Our File: 2211-47791-00

TECHNICAL MEMO

To	From
Kris La Rose, P.Eng. **Comox Valley Regional District**	**Matt Sanderson, P.L.Eng.** **McElhanney Ltd.**
Re	**Date**
Hudson Trunk Sewer Capacity Review	**August 27, 2024**

McElhanney has been retained by the Comox Valley Regional District (CVRD) to provide a sewer capacity assessment and computer model development for a limited section of the Hudson Trunk Sewer (HTS). These tasks are to support the CVRD's goals in managing pipe capacity with several developments forthcoming within the catchment.

This scope of work follows our June 27, 2024, proposal and subsequent discussions, as agreed by the CVRD, consisting of the following tasks:

- Develop a PCSWMM hydraulic model for the HTS, upstream of Knight Road.
- Establish an 'Original Design' development sewage loading scenario assuming 10 units / hectare as a baseline. Update due to recent development from Aspen Road – Lot 2 subdivision.
- Operate the model on a 24-hour diurnal cycle basis.
- Verify maximum flow capacity within the HTS system.
- Review and confirm sewer calculations as presented from the 2123 Hector Road servicing report.
- Review HTS responses, and recommended upgrades, related to development proposals at 941 Aspen, 2077 Hector and 2123 Hector Road.
- Establish concept-level Hector Road Lift Station design parameters.
- Review HTS responses, and recommended upgrades, related to development proposals at the Lannan Road.
- Provide a brief report summarizing findings.

Several previously completed design documents and technical guidelines were referenced for the above tasks. They include:

- HTS record drawings & 50% Design Brief, July 2016, (McElhanney 47376-01)
- Aspen Road - Lot 2 (Phase 2) record drawings, September 2022, (McElhanney 47463-00)
- Master Municipal Construction Documents (MMCD) Design Guidelines 2022
- Zoning application – 2123 Hector Road, May 2024, (Broadstreet Properties / Wedler Engineering)
- Servicing report – 941 Aspen Road & 2077 Hector Road, October 2022, (Highstreet Ventures / Islander Engineering)
- Servicing report – Lannan Road Development, March 2024, (Silverado Land Corporation / Koers Engineering)

This sewer capacity assessment has generated several new modeling scenarios which are briefly summarized below:

1. **24-01 Existing** – Described in Section 2.0, outputs in **Appendix A**. Premise: Existing Conditions Baseline Model, to compare against all other scenarios.
2. **24-01 Maximum Capacity** – Described in Section 3.0, outputs in **Appendix B**. Premise: Identify maximum hydraulic capacity without surcharge independent of population loads.
3. **24-02 2123 Hector** – Described in Section 4.0, outputs in **Appendix C**. Premise: Determine HTS response to development sewer loads as proposed in the project's servicing report, comparing against the baseline model.
4. **24-03 All Three Lots to Aspen** – Described in Section 5.0, outputs in **Appendix D**. Premise: Determine HTS response to combined sewer loads from three development proposals at 941 Aspen Road, 2077 Hector Road & 2123 Hector Road, comparing against the baseline model.
5. **24-03A Three Lots (Upgraded)** – Described in Section 5.0, outputs in **Appendix D**. Premise: Determine the HTS upgrades required to re-establish a maximum 80% system capacity based on the 24-03 model.
6. **24-04 Hector Multi-Family Projects to Hector Road Lift Station** – Described in Section 6.0, outputs in **Appendix E**. Premise: Consider servicing for the two Hector Road multi-family projects as originally envisioned in the HTS 50% Design Brief.
7. **24-04A Hector Multi-Families (Upgraded)** – Described in Section 6.0, outputs in **Appendix E**. Premise: Determine the HTS upgrades required to re-establish a maximum 80% system capacity based on the 24-04 model.

8. **24-05** Lannan Road – Described in Section 7.0, outputs in **Appendix F**. Premise: Determine HTS response due to change in density within the Lannan Road development, comparing against the baseline model.

Note: Scenarios **24-02** through **24-04** and their derivatives include the higher density proposed at Lannan Road property (Model Scenario **24-05**).

August 20th Memo Update

Following a meeting between the CVRD, Town of Comox and City of Courtenay on August 13, 2024, it was agreed that the Electoral Area 'B' properties would be removed from these assessments. Any future connections of individual neighbourhoods would require annexation into the neighbouring municipality and the sewer conveyance capacities re-assessed.

A second series of models, labeled as **24-5x**, were developed using the same sewer load scenarios but removing Area 'B' properties. This allows comparison to the original model series (**24-0x**, described in items 1-8 above) for the impact of the Area 'B' properties. The second series models include scenarios **24-51**, **24-52**, **24-53**, **24-54**, and **24-55** which are further described in their respective sections below.

Other changes made with the August 20th update include:

- The modeled pipe network was expanded downstream to the end of the HTS.
- Flows from the Lannan Road development with higher density was carried throughout the **24-5x** models.

August 27th Memo Update

During the meeting of August 21, it was noted that the **24-5x** development models contained an error applying the peaking factor in the discharge calculations to the Aspen Road corridor. The error was identified and corrected. The models were reviewed, and outputs republished for this update.

Other changes made with the August 27th update include:

- New pipe upgrade scenarios were added, **24-53A Three Lots to Aspen** and **24-54A Hector MF to LS** (for direct comparison to 24-03A and 24-04A, respectively).
- In response to a request from the Town, a variation to the **24-53** model to quantify how much development in the Aspen area could proceed prior to any issues develop in the HTS was generated and summarized in Section 5. This model variant is identified as scenario **24-53B**.

Tables and maps were updated and included in the relevant Appendix. Additional comments are included below to consider this change.

1. MODEL DEVELOPMENT

A detailed computer model was developed to characterize the HTS's hydraulic and sewer parameters using PCSWMM modeling software, itself derived from the US Environmental Protection Agency's Storm Water Management Model. This platform is widely held as an industry standard for hydrologic and hydraulic simulation. The software's hydraulic engine is ideal for time-based synthesis of flow conveyance in sewer applications. The platform georeferenced database allows for GIS integration. Scenario handling capabilities allow for direct comparison of various sewer loads and system responses.

The study area for this report is limited to the HTS, upstream of Knight Road. See **Figure 1**, below. The bright green outline is the catchment area. Properties within the Town of Comox area represented by light green hatching and those within the City of Courtenay by light blue hatching. The dark grey area is 2123 Hector Road, subject to a rezoning application presently considered by the Town of Comox.

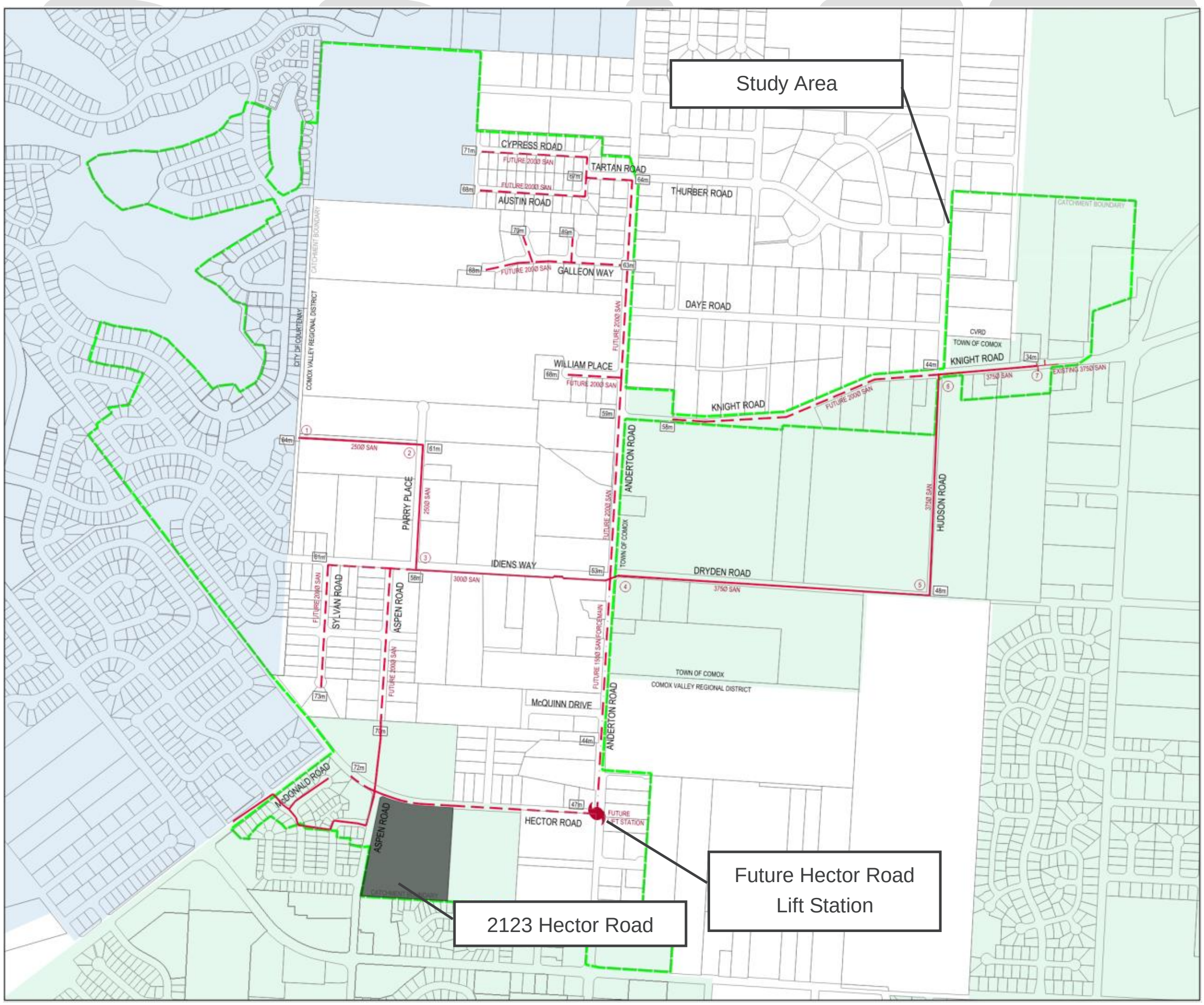

Figure 1 - Hudson Trunk Sewer Catchment Area

1.1. PHYSICAL INFRASTRUCTURE

Record drawings from the 2017-2018 construction (McElhanney 47376-01) of the HTS provided the physical data for manholes and pipes. The model was expanded to include the sewers built as part of the Valley View Lot 2 development extending into the Town of Comox. The future pump station at Hector Road, noted in the 50% Design Brief, was also included conceptually on the basis that pumped flow is generally twice as high as gravity flow. This behaviour was not originally accounted for in the HTS pipe sizing calculations.

Background scenery is based on cadastral linework downloaded from ParcelMapBC. Initial sewer loads to establish the baseline 'design condition' were derived from the HTS 50% Design Brief then segmented to a parcel-by-parcel basis.

1.2. SEWERAGE AND INFLOW / INFILTRATION RATES

The 2024 model criteria included population density and sewerage rates from the HTS 50% design memo with updates to 2022 MMCD Design Guidelines for inflow and infiltration as follows:

Parameter	Value
Development Density	10 residential units per hectare. No commercial / institutional / industrial land use
Population Density:	2.4 people per unit
Average Dry Weather Flow (ADWF)	350 L/day/capita
Infiltration Rate (land area)	0.12 L/s/ha
New system / above groundwater	0.45 L/mm dia / 100m length / hour
Old system / below groundwater	1.0 L/mm dia / 100m length / hour

Inflow and infiltration (I&I) is calculated in one of three ways. Urban and suburban areas rely on I&I calculated as a function of developed land area. Otherwise, where pipes are in very low-density areas, the calculation is determined by the pipe length, diameter and age as well as presence of groundwater. For this analysis, we understand the area to be compromised of soils with shallow groundwater and have elected to utilize the higher rate for pipe based I&I.

1.3. PIPE HYDRAULIC PARAMETERS

Manning's pipe roughness factor is used to represent friction with a conservative value of 0.013 used for all pipes to represent an 'in-service' condition.

Minimum allowable gravity velocities to maintain scouring is 0.60 m/s. Pipes with flow depth of 80% or higher are considered 'full' with the potential for replacement.

1.4. CONCEPT HECTOR ROAD LIFT STATION

The future pump station at Hector Road, noted in the 50% Design Brief, was also included conceptually on the basis that pumped flow is generally twice as high as gravity flow. This behaviour was not originally accounted for in the HTS pipe sizing calculations.

In the **24-01 Existing** model, the station has an estimated peak inflow of approximately 15 L/sec entering a 3.0m diameter wet well with pumps sufficient for 30 L/sec discharge to Anderton Road and Idiens Way intersection. These are conceptual values for conveyance purposes and will require refinement upon further design.

1.5. PEAKING FACTOR

SWMM based modeling allows for 'time-of-day' flow variation mimicking human behaviours based on actual data recorded in flow studies; sewer flows surge mid-morning as people get ready for their day and again in early evening. In contrast, Harmon, MMCD, BCBC, and other traditional formulae provide very conservative approaches to determining an instantaneous peak flow as a single event.

Previous flow studies have found that the actual recorded differences between maximum and minimum flows approach a 2.0x peaking factor as shown below in **Figure 2**. The time series is recalculated to establish a 3.0x peaking factor, offering an additional safety factor.

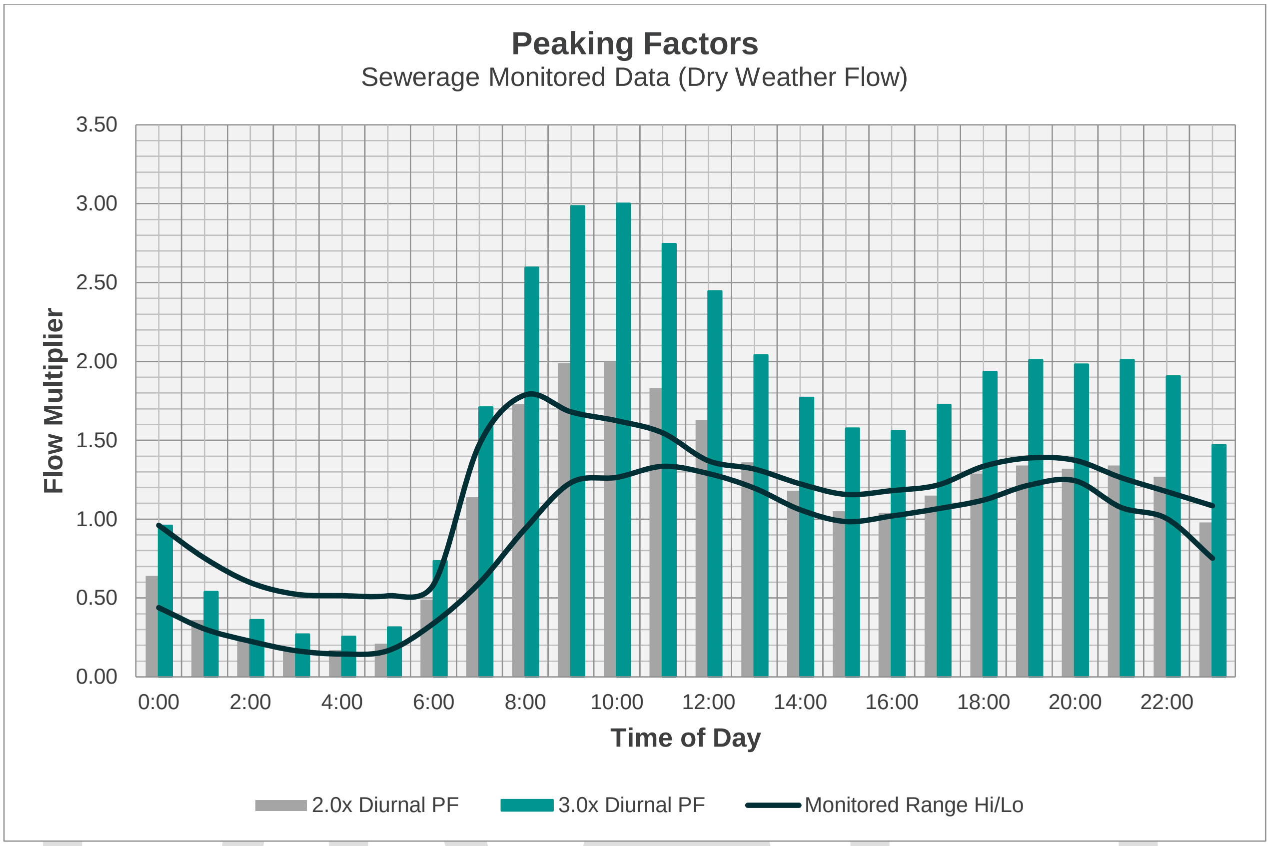

Figure 2 - Peaking Factor over 24 Hours

2. EXISTING 2024 SCENARIO RESULTS

The first model is named **24-01 Existing** and incorporates all the parameters and assumptions outlined in the sections above. This model provides the baseline for all future development impact assessments and includes all Area 'B' properties within the service area. **Appendix A** contains a table showing peak flow and capacity within each mainline pipe along with a map showing the pipes and maintenance holes.

The results show that all pipes are flowing less than 80% full. Pipe utilization is slightly higher than the original 50% Design Brief, largely due to the pump station modeling as noted above.

The **24-51 Existing** model removed the Area 'B' properties where a majority contributed to MH 20 at Anderton Road / Idiens Way / Dryden Road. This model contains approx. 75 L/sec less flow downstream of MH 20.

3. MAXIMUM CAPACITY SCENARIO RESULTS

A separate scenario, using the **24-01 Existing** model as a starting point, was generated to verify the maximum flow conveyance ability of the HTS. First, all population loads were removed from the model.

Then, beginning at the upstream end of each pipe run, flow was added until nearby downstream pipes were filled to 100% capacity. More flow was added below the full section until the next pipes were filled. This process continued until the whole system was saturated. This scenario excluded the Hector Road pump station in the system. Results listed pipe by pipe are listed in **Appendix B**. Refer to the map within **Appendix A** for pipe locations.

The maximum capacity assessment is unaffected by the Area ‘B’ property removals in the **24-5x** series.

4. 2123 HECTOR SERVICING IMPACTS

McElhanney has reviewed “Site Servicing Report - 2123 Hector Road, Comox, BC”, November 2023, prepared for Broadstreet Properties Ltd by Wedler Engineering. Sewerage calculations were derived using Town of Comox Bylaw 1261 values, supplemented by MMCD Design Guidelines. Peak wet weather flow (PWWF) is proposed to be 9.28 L/s.

The subject property, shown in grey hatching in **Figure 1**, was originally intended to drain to the east along Hector Road to a future lift station at the Hector Road / Anderton Road intersection. However, this lift station has not yet been constructed. Instead, the proponent intends to connect to existing sewers on Aspen Road and drain north.

McElhanney generated a second model, named **24-02 2123 Hector** and founded on **24-01 Existing**, to illustrate the HTS response to the proposed development. **Appendix C** shows pipe flow and capacity for each pipe and compares to the **24-01 Existing** scenario. A map is included with the pipes shown in colors corresponding to their flow depths with no pipes exceeding 80% flow depth.

The new project consumes approximately 18-25% of available capacity in the upper Aspen Road reach of the HTS system (manholes 43 to 35). Impacts downstream along Idiens Way, Dryden Road and Hudson Road are minor.

By removing the Area ‘B’ properties for the **24-52 2123 Hector** model, the number of pipes that are below 50% full increase, while no pipes are over 80% full.

5. THREE PROJECTS ROUTED TO ASPEN ROAD CORRIDOR

The CVRD has received further information for an additional project to redevelop both 941 Aspen Road and 2077 Hector Road in addition to the 2123 Hector Road development (Section 4 above). All three projects propose to utilize the Aspen Road sewer system (manhole 43 to 35) for their off-site connections. Refer to **Figure 3** for location of 941 Aspen Road and 2077 Hector Road.

“Functional Servicing Report, 2077 Hector and 941 Aspen Road Multi-Family Development”, October 2022, by Islander Engineering on behalf of Highstreet Ventures Inc, was reviewed for sewer connection locations and calculations. A new sewer model, founded on **24-02 2123 Hector**, was created and titled

24-03 All Three Lots to Aspen Road. Sewer loads were added as outlined in the report. The resultant pipe flows and capacities are listed in a table and illustrated on a map contained in **Appendix D**.

We note that the developments are proposing much higher intensity than the original 10 units per hectare envisioned during the Aspen Road sewer design and construction. As such, the existing pipes are significantly undersized. Flooding is predicted at MH 36 as shown by the red circle on the profile in **Appendix D**.

Much of the Hudson Trunk Sewer would require replacement (upsizing of pipes) to reestablish pipe flow depths below 80%. An auxiliary model named **24-03A All Three Lots (Upgraded)** contains pipe size increases generally in the order of one additional size. A map showing the upgrades and resultant pipe capacity results is also in **Appendix D**.

August 27th Memo Update

The **24-53** model maintains the same proposed developments at 941 Aspen, 2077 Hector and 2123 Hector, but removes all Area 'B' properties. This scenario maintains that the Aspen Road corridor requires upgrades with surcharge extending up into the upper Town of Comox system. Downstream of Aspen Road, with no Area 'B' sewer contributions, the HTS has more capacity for the proposed developments. The last two pipes on Knight Road become surcharged due to their flatter grades before joining the Greenwood Trunk.

Per the Town's request, McElhanney created model **24-53B** to assess how much development could occur and discharge to the existing 200mm sewers on the Aspen Road, prior to upgrades being required to support the full development. For clarity, upgrades are assumed to be needed once a pipe reaches or exceeds 80% capacity. The following development could proceed prior to the Aspen Road corridor requiring upgrades with equal opportunity to two developers:

- 2123 Hector Road (Broadstreet) at 100% of project at 252 units (555 people) PWWF 9.28 L/sec
- 2077 Hector Road (Highstreet Phase 1 of 3) at 245 units (611 people) PWWF 9.24L/sec.

The Aspen Road corridor can support approximately 18.5 L/s additional flow before exceeding thresholds. Other potential servicing combinations tend to favour one developer over another. Various combinations for unfair access to service projects has not been fully investigated.

Pipe capacity is below the 80% threshold. Flatter pipe grades on Aspen Road, approaching Anderton Road and the last two pipes on Knight Road are more sensitive, but within criteria in this scenario. Outputs and map from Model **24-53B** are included in **Appendix D**.

6. HECTOR ROAD DEVELOPMENTS ROUTED TO LIFT STATION

The original HTS design included provision for a lift station near Hector and Anderton Roads. This facility was intended to service several properties south of Idiens Way, along Hector Road, McQuinn Drive, Acacia Road and Toronitz Road. **Figure 3** below shows the lift station ("LS") catchment area with properties highlighted in blue.

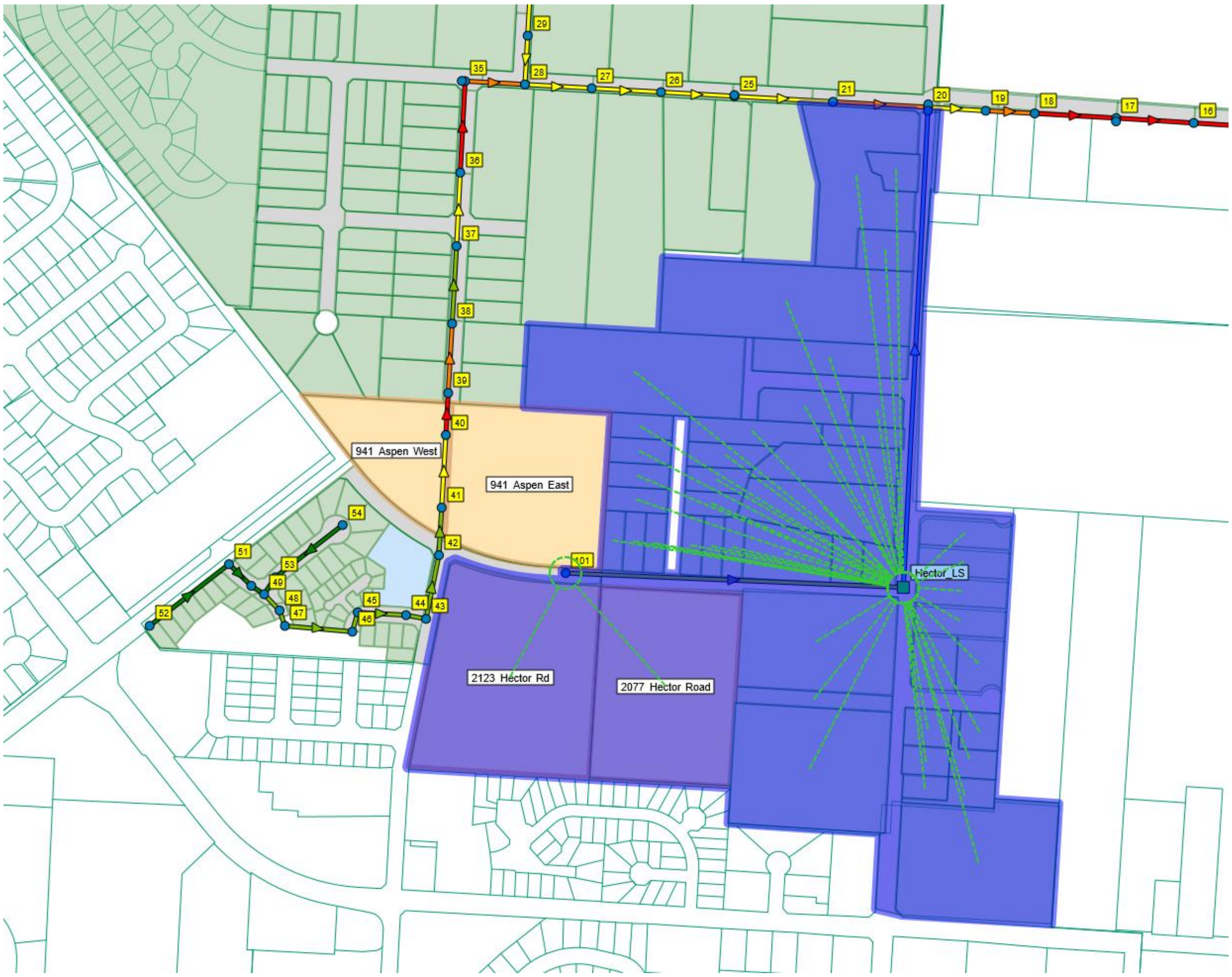

Figure 3 - Hector Road Lift Station Catchment

A separate model was developed, **24-04 Hector MF to LS**, to explore sewer system responses. Projects at 2077 and 2123 Hector Road were routed down a theoretical 250mm sewer to the Hector Road LS. The development density for these two multi-family sites is much higher than originally anticipated. One consequence is that the pumps for the Hector Road LS would need to be larger, now able to discharge at 45 L/sec, up from the original 30 L/sec (per the 50% Design Brief).

Note additional gravity sewer pipes, tributary to the Hector Road LS, are required to fulfill the servicing but were not included in the modeling. Minor shifts in sewer travel time can be expected. Further development of the servicing design is warranted should this scenario be pursued.

The topography for 941 Aspen suggests gravity sewer servicing would be connected to the Aspen Road sewers. This development is anticipated to contribute a total PWWF of 20.1 L/sec. The present-day sewers are shown to not have sufficient capacity and would result in surcharging.

Model **24-04A Hector MF (Upgrades)** was created to capture the many pipe size changes to resolve the capacity issues identified in model 24-04 and demonstrate general conformance to design guidelines.

In Model **24-54**, the lift station design output is set to 36 L/sec. The service area is limited to the 2077 and 2123 Hector Road properties contributing 18.5 L/sec PWWF. 941 Aspen development continues to utilize the Aspen Road corridor, as the land does not support draining to the Hector Road LS.

Appendix E contains a table showing the flows, capacities and needed pipe upgrades to support the **24-24-04** & **24-04A** scenarios. Two maps show the system response and locations of upgrades necessary.

7. LANNAN ROAD DEVELOPMENT

Silverado Land Corporation, within the City of Courtenay, proposes to develop approx. 12 hectares formerly known as the Lannan Forest. Originally, the HTS pipes were sized for sewer loads resulting from 10 units per hectare with 2.4 persons per unit [24 persons per hectare]. This was consistent with design assumptions at the time. In writing of this report, CVRD staff reached out and received an update to the development proposal which increased the population from 302 people to 569 or 46% increase but no change in land area. Further, inflow and infiltration rate is proposed at 0.06 L/sec/ha down from the original 0.12 L/sec/ha. With these changes, the HTS will see a net increase of 3.5 L/sec PWWF.

Model **24-05** and **24-55,** which removed sewer flows from Area ‘B’ properties, was generated to quantify the impacts of this project independently of the other proposals noted in previous sections. The model suggests that while no pipes breach the 80% full threshold, the small increase in sewer discharge from this development does reduce headspace and ability to service other areas.

Post development Models **24-02** through **24-04,** along with **24-52** through **24-54,** carry the increased Lannan Road development discharges. This approach maintains conservancy in the CVRD’s ability to convey sewer. To isolate and quantify the effect of the Aspen and Hector Road projects, readers may subtract 3.5 L/sec from the listed pipe flows downstream of SMH 28.

Appendix F contains a table outlining the flows and capacity changes due to the increased sewer load from the Lannan Road project. The associated maps show the results spatially.

8. CONCLUSIONS

Considering Area 'B' property servicing allowances at 10 units / ha & 2.4 persons / unit. **[24-0x models]**

- The development at 2123 Hector Road may be serviced by the Aspen Road sewers (manholes 43 to 35) rather than draining towards a lift station at the bottom of Hector Road at Anderton Road. All pipes remain within an 80% capacity threshold (Model Scenario **24-02**, **Appendix C**).
- Should all three proposed properties connect to the Aspen Road sewers, significant upgrades to the HTS are required (Model Scenario **24-03A**, **Appendix D**).
- Routing the two Hector Road multi-family projects to the Hector Road lift station results in larger pumps required due to the higher than 10 units / hectare density originally envisioned in the area (Model Scenario **24-04**, **Appendix E**).
- The development at 941 Aspen Road, serviced as proposed, will overwhelm several downstream sewers on Aspen Road and Idiens Way. Pipe size upgrades will be required to return servicing to the 80% capacity threshold (Model Scenario **24-04A**, **Appendix E**).
- Diverting any properties away from the Hector Road Lift Station catchment reduces the CVRD's ability to develop the lift station. Financing, and construction timing, of the lift station, and its associated collection sewers and forcemain, is beyond the scope of this report.
- The upgraded pipe sizes as presented in these scenarios re-establish a maximum 80% capacity utilization within the respective scenario (Model Scenarios **24-03A** and **24-04A**), given the proposed high-density development while maintaining 10 units per hectare elsewhere.
- Lannan Road development (Model Scenario **24-05**) does not exceed the 80% replacement threshold. However, the project's increased density contributes 3.5 L/sec more sewer than originally assumed in sizing the HTS pipes. Affording this project the additional capacity will be at the cost of servicing other lands.
- Post development Model Scenarios **24-02** through **24-04** for projects within the Town of Comox include the increased Lannan Road development discharges to ensure a conservative approach.

Considering Area 'B' properties removed. **[24-5x models – August 20 Update]**

- Removing Area 'B' properties from the baseline model frees up significant pipe capacity, particularly downstream of Anderton Road / Idiens Way / Dryden Road intersection.
- There are no pipes exceeding 80% full threshold when servicing 2123 Hector Road (Model Scenario **24-52**, **Appendix C**).

- Several pipes exceed 80% full threshold should 941 Aspen, 2077 Hector Road, and 2123 Hector Road projects connect to the Aspen Road corridor (Model Scenario **24-53, Appendix D**).

- 2123 Hector Road and 2077 Hector Road projects are both very similar in unit count and land area generating similar sewer discharges. The Aspen Road corridor can support both projects and remain below 80% full (**Model Scenario 24-53B, Appendix D**). Upgrades to the HTS would be necessary before Highstreet's remaining two phases on 941 Aspen could be serviced.

- 941 Aspen may proceed to discharge to the Aspen Road corridor without exceeding the 80% threshold. The pumped discharges of the Hector Road LS create momentary surges of flow downstream in the HTS, which render the pipes below MH 103 on Knight Road around 85% full.(Model Scenario **24-54, Appendix E**). The last two pipes on Knight Road are shown as upgrades in the **24-54A** scenario.

- Lannan Road development, Model Scenario **24-55**, independently does not adversely affect the downstream with all pipes below the 80% threshold.

9. RECOMMENDATIONS

- As evident from the development applications discussed above and trends for higher density housing in government policies, we recommend a reassessment of population loads within the HTS catchment. Future development is anticipated to be higher than the 10 units per hectare that was assumed in the original HTS design.

- A servicing staging plan is recommended to consider outcomes from a high-density population study noted above and combined with anticipated timelines for the four proposed projects. This may include interim service phases using existing sewers with an upgrade sequencing plan and cost estimates.

- Maintain the HTS sewer model to track pipe capacity to service future developments and existing areas within Area 'B'.

We trust this information is satisfactory. We look forward to discussing these outcomes.

Sincerely,
McElhanney Ltd.

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Revision History

Date		Status	Revision	Author
July 15, 2024		Draft	Rev 0	MS
July 26, 2024		Draft	Rev 1	MS
August 20, 2024		*Draft*	*Rev 2*	*MS*
August 27, 2024		*Draft*	*Rev 3*	*MS*

Limitation

This report has been prepared for the exclusive use of the Comox Valley Regional District. The material in it reflects the best judgement of the Consultant in light of the information available to the Consultant at the time of preparation. As such, McElhanney, its employees, sub-consultants and agents will not be liable for any losses or other consequences resulting from the use or reliance on the report by any third party.

APPENDIX A

Model 24-01 Existing Hudson Trunk Sewer Flows and Capacities

Comox Valley Regional District Sanitary Model Analysis

Hudson Trunk

				24-01 Pre-Development (Existing)		24-51 Pre-Development (Existing)	
SMH	Downstream Pipe Diameter (mm)	Downstream Pipe Slope (%)	Total Pipe Capacity (L/s)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)
43	200	0.47	22.5	2.5	22%	2.5	22%
42	200	0.63	25.1	2.5	24%	2.5	21%
41	200	0.51	22.8	4.8	30%	2.6	22%
40	200	0.51	22.9	4.8	30%	2.6	22%
39	200	0.55	24.0	5.5	32%	2.6	22%
38	200	3.23	61.8	6.2	22%	2.7	15%
37	200	2.96	58.0	6.4	24%	2.7	15%
36	200	0.58	25.0	6.8	35%	2.8	22%
35	200	0.74	28.1	11.2	44%	2.8	21%
34	250	0.50	42.1	25.7	55%	23.3	52%
33	250	1.29	67.8	25.8	43%	23.4	41%
32	250	0.40	37.9	28.0	59%	23.4	53%
31	250	0.49	41.5	29.0	59%	23.5	52%
30	250	0.97	58.8	30.0	51%	23.6	44%
29	250	1.05	61.2	30.0	50%	23.6	43%
28	300	0.56	72.9	42.3	54%	26.5	42%
27	300	0.60	74.9	44.2	55%	26.6	41%
26	300	1.17	104.3	45.9	46%	26.7	34%
25	300	2.56	152.7	47.3	48%	26.8	33%
21	300	0.47	66.8	47.4	60%	26.9	43%
20	375	1.08	182.2	98.4	52%	26.9	26%
19	375	1.02	175.8	98.5	58%	27.0	26%
18	375	0.50	124.8	98.6	65%	27.1	32%
17	375	0.51	124.9	98.7	65%	27.2	32%
16	375	0.45	117.8	99.0	69%	27.4	32%
15	375	0.40	111.2	99.0	69%	27.5	33%
14	375	0.44	116.2	98.8	67%	27.6	33%
13	375	0.43	114.9	98.8	65%	27.6	32%
12	375	0.44	116.4	98.9	68%	27.7	33%
11	375	0.44	116.1	98.7	66%	27.8	33%

Comox Valley REGIONAL DISTRICT

Comox Valley Regional District Sanitary Model Analysis

Hudson Trunk

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				24-01 Pre-Development (Existing)		24-51 Pre-Development (Existing)	
SMH	Downstream Pipe Diameter (mm)	Downstream Pipe Slope (%)	Total Pipe Capacity (L/s)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)
10	375	0.42	113.2	98.5	68%	27.9	33%
9	375	0.48	121.4	98.3	65%	28.0	32%
8	375	0.53	127.5	98.2	64%	28.1	32%
7	375	0.51	125.7	98.0	64%	28.2	32%
6	375	0.97	171.9	98.0	54%	28.3	27%
5	375	0.90	166.1	98.0	55%	28.4	28%
4	375	3.71	342.4	102.7	38%	28.7	20%
3	375	3.69	332.0	102.9	38%	28.9	20%
2	375	4.02	349.7	104.9	37%	29.3	19%
1	375	2.63	283.8	107.8	43%	29.4	21%
111	-	-	-	-	-	29.9	21%
110	-	-	-	-	-	30.1	21%
109	-	-	-	-	-	30.1	27%
108	-	-	-	-	-	30.2	28%
107	-	-	-	-	-	31.4	27%
106	-	-	-	-	-	31.4	31%
105	-	-	-	-	-	31.5	34%
104	-	-	-	-	-	31.6	37%
103	-	-	-	-	-	31.6	47%
102	-	-	-	-	-	31.7	47%

Pipes over 80% capacity will be highlighted.

LEGEND
Junctions
Outfalls
Storages
Conduits
< 0.25
0.25 - 0.5
0.5 - 0.8
0.8 - 1
> 1
Pumps
Subcatchments
Res
Park
Multi-Residential
ROW
CVRD-Town-City-Comp-Linework only
1
2
3
4
5
6
7
8
9
10
11
12
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21
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34A
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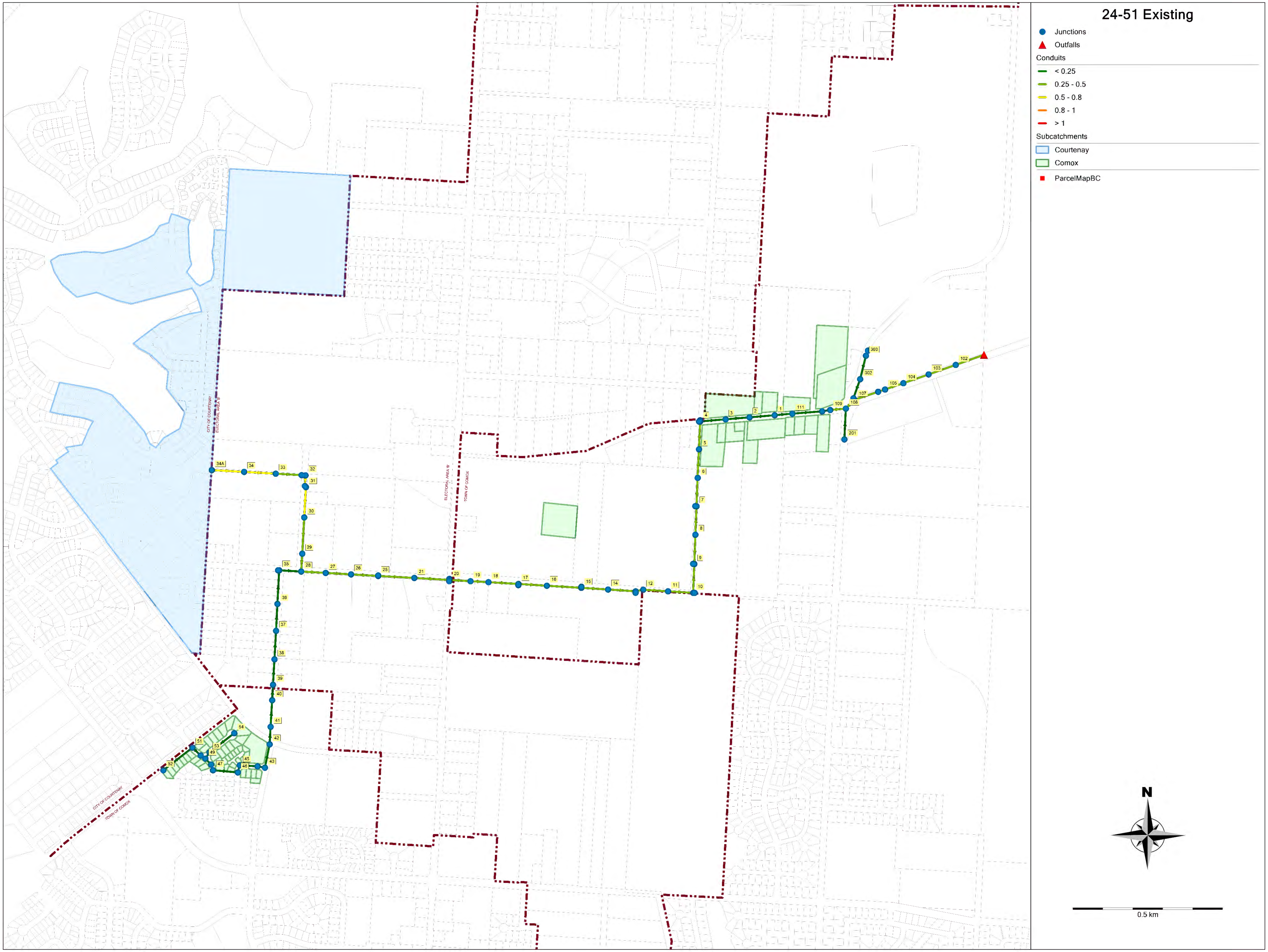
45
47
49
51
52
54
Hector_LS
24-01 Existing
N
400 m


24-51 Existing
Junctions
Outfalls
Conduits
< 0.25
0.25 - 0.5
0.5 - 0.8
0.8 - 1
> 1
Subcatchments
Courtenay
Comox
ParcelMapBC
N
0.5 km

APPENDIX B

Model 24-01 Maximum Capacity Flows

2024-07-15
NG / AM
Rev 0

Comox Valley Regional District Sanitary Model Analysis

Hudson Trunk - Maximum Pipe Capacity

				Pre-Development (Existing)	
SMH	Downstream Pipe Diameter (mm)	Downstream Pipe Slope (%)	Total Pipe Capacity (L/s)	Peak Flow (L/s)	Pipe Utilization (d/D, %)
43	200	0.47	22.5	22.5	100%
42	200	0.63	26.2	22.5	86%
41	200	0.51	23.4	22.5	96%
40	200	0.51	23.2	22.5	97%
39	200	0.55	24.5	22.5	92%
38	200	3.23	59.2	22.5	38%
37	200	2.96	56.3	22.5	40%
36	200	0.58	25.0	22.5	90%
35	200	0.74	28.2	27.9	99%
34	250	0.50	41.7	37.5	90%
33	250	1.29	67.0	37.5	56%
32	250	0.40	37.9	37.5	99%
31	250	0.49	41.7	37.5	90%
30	250	0.97	58.8	38.3	65%
29	250	1.05	60.7	38.3	63%
28	300	0.56	72.7	66.2	91%
27	300	0.60	75.2	66.2	88%
26	300	1.17	105.0	66.2	63%
25	300	2.56	153.8	66.2	43%
21	300	0.47	66.2	66.2	100%
20	375	1.08	181.2	114.2	63%
19	375	1.02	175.6	114.2	65%
18	375	0.50	124.1	114.2	92%
17	375	0.51	124.1	114.2	92%
16	375	0.45	117.7	114.2	97%
15	375	0.40	111.9	114.2	**102%**
14	375	0.44	115.3	114.2	99%
13	375	0.43	115.3	114.2	99%
12	375	0.44	116.5	114.2	98%
11	375	0.44	116.5	114.2	98%
10	375	0.42	113.0	114.2	**101%**
8	375	0.53	126.8	114.2	90%
7	375	0.51	125.4	114.2	91%
6	375	0.97	172.0	165.2	96%
5	375	0.90	166.8	165.2	99%
4	375	3.71	339.5	285.2	84%
3	375	3.69	335.5	285.2	85%
2	375	4.02	352.0	285.2	81%
1	375	2.63	285.2	285.2	100%

Pipes over 100% capacity will be highlighted.

APPENDIX C

Model 24-02 2123 Hector Road Development Results

Comox Valley Regional District Sanitary Model Analysis

Hudson Trunk - 2123 Hector Road

				24-01 Existing (Pre-Development)		24-02 2123 Hector (Post Development)		24-51 Pre-Development (Existing)		24-52 2123 Hector (Post Development)	
SMH	Downstream Pipe Diameter (mm)	Downstream Pipe Slope (%)	Total Pipe Capacity (L/s)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)
43	200	0.47	22.5	2.5	22%	11.7	49%	2.5	22%	12.0	50%
42	200	0.63	25.1	2.5	24%	11.7	49%	2.5	21%	12.0	47%
41	200	0.51	22.8	4.8	30%	13.9	54%	2.6	22%	12.0	49%
40	200	0.51	22.9	4.8	30%	13.9	54%	2.6	22%	12.0	49%
39	200	0.55	24.0	5.5	32%	14.6	54%	2.6	22%	12.1	48%
38	200	3.23	61.8	6.2	22%	15.2	35%	2.7	15%	12.1	31%
37	200	2.96	58.0	6.4	24%	15.4	42%	2.7	15%	12.2	36%
36	200	0.58	25.0	6.8	35%	15.7	56%	2.8	22%	12.2	48%
35	200	0.74	28.1	11.2	44%	20.1	62%	2.8	21%	12.3	46%
34	250	0.50	42.1	25.7	55%	28.2	58%	23.3	52%	26.9	56%
33	250	1.29	67.8	25.8	43%	28.2	45%	23.4	41%	27.0	44%
32	250	0.40	37.9	28.0	59%	30.5	62%	23.4	53%	27.0	58%
31	250	0.49	41.5	29.0	59%	31.4	62%	23.5	52%	27.1	57%
30	250	0.97	58.8	30.0	51%	32.3	53%	23.6	44%	27.2	48%
29	250	1.05	61.2	30.0	50%	32.3	52%	23.6	43%	27.2	47%
28	300	0.56	72.9	42.3	54%	53.3	62%	26.5	42%	39.5	52%
27	300	0.60	74.9	44.2	55%	55.2	63%	26.6	41%	39.6	51%
26	300	1.17	104.3	45.9	46%	56.8	53%	26.7	34%	39.7	43%
25	300	2.56	152.7	47.3	48%	58.1	55%	26.8	33%	39.8	42%
21	300	0.47	66.8	47.4	60%	58.1	69%	26.9	43%	39.9	54%
20	375	1.08	182.2	98.4	52%	109.1	56%	26.9	26%	40.0	32%
19	375	1.02	175.8	98.5	58%	109.2	63%	27.0	26%	40.0	33%
18	375	0.50	124.8	98.6	65%	109.3	70%	27.1	32%	40.1	39%
17	375	0.51	124.9	98.7	65%	109.3	71%	27.2	32%	40.2	39%
16	375	0.45	117.8	99.0	69%	109.8	75%	27.4	32%	40.5	40%
15	375	0.40	111.2	99.0	69%	109.7	76%	27.5	33%	40.5	40%

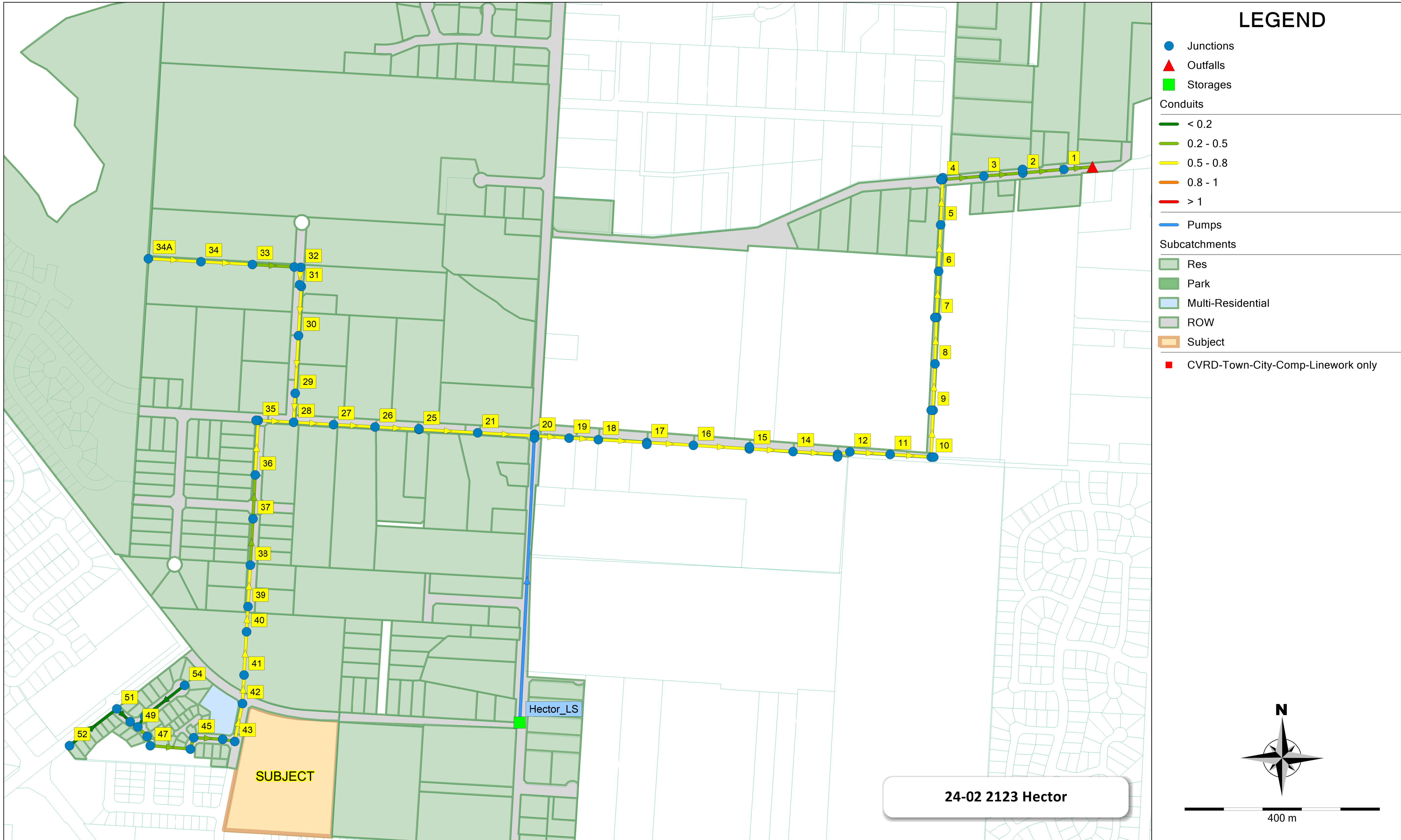
Comox Valley Regional District Sanitary Model Analysis

2024-08-27
ER / AM
Rev 2

Hudson Trunk - 2123 Hector Road

				24-01 Existing (Pre-Development)		24-02 2123 Hector (Post Development)		24-51 Pre-Development (Existing)		24-52 2123 Hector (Post Development)	
SMH	Downstream Pipe Diameter (mm)	Downstream Pipe Slope (%)	Total Pipe Capacity (L/s)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)
14	375	0.44	116.2	98.8	67%	109.3	72%	27.6	33%	40.6	40%
13	375	0.43	114.9	98.8	65%	109.3	69%	27.6	32%	40.7	40%
12	375	0.44	116.4	98.9	68%	109.4	74%	27.7	33%	40.8	40%
11	375	0.44	116.1	98.7	66%	108.9	71%	27.8	33%	40.8	40%
10	375	0.42	113.2	98.5	68%	108.3	72%	27.9	33%	40.9	40%
9	375	0.48	121.4	98.3	65%	107.9	70%	28.0	32%	41.0	40%
8	375	0.53	127.5	98.2	64%	107.6	68%	28.1	32%	41.1	39%
7	375	0.51	125.7	98.0	64%	107.3	68%	28.2	32%	41.2	39%
6	375	0.97	171.9	98.0	54%	107.3	57%	28.3	27%	41.3	33%
5	375	0.90	166.1	98.0	55%	107.2	58%	28.4	28%	41.4	34%
4	375	3.71	342.4	102.7	38%	111.9	40%	28.7	20%	41.7	24%
3	375	3.69	332.0	102.9	38%	112.1	40%	28.9	20%	41.9	24%
2	375	4.02	349.7	104.9	37%	114.1	39%	29.3	19%	42.4	23%
1	375	2.63	283.8	107.8	43%	117.0	45%	29.4	21%	42.6	25%
111	-	-	-	-	-	-	-	29.9	21%	43.1	25%
110	-	-	-	-	-	-	-	30.1	21%	43.8	26%
109	-	-	-	-	-	-	-	30.1	27%	43.8	32%
108	-	-	-	-	-	-	-	30.2	28%	43.9	34%
107	-	-	-	-	-	-	-	31.4	27%	44.7	32%
106	-	-	-	-	-	-	-	31.4	31%	44.8	37%
105	-	-	-	-	-	-	-	31.5	34%	44.8	41%
104	-	-	-	-	-	-	-	31.6	37%	44.9	46%
103	-	-	-	-	-	-	-	31.6	47%	45.0	58%
102	-	-	-	-	-	-	-	31.7	47%	45.1	57%

Pipes over 80% capacity will be highlighted.



LEGEND
Junctions
Outfalls
Storages
Conduits
< 0.2
0.2 - 0.5
0.5 - 0.8
0.8 - 1
> 1
Pumps
Subcatchments
Res
Park
Multi-Residential
ROW
Subject
CVRD-Town-City-Comp-Linework only
1
2
3
4
5
6
7
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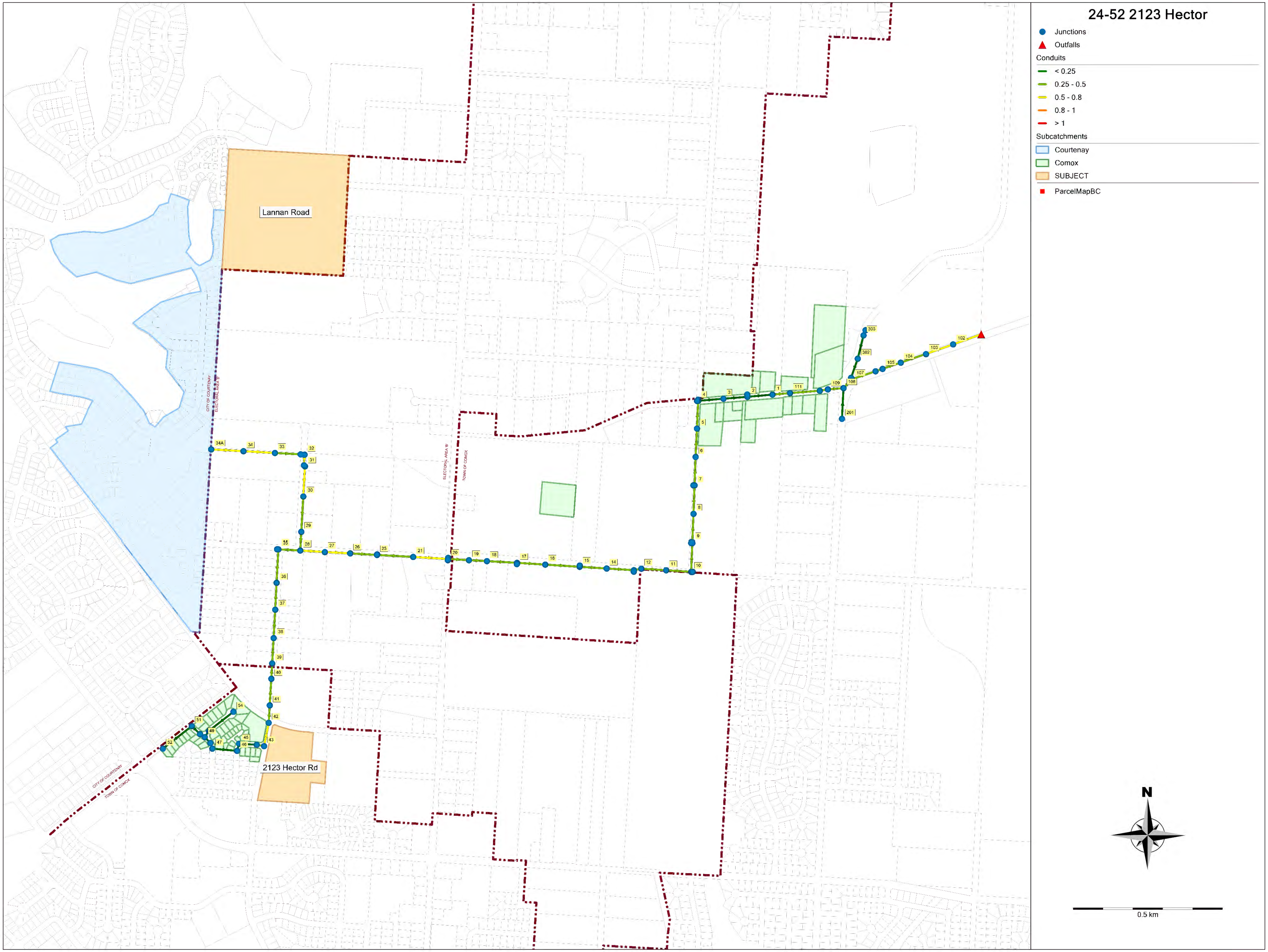
Hector_LS
SUBJECT
24-02 2123 Hector
N
400 m


24-52 2123 Hector
Junctions
Outfalls
Conduits
< 0.25
0.25 - 0.5
0.5 - 0.8
0.8 - 1
> 1
Subcatchments
Courtenay
Comox
SUBJECT
ParcelMapBC
Lannan Road
2123 Hector Rd
N
0.5 km

APPENDIX D

Model 24-03 All Three Lots to Aspen Road

Comox Valley REGIONAL DISTRICT

Comox Valley Regional District Sanitary Model Analysis

Hudson Trunk - All Three Lots

				24-01 Existing (Pre-Development)		24-03 All Three Lots (Post Development)		24-03A All Three Lots (Upgrade) (Post Development)			24-51 Existing (Pre-Development)		24-53 All Three Lots (Post Development)		24-53A All Three Lots (Upgrade) (Post Development)		
SMH	Downstream Pipe Diameter (mm)	Downstream Pipe Slope (%)	Total Pipe Capacity (L/s)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Upgraded Pipe Diameter (mm)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Upgraded Pipe Diameter (mm)
43	200	0.47	22.5	2.5	22%	13.4	100%	2.4	22%		2.5	22%	13.4	100%	11.7	58%	
42	200	0.63	25.1	2.5	24%	34.7	100%	2.4	15%	250	2.5	21%	34.6	100%	34.7	65%	250
41	200	0.51	22.8	4.8	30%	34.7	100%	2.4	16%	250	2.6	22%	34.6	100%	34.7	67%	250
40	200	0.51	22.9	4.8	30%	41.2	100%	3.9	16%	300	2.6	22%	41.0	100%	41.1	54%	300
39	200	0.55	24.0	5.5	32%	41.9	93%	4.6	17%	300	2.6	22%	41.1	93%	41.2	53%	300
38	200	3.23	61.8	6.2	22%	42.6	84%	5.2	12%	300	2.7	15%	41.1	81%	41.2	33%	300
37	200	2.96	58.0	6.4	24%	42.8	100%	5.3	12%	300	2.7	15%	41.2	100%	41.3	41%	300
36	200	0.58	25.0	6.8	35%	42.3	100%	5.7	19%	300	2.8	22%	41.2	100%	41.3	53%	300
35	200	0.74	28.1	11.2	44%	46.8	100%	10.1	23%	300	2.8	21%	41.3	93%	41.4	50%	300
34	250	0.50	42.1	25.7	55%	29.3	59%	21.1	49%		23.3	52%	26.9	56%	26.9	56%	
33	250	1.29	67.8	25.8	43%	29.4	46%	21.1	38%		23.4	41%	27.0	44%	27.0	44%	
32	250	0.40	37.9	28.0	59%	31.6	64%	23.3	53%		23.4	53%	27.0	58%	27.0	58%	
31	250	0.49	41.5	29.0	59%	32.7	64%	24.3	53%		23.5	52%	27.1	57%	27.1	57%	
30	250	0.97	58.8	30.0	51%	33.6	54%	25.1	46%		23.6	44%	27.2	48%	27.2	48%	
29	250	1.05	61.2	30.0	50%	33.6	76%	25.1	45%		23.6	43%	27.2	59%	27.2	59%	
28	300	0.56	72.9	42.3	54%	81.0	100%	36.2	36%	375	26.5	42%	68.5	74%	68.6	74%	375
27	300	0.60	74.9	44.2	55%	83.0	87%	38.1	36%	375	26.6	41%	68.6	72%	68.7	72%	375
26	300	1.17	104.3	45.9	46%	84.7	68%	39.7	31%	375	26.7	34%	68.7	59%	68.8	59%	375
25	300	2.56	152.7	47.3	48%	86.1	77%	41.0	30%	375	26.8	33%	68.8	66%	68.9	66%	375
21	300	0.47	66.8	47.4	60%	86.2	88%	41.0	40%	375	26.9	43%	68.9	80%	69.0	80%	375
20	375	1.08	182.2	98.4	52%	137.2	65%	92.0	50%		26.9	26%	68.9	43%	69.0	43%	
19	375	1.02	175.8	98.5	58%	137.2	84%	92.1	51%		27.0	26%	69.0	46%	69.1	46%	
18	375	0.50	124.8	98.6	65%	137.0	100%	92.2	47%	450	27.1	32%	69.1	52%	69.2	52%	450
17	375	0.51	124.9	98.7	65%	135.0	100%	92.3	47%	450	27.2	32%	69.2	52%	69.3	52%	450
16	375	0.45	117.8	99.0	69%	133.9	100%	92.4	48%	450	27.4	32%	69.4	53%	69.5	54%	450
15	375	0.40	111.2	99.0	69%	130.4	95%	92.4	49%	450	27.5	33%	69.5	55%	69.6	55%	450
14	375	0.44	116.2	98.8	67%	128.9	86%	92.5	48%	450	27.6	33%	69.6	54%	69.7	54%	450
13	375	0.43	114.9	98.8	65%	128.5	84%	92.5	48%	450	27.6	32%	69.6	53%	69.8	53%	450
12	375	0.44	116.4	98.9	68%	128.5	91%	92.5	48%	450	27.7	33%	69.7	54%	69.8	54%	450
11	375	0.44	116.1	98.7	66%	128.3	91%	92.5	48%	450	27.8	33%	69.8	54%	69.9	54%	450
10	375	0.42	113.2	98.5	68%	128.3	88%	92.5	49%	450	27.9	33%	69.9	55%	70.0	55%	450
9	375	0.48	121.4	98.3	65%	128.1	83%	92.4	48%	450	28.0	32%	70.0	53%	70.1	53%	450
8	375	0.53	127.5	98.2	64%	128.1	80%	92.3	47%	450	28.1	32%	70.1	52%	70.2	52%	450
7	375	0.51	125.7	98.0	64%	127.9	78%	92.2	47%	450	28.2	32%	70.2	53%	70.3	53%	450
6	375	0.97	171.9	98.0	54%	127.9	64%	92.1	52%		28.3	27%	70.3	44%	70.4	44%	
5	375	0.90	166.1	98.0	55%	128.0	66%	92.0	53%		28.4	28%	70.4	45%	70.5	45%	
4	375	3.71	342.4	102.7	38%	132.7	44%	96.7	37%		28.7	20%	70.6	31%	70.8	31%	
3	375	3.69	332.0	102.9	38%	133.0	44%	96.9	37%		28.9	20%	70.8	31%	71.0	31%	

2024-08-27
ER / AM
Rev 2

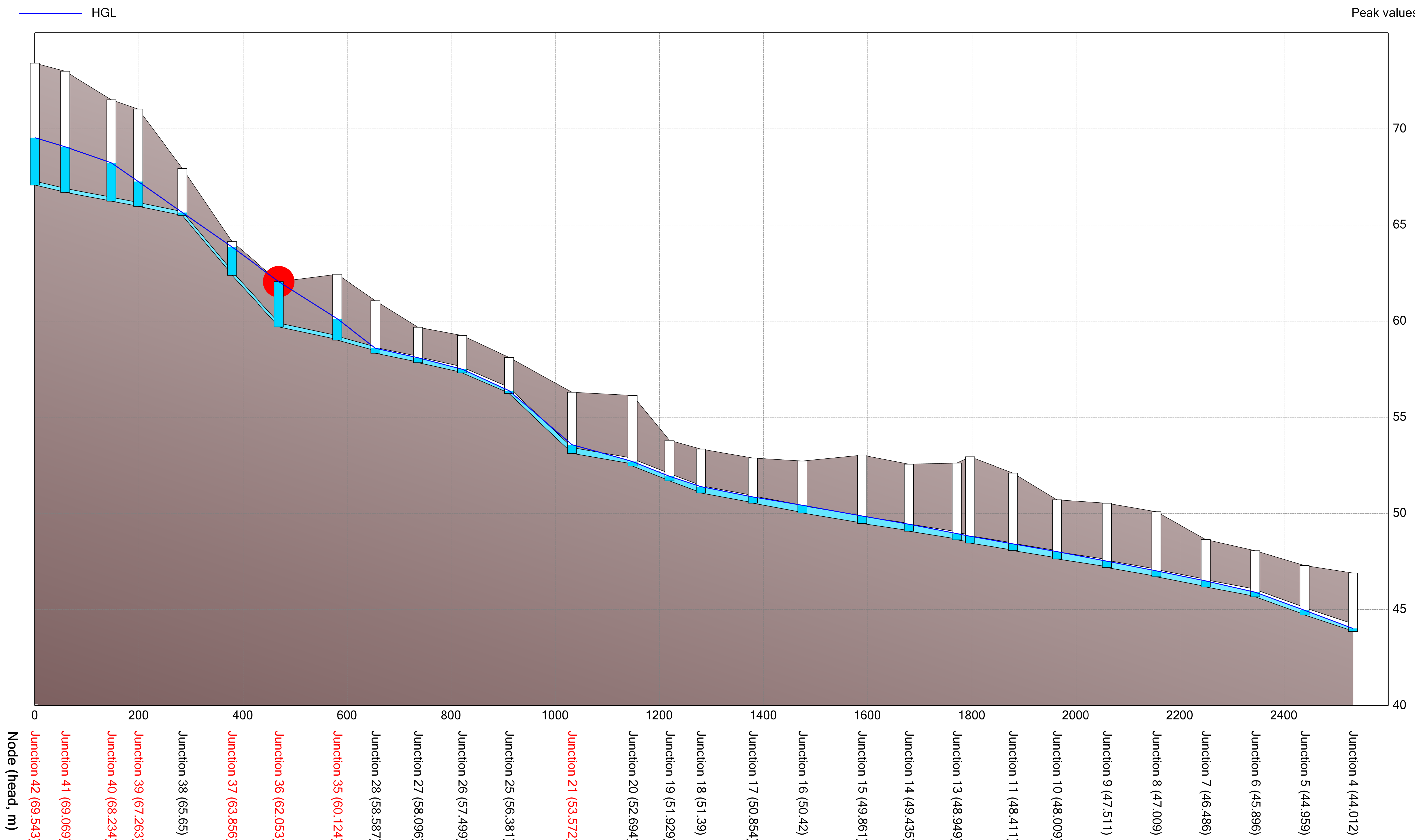
Comox Valley Regional District Sanitary Model Analysis

Hudson Trunk - All Three Lots

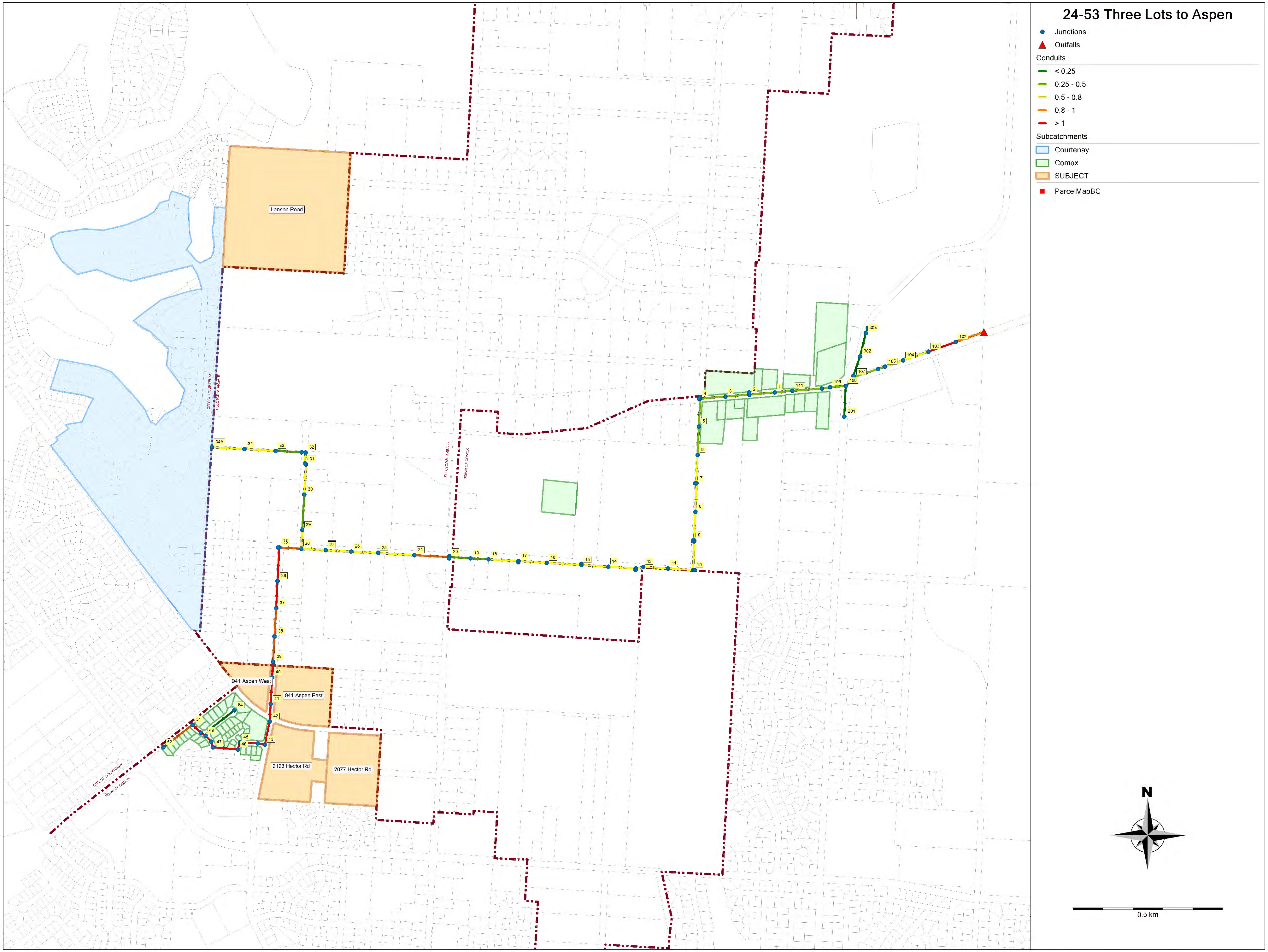
				24-01 Existing (Pre-Development)		24-03 All Three Lots (Post Development)		24-03A All Three Lots (Upgrade) (Post Development)			24-51 Existing (Pre-Development)		24-53 All Three Lots (Post Development)		24-53A All Three Lots (Upgrade) (Post Development)		
SMH	Downstream Pipe Diameter (mm)	Downstream Pipe Slope (%)	Total Pipe Capacity (L/s)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Upgraded Pipe Diameter (mm)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Upgraded Pipe Diameter (mm)
2	375	4.02	349.7	104.9	37%	135.0	43%	98.9	36%		29.3	19%	71.3	31%	71.5	31%	
1	375	2.63	283.8	107.8	43%	137.9	49%	101.8	41%		29.4	21%	71.5	33%	71.7	33%	
111	-	-	-	-	-	-	-	-	-		29.9	21%	72.0	33%	72.2	33%	
110	-	-	-	-	-	-	-	-	-		30.1	21%	72.7	34%	72.9	34%	
109	-	-	-	-	-	-	-	-	-		30.1	27%	72.7	42%	72.9	43%	
108	-	-	-	-	-	-	-	-	-		30.2	28%	72.8	45%	73.0	45%	
107	-	-	-	-	-	-	-	-	-		31.4	27%	73.6	42%	73.8	42%	
106	-	-	-	-	-	-	-	-	-		31.4	31%	73.7	49%	73.9	49%	
105	-	-	-	-	-	-	-	-	-		31.5	34%	73.7	54%	73.9	54%	
104	-	-	-	-	-	-	-	-	-		31.6	37%	73.8	74%	74.0	57%	
103	-	-	-	-	-	-	-	-	-		31.6	47%	73.8	100%	74.1	55%	
102	-	-	-	-	-	-	-	-	-		31.7	47%	73.8	85%	74.1	55%	

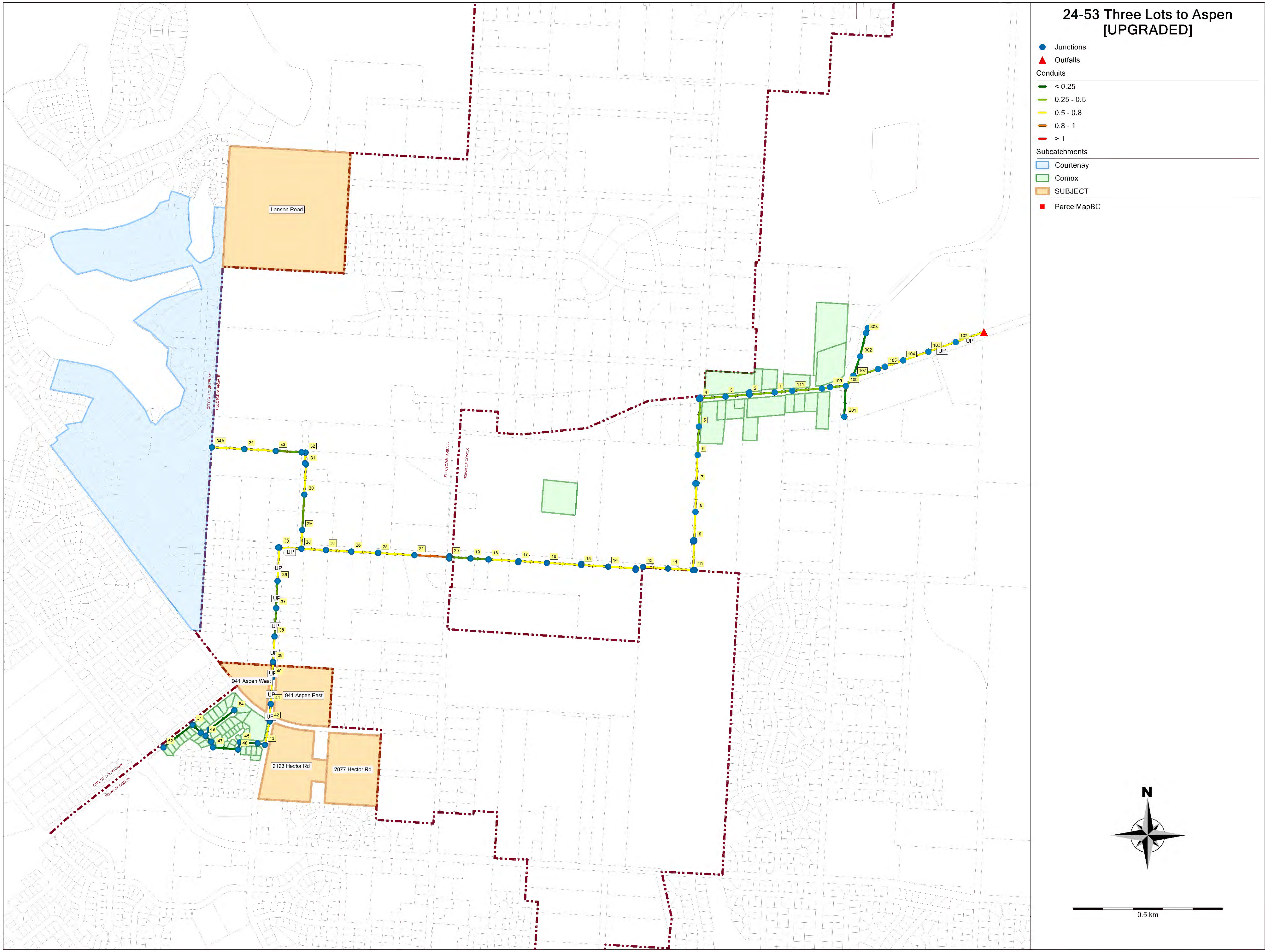
Pipes over 80% capacity are highlighted.

Legend
Junctions
Outfalls
Storages
Conduits
< 0.25
0.25 - 0.5
0.5 - 0.8
0.8 - 1
> 1
Pumps
Subcatchments
Res
Park
Multi-Residential
ROW
Subject
CVRD-Town-City-Comp-Linework only
941 Aspen West
941 Aspen East
2123 Hector Rd
2077 Hector Road
Hector_LS
24-03 Three Lots to Aspen
N
400 m


HGL
Peak values
70
65
60
55
50
45
40
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
Node (head, m)
Junction 42 (69.543)
Junction 41 (69.069)
Junction 40 (68.234)
Junction 39 (67.263)
Junction 38 (65.65)
Junction 37 (63.856)
Junction 36 (62.053)
Junction 35 (60.124)
Junction 28 (58.587)
Junction 27 (58.096)
Junction 26 (57.499)
Junction 25 (56.381)
Junction 21 (53.572)
Junction 20 (52.694)
Junction 19 (51.929)
Junction 18 (51.39)
Junction 17 (50.854)
Junction 16 (50.42)
Junction 15 (49.861)
Junction 14 (49.435)
Junction 13 (48.949)
Junction 11 (48.411)
Junction 10 (48.009)
Junction 9 (47.511)
Junction 8 (47.009)
Junction 7 (46.486)
Junction 6 (45.896)
Junction 5 (44.959)
Junction 4 (44.012)


Legend
Junctions
Outfalls
Storages
Conduits
< 0.25
0.25 - 0.50
0.50 - 0.80
0.80 - 1
> 1
Pumps
Subcatchments
Res
Park
Multi-Residential
ROW
Subject
CVRD-Town-City-Comp-Linework only
N
400 m
941 Aspen West
941 Aspen East
2123 Hector Rd
2077 Hector Road
Hector_LS
24-03A Three Lots (Upgraded)


24-53 Three Lots to Aspen
Junctions
Outfalls
Conduits
< 0.25
0.25 - 0.5
0.5 - 0.8
0.8 - 1
> 1
Subcatchments
Courtenay
Comox
SUBJECT
ParcelMapBC
Lannan Road
941 Aspen West
941 Aspen East
2123 Hector Rd
2077 Hector Rd
N
0.5 km



24-53 Three Lots to Aspen
[UPGRADED]
Junctions
Outfalls
Conduits
< 0.25
0.25 - 0.5
0.5 - 0.8
0.8 - 1
> 1
Subcatchments
Courtenay
Comox
SUBJECT
ParcelMapBC
Lannan Road
941 Aspen West
941 Aspen East
2123 Hector Rd
2077 Hector Rd
CITY OF COURTENAY
TOWN OF COMOX
N
0.5 km

2024-08-27
ER / AM
Rev 0

Comox Valley Regional District Sanitary Model Analysis

Hudson Trunk -First Phases Aspen

				24-51 Existing (Pre-Development)		24-53B First Phases Aspen (Post Development)	
SMH	Downstream Pipe Diameter (mm)	Downstream Pipe Slope (%)	Total Pipe Capacity (L/s)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)
43	200	0.47	23.0	2.5	22%	11.7	52%
42	200	0.63	25.9	2.5	21%	21.0	69%
41	200	0.51	23.6	2.6	22%	21.0	73%
40	200	0.51	23.6	2.6	22%	21.0	72%
39	200	0.55	24.2	2.6	22%	21.0	68%
38	200	3.23	58.7	2.7	15%	21.1	41%
37	200	2.96	55.6	2.7	15%	21.1	53%
36	200	0.58	25.3	2.8	22%	21.2	68%
35	200	0.74	28.5	2.8	21%	21.2	64%
34	250	0.50	41.9	23.3	52%	26.9	56%
33	250	1.29	67.2	23.4	41%	27.0	44%
32	250	0.40	37.5	23.4	53%	27.0	58%
31	250	0.49	41.8	23.5	52%	27.1	57%
30	250	0.97	58.2	23.6	44%	27.2	48%
29	250	1.05	60.6	23.6	43%	27.2	48%
28	300	0.56	71.9	26.5	42%	48.5	59%
27	300	0.60	75.0	26.6	41%	48.6	58%
26	300	1.17	103.7	26.7	34%	48.6	48%
25	300	2.56	154.7	26.8	33%	48.7	49%
21	300	0.47	66.6	26.9	43%	48.8	61%
20	375	1.08	183.2	26.9	26%	48.9	35%
19	375	1.02	176.8	27.0	26%	49.0	37%
18	375	0.50	123.9	27.1	32%	49.1	43%
17	375	0.51	124.0	27.2	32%	49.2	43%
16	375	0.45	118.5	27.4	32%	49.4	44%
15	375	0.40	111.8	27.5	33%	49.5	45%

Comox Valley REGIONAL DISTRICT

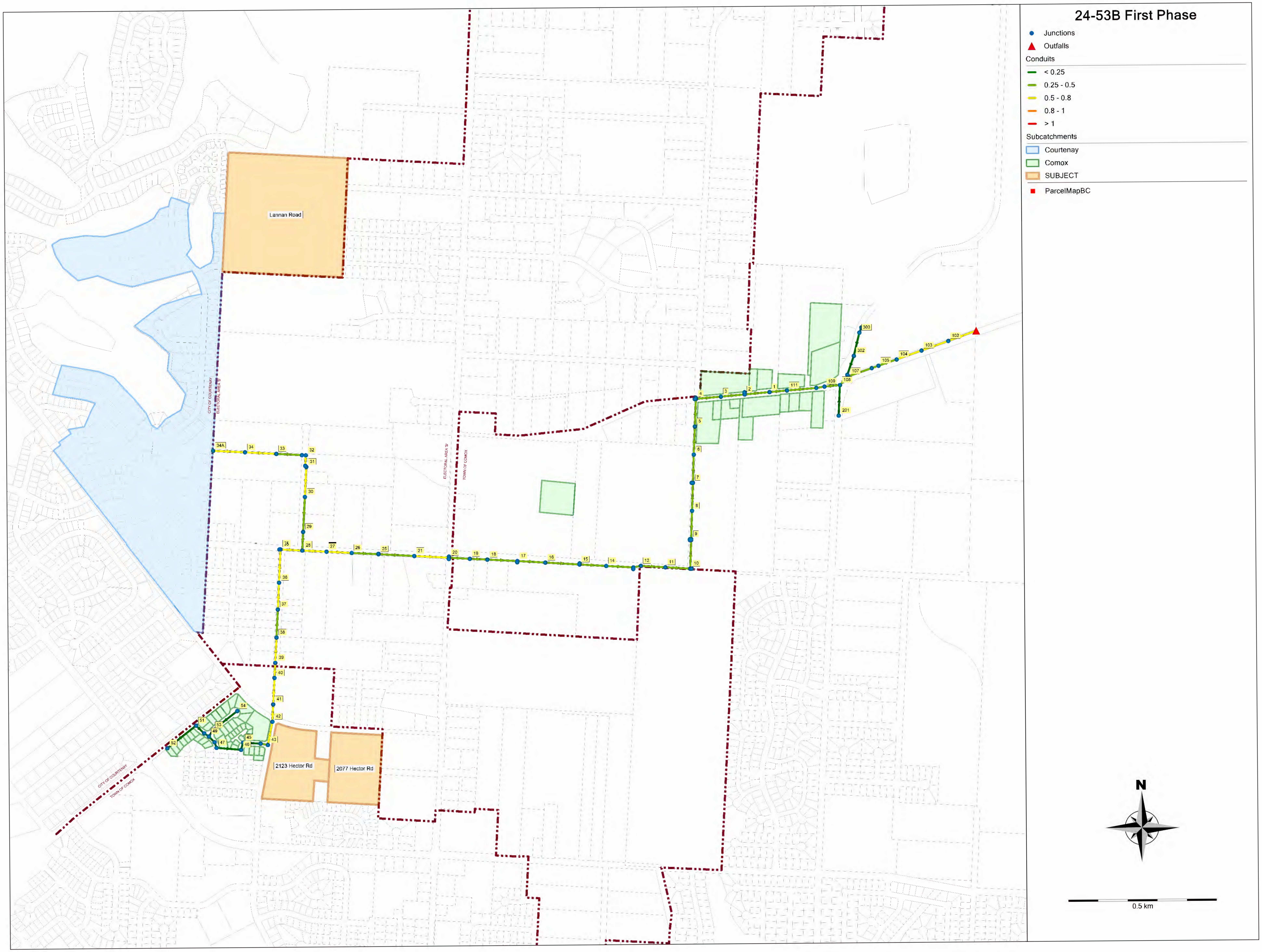
2024-08-27
ER / AM
Rev 0

Comox Valley Regional District Sanitary Model Analysis

Hudson Trunk -First Phases Aspen

SMH	Downstream Pipe Diameter (mm)	Downstream Pipe Slope (%)	Total Pipe Capacity (L/s)	24-51 Existing (Pre-Development) Peak Flow (L/s)	24-51 Existing (Pre-Development) Pipe Utilization (d/D, %)	24-53B First Phases Aspen (Post Development) Peak Flow (L/s)	24-53B First Phases Aspen (Post Development) Pipe Utilization (d/D, %)
14	375	0.44	115.5	27.6	33%	49.6	45%
13	375	0.43	115.5	27.6	32%	49.6	44%
12	375	0.44	115.6	27.7	33%	49.7	44%
11	375	0.44	116.8	27.8	33%	49.8	44%
10	375	0.42	112.5	27.9	33%	49.9	45%
9	375	0.48	120.5	28.0	32%	50.0	44%
8	375	0.53	126.6	28.1	32%	50.1	43%
7	375	0.51	124.7	28.2	32%	50.2	44%
6	375	0.97	172.9	28.3	27%	50.3	37%
5	375	0.90	167.0	28.4	28%	50.4	38%
4	375	3.71	332.7	28.7	20%	50.6	26%
3	375	3.69	333.1	28.9	20%	50.9	26%
2	375	4.02	350.6	29.3	19%	51.3	26%
1	375	2.63	282.1	29.4	21%	51.6	28%
111	-	-	-	29.9	21%	52.1	28%
110	-	-	-	30.1	21%	52.7	28%
109	-	-	-	30.1	27%	52.8	36%
108	-	-	-	30.2	28%	52.9	38%
107	-	-	-	31.4	27%	53.7	36%
106	-	-	-	31.4	31%	53.7	41%
105	-	-	-	31.5	34%	53.8	45%
104	-	-	-	31.6	37%	53.9	52%
103	-	-	-	31.6	47%	53.9	66%
102	-	-	-	31.7	47%	54.0	64%

Pipes over 80% capacity are highlighted.



24-53B First Phase
Junctions
Outfalls
Conduits
< 0.25
0.25 - 0.5
0.5 - 0.8
0.8 - 1
> 1
Subcatchments
Courtenay
Comox
SUBJECT
ParcelMapBC
Lannan Road
2123 Hector Rd
2077 Hector Rd
N
0.5 km

APPENDIX E

Model 24-04 Hector Multi-Family Projects to Lift Station

Comox Valley
REGIONAL DISTRICT

2024-08-27
ER / AM
Rev 2

Comox Valley Regional District Sanitary Model Analysis

Hudson Trunk - 2123 Hector Road

				24-01 Existing (Pre-Development)		24-04 Hector MF to LS (Post Development)		24-04A Hector MF (Upgrades) (Post Development)			24-51 Existing (Pre-Development)		24-54 Hector MF to LS (Post Development)		24-54A Hector MF (Upgrades) (Post Development)		
SMH	Downstream Pipe Diameter (mm)	Downstream Pipe Slope (%)	Total Pipe Capacity (L/s)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Upgraded Downstream Pipe Diameter (mm)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Upgraded Downstream Pipe Diameter (mm)
43	200	0.47	22.5	2.5	22%	2.4	22%	2.4	22%		2.5	22%	2.4	22%	2.4	22%	
42	200	0.63	25.1	2.5	24%	2.4	21%	2.4	21%		2.5	21%	2.4	48%	2.4	48%	
41	200	0.51	22.8	4.8	30%	2.4	22%	2.4	22%		2.6	22%	22.6	78%	22.6	78%	
40	200	0.51	22.9	4.8	30%	3.9	27%	3.9	20%	250	2.6	22%	22.6	78%	22.6	78%	250
39	200	0.55	24.0	5.5	32%	4.6	29%	4.6	21%	250	2.6	22%	22.6	72%	22.6	72%	250
38	200	3.23	61.8	6.2	22%	5.2	20%	5.2	15%	250	2.7	15%	22.7	43%	22.7	43%	250
37	200	2.96	58.0	6.4	24%	5.3	22%	5.3	16%	250	2.7	15%	22.7	56%	22.7	56%	250
36	200	0.58	25.0	6.8	35%	5.7	32%	5.7	24%	250	2.8	22%	22.8	72%	22.8	72%	250
35	200	0.74	28.1	11.2	44%	10.1	41%	10.1	30%	250	2.8	21%	22.8	67%	22.8	67%	250
34	250	0.50	42.1	25.7	55%	21.1	49%	21.1	49%		23.3	52%	26.9	56%	26.9	56%	
33	250	1.29	67.8	25.8	43%	21.1	38%	21.1	38%		23.4	41%	27.0	44%	27.0	44%	
32	250	0.40	37.9	28.0	59%	23.3	53%	23.3	53%		23.4	53%	27.0	58%	27.0	58%	
31	250	0.49	41.5	29.0	59%	24.3	53%	24.3	53%		23.5	52%	27.1	57%	27.1	57%	
30	250	0.97	58.8	30.0	51%	25.1	46%	25.1	46%		23.6	44%	27.2	48%	27.2	48%	
29	250	1.05	61.2	30.0	50%	25.1	45%	25.1	45%		23.6	43%	27.2	48%	27.2	48%	
28	300	0.56	72.9	42.3	54%	36.2	49%	36.2	49%		26.5	42%	50.1	60%	50.1	60%	
27	300	0.60	74.9	44.2	55%	38.1	50%	38.1	50%		26.6	41%	50.2	59%	50.2	59%	
26	300	1.17	104.3	45.9	46%	39.7	43%	39.7	43%		26.7	34%	50.2	49%	50.2	49%	
25	300	2.56	152.7	47.3	48%	41.0	43%	41.0	43%		26.8	33%	50.3	50%	50.3	50%	
21	300	0.47	66.8	47.4	60%	41.0	55%	41.0	55%		26.9	43%	50.4	62%	50.4	62%	
20	375	1.08	182.2	98.4	52%	92.0	50%	92.0	50%		26.9	26%	86.5	49%	86.5	49%	
19	375	1.02	175.8	98.5	58%	92.2	55%	92.1	51%		27.0	26%	86.8	53%	86.8	53%	
18	375	0.50	124.8	98.6	65%	92.1	62%	92.2	47%	450	27.1	32%	86.7	60%	86.7	60%	450
17	375	0.51	124.9	98.7	65%	92.2	62%	92.3	47%	450	27.2	32%	86.8	60%	86.8	60%	450
16	375	0.45	117.8	99.0	69%	92.5	65%	92.4	48%	450	27.4	32%	87.1	62%	87.1	62%	450
15	375	0.40	111.2	99.0	69%	92.1	65%	92.4	49%	450	27.5	33%	86.8	62%	86.8	62%	450
14	375	0.44	116.2	98.8	67%	91.9	64%	92.5	48%	450	27.6	33%	86.6	61%	86.6	61%	450
13	375	0.43	114.9	98.8	65%	91.9	62%	92.5	48%	450	27.6	32%	86.7	60%	86.7	60%	450
12	375	0.44	116.4	98.9	68%	92.0	64%	92.5	48%	450	27.7	33%	86.5	61%	86.5	61%	450
11	375	0.44	116.1	98.7	66%	91.4	63%	92.5	48%	450	27.8	33%	86.4	61%	86.4	61%	450
10	375	0.42	113.2	98.5	68%	91.0	64%	92.5	49%	450	27.9	33%	86.0	62%	86.0	62%	450
9	375	0.48	121.4	98.3	65%	90.6	62%	92.4	48%	450	28.0	32%	85.7	60%	85.7	60%	450
8	375	0.53	127.5	98.2	64%	90.3	61%	92.3	47%	450	28.1	32%	85.4	59%	85.4	59%	450
7	375	0.51	125.7	98.0	64%	90.0	61%	92.0	62%		28.2	32%	85.1	59%	85.1	59%	
6	375	0.97	171.9	98.0	54%	89.9	51%	91.9	52%		28.3	27%	85.0	50%	85.0	50%	
5	375	0.90	166.1	98.0	55%	89.8	52%	91.8	53%		28.4	28%	84.9	51%	84.9	51%	
4	375	3.71	342.4	102.7	38%	94.5	36%	96.5	37%		28.7	20%	85.0	34%	85.0	34%	

Comox Valley Regional District Sanitary Model Analysis

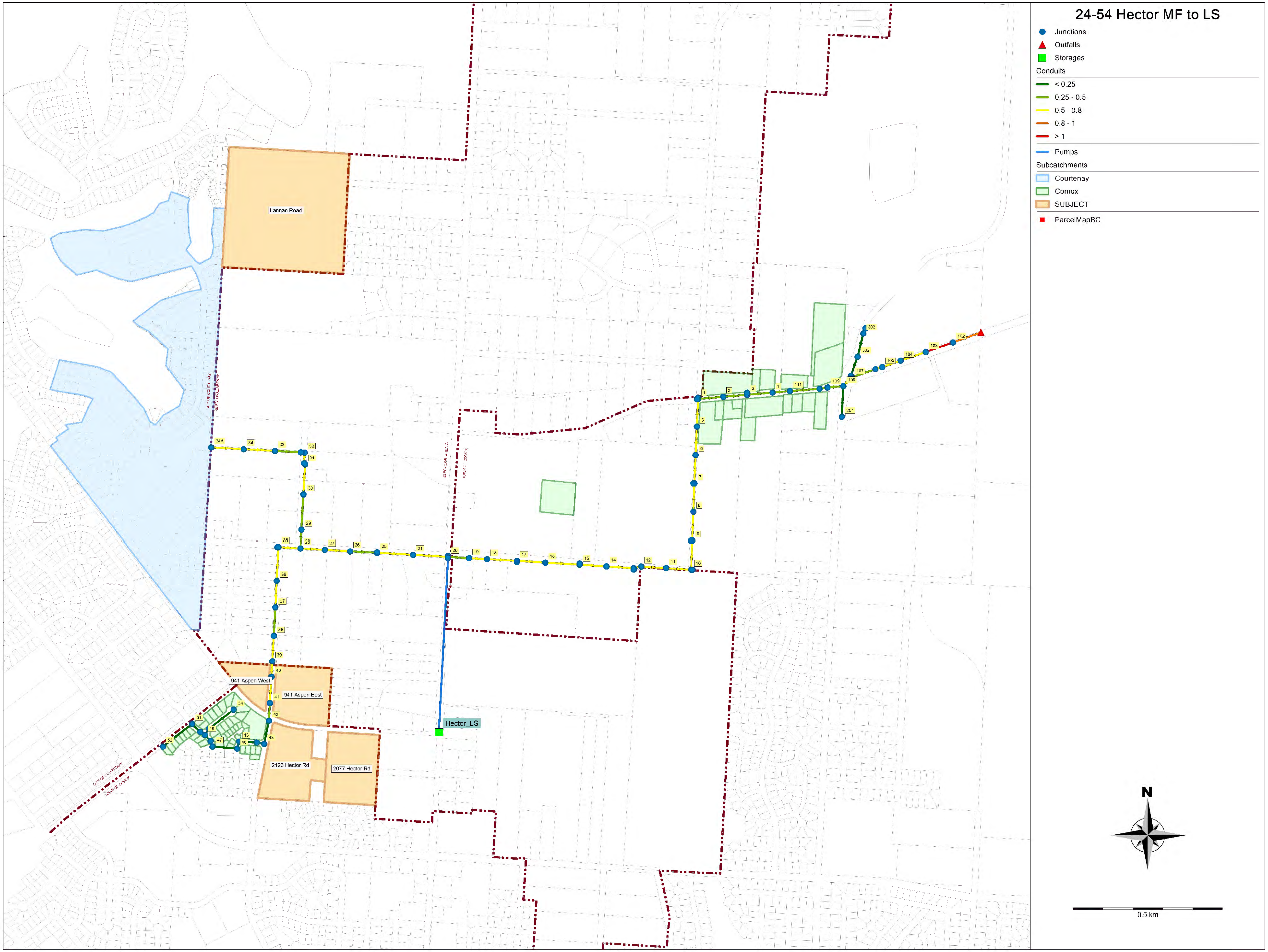
Hudson Trunk - 2123 Hector Road

				24-01 Existing (Pre-Development)		24-04 Hector MF to LS (Post Development)		24-04A Hector MF (Upgrades) (Post Development)			24-51 Existing (Pre-Development)		24-54 Hector MF to LS (Post Development)		24-54A Hector MF (Upgrades) (Post Development)		
SMH	Downstream Pipe Diameter (mm)	Downstream Pipe Slope (%)	Total Pipe Capacity (L/s)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Upgraded Downstream Pipe Diameter (mm)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Upgraded Downstream Pipe Diameter (mm)
3	375	3.69	332.0	102.9	38%	94.7	36%	96.7	37%		28.9	20%	85.2	34%	85.2	34%	
2	375	4.02	349.7	104.9	37%	96.7	36%	98.7	36%		29.3	19%	85.6	34%	85.6	34%	
1	375	2.63	283.8	107.8	43%	99.6	41%	101.6	41%		29.4	21%	85.8	36%	85.8	36%	
111	-	-	-	-	-	-	-	-	-		29.9	21%	86.2	36%	86.2	36%	
110	-	-	-	-	-	-	-	-	-		30.1	21%	86.9	37%	86.9	37%	
109	-	-	-	-	-	-	-	-	-		30.1	27%	86.9	47%	86.9	47%	
108	-	-	-	-	-	-	-	-	-		30.2	28%	87.0	50%	87.0	50%	
107	-	-	-	-	-	-	-	-	-		31.4	27%	87.8	47%	87.8	47%	
106	-	-	-	-	-	-	-	-	-		31.4	31%	87.8	55%	87.8	55%	
105	-	-	-	-	-	-	-	-	-		31.5	34%	87.7	60%	87.7	60%	
104	-	-	-	-	-	-	-	-	-		31.6	37%	87.8	76%	87.8	64%	
103	-	-	-	-	-	-	-	-	-		31.6	47%	87.9	100%	87.9	61%	
102	-	-	-	-	-	-	-	-	-		31.7	47%	87.9	88%	86.8	60%	

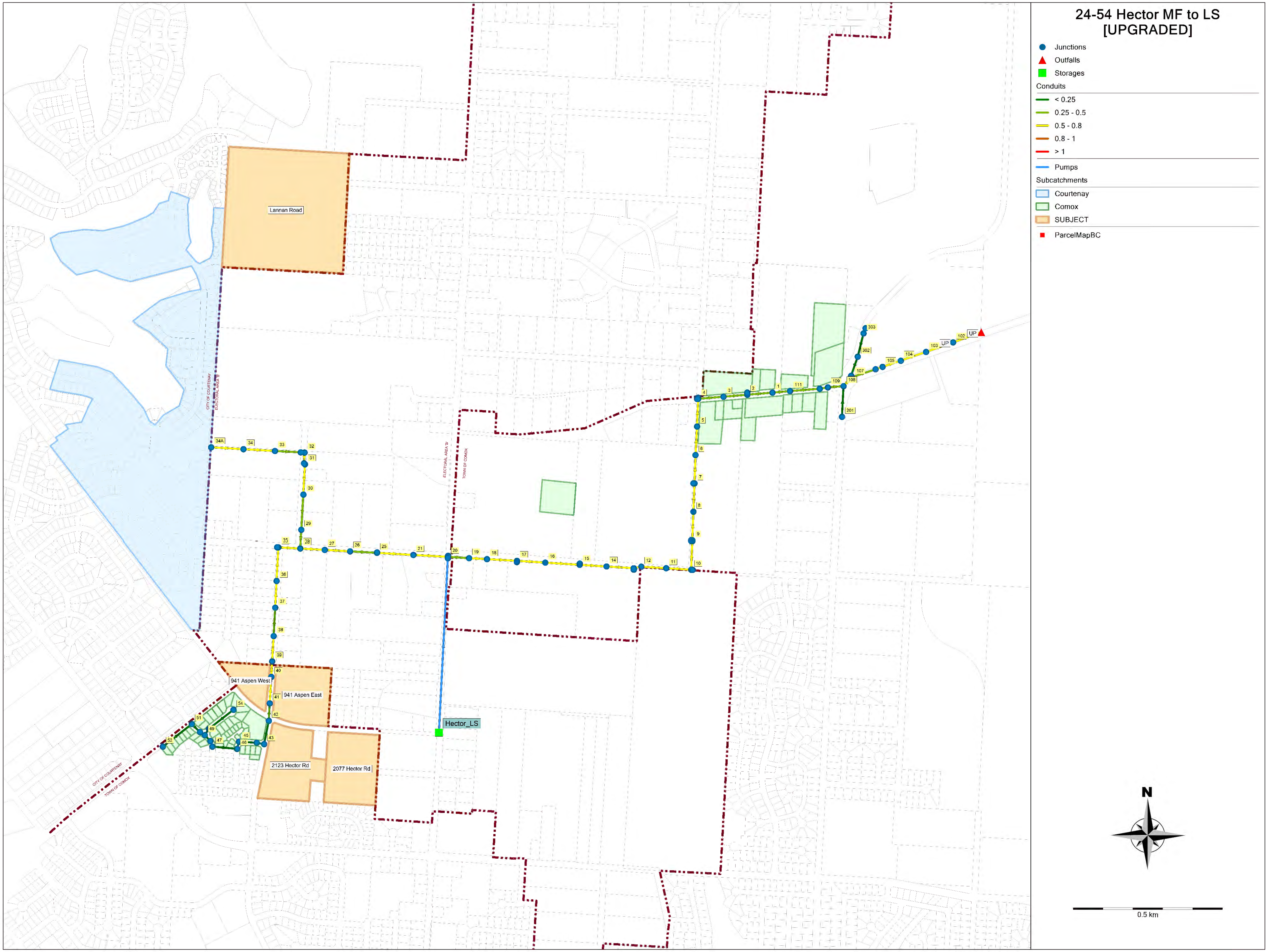
Pipes over 80% capacity will be highlighted.


Legend
Junctions
Outfalls
Storages
Conduits
< 0.25
0.25 - 0.5
0.5 - 0.8
0.8 - 1
> 1
Pumps
Subcatchments
Res
Park
Multi-Residential
ROW
Subject
CVRD-Town-City-Comp-Linework only
941 Aspen West
941 Aspen East
2123 Hector Rd
2077 Hector Road
Hector_LS
N
400 m
24-04 Hector MF to LS

Legend
Junctions
Outfalls
Storages
Conduits
< 0.25
0.25 - 0.5
0.5 - 0.8
0.8 - 1
> 1
Pumps
Subcatchments
Res
Park
Multi-Residential
ROW
Subject
CVRD-Town-City-Comp-Linework only
941 Aspen West
941 Aspen East
2123 Hector Rd
2077 Hector Road
Hector_LS
N
400 m
24-04A Hector MF to LS (Upgraded)



24-54 Hector MF to LS
Junctions
Outfalls
Storages
Conduits
< 0.25
0.25 - 0.5
0.5 - 0.8
0.8 - 1
> 1
Pumps
Subcatchments
Courtenay
Comox
SUBJECT
ParcelMapBC
Lannan Road
941 Aspen West
941 Aspen East
2123 Hector Rd
2077 Hector Rd
Hector_LS
N
0.5 km


24-54 Hector MF to LS
[UPGRADED]
Junctions
Outfalls
Storages
Conduits
< 0.25
0.25 - 0.5
0.5 - 0.8
0.8 - 1
> 1
Pumps
Subcatchments
Courtenay
Comox
SUBJECT
ParcelMapBC
Lannan Road
941 Aspen West
941 Aspen East
2123 Hector Rd
2077 Hector Rd
Hector_LS
UP
N
0.5 km

APPENDIX F

Model 24-05 Lannan Road Development

2024-08-27
ER / AM
Rev 2

Comox Valley REGIONAL DISTRICT

Comox Valley Regional District Sanitary Model Analysis

Hudson Trunk - 24-05 Lannon Road

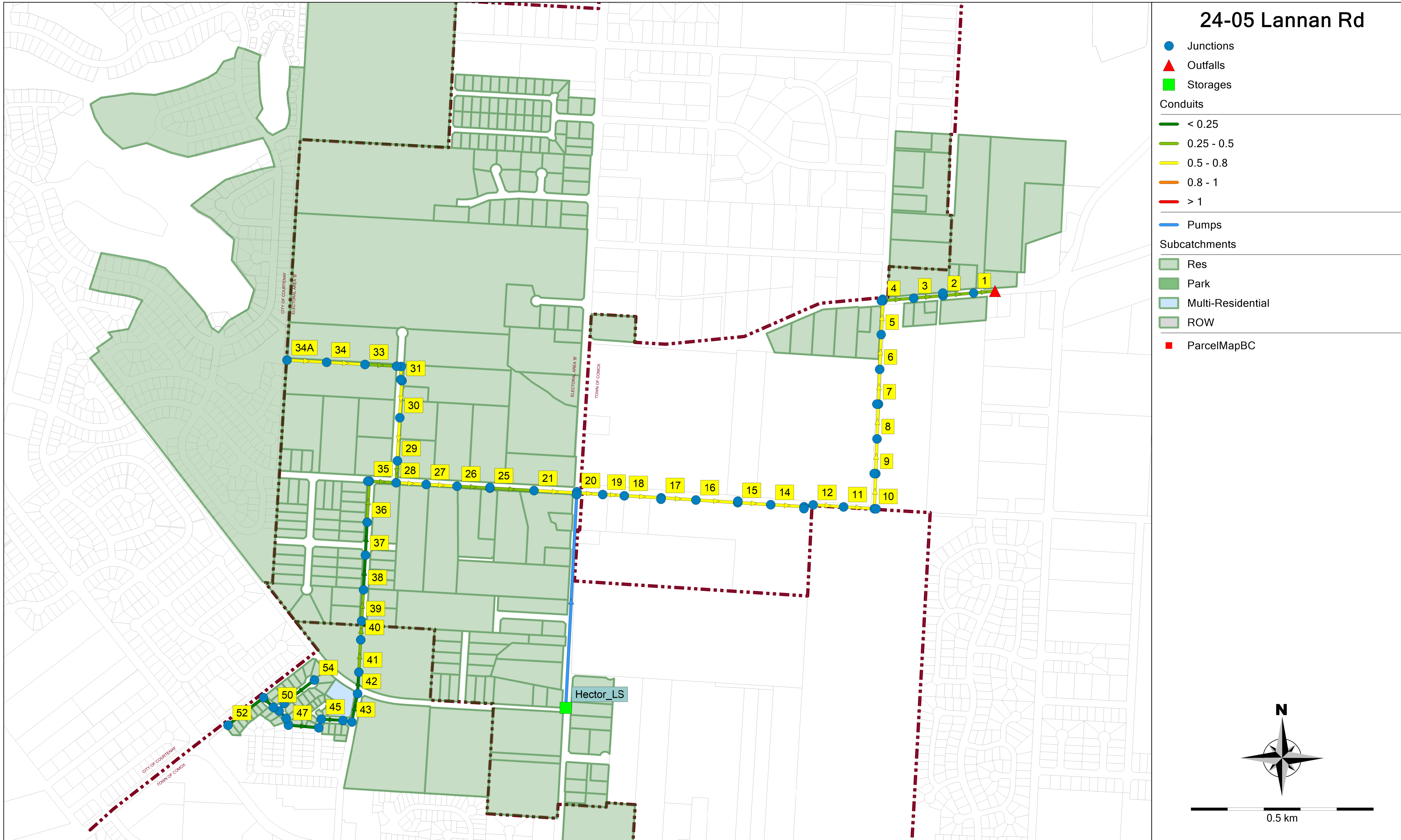
				24-01 Existing (Pre-Development)		24-05 Lannon Road (Post Development)		24-51 Existing (Pre-Development)		24-55 Lannon Road (Post Development)	
SMH	Downstream Pipe Diameter (mm)	Downstream Pipe Slope (%)	Total Pipe Capacity (L/s)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)
34A	250	0.50	42.0	25.6	57%	25.6	57%	23.2	54%	26.8	59%
34	250	0.50	42.1	25.7	55%	25.6	55%	23.3	52%	26.9	56%
33	250	1.29	67.8	25.8	43%	25.6	43%	23.4	41%	27.0	44%
32A	250	0.69	49.6	25.8	51%	25.6	51%	23.4	48%	27.0	53%
32	250	0.40	37.9	28.0	59%	27.8	59%	23.4	53%	27.0	58%
31A	250	0.12	20.6	28.0	59%	27.8	58%	23.4	53%	27.0	57%
31	250	0.49	41.5	29.0	59%	28.7	59%	23.5	52%	27.1	57%
30	250	0.97	58.8	30.0	51%	29.6	50%	23.6	44%	27.2	48%
29	250	1.05	61.2	30.0	50%	29.6	49%	23.6	43%	27.2	47%
28	300	0.56	72.9	42.3	54%	41.3	53%	26.5	42%	30.1	45%
27	300	0.60	74.9	44.2	55%	43.2	54%	26.6	41%	30.2	44%
26	300	1.17	104.3	45.9	46%	44.9	46%	26.7	34%	30.3	37%
25	300	2.56	152.7	47.3	48%	46.2	47%	26.8	33%	30.4	36%
21	300	0.47	66.8	47.4	60%	46.2	59%	26.9	43%	30.5	46%
20	375	1.08	182.2	98.4	52%	97.1	52%	26.9	26%	30.5	28%
19	375	1.02	175.8	98.5	58%	97.2	58%	27.0	26%	30.6	28%
18	375	0.50	124.8	98.6	65%	97.3	64%	27.1	32%	30.7	34%
17	375	0.51	124.9	98.7	65%	97.4	65%	27.2	32%	30.8	34%
16	375	0.45	117.8	99.0	69%	97.7	68%	27.4	32%	31.0	34%
15	375	0.40	111.2	99.0	69%	97.7	68%	27.5	33%	31.1	35%
14	375	0.44	116.2	98.8	67%	97.6	66%	27.6	33%	31.2	35%
13	375	0.43	114.9	98.8	65%	97.6	65%	27.6	32%	31.2	35%
12	375	0.44	116.4	98.9	68%	97.7	67%	27.7	33%	31.3	35%
11	375	0.44	116.1	98.7	66%	97.5	66%	27.8	33%	31.4	35%
10	375	0.42	113.2	98.5	68%	97.3	67%	27.9	33%	31.5	35%
9	375	0.48	121.4	98.3	65%	97.1	65%	28.0	32%	31.6	34%
8	375	0.53	127.5	98.2	64%	97.0	63%	28.1	32%	31.7	34%

Comox Valley Regional District Sanitary Model Analysis

Hudson Trunk - 24-05 Lannon Road

				24-01 Existing (Pre-Development)		24-05 Lannon Road (Post Development)		24-51 Existing (Pre-Development)		24-55 Lannon Road (Post Development)	
SMH	Downstream Pipe Diameter (mm)	Downstream Pipe Slope (%)	Total Pipe Capacity (L/s)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)	Peak Flow (L/s)	Pipe Utilization (d/D, %)
7	375	0.51	125.7	98.0	64%	96.8	64%	28.2	32%	31.8	34%
6	375	0.97	171.9	98.0	54%	96.8	54%	28.3	27%	31.9	29%
5	375	0.90	166.1	98.0	55%	96.8	55%	28.4	28%	32.0	30%
4	375	3.71	342.4	102.7	38%	101.5	38%	28.7	20%	32.3	21%
3	375	3.69	332.0	102.9	38%	101.7	38%	28.9	20%	32.5	21%
2	375	4.02	349.7	104.9	37%	103.7	37%	29.3	19%	33.0	21%
1	375	2.63	283.8	107.8	43%	106.6	42%	29.4	21%	33.2	22%
111	-	-	-	-	-	-	-	29.9	21%	33.7	22%
110	-	-	-	-	-	-	-	30.1	21%	34.3	23%
109	-	-	-	-	-	-	-	30.1	27%	34.4	29%
108	-	-	-	-	-	-	-	30.2	28%	34.5	30%
107	-	-	-	-	-	-	-	31.4	27%	35.3	29%
106	-	-	-	-	-	-	-	31.4	31%	35.3	33%
105	-	-	-	-	-	-	-	31.5	34%	35.4	36%
104	-	-	-	-	-	-	-	31.6	37%	35.5	40%
103	-	-	-	-	-	-	-	31.6	47%	35.5	50%
102	-	-	-	-	-	-	-	31.7	47%	35.6	50%

Pipes over 80% capacity will be highlighted.



24-05 Lannan Rd
Junctions
Outfalls
Storages
Conduits
< 0.25
0.25 - 0.5
0.5 - 0.8
0.8 - 1
> 1
Pumps
Subcatchments
Res
Park
Multi-Residential
ROW
ParcelMapBC
N
0.5 km
Hector_LS
1
2
3
4
5
6
7
8
9
10
11
12
14
15
16
17
18
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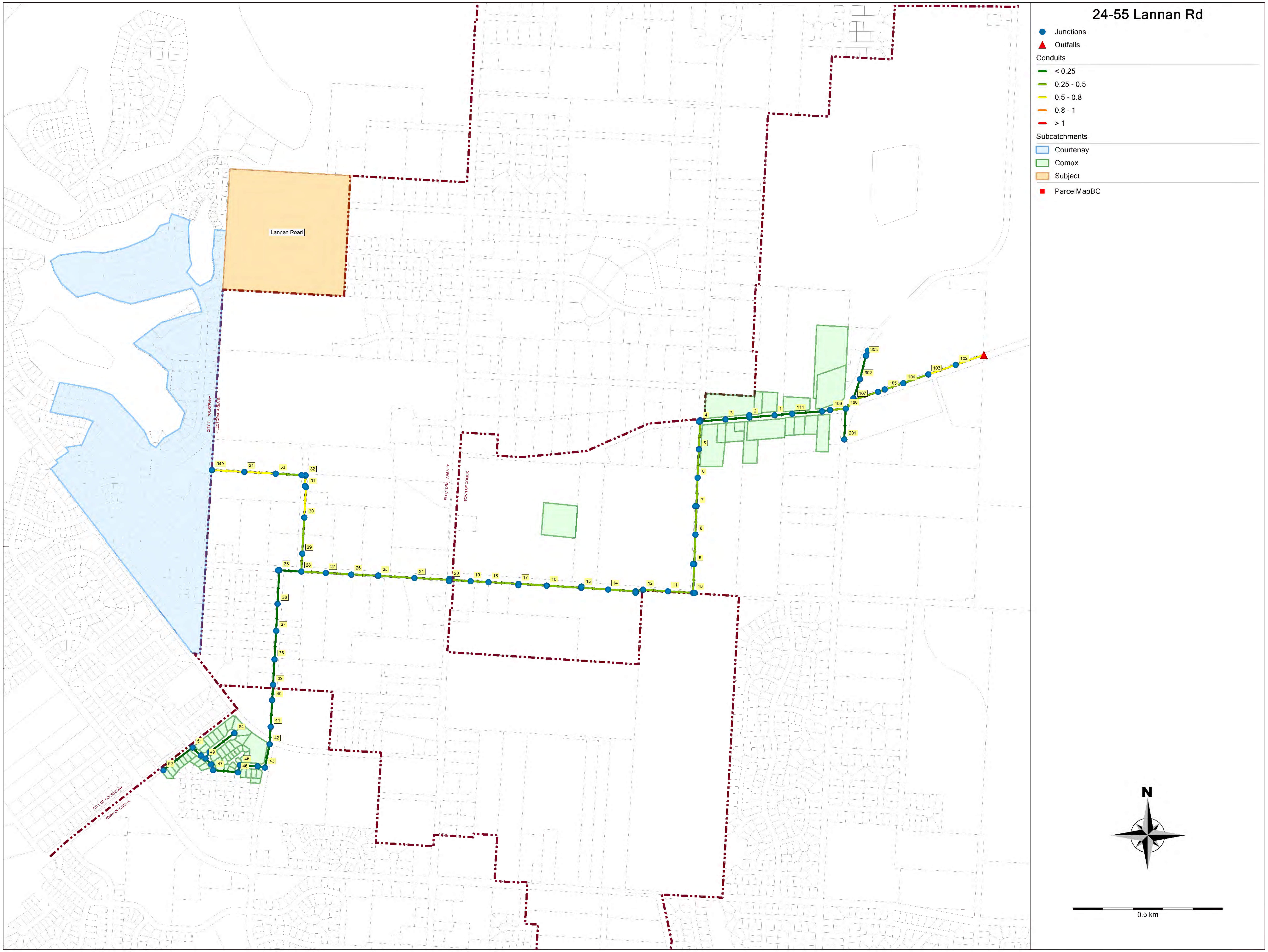
24-55 Lannan Rd
Junctions
Outfalls
Conduits
< 0.25
0.25 - 0.5
0.5 - 0.8
0.8 - 1
> 1
Subcatchments
Courtenay
Comox
Subject
ParcelMapBC
Lannan Road
N
0.5 km