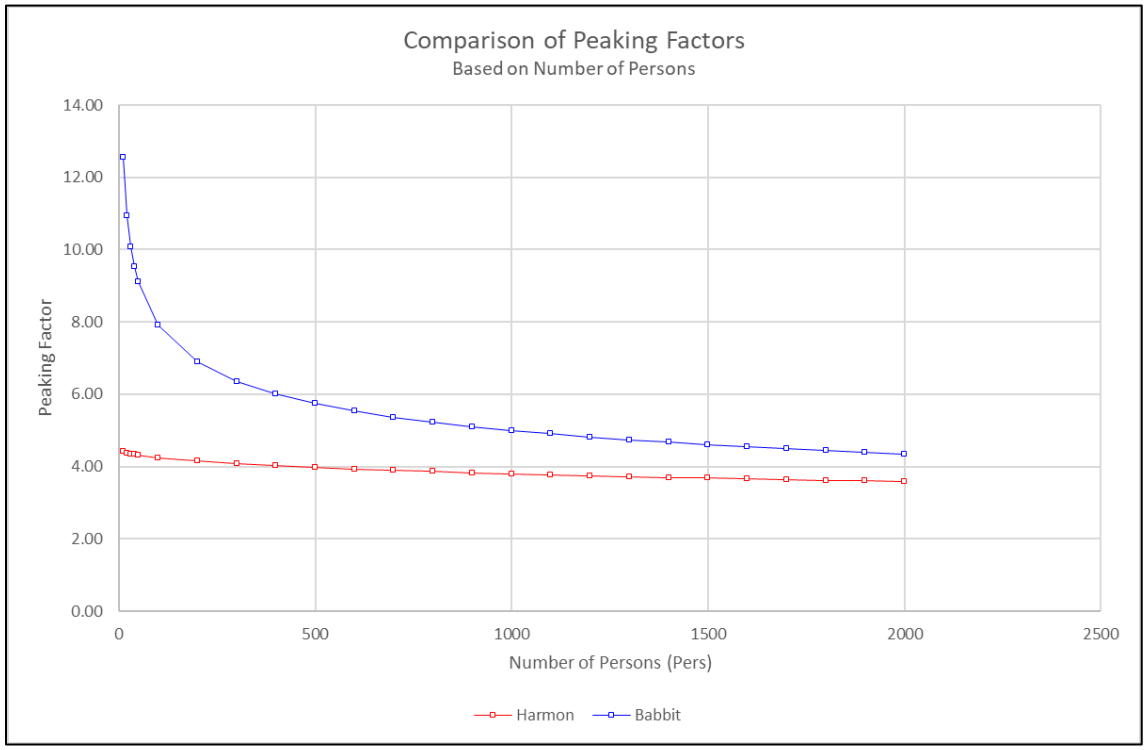

Figure 1 Comparison of Harmon and Babbit peaking factors.

The proposed design ICI rate is based on the MMCD rate. The proposed rates are in the middle range of the above comparison.

The current bylaw requires that ICI water consumption be determined case-by-case. This will remain the case when assessing land development applications, as ICI rates can differ significantly depending on the nature of an application. However, the above rates will be used to assess future needs so that the DCC bylaw rates can be calculated.

Population Analysis (Persons Per Unit)

Licker Geospatial Consulting Ltd. (LGeo) and subcontractor Mulholland Parker Land Economists Ltd. (MP) created detailed land-use-informed population projections for North Cowichan. Included in this modelling was the development of new person per household values by key archetype based on recent assessment and census data. Table 5 shows the new proposed design PPU values.

Table 5 Proposed design PPU.

Archetype	Unit Size		Persons Per Unit
	(ft^2)	(m^2)	(pers/unit)
Apartment	800	74	1.52
Manufactured Home	800	74	1.47
Single Family	2,430	226	2.36
Single Family w Suite (per dwelling unit)	1,270	118	2.13
Small Scale Multi-Unit Housing	1,270	118	2.13
Townhomes	1,410	131	2.46

The average PPU from the LGeo analysis for all archetypes is 2.17 PPU. The design PPU in the current standards is 3.10 PPU regardless of archetype. The 2019 Rennie report, prepared for the Cowichan Valley Regional District, indicated that the average number of persons per dwelling in 2017 in North Cowichan was 2.33 PPU.

Adopting the new PPU values will ensure that modelling and the setting of DCC rates will better reflect the impact of any given development on North Cowichan's systems. As the average PPU is lower, the capacity of systems assessed based on units (i.e. the Joint Utility Board Sewage Treatment Plant) may need to be reassessed for their capacity. As the PPU is generally lower, this yields more residual capacity in such facilities than would otherwise be the case.

OPTIONS

1. **(Recommended Option)** THAT Council gives first, second and third readings to Subdivision Control Bylaw Amendment Bylaw No. 3986, 2025.

IMPLICATIONS

Having design criteria that is representative of current water consumption rates, fire flow requirements, and sewage generation rates is important for numerous reasons:

1) When assessing the impact of land development applications on existing infrastructure, it is important that the load that a development places on the infrastructure be representative of the anticipated demand for the systems.
2) Once upgrades are triggered, the updated design criteria will allow for the proper infrastructure sizing. Oversizing of infrastructure wastes money. Under sizing infrastructure can result in low water pressure, insufficient water for fire protection, and sewage overflows at manholes and pump stations. The new standards ensure the proper sizing of infrastructure to service not only the development occurring in the near-term; it also ensures that the infrastructure is sized properly for development that has not even arrived yet. As the infrastructure is sized to service current and future development, the cost associated with new/upsized infrastructure will be properly captured in the new DCC rates so that all developers, near-term and future developers, will be paying for their fair share of the infrastructure upgrade costs.
3) The current standards are based on calibrated models and are more closely aligned with actual demands and loads. The net effect of implementing these new standards is infrastructure that is

right-sized to the demands and loads expected, resulting in less cost to developers and rate payers moving forward than would otherwise be the case.

4) The increased fire flow standard for multi-family will result in the need to increase piping size. Reservoir sizing may also be affected in those areas where the sizing of reservoirs is not based on commercial/institutional or industrial fire flow rates. This is unavoidable and necessary. However, staff propose using a flow standard that is at the lower end of the acceptable range, but that is reasonably achievable through the implementation of measures at the building level to reduce fire flows to meet the level of service selected. This helps keep the DCC charges down while providing developers with the opportunity to decide whether they prefer to invest in reducing the required fire flow for their developments or not and invest in upgrading the infrastructure.
5) The use of design criteria that is not representative will result in the incorrect inclusion of projects or omission of projects when updating the DCC bylaw. The infrastructure that is to be included in the DCC bylaw update may be improperly sized, resulting in inaccurate DCC rates.

RECOMMENDATION

THAT Council gives first, second and third readings to Subdivision Control Bylaw Amendment Bylaw No. 3986, 2025.

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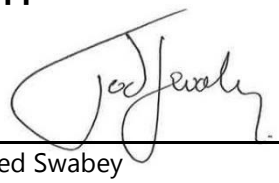

Ted Swabey
Chief Administrative Officer

Attachment:
(1) Subdivision Control Bylaw Amendment Bylaw No. 3986, 2025