COWICHAN - NORTH DEVELOPMENT PROPERTIES

STORMWATER MANAGEMENT REPORT

30% SUBMISSION | 2023-11-08

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1.0 INTRODUCTION

This Drainage Report is provided in support of the Cowichan North Development Properties Project.

This submission outlines the existing drainage conditions, proposed stormwater management strategy for the site and the drainage improvements offsite. The stormwater management design adheres to the Municipality of North Cowichan Engineering Standards (1993) and the Municipality of North Cowichan Storm Water and Rain Water Design Guidelines (2012).

2.0 ONSITE

2.1 SITE DESCRIPTION

The North Development Properties (NDP) project site is located at 6833/6823 Bell McKinnon Road and 2850 Herd Road, north of the new Cowichan District Hospital. The development is considered a Residential-High (RH) land use consisting of residential and commercial facilities, including a community building, daycare facilities, shops, and other services. The site is bounded by Bell McKinnon Street to the west, Herd Road on the north, and agricultural land to the east. The property within the existing property line covers an area of approximately 5.27ha. The proposed development includes space dedication for municipal roads to facilitate site access and circulation. The development will be divided into three subcomponents: the west parcel, covering 1.77 ha of developable area; the central parcel, covering 1.40 ha of developable area; and the east parcel, covering 1.20 ha of developable area and parkland dedication. It is worth noting that developable areas are preliminary and subject to change at this stage. The current NDP proposed site plan at the time of writing is shown in Figure 1 below.



Figure 1 - Proposed Site Plan

2.2 PRE- AND POST-DEVELOPMENT CONDITIONS

The pre-development conditions were assessed by reviewing site survey data and identifying pervious and impervious areas. shows the existing property lines of the NDP site (blue) against topography-based pre-development catchment areas and surface flow directions (green), which are separated into a west (yellow) catchment of approximately 2.1 ha and an east (red) catchment of approximately 5.4 ha. As shown in the figure, the east catchment includes private development areas outside, and upstream of, the NDP site. The NDP stormwater management strategy focuses on drainage within the NDP site, and it is assumed drainage upstream of the site will be managed by others if it is developed.

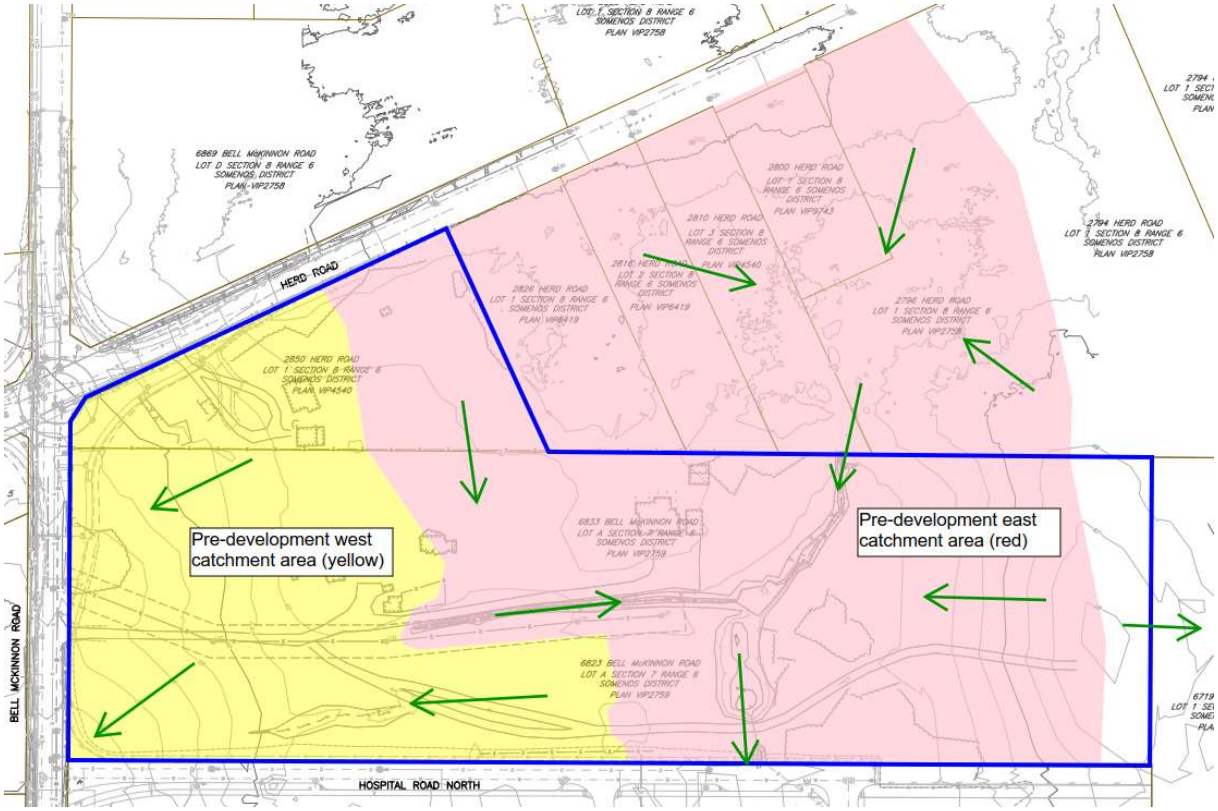


Figure 2 - Pre-Development Catchment Areas

Intensity-Duration Frequency (IDF) curve from the Municipality's Engineering Standards were utilized for pre-development conditions. Pre-development analysis indicates the 5-year peak flow rate from the west catchment (yellow in Figure 2) is approximately 50L/s or 24 L/s/ha, while the east catchment peak flow (including the north property) is 50L/s or 9.3 L/s/ha. Pre-development low targets from here-on are presented as "release rates" in L/s/ha to acknowledge that development sites within the catchment must satisfy flow rates *proportional* to the catchment area they are developing.

Pre-development site conditions are known to be characterized by low-to-moderately sloped topography with surface cover consisting of grass, trees, and dense vegetation. The area is largely pervious but is underlain by soils with low infiltration potential. As such, the runoff response for pre-development conditions is expected to generate relatively large volumes of surface flow, but with flow rates that are slowed by ground cover and system conveyance capacity. The pre-development flow for the east catchment accounts for an existing 200mm culvert which limits peak outflow rates off-site. Our pre-development model accounts for each of these key characteristics with parameters that reflect imperviousness, catchment slopes, surface runoff and depression storage, infiltration capacity, pond/wetland extents, and culverts. The post-development peak flows will be controlled to match the pre-development release rates by detention and flow control structures, as discussed in section 2.4 below.

Post-development conditions are based on concept-level site plans at the 30% design stage. Figure 3 shows the three subcatchment development areas within the NDP alongside public road dedications and the northern private property with potential for future development by others.

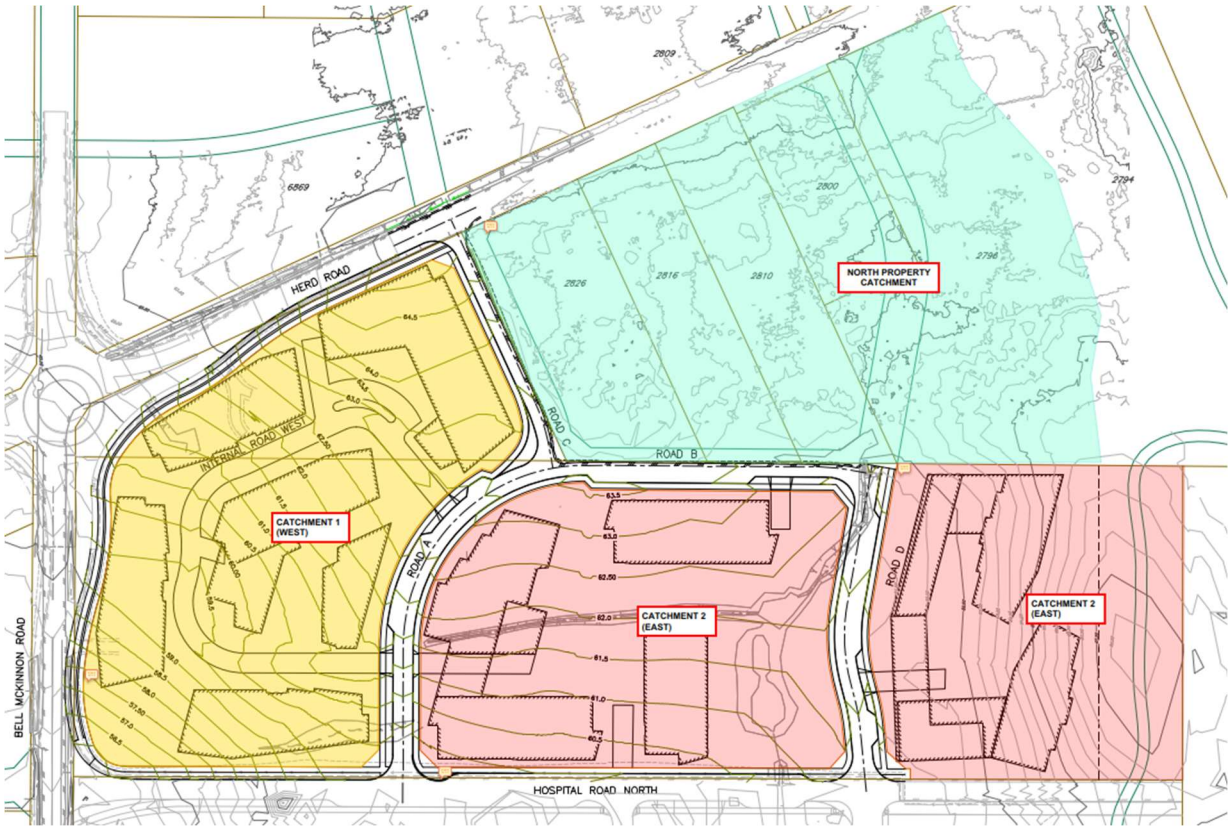


Figure 3 - Post-Development Catchment Areas

2.3 CONVEYANCE SYSTEM

The proposed stormwater conveyance system will be detailed during subsequent design stages. It will consist of the minor and major systems and, since the site and contributing area is less than 20 hectares, will be sized based on the Intensity-Duration Frequency (IDF) curve from the Municipality's Engineering Standards (1993), which was utilized for pre-development conditions. A 20% increase (as requested by the Municipality during the CDHRP project) was applied to the intensities for the post-development conditions to account for climate change.

2.4 DETENTION SYSTEM

On-site detention storage will be provided to satisfy the Municipality's Storm Water and Rain Water Design Guidelines design criteria and the requirements to limit post-development release rates to predevelopment peak flow rates for the 5-year event. Pre-development release rates (24 L/s/ha for the west catchment and 9.3 L/s/ha for the east catchment per section 2.2) were determined based on existing land uses, existing natural and human-made drainage systems, and rainfall data from IDF curves in MNC's Engineering Standards. Post-development conditions account for land use change per the BMLAP and NDP site layout, climate change rainfall volumes, and proposed infrastructure systems to service the NDP.

Based on existing topography, there are effectively two locations ("control points") where runoff is currently released from the site, and where release rate attenuation will be targeted. One control point is the southwest corner of the site (collecting runoff from the west catchment noted in section 2.2), and the other control point is at the south (collecting runoff from the east catchment). The southwest and south control points will both service runoff from the NDP on-site catchment area.

It is expected the south control point will also receive inflows from future development properties to the north of the site, and it is assumed that future development of these properties will independently control runoff to the 5-year pre-development release rate of 9.3 L/s/ha before discharging into the NDP.

Table 1 below summarizes the catchment areas, target outflow flow rates, and approximate storage, volume, and water level depth based on preliminary modelling and design of the NDP. The detention requirements summarized in Table 1 are conservative estimates at the planning stage to inform building layout and space allocation for detention facilities. Detention storage will be refined during design and is subject to factors including site imperviousness, on-site routing of drainage, site grading, interface with on-site and off-site drainage infrastructure, and landscape architect input (for planting selection and tolerable slopes).

Table 1 - Preliminary Detention Storage Sizing

	Southwest Control Point	South Control Point
NDP Catchment Imperviousness (%)[1]	80	73
NDP Catchment Area (ha)[2]	1.77	2.60
5-year Pre-development Release Rate (L/s/ha)	24	9.3
NDP 5-year Post-development Outflow Rate (L/s)	42	24
Peak Detention Volume (m^3)	180	730
Peak Water Depth (m)[3]	0.7	1.2
Detention Storage Footprint Area (m^2)[4]	530	1,150

1) Area-weighted catchment impervious based on BMLAP land uses and accounting for parkland dedication to east side of NDP.
2) Based on NDP development areas only. Excludes north private property and public roads within the NDP site.
3) Minimum 0.3m freeboard is proposed on top of the peak water depth to determine the top of detention storage depth and footprint.
4) To top of bank of detention storage based upon assumed length to width ratio of 2:1 and side slopes of 5H:1V. It does not account for environmental setbacks, which are being prescribed by others. Detention facility geometry to be confirmed during detailed design.

The "Cowichan District Hospital Replacement Project – Stormwater Management Report" (Urban System, 2023) stated that performance of the proposed and existing stormwater system is contingent upon developments, such as the NDP, providing at least the same standard of stormwater control as the hospital project (5-year post-development flows to pre-development levels). To achieve this, an important consideration for the NDP stormwater management strategy moving forward is controlling runoff from public road right-of-ways within the NDP site to pre-development release rates. At this time, the preliminary detention sizing presented in Table 1 is for controlling the private development areas of the NDP only. If only the private development areas are controlled and public areas are not, then the cumulative release rate from the NDP site could exceed pre-development targets. **We seek the Municipality's perspective on preferred approaches to manage stormwater from the NDP public roads** and present the following potential options for consideration and further discussion.

- Option 1 – The Municipality supports design, construction, and ownership of infrastructure within the road corridors to control release rate. This could include subsurface storage, such as in the form an oversize circular pipe. Alternatively, storage can be provided on road surfaces, similar to the City of Calgary's stormwater management approach for developments, where inlet control devices (orifice plates) are placed in catch basins to controls flows, and roads are intentionally designed with surface depressions to provide detention storage.
- Option 2 – The public sewer system servicing road drainage is directed to detention facilities located on the private development sites. This approach would likely require agreements for ownership responsibility, easements, cost-sharing agreements for implementation and maintenance.

- Option 3 – Design the private development storage to "over-detain" and discharge at lower release rates than are currently targeted, such as to allow road drainage to release with lesser or no control.

2.5 WATER QUALITY CONTROL

Water quality controls will be sized based on the Municipality of North Cowichan Storm Water and Rain Water Design Guidelines, which specifies to treat 90% of rainfall events - equivalent to the 50% MAR. The Municipality's guidelines state a 50% MAR of 24mm (MAR of 48mm), for an average rate of 1.0mm/hr. Further details on water quality control structures will be provided during design development.

3.0 OFFSITE

In accordance with the Municipality of North Cowichans Engineering Standards, the 10-year return period flow will be conveyed in the minor drainage system.

3.1 HOSPITAL ROAD NORTH

The temporary north ditch established for the hospital project to manage surface runoff will be replaced with curb and gutter, a boulevard/parking lane, and a sidewalk. Catch basins will connect to the 300mm storm pipe in Hospital Road North as needed. Further specifics regarding road drainage will be provided in the detailed design phase.

3.2 BELL MCKINNON ROAD

The existing ditch on the east side of Bell McKinnon Road fronting the NDP site will be removed and replaced with curb and gutter, boulevard, bike path and sidewalk. Catch basins will connect to the existing 300mm storm pipe as needed to accommodate road drainage. Further specifics regarding road drainage will be provided in the detailed design phase.

3.3 HERD ROAD

The section fronting the NDP site at the roundabout includes catch basins and storm enclosed pipes. At the east of the roundabout there is existing roadside ditches on the south side of Herd Road. The proposed road improvements for Herd Road include removing and replacing the existing ditch with curb and gutter, boulevard, bike path, and sidewalk. It is anticipated that storm piping will be required in Herd Road to accommodate the minor road drainage system. Detailed information about pipe sizing and location along Herd Road will be provided in a future submission.

We trust that this submission provides a comprehensive review of the stormwater management strategy at the 30% design stage for the North Development project. At this time, we especially seek the Municipality's input on the proposed approaches to control stormwater from public road right-of-ways as discussed in section 2.4, and are open to further conversations on the matter. As the project continues to evolve during the design development phase, we anticipate providing more detailed information. Should you have any questions or require clarification on the above, please do not hesitate to contact the undersigned.

Sincerely,

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