



Technical Memorandum

Date: February 22, 2022 **Project No.:** 300038790.0000

Project Name: South Innisfil Creek Drain - Proposed 2022 Improvements

Client Name: Town of Innisfil

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1.0 Introduction

Following the approval of the detailed design of the South Innisfil Creek Drain (SICD) completed by Burnside, and after all appeals were disposed of, the Town Council gave third and final reading to the By-Law to authorize its improvement in November 2019. After a tender process and the subsequent award of a contract in late 2020, construction activities were proposed to be commenced at the south limits of the drain on Phase I in January of 2021.

As noted in the Hydraulic Report, which was included as Appendix H of the (Amended) Final Engineer's Report for the SICD Improvement, the existing Highway 400 crossings are perched and therefore a restriction to the conveyance of (free) flow within the drain. As a result of the culvert crossings restricting conveyance, a ponded area (head pond) exists within the drain from the upstream side of the Highway 400 crossings (Station 2+245) to a location to just north of the crossing of the Main Drain under 3rd Line (or about Station 6+500). Landowners upstream of the Highway 400 crossings have reported flooding in areas of Concessions 1 and 2 during minor system storm events in the past with flows overtopping the drain banks.

To increase conveyance within the SICD, not only has the designed cross section of the Main Drain been enlarged (widened) both upstream and downstream of Highway 400, more importantly, the invert (drain bottom) elevation is also proposed to be lowered (deepened), specifically from the Highway 400 crossings upstream to approximately the 3rd Line. Accordingly, the replacement of the existing culvert crossings under Highway 400 to the

proposed lower elevation is a critical component of the project in order to provide free flowing conditions in the drain based on a 2-year event.

In advance of the commentary provided below, the detailed Hydrologic (Report) and Hydraulic (Report) analysis completed by Burnside in 2018, and in support of the proposed SICD Improvements included as Appendix H of the Engineer's Report, will be referenced as needed to outline various hydrotechnical aspects of the proposed improvements to the SICD.

2.0 Proposed Construction and Phasing

Figure 1 – SICD Construction Phasing Plans is on page 3 of this Memo. The left-hand SICD Location Map with the heading 2021 illustrates the original Phased construction schedule for the proposed improvements to the SICD. The right-hand SICD Location Map with the heading 2022 again shows the various Phases; however, they have been REVISED.

The following Sub-Sections provide an explanation of the differences between these side-by-side views, as well as information that led to the revision of the 2022 SICD Location Map.

2.1 Construction Completed in 2021

As illustrated in Figure 1, Phase I as shown in Red in both the 2021 and 2022 views was scheduled for and completed in November 2021. Phase I of the SICD project included the deepening, widening and improvement works on the Main Drain from the 15th Line right-of-way upstream to approximately the west side of the Highway 400 right-of-way. It also included the proposed improvements on Branch A.

2.2 Pending Construction

The Ministry of Transportation (MTO) indicated early in this project, and prior to the filing of the engineer's report for the SICD Improvement in 2019, that the ultimate replacement of the existing culvert crossings under Highway 400 would not be undertaken until the expansion of that major highway was realized at a future date. However, an interim drainage solution has been accepted by the MTO to provide improved conveyance of the flows (solely for the 2-year event) in the Main Drain by installing additional new culvert crossings under Highway 400 until the ultimate replacement can be constructed.

The improvements proposed for the Main Drain by the Town (in the Burnside Report) from the limits of the Highway 400 crossings to approximately the 3rd Line, primarily include the lowering of the invert of the drain bottom and the widening of the cross section to enhance conveyance.

Recent communication with MTO staff has revealed that the construction of the interim drainage solution and the installation of the additional culvert crossings within the Highway 400 right-of-way (or corridor) will not be commenced until sometime in 2023, at the earliest.

Figure 1 - SICD Construction Phasing Plans



The delay in delivering the interim drainage solution under Highway 400 has a direct and significant impact on the deepening and widening improvements proposed for the Main Drain upstream thereof; because without the construction and completion of the above-noted “interim drainage solution”, the proposed Main Drain Improvements are neither feasible nor recommended.

Accordingly, and recognizing the magnitude of the drainage improvements and construction work left to be completed, Burnside and the Town of Innisfil explored the potential impacts of proceeding with other portions of the SICD improvement project upstream of the 3rd Line.

To that end, the main purpose of this Technical Memorandum is to provide commentary on the following:

1. Firstly, to identify any sections of Main Drain as well as any Branches that may be able to have their respective proposed improvements completed in 2022 and which are outside or beyond the Highway 400 head pond area; please refer to Section 2.3.
2. Secondly, and based on the results from Item 1., assess the potential impacts (if any) to downstream properties that may result if any of the proposed improvements are undertaken in 2022; please refer to Sections 3.0 and 4.0.

2.3 Construction to be Completed in 2022

As illustrated in Figure 1, Phase II shown in Green in both the 2021 and 2022 views was scheduled for completion from November 2021 to November 2022. However, and further to Section 2.2, changes are now required in an effort to defer work previously proposed in the “head pond area” until after the completion of the interim drainage solution within the Highway 400 right-of-way. Further, it is also the desire of the Town (and presumably the watershed community) to not delay (unless absolutely necessary) the continuation of the implementation and construction of this multi-phased SICD Improvement project.

To that end, Phase II shown in Green in the 2021 view was contingent on the design, installation, and completion of the Highway 400 interim drainage solution culvert crossings in order to proceed. In the 2022 view, you will notice that it has been switched with Phase III shown in Blue. Additionally, the portion of the Main Drain between 3rd Line and 4th Line has also become part of Phase III.

Accordingly, the sections of the SICD that form the new Phase II as shown in Green are being proposed for construction from November 2021 to November 2022. Specifically, these sections of the SICD include the following:

- a) The SICD Main Drain upstream from 4th Line to the 5th Line including the replacement of the crossing under 4th Line;
- b) The 10 Sideroad Branch Drain including replacing the crossing under 3rd Line;
- c) The 3rd Line Branch Drain; and
- d) The 3rd Line Spur Branch Drain.

2.4 Construction to be Completed in 2023

In Figure 1, Phase III was shown in Blue in both the 2021 and 2022 views; however, its location in the 2022 right hand view has been changed to reflect the proposed changes identified in Section 2.3 and which are now part of Phase II; the works in this phase are proposed to be completed from November 2022 to November 2023.

Phase III of the SICD project will include the proposed deepening, widening and improvement work on the Main Drain from the Reive Boulevard right-of-way upstream to the south side of the 4th Line culvert crossing scheduled to be completed as part of Phase II in 2022.

3.0 Hydrological Commentary

The balance of this Technical Memorandum is in support of the Phase II 2022 Drain Improvements shown on Green, and their associated impacts to downstream properties if any.

Burnside completed a detailed Hydrological Report for the SICD Improvements in 2018. The purpose of that Report was to gain a detailed understanding of how rainfall interacts with land use and soil composition within the SICD watershed, and how conveyance mechanisms work within the entire Main Drain. This detailed analysis was used to derive peak flows at various locations within and along the course of the Main Drain for detailed design purposes.

It is very important for the reader to understand that the proposed drainage improvements do not impact or change any of the following factors within the SICD watershed:

1. the rainfall depth that any part of the watershed may be subjected to under any event; or
2. the duration of time over which any rainfall event may occur; or
3. the soils composition of the watershed; or
4. land use characteristics.

As the above key hydrological parameters do not change, regardless of extent of the work undertaken on the SICD, the magnitude of peak flows within the drain will also not change as a result of the proposed drainage improvements.

The proposed drainage improvements have been specifically designed to contain the 2-year peak flows within the banks of the SICD Main Drain. Therefore, the intent and focus of the proposed drainage improvements have been solely based on the 2-year event. Accordingly, and as supported by both the Hydrology and Hydraulic reports for the SICD, storm events greater than the 2-year, as well as their potential impact on the SICD Main Drain and its associated floodplain, are beyond the scope of this project.

The construction of the Phase II improvements, proposed for completion in 2022, will not affect the rainfall, land use or soils composition within the SCID watershed; therefore, they will not impact peak flows downstream of the proposed work zone in the head pond area.

4.0 Hydraulic Commentary

Section 6.0 commences on page 11 of the Hydraulic Report; it cites information relating to the existing condition hydraulic analysis completed for the SICD. We have for reference included Table 3, as well as an excerpt of a portion of the commentary contained in Section 6.1.1 entitled “The Funnel Effect and Flow Restrictions”.

Table 3 Existing Drain Capacity Table vs the 2-year Design Flow

Reach	Min Flow Capacity (m3/s)	Max Flow Capacity (m3/s)	Average Flow Capacity (m3/s)	2-year Standard Design Flow (m3/s)	2-year CC Design Flow (m3/s)
Highway 89 to Highway 400	5	10	7.5	13.64	27.13
2nd & 3rd line	8	15	11.5	11.51	21.14

Based on the above noted existing drain capacities and comparing them with the 2-year Standard and 2-year Climate change flows, it is apparent that the existing drain geometry is insufficient to convey the 2-year standard and 2-year climate change flows. This analysis was also completed without drain crossings in place. Drain crossings ultimately impeded flows within the drain and for simplicity, we assume at this stage of the report that conveyance capacity would be lower during field conditions as a result of current crossing restrictions in the drain.

Regardless of the improvements upstream of Highway 400, and until the MTO’s interim drainage solution has been implemented, the portion of the SICD in the head pond area will continue to see the same magnitude of peak flows and extents of flooding.

5.0 Conclusions

Based on the content of this Technical Memorandum, as a result of the timing of the Highway 400 interim drainage solution and installation of the new culvert crossings thereunder as confirmed by MTO, and in an effort to continue to move forward with the remaining improvements for the Main Drain and Branches, it is recommended the Town proceed with the new Phase II for the construction of the proposed drainage improvements for the SICD, as outlined in this Technical Memorandum.

Furthermore, proceeding with the suggested construction for 2022 (Section 2.3) will move the SICD Improvement project closer to completion, with only Phase III to be completed once the Highway 400 interim drainage solution is realized.

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Learn more and see related documents at [South Innisfil Creek Drain](#)

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