APPENDIX

C

EXISTING CAPACITY ASSESSMENT FOR THE ST. ALBERT TRAIL PROPOSED DEVELOPMENT

MEMO

TO: Neeraj Sinha, Utilities Engineer, City of St. Albert

FROM: Joshua Maxwell, Water Resources Team Lead, WSP Canada Inc.

SUBJECT: Existing Stormwater System Capacity Assessment for the St Albert Trail Proposed Development

DATE: June 24th, 2021

The City of St Albert (City) has retained WSP Canada Inc. (WSP) to review the effects of additional lanes along St. Albert Trail on the performance of the stormwater system downstream. The purpose of this Technical Memorandum (Tech Memo) is to present the results of the capacity assessments of the City's stormwater system.

This Tech Memo is organized into the following sections:

- Scope of work
- Drainage Modelling Framework
- Stormwater System Assessment
- Stormwater Management Facility (SWMF) Performance
- Downstream Trunk Sewers
- Conclusions

SCOPE

Within the development limits of the North St. Albert Trail Corridor Plan (Phase 2 & 3), the existing St. Albert Trail is a 4-lane divided arterial roadway with a rural cross-section, as shown in Figure 1. The proposed new design concepts for St Albert Trail from Boudreau/Giroux Road to the north City limit envision the evolution of the corridor as a modern 6-lane urban boulevard that accommodates commercial developments, commuter roads, and pedestrian and cycling paths. In addition, the corridor should also include Bus Rapid Transit (BRT) in the medium term and Light Rail Transit (LRT) in the long term. The proposed typical cross-section of the corridor within the project area is illustrated in Figure 2. The proposed layout of the corridor keeps development within the existing St. Albert Trail right-of-way (ROW). For the northbound roadway, the design retains the existing carriageway with all widening towards the road's median. For the southbound roadway, the proposed lanes will be graded toward the existing northbound roadway and would generally be constructed over the current ditch median.

Figure 1 The Development Area of St Albert Trail

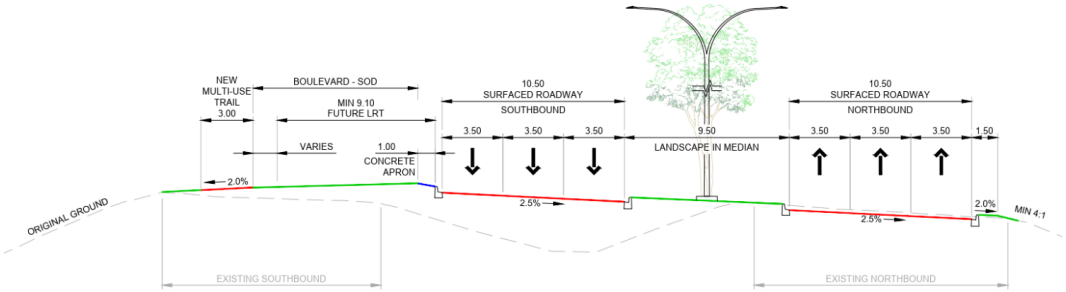

Figure 2 Typical Corridor Cross-Section

WSP was retained to review the effects of the proposed development of the St. Albert Trail Corridor on the downstream drainage system, particularly for the SWMFs in Element Park and Edgewater Park within the Erin Ridge Neighbourhood, see Figure 1. It is understood that the principal concern is the near-term/temporary impacts upon the Erin Ridge and Oakmont stormwater system prior to construction of the outfall to the Sturgeon River (Project 5). It was also agreed upon that analysing the effects on Carrot Creek or its tributary is beyond the focus of this document. The MIKE URABN model that has been recently updated as part of the St. Albert Wastewater and Stormwater UMP Update project was utilized for this assessment. To achieve this, we implemented the following tasks:

For the purpose of this Tech Memo and following discussions between WSP and St. Albert, the following items were considered in assessing the proposed development plans:

1. Reconnection of the Erin Ridge Neighbourhood into the Oakmont Neighborhood, as it was assumed that Project 5 had been completed for the purpose of recent UMP.
2. Assessing the performance and capacity of the existing control structure and SWMF storages in the Erin Ridge Neighbourhood.
3. For the purposes of this analysis, the interactions with the Erin Ridge North SWMF 1 catchment, North of Neil Ross Rd, was neglected. This area is on a temporary pumping program and does not currently release stormwater during rain events.
4. Creating a post-development model, with higher imperviousness along St. Albert trail to reflect the new corridor cross-sections.
5. Producing model outputs, under pre- and post-development scenarios, provide system results under the 100 Year 24-Hour and the 5 Year 4-Hour stormwater events.

As inputs to this analysis, we utilized the documents and models already available to WSP as part of UMP update. The following documents, associated with the development of Erin Ridge, were utilized as references for this Tech Memo:

1. Erin Ridge North Engineering Design Brief Stormwater Management Plan July 2009, ISL Engineering and Land Services Ltd.
2. Lutheran Church Lands Stormwater Management Plan October 2016, ISL Engineering and Land Services Ltd.
3. North St. Albert Trail Corridor Management Implementation Preliminary Design Report (Phase 2 & 3) October 2020, Associated Engineering Ltd.
4. Stormwater Existing System Capacity Assessment March 2021, WSP Canada Inc.

DRAINAGE MODELLING

A preliminary review of the drainage pattern in the project area was conducted to identify and delineate the catchments directly connected to the Erin Ridge system, as shown in Figure 3. The south catchment area includes most of the corridor area between Villeneuve Rd and Neil Ross Rd and directs flows through both the major and minor drainage systems to the Element Park Pond and ultimately to Edgewater Park Pond in the Erin Ridge Neighbourhood. The north catchment area directs surface runoff north toward a Carrot Creek tributary. As stated earlier, this Tech Memo is only addressing the south catchment area.

The City of St Albert's stormwater hydraulic model titled *"St.Albert_Storm_GrowthModel 2021_update"* was utilized in this assessment of the downstream capacity. The model is a Mike Urban model, and Figure 4 shows an overview of the stormwater model.

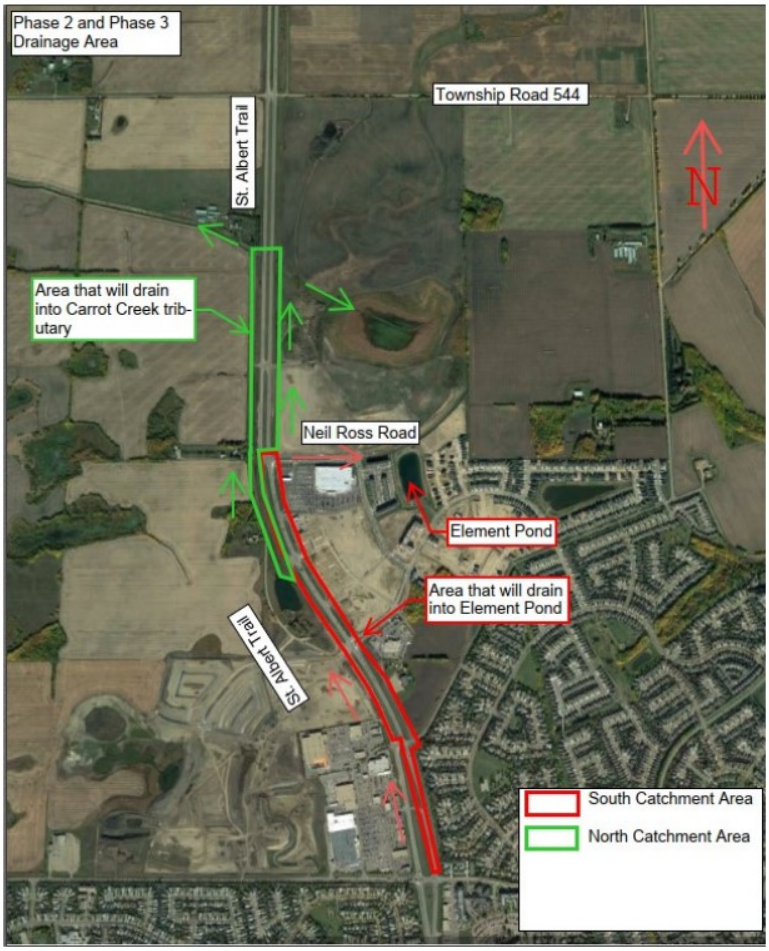

Figure 3 Surface Drainage Delineation

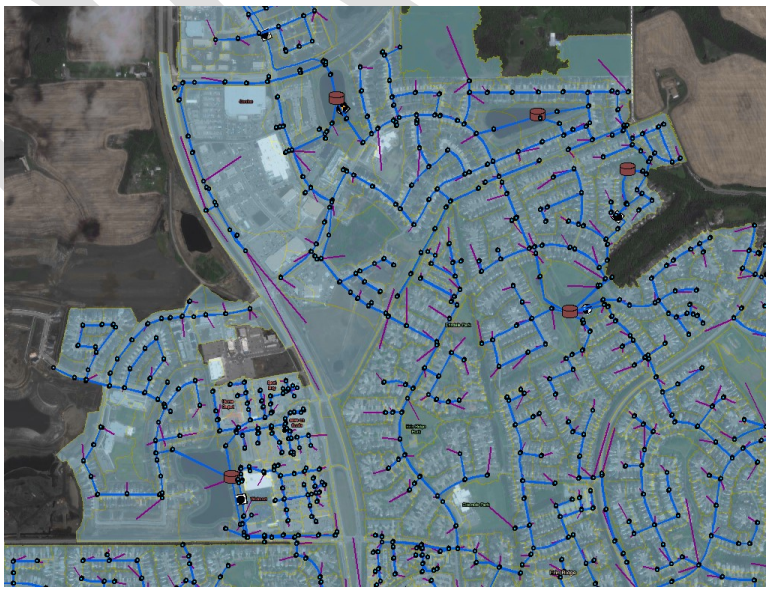

Figure 4 Stormwater Drainage System Model

SWMF ASSESSMENT

The system performance for the two scenarios was conducted using simulation results of the St. Albert stormwater model. The analysis hereafter focuses on the downstream SWMFs including Element Pond, Edgewater Pond, Embassy Pl. Pond and Ted Hole Pond, as shown in Figure 5.

Figure 5 Downstream Stormwater Management Facilities

Generally, it was found that the expected impacts of the St Albert Corridor Development Plan on the downstream SWMFs are relatively minor. During the 100 Year 24-Hour and 5 Year 4-Hour events, no flooding occurred in both the pre- and post-development conditions models. As expected, the maximum water levels for the stormwater storage elements were higher during the 100 Year 24-Hour compared to 5 Year 4-Hour scenario. Consider the 100 Year 24-Hour Event, the change in the SWMF water levels ranged between 0.2 and 16.8 cm. The maximum percentage increase in volume was about 10%, except for Embassy Place Pond where the percentage ranged between 326% for the 100 Year 24-Hour and 76% for the 5 Year 4-Hour storms. However, the maximum water level over the simulated period for Embassy Place Pond only utilized approximately 20% of the available pond depth; therefore, the increase in volume is not a concern. Tables 1, 2 and 3 provide a summary of the simulation results. Please also refer to the attached figures for the water levels of the pre- and post-development condition models, Figures 6 to 21.

For the Edgewater Pond, the outlet control orifice has a 200 mm square vent which is designed to allow a maximum flow rate of 117 L/s, as it is believed that there is a capacity restriction within the downstream minor system. Over the 100 Year 24-Hour simulation, the maximum discharge from Embassy Place Pond. pond reached a peak rate of 90 L/s resulting in increasing water levels over the simulated period. Also, these elevated water levels at Edgewater Pond are consistent with the "2017_ model" results under the same conditions.

Table 1 Stormwater Pond Properties

SWMF	Element	Edgewater	Embassy Pl.	Ted Hole
Drainage Area (ha)	97.72	179.95	188.76	225.38
BED Level* (m)	682.30	680.40	679.30	680.89
Rim Level* (m)	684.30	682.10	683.81	683.00

*As per the elevations of the respective storage node in the model

Table 2 SWMF Performance for the 1:100 Year 24-Hour Storm

SWMF	Element		Edgewater		Embassy Pl.		Ted Hole	
Conditions	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
HWL (m)	683.18	683.182	681.573	681.649	679.482	679.650	682.552	682.666
Outflow (m^3/s)	0.073	0.073	0.083	0.085	0.040	0.111	0.204	0.21
Release Rate (L/s/ha)	0.75	0.75	0.46	0.47	0.21	0.59	0.91	0.93
Flooding*	No	No	No	No	No	No	No	No
Volume (m^3)	16,317	16,357	25,336	27,950	53	228	15,719	17,277
Level Change (m)		0.002		0.076		0.168		0.114
Volume Change (m^3)		40		2614		174		1558
Volume Change (%)		0.25		10.32		326.65		9.91

*Flooding as per the GL elevation of the respective storage node in the model

Table 3 SWMF Performance for the 1:5 Year 4-Hour Storm

SWMF	Element		Edgewater		Embassy Pl.		Ted Hole	
Conditions	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
HWL (m)	682.594	682.576	680.931	680.934	679.455	679.49	681.75	681.744
Outflow (m^3/s)	0.0641	0.0440	0.0772	0.0576	0.1300	0.0457	0.2102	0.1756
Release Rate (L/s/ha)	0.66	0.45	0.43	0.32	0.69	0.24	0.93	0.78
Flooding*	No	No	No	No	No	No	No	No
Volume (m^3)	4,966	4,644	11,021	11,091	34	60	6737	6,680
Level Change (m)		-0.018		0.003		0.035		-0.006
Volume Change (m^3)		-323		70		26		-57
Volume Change (%)		-6.49		0.64		76.27		-0.85

*Flooding as per the GL elevation of the respective storage node in the model

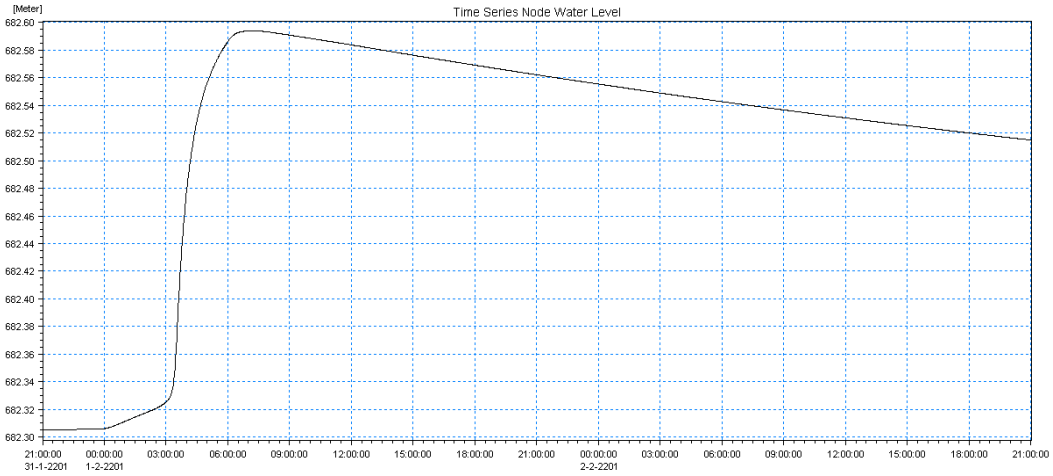

Figure 6 Element Pond Water Levels 5 Year 4-Hour (Pre-development)

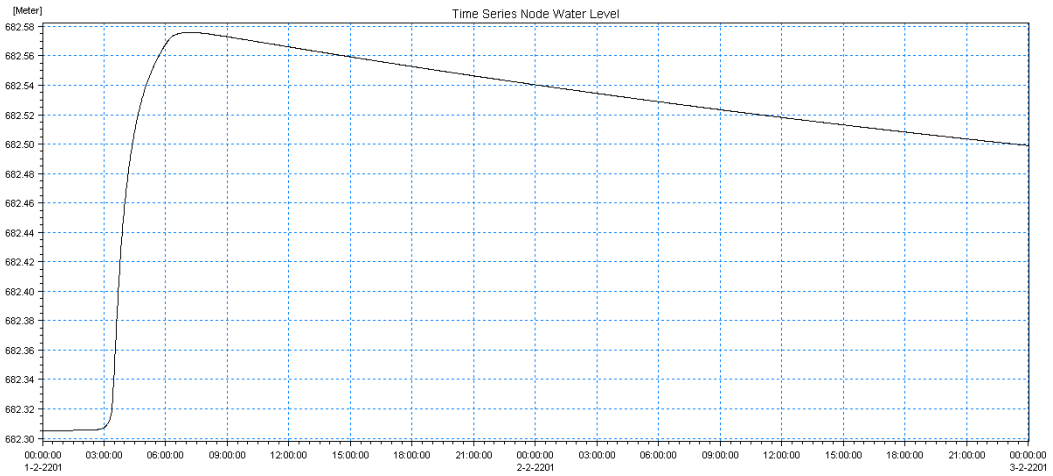

Figure 7 Element Pond Water Levels 5 Year 4-Hour (Post-development)

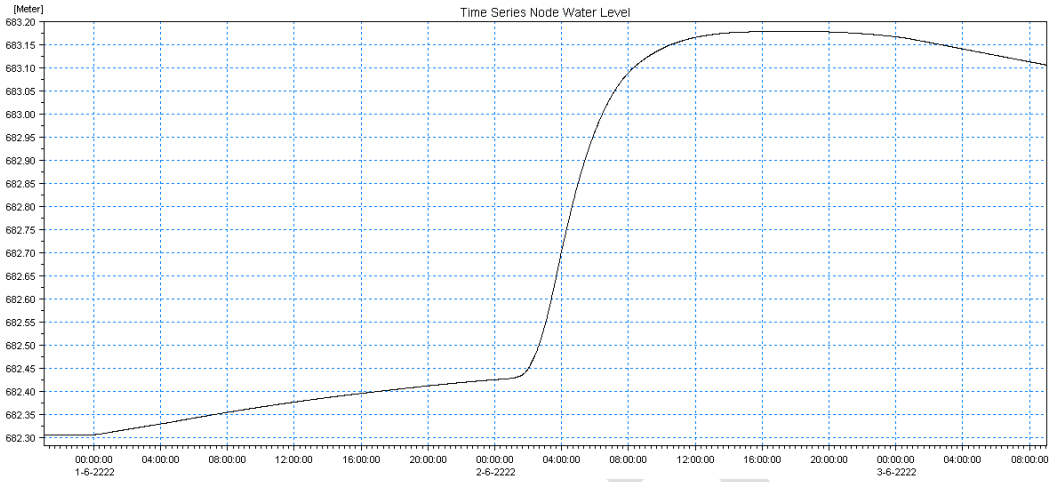

Figure 8 Element Pond Water Levels100 Year 24-Hour (Pre-development)

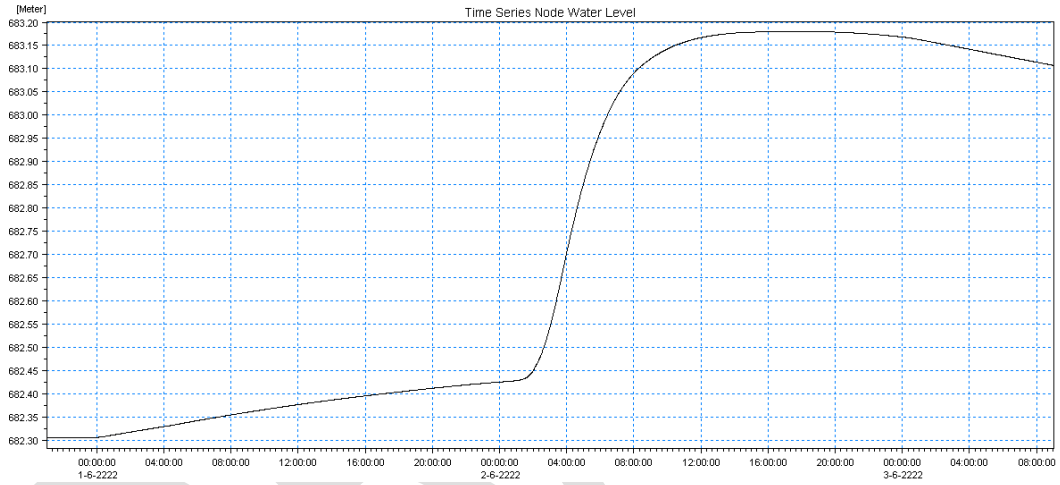

Figure 9 Element Pond Water Levels100 Year 24-Hour (Post-development)

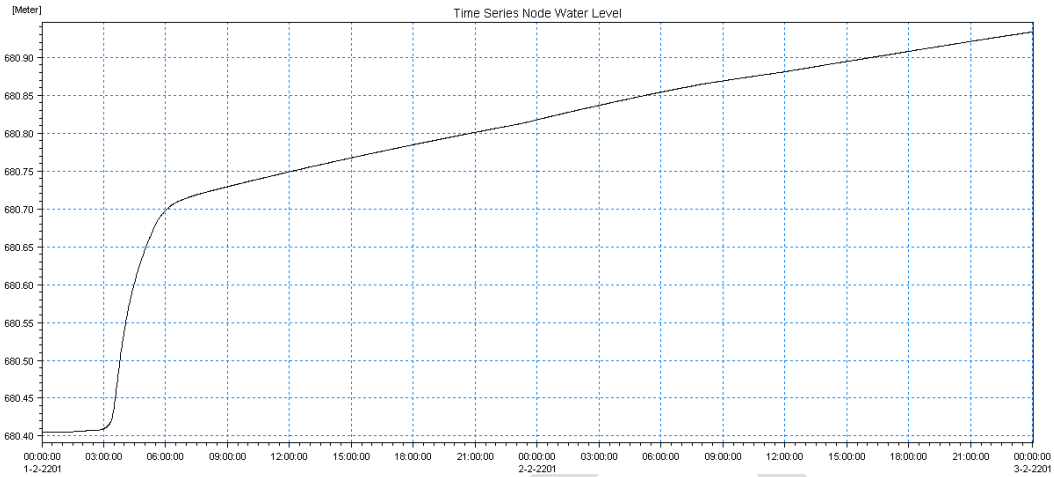

Figure 10 Edgewater Pond Water Levels 5 Year 4-Hour (Pre-development)

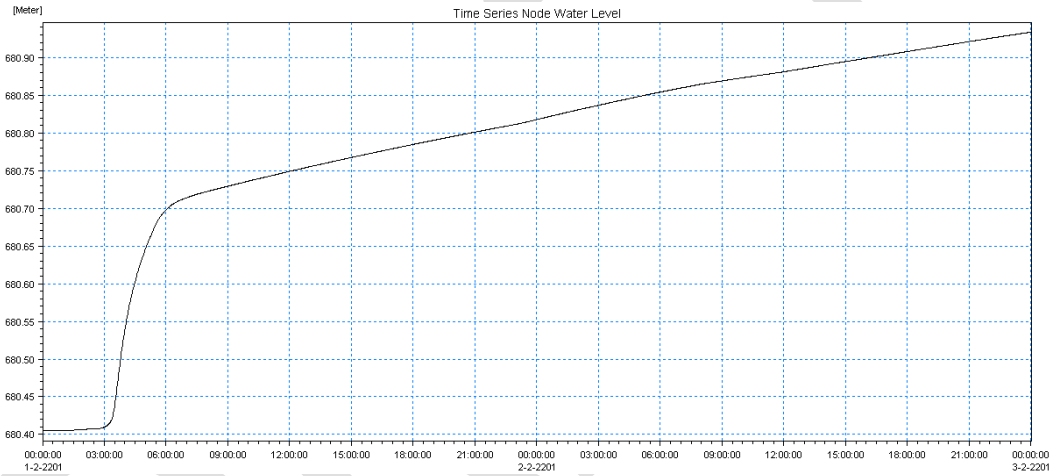

Figure 11 Edgewater Pond Water Levels 5 Year 4-Hour (Post-development)

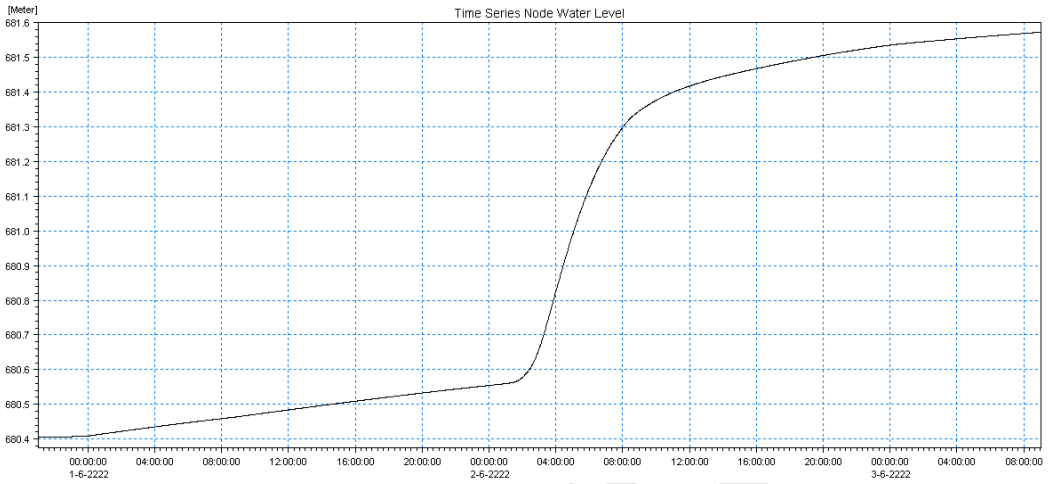

Figure 12 Edgewater Pond Water Levels 100 Year 24-Hour (Pre-development)

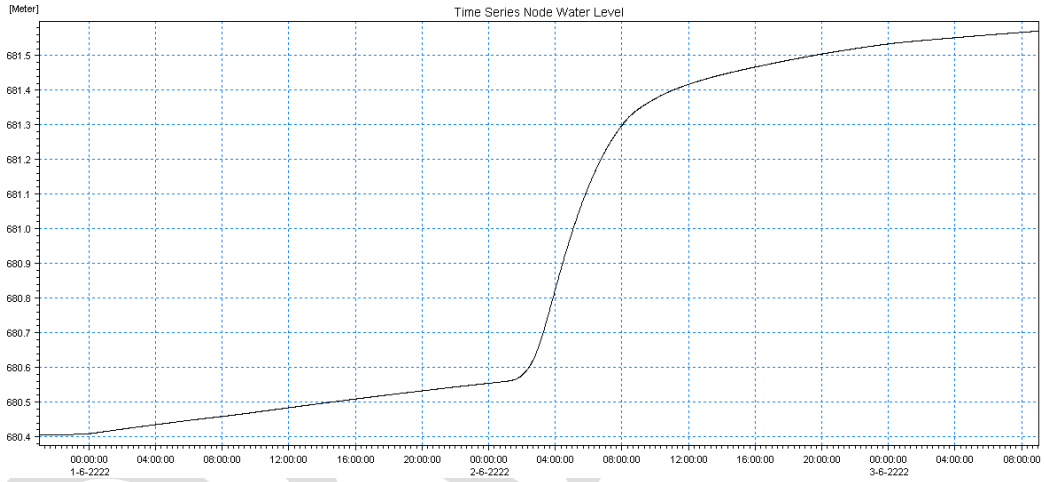

Figure 13 Edgewater Pond Water Levels 100 Year 24-Hour (Post-development)

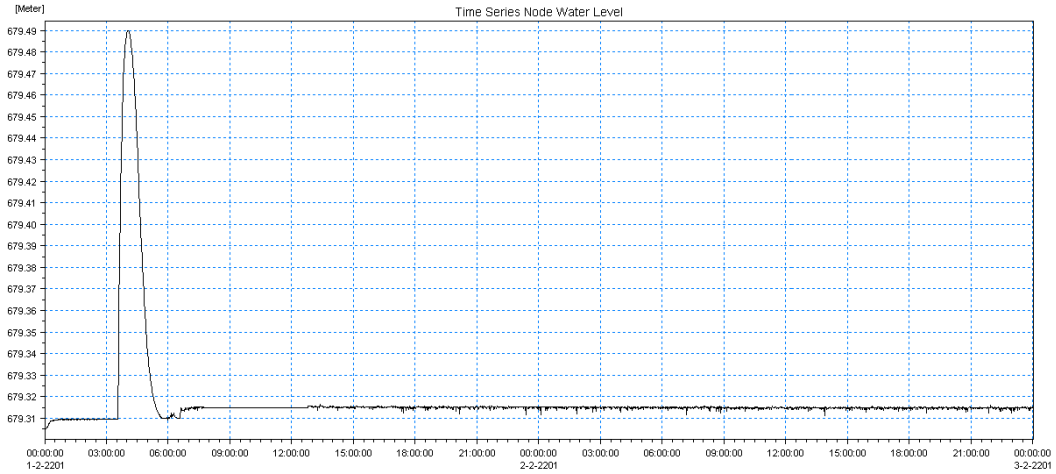

Figure 14 Embassy Place Pond Water Levels 5 Year 4-Hour (Pre-development)

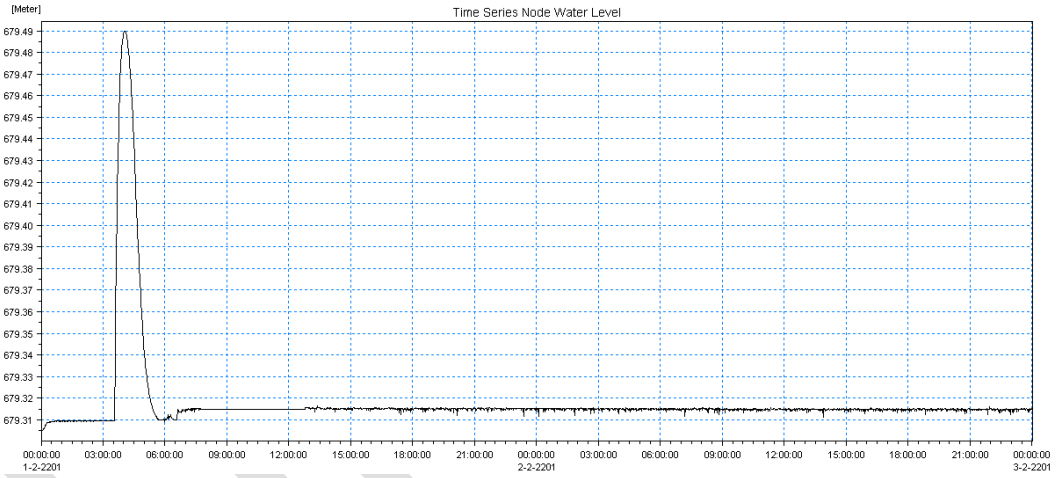

Figure 15 Embassy Place Pond Water Levels 5 Year 4-Hour (Post-development)

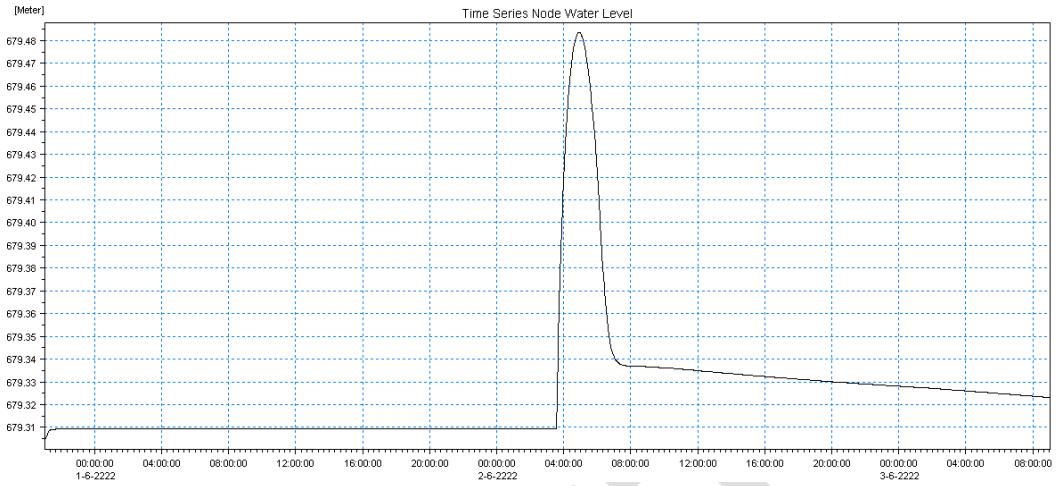

Figure 16 Embassy Place Pond Water Levels 100 Year 24-Hour (Pre-development)

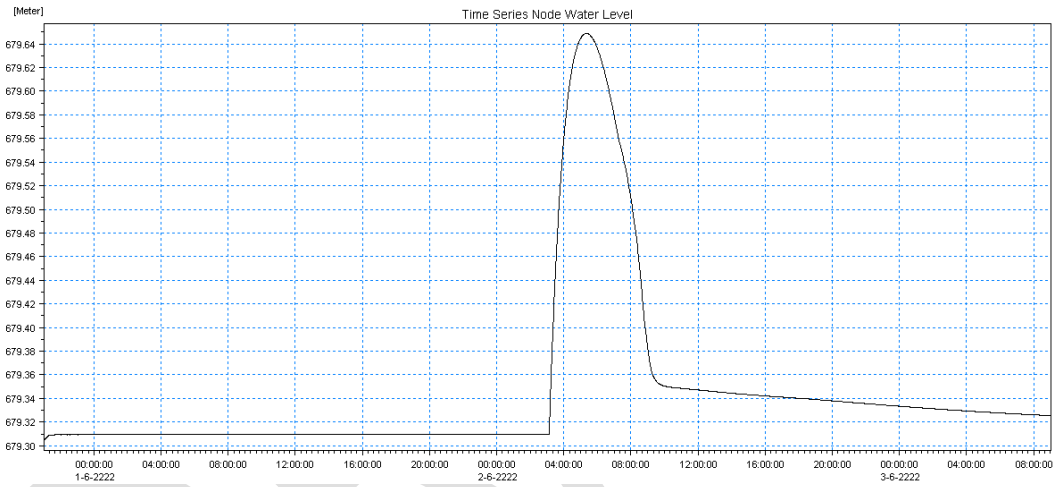

Figure 17 Embassy Place Pond Water Levels 100 Year 24-Hour (Post-development)

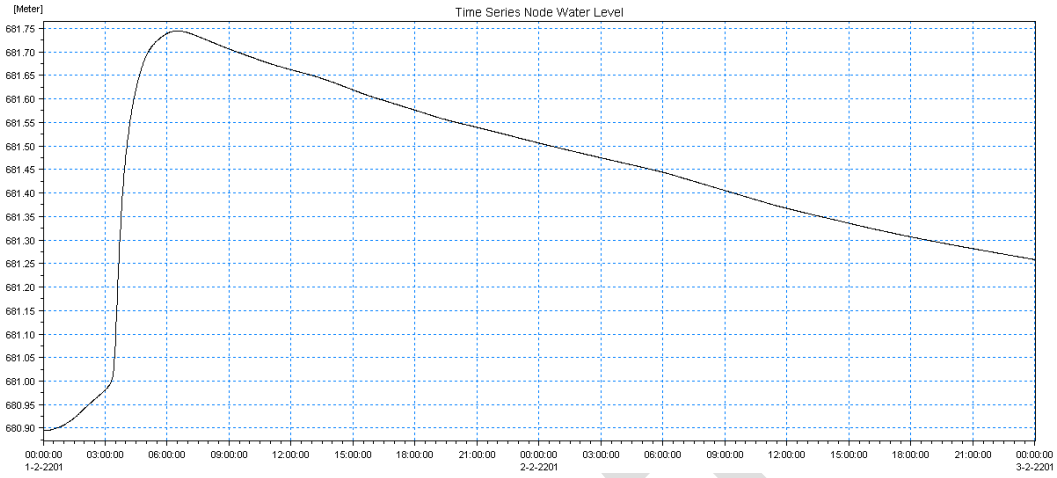

Figure 18 Ted Hole Pond Water Levels 5 Year 4-Hour (Pre-development)

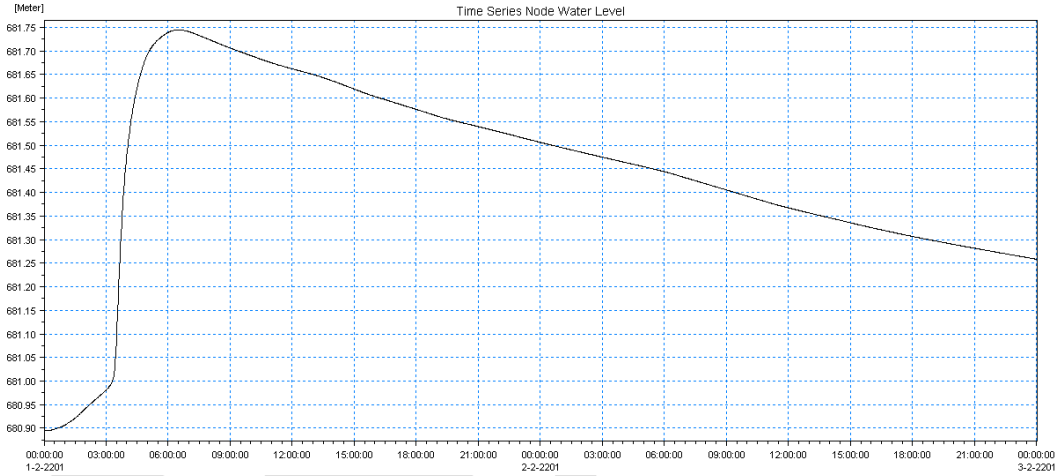

Figure 19 Ted Hole Pond Water Levels 5 Year 4-Hour (Post-development)

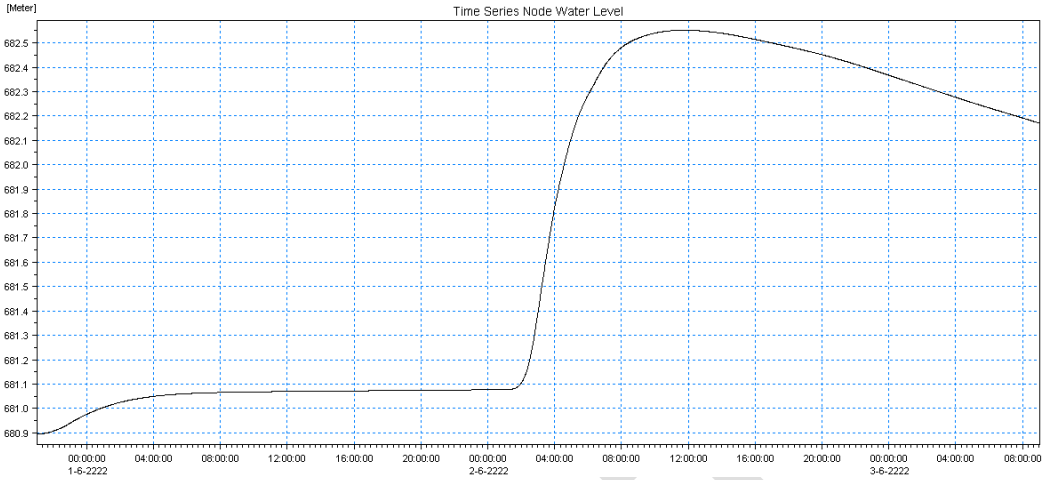

Figure 20 Ted Hole Pond Water Levels 100 Year 24-Hour (Pre-development)

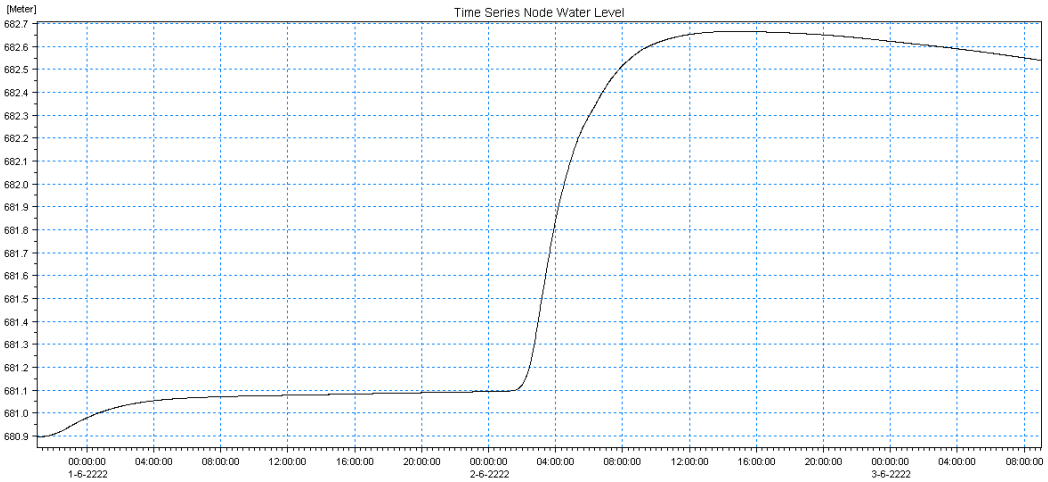

Figure 21 Ted Hole Pond Water Levels 100 Year 24-Hour (Post-development)

DOWNSTREAM SEWER TRUNKS

The effect of the St. Albert Trail Corridor proposed development on the extended downstream stormwater system was also investigated. Please refer to Figure 22 for the stormwater trunks system connecting the development area to the stormwater system and ultimately to the outfall on Sturgeon River. The five highlighted sewer trunks were examined, and their respective pre- and post- development hydraulic gradient lines (HGL) were compared. Please refer to Figures 23 to 28 for the HGL of the downstream trunk sewers for both pre- and post-development conditions. Performance assessment under the two scenarios considered was conducted using simulation results of the St. Albert stormwater model. Overall, the changes in HGL for the downstream sewer trunk were within reasonable limits, and increased water levels remained contained within the sewer system, posing no significant changes to the existing level of service. For the 100 Year 24-Hour storm event, the routed stormwater volumes at Outfall (16) on Sturgeon River increased by approximately 1450 m^3 which is roughly 1.8% of the pre-development value.

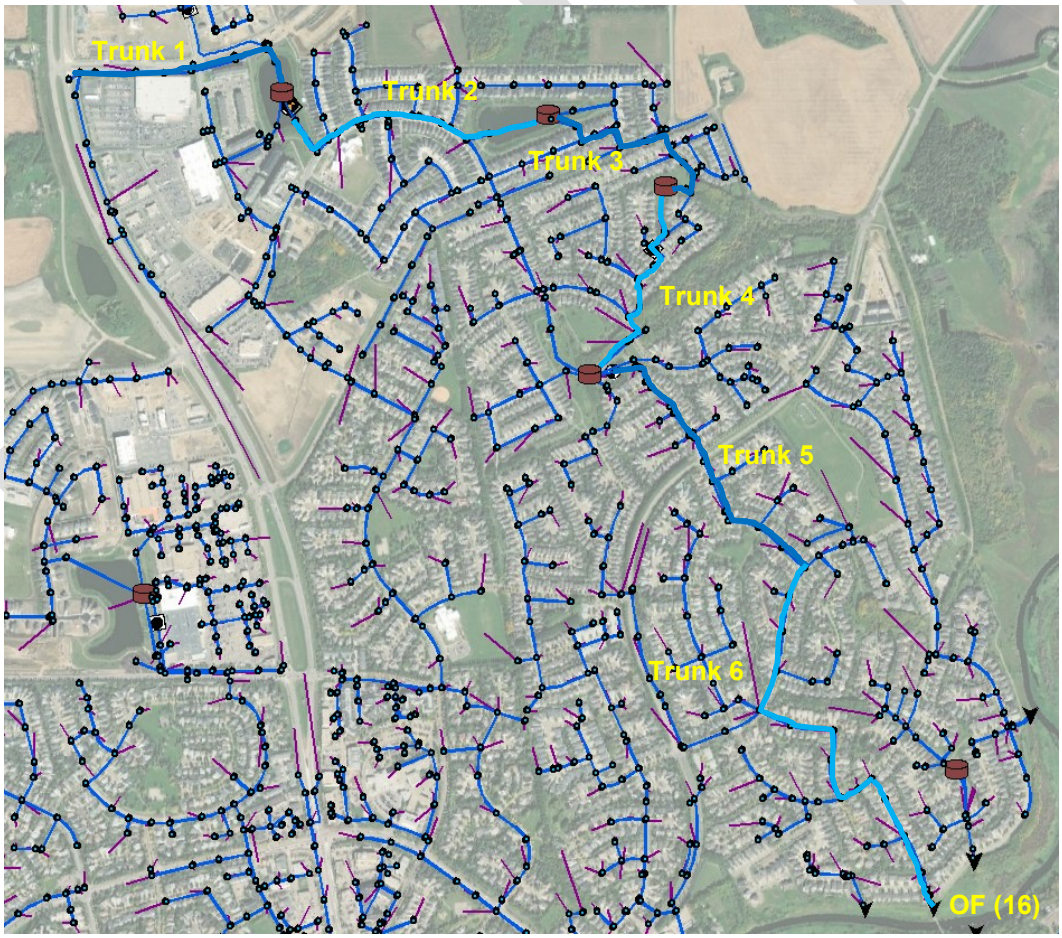

Figure 22 HGL of Downstream Stormwater Trunks

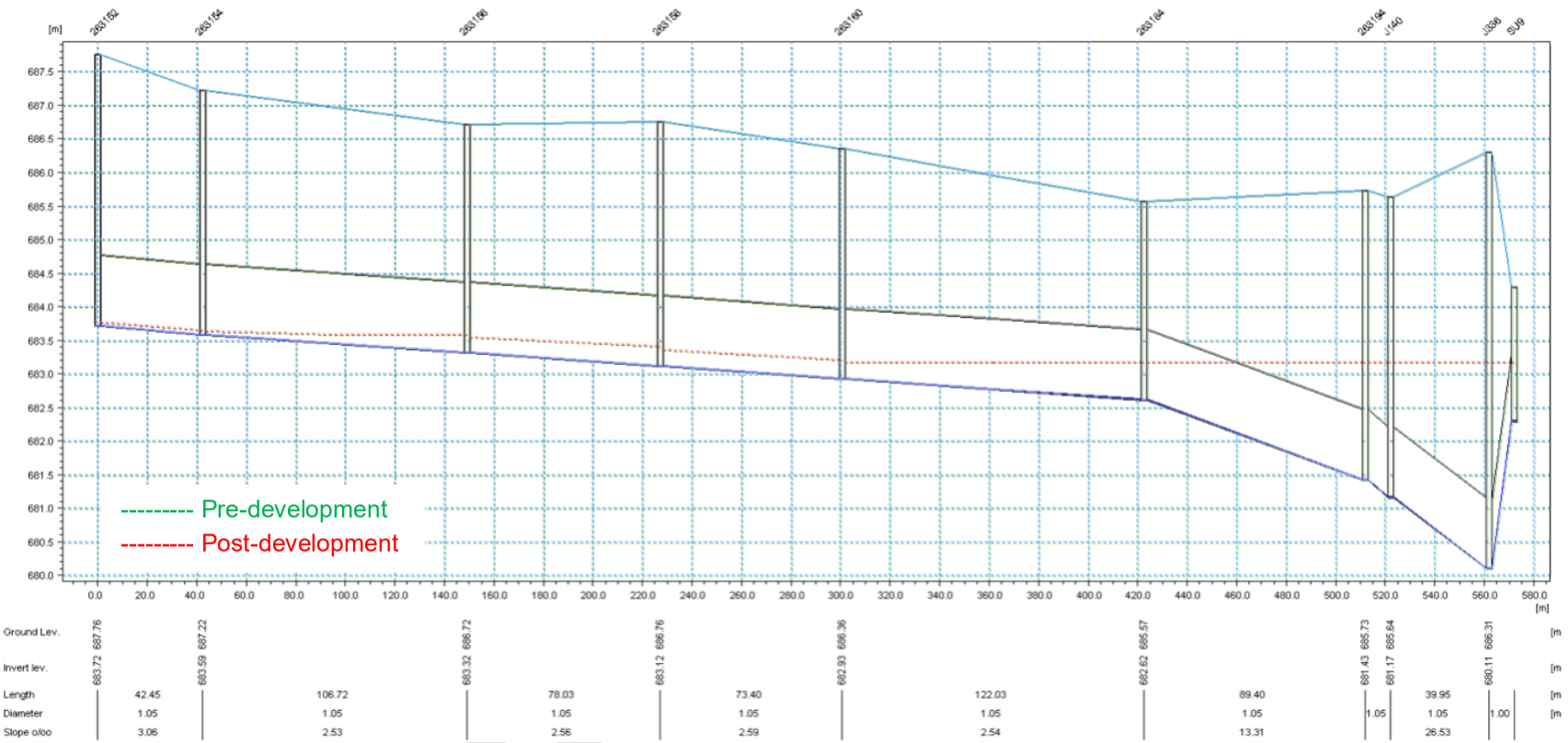

Figure 23 Trunk 1 HGL 100 Year 24-Hour

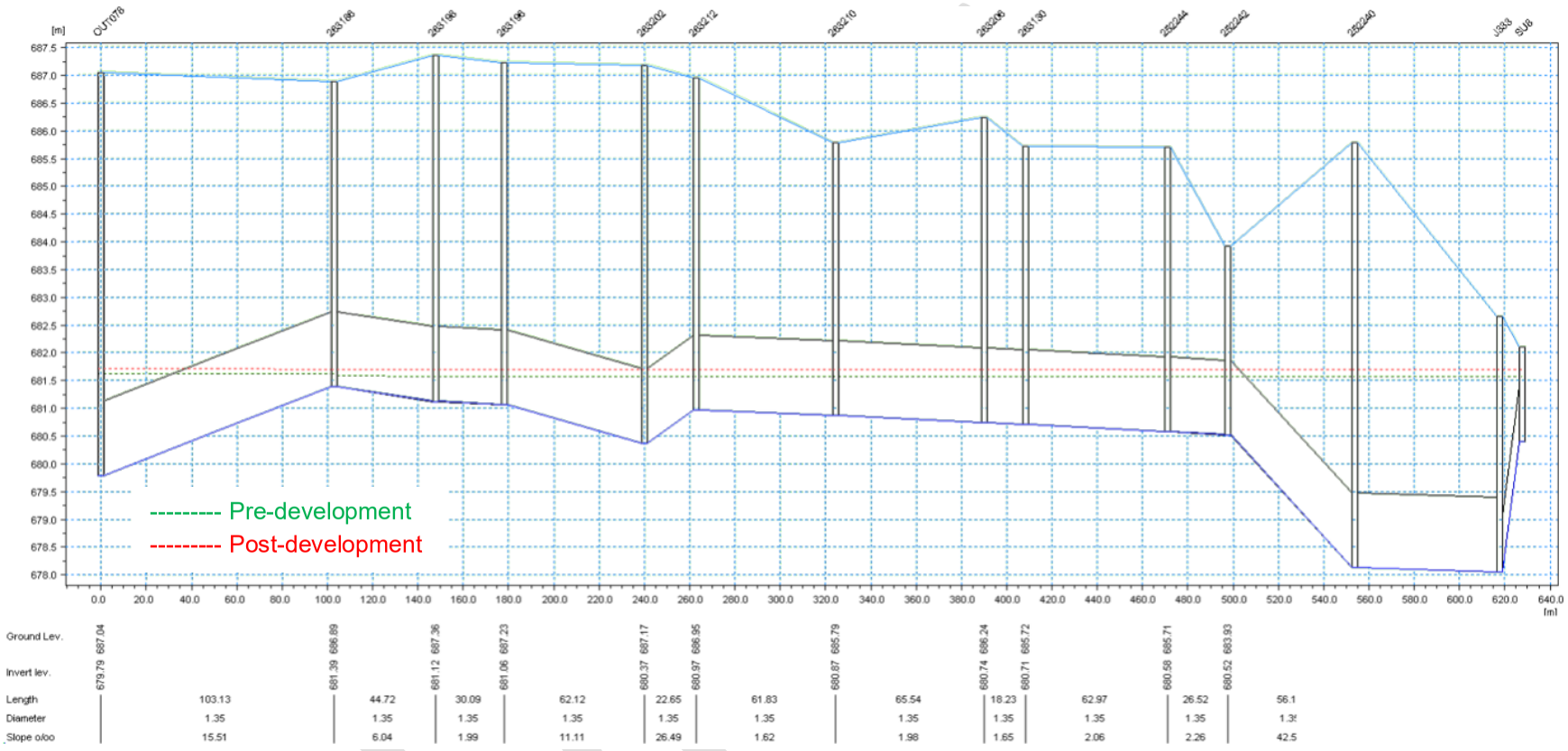

Figure 24 Trunk 2 HGL 100 Year 24-Hour

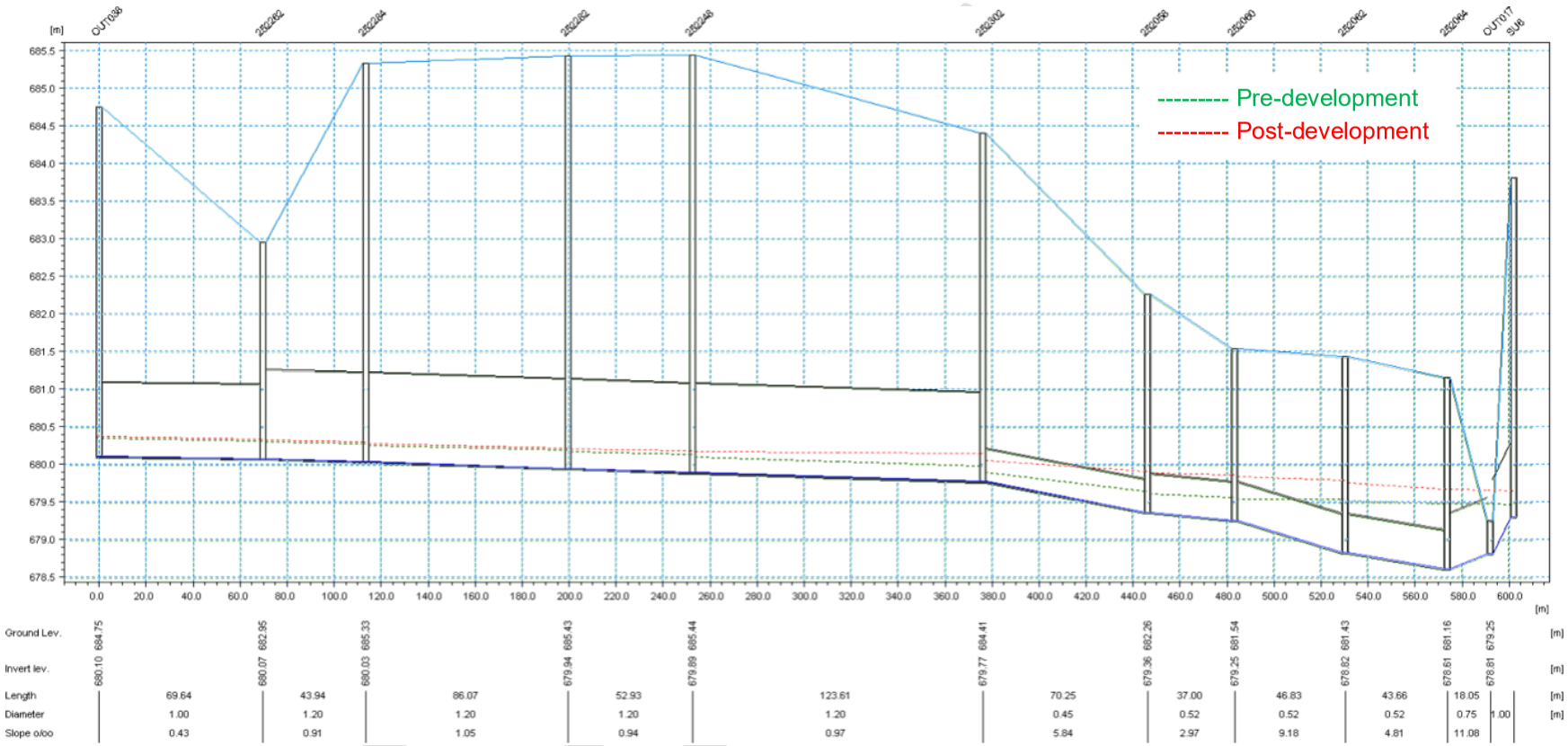

Figure 25 Trunk 3 HGL 100 Year 24-Hour

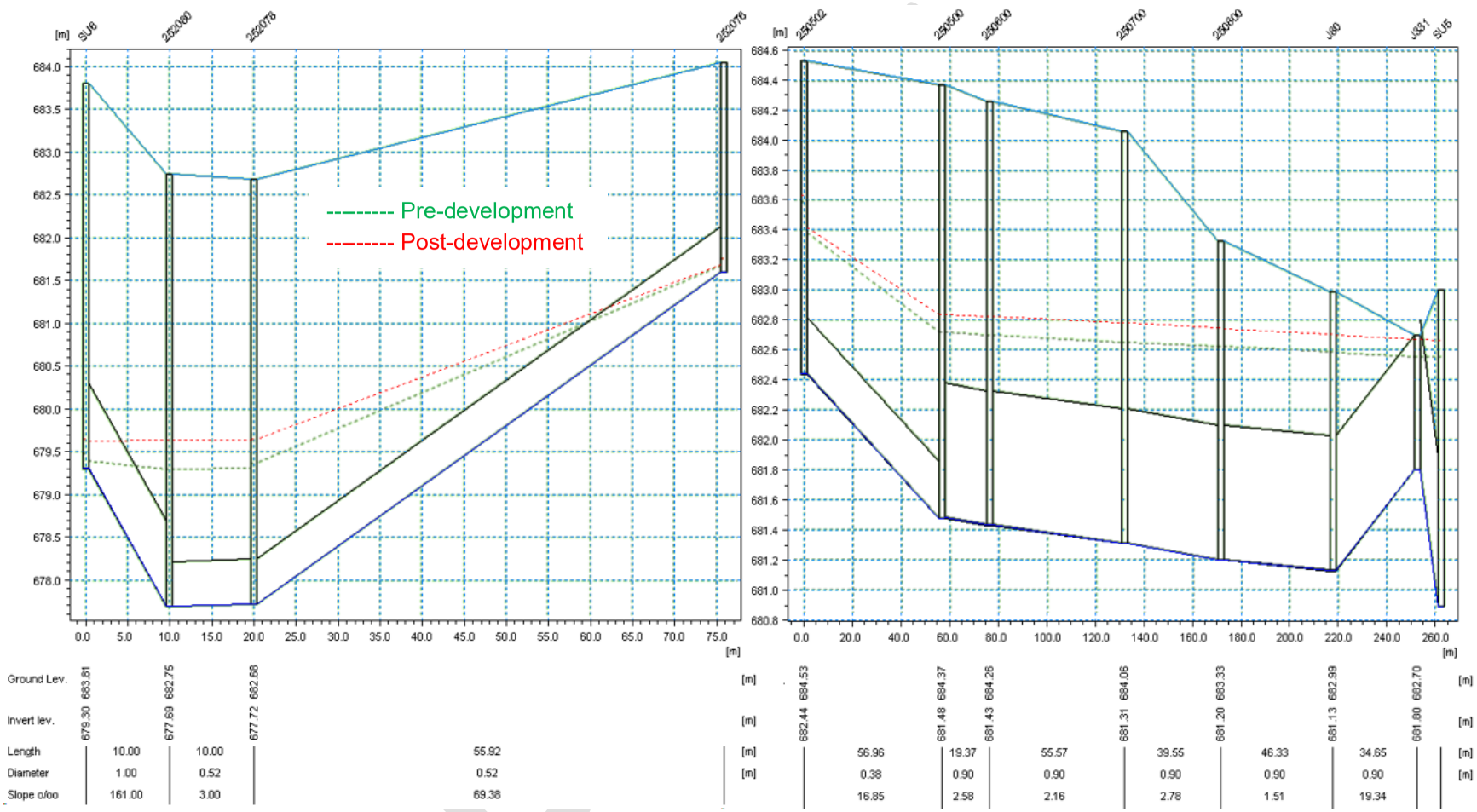

Figure 26 Trunk 4 HGL 100 Year 24-Hour

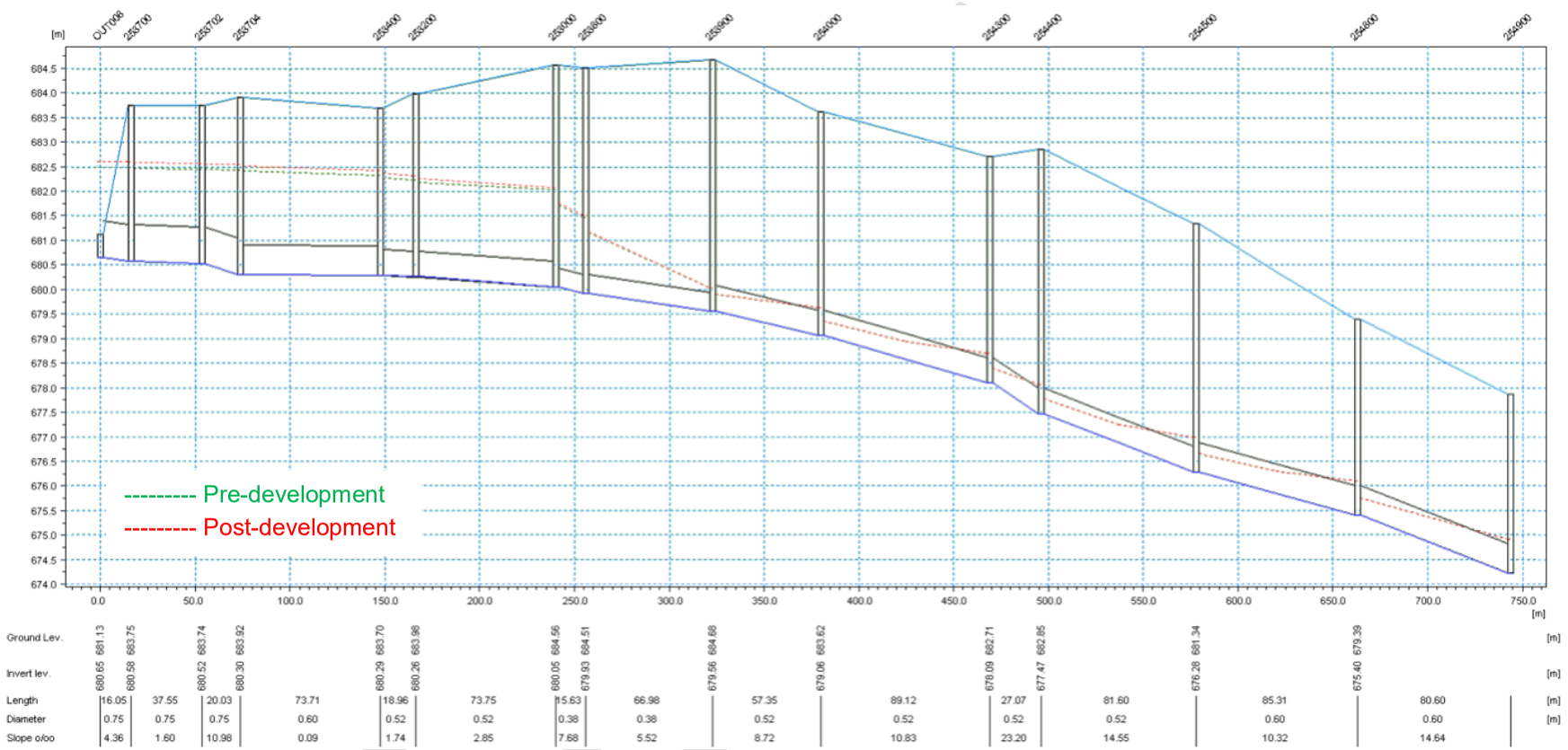

Figure 27 Trunk 5 HGL 100 Year 24-Hour

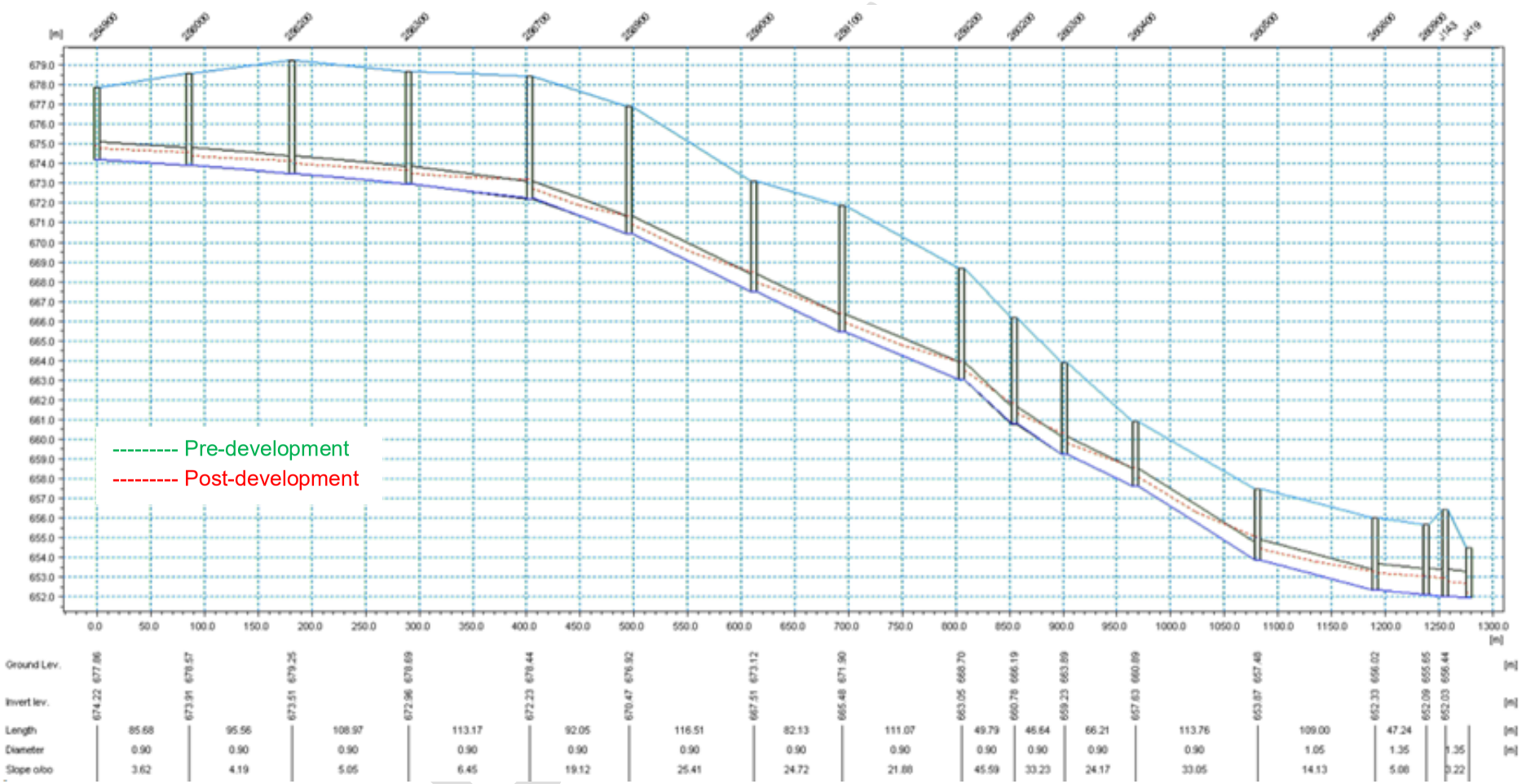

Figure 28 Trunk 6 HGL 100 Year 24-Hour

CONCLUSION

The two rainfall scenarios were utilized to examine the impact of the proposed developments on the St. Albert Trail corridor. Generally, the proposed changes pose low flooding and capacity risks on the existing stormwater system and SWMFs. Utilizing the City's stormwater model, no changes were found to the flooding status of the existing stormwater ponds and downstream sewer trunks down to the system outfall on Sturgeon River. However, minor changes in water levels and volumes of the receiving stormwater systems downstream. For Example, the changes in the water levels in the four stormwater ponds do not raise concerns in the short term. The downstream trunk system can experience a limited increase in HGL, not causing significant changes to system capacity or flooding. It should be noted that, this analysis neglected the discharge from the Erin Ridge North area, which can have additional loads on the sewer system downstream as it ties to the existing system at Element Pond. Considering the new Sturgeon River stormwater outfall (Project 5, currently under design), the response of the local and extended stormwater system is expected to improve. Based upon the above analysis, we conclude that the impact of the proposed project will be acceptable given the observed effect on flood risk and the duration.