TOWN OF CALEDON PLANNING RECEIVED Sept.17, 2021

Appendix A.1: Background Information

Appendix A Stormwater Management

Please refer to Attached CD for:

• Kennedy SWM Facility Report by GHD





3.483	262.941	262.555	262.397	262.379	262.597	262.167	261.894	
900	4+920	4+940	4+960	4+980	5+000	5+020	5+040	Ę







Return Period	Design Storms
	Chicago (3, 4 and 12 hours)
2 to 100 Year	AES (1, 6, 12 and 24 hours)
	SCS Type II (6, 12, and 24 hours)

Table 5.1 Potential Storm Distributions for Etobicoke Creek

Tables included in Appendix F2 present the resulting 100-year flows for all design storm distributions at all selected flow node locations. As seen from these Tables, the most conservative peak flow rates were generally found to be associated with the 12-hour AES rainfall distribution. Given that the 12-hour AES distribution is also used by TRCA in other urban watersheds (i.e., Humber and Rouge River watersheds), the present study recommends the 12-hour AES distribution for use in the Etobicoke Creek watershed for establishing peak flows. Tables 5.2 and 5.3 summarize the resulting 2 to 100-year peak flow rates by using selected 12-hour AES design storm distributions for existing and future conditions respectively.

It is recommended that for sites with small drainage areas (i.e., individual site) that the Chicago storm with 5 min time steps be used for hydrologic modelling.

6.2.3 Lower-Basins (Sub-Basins # 8, 11 and 12)

As mentioned previously, for the downstream part of the watershed (Sub-Basins #8, 11 and 12), no controls are typically required. This is because if storages are provided for the infill re-development areas (with increased imperviousness) to attenuate the peak flows to the existing levels, such controls (storage routing) will delay the peak flows (i.e., longer time to peak values) from infill areas. For large sized watersheds (e.g., Etobicoke Creek watershed has a total drainage area more than 200 km²), such delayed peak flows from the downstream watersheds will be added to the peak flows in the main branch coming from the upstream watersheds which typically occur later. As such, the peak flows in the main branch of the water course will increase due to this "timing effect" if the infill re-developments within the lower downstream part of the watershed (Sub-Basins #8, 11 and 12) are controlled. Detailed information for the Lower-Basins is included in Appendix J3.

6.2.4 Summary of Established Unit Flow Rates for 1 in 2 to 1 in 100 year Design Storm Events

In order to examine the identified quantity control strategies on an overall watershed basis, the entire Etobicoke Creek hydrology model was modified to reflect.

- Headwatersheds (Sub-Basin #1) Control peak flows from ultimate development areas to 60% of the existing levels.
- Mid-Basins and Tributaries (Sub-Basins # 2 to 7, 9 and 10) Control peak flows from infill redevelopment lands (maximum 20% increases of imperviousness) to existing levels; and
- ▶ Lower-Basins (Sub-Basins # 8, 11 and 12) No quantity controls are required.

A summary of the resulting flows is presented in Table 6.1. As shown in the Table, by implementing the identified quantity control strategy (1 in 2 to 1 in 100 year) for the Etobicoke Creek watershed under ultimate development conditions, there will be no hydrological impact to the flows in the Etobicoke Creek watercourses (e.g.see results from Pun 4 vs. target flows for existing conditions).

Consequently, the recommended Unit Flow Rates (UFRs) for 2- to 100-year design storm events (12hr AES) for Etobicoke Creek watershed are summarized in Appendix J4. The existing catchment numbers are shown in Drawing J.1 in the rear pocket.

6.3 Development of Unit Flow Rates for Regional Storms

Based on discussion with TRCA staff, for Regional Storm (final 12-hours of Hurricane Hazel), ultimate developments are required to be controlled so that there are no increases of peak flows from future development models for the Etobicoke Creek water courses.

Similar to the approaches applied to establish Unit Flow Rates for 1 in 2 to 1 in 100 year design storms, the following control strategies were implemented in the Etobicoke Creek watershed model for Regional Storms:

- Headwatersheds (Sub-Basin #1) Control peak flows from ultimate development areas to 60% of resulting flows from the future conditions model.
- Mid-Basins and Tributaries (Sub-Basins # 2 to 7, 9 and 10) Control peak flows from infill redevelopment lands (maximum 20% increases of imperviousness) to those from base model; and
- ► Lower-Basins (Sub-Basins # 8, 11 and 12) No quantity controls are required.

A summary of the resulting flows is presented in Table 6.2. As shown in Table 6.2, by implementing the identified quantity control strategy for Regional Storm for the Etobleoke Creek watershed under ultimate development conditions, there will be no hydrological impact to the flows in the Etobleoke Creek watercourses (e.g. results from Run 8 vs. target flows for future conditions).

Consequently, the recommended Unit Flow Rates (UFRs) for Regional Storms (final 12-hours of Hurricane Hazel with no SWM ponds) for Etobicoke Greek watershed are summarized in Appendix J5. The future catchment numbers are shown in Drawing J.2 in the rear pocket.

Required Additional Storages for Regional Controls

Hurricane Hazel is a 48-hr duration historical storm. As discussed previously, final 12-hours of Hurricane Hazel has been identified as Regional Storm for Etobicoke Creek watershed. The saturated antecedent moisture condition (AMC III) is required to be applied for the catchment to simulate the wet soil conditions resulting from the first 36-hours of Hurricane Hazel. As such, when determining the required detention storage for regional controls, it is necessary to provide additional storage to accommodate the first 36-hours of Hurricane Hazel. Since no distribution was recorded during first 36-hour Hurricane Hazel historical storm, two hypothetical distributions (constant intensities and increased intensities, both with a total depth of 73mm) were applied in the existing model to determine the storage volumes used by the existing SWM ponds within the Etobicoke Creek watershed. All study results are included in Appendix J6. As indicated, a unit storage volume of 214 m³/ha will be required as additional storages for Regional controls. Such storages should be added to the calculated storage volumes to control the post-development peak flows to the identified Unit Flow Rates for the Regional Storm.

ETOBICOKE WATERSHED QUANTITY CONTROL STRATEGY - UNIT FLOW RATES

Existing	Unit Flow Rates (m ³ /s/ha)							
Catchment #	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr		
16	0.01111	0.01854	0.02409	0.03151	0.03728	0.04325		
24	0.01109	0.01920	0.02534	0.03363	0.04012	0.04685		
41	0.01011	0.01785	0.02375	0.03177	0.03808	0.04465		
45	0.01234	0.02085	0.02721	0.03576	0.04240	0.04928		
64	0.01283	0.02240	0.02964	0.03945	0.04713	0.05511		
447	0.01321	0.02206	0.02865	0.03745	0.04428	0.05132		
699	0.01475	0.02503	0.03273	0.04305	0.05108	0.05939		
734	0.01667	0.02851	0.03723	0.04878	0.05768	0.06676		
All Others	0.03300	0.04485	0.05300	0.06337	0.07113	0.07894		

Basin 6 - Spring Creek (U/S of Spring Creek Flow Guge) - Control to Existing Flow



ETOBICOKE WATERSHED QUANTITY CONTROL STRATEGY - UNIT FLOW RATES REGIONAL CONTROL

Basin 6 - Spring Creek (U/S of Spring Creek Flow Guge) - Control to Future Flow

Future Catchment #	Unit Flow Rates (m ³ /s/ha)
	Regional
542, 734, 764, 765, 769, 6992, 7602, 7612	0.11835
All Others	0.12744



Fluvial Geomorphological Assessment and Flow Monitoring

Tributary of Etobicoke Creek

Snell's Hollow Secondary Plan Town of Caledon, Ontario



Prepared for: Snell's Hollow Landowners Group c/o Jason Afonso, MCIP, RPP Glen Schnarr and Associates Inc. 700-10 Kingsbridge Garden Circle Mississauga, ON L5R 3K6

April 15, 2020 PN19033

GEO

MORPHIX

Geomorphology Earth Science Observations



Report Prepared by:	GEO Morphix Ltd. 36 Main St. N. Campbellville, ON LOP 1B0
Report Title:	Fluvial Geomorphological Assessment and Flow Monitoring, Tributary of Etobicoke Creek Snell's Hollow Secondary Plan Area Town of Caledon
Project Number:	PN19033
Status:	FINAL
Version:	1.0
Submission Date:	April 17, 2020
Prepared by:	Suzanne St. Onge, M.Sc., Tye Rusnak, B.Sc. Env.
Approved by:	Paul Villard, Ph.D., P.Geo., CAN-CISEC, EP, CERP

Table of Contents

1	Intro	duction and Background	.1
2	Back	ground Review and Desktop Assessment	.1
	2.1	Physiography and Geology	.1
	2.2	Reach Delineation	.2
3	Field	Assessment	.2
	3.1	General Reach Observations	.3
	3.2	Detailed Geomorphological Assessment	.4
4	Erosi	on Threshold Assessment	.5
	4.1	Methodology	.5
	4.2	Results	.5
5	Flow	Monitoring	.6
	5.1	Water Level Monitoring	.7
	5.2	Velocity and Discharge Monitoring	.7
6	Sumr	mary and Conclusions	.8
7	Refer	ences	10

List of Tables

Table 1. General channel characteristics	3
Table 2. Measured and computed channel parameters	4
Table 3. Erosion thresholds and average channel parameters	6
Table 4. Flow monitoring sites, sampling parameters, and sampling duration in 2019	6
Table 5. Minimum and maximum water depths at each sampling location	7
Table 6. Average velocity and measured discharge at each sampling location	8

Appendices

- Appendix A Reach Delineation and Monitoring Station Locations
- Appendix B Photographic Record
- Appendix C Field Observations
- Appendix D Detailed Geomorphological Assessment Summary
- Appendix E Flow Monitoring Data

1 Introduction and Background

GEO Morphix Ltd. was retained to complete a fluvial geomorphological assessment and flow monitoring in support of the Snell's Hollow Secondary Plan in the Town of Caledon, hereafter referred to as the subject lands. The subject lands are bounded by Highway 410 to the north and east, Kennedy Road to the west, and Mayfield Road to the south. A portion of the Heart Lake Wetland Complex, a provincially significant wetland (PSW), is located in the southern portion of the subject lands. This wetland complex and associated drainage features are located within the Etobicoke Creek watershed and the jurisdiction of Toronto and Region Conservation Authority (TRCA).

The following activities were completed as part of the fluvial geomorphological assessment:

- Conduct rapid geomorphological assessments and collect general observations to document existing channel conditions
- Complete a detailed geomorphological assessment, including a survey of the longitudinal profile and six (6) cross sections (including two monumented cross sections)
- Install erosion pins to quantify the rate and extent of erosion at monumented crosssections
- Complete grain size analysis using a modified Wolman (1954) pebble count or through collection of bed sample to observe changes in bed composition over time, as appropriate
- Determine an erosion threshold for the reach downstream of Mayfield Road
- Collect time stamped monumented photographs to provide a record of existing conditions

The following activities were completed as part of the 2019 flow monitoring program:

- Install stream flow monitoring equipment in four (4) locations within the subject lands to record water level and temperature at 15-minute intervals
- Record local atmospheric temperature and pressure at 15-minute intervals
- Install monumented cross-sections at each monitoring station for the periodic collection of velocity measurements
- Collect time stamped monumented photographs to provide a record of existing conditions

Stream flow monitoring activities will continue in 2020, with all 4 monitoring stations re-installed on March 24, 2020 for the April 1st start of the monitoring season. This report will subsequently be updated to include additional data following removal of all monitoring equipment in the late fall of 2020.

2 Background Review and Desktop Assessment

2.1 Physiography and Geology

Channel morphodynamics are largely governed by the flow regime and the availability and type of sediments (i.e., surficial geology) within the stream corridor. These factors are explored as they not only offer insight into existing conditions, but also potential changes that could be expected in the future as they relate to a proposed activity.

The subject lands are located within the gently sloping drumlinized till plains of South Slope physiographic region (Chapman and Putnam, 2007). Published mapping indicates that the local surficial geology within and north of the subject lands consists of clay to silt-textured till derived from glaciolacustrine deposits or shale. These fine-grained till deposits are considered to be

relatively resistant to erosion. In areas where wetlands are currently present, surficial geology consists of organic deposits (OGS, 2010).

2.2 Reach Delineation

Reaches are homogeneous segments of channel used in geomorphological investigations. They are studied semi-independently as each is expected to function in a manner that is at least slightly different from adjoining reaches. This allows for the meaningful characterization of a watercourse as the aggregate of reaches, or an understanding of a particular reach, for example, as it relates to a proposed activity. Reaches in the study area were delineated first through a desktop assessment using the Ministry of Natural Resources and Forestry (MNRF) stream layer and recent digital aerial photography from Google Earth Pro. Reaches were delineated based on changes in the following:

- Channel planform
- Channel gradient
- Physiography
- Land cover (land use or vegetation)
- Flow, due to tributary inputs
- Soil type and surficial geology
- Certain types of anthropogenic channel modifications

This follows scientifically defensible methodology proposed by Montgomery and Buffington (1997), Richards et al. (1997), Brierley and Fryirs (2005), and the Toronto and Region Conservation Authority (2004). A reach map is provided in **Appendix A**. Reaches were numbered from downstream to upstream to provide geographic context and then verified during field reconnaissance.

Five reaches were delineated within the subject lands. Reach **EC-1** extended from Mayfield Road to Heart Lake. Reach **EC-2** consisted of the pond feature north of Mayfield Road. Reach **EC-2a** extended from an agricultural field at the north extent of the subject lands to the pond feature. Reach **EC-3** contained the wetland that extended from Kennedy Road to the pond feature. Reach **EC-3a** extended from the property line of a landowner in the western extent of the subject lands to the subject lands to the wetland seature.

R.J. Burnside and Associates Limited (Burnside) completed headwater drainage feature assessments (HDFAs) within the subject lands in 2019. Existing conditions documented herein focus on geomorphologic observations and should be considered in conjunction with HDFA assessment results prepared by Burnside under separate cover.

3 Field Assessment

Field assessments of reaches within the subject lands were completed on May 10, 2019 and included the following activities:

- Observations of riparian conditions
- Estimates of bankfull channel dimensions, as appropriate
- Characterization of bed and bank material composition and structure
- Observations of erosion, scour, or deposition
- Collection of georeferenced photographs

These observations and measurements are summarized below and in **Table 1** in the following section. The descriptions are supplemented and supported with representative photographs, which

are included in **Appendix B.** Reach summary field sheets are provided in **Appendix C.** The Rapid Geomorphological Assessment (RGA; MOE, 2003) and the Rapid Stream Assessment Technique (RSAT; Galli, 1996) were not applicable due to the poorly defined nature of the features.

3.1 General Reach Observations

Reach **EC-1** began at the outlet of the pond feature (**EC-2**) and flowed through a steel culvert under Mayfield Road, continuing south through a confined valley towards Heart Lake. The reach had a low gradient and where defined, contained a wide, shallow channel. Riparian vegetation was mainly comprised of mature trees and was greater than 10 channel widths. Bank materials ranged from clay to sand and little to no bank erosion was observed. There were no riffles or pools. Bed materials consisted of organic material, clay, silt, and fine sand. Two trail crossings were present across the channel and valley. Woody debris was present in the channel but was not attributed to channel widening. Reach **EC-1** was chosen as the location for the detailed geomorphological assessment and erosion threshold analysis.

Reach **EC-2** consisted of a pond feature that separated wetland reach **EC-3** upstream to the west and Mayfield Road downstream to the southeast. Reach **EC-2a** extended from the border of an agricultural field to the north. This feature was characterized as poorly defined and had a moderate gradient. Burnside identified the upstream portion of this reach as a headwater drainage feature. The riparian vegetation buffer was continuous and comprised of grasses that extended more than 10 channel widths. The feature was extensively encroached with grasses, and a large, man-made woody debris pile was present in the middle of the reach. Bankfull width and depth at the downstream extent of the reach were 6.0 m and 0.4 m, respectively. Bank materials consisted of clay, silt, and sand. Bank angles ranged from 30 – 60 degrees with little to no erosion. There was no evidence of riffle-pool morphology. Bed materials were comprised of clay, silt, and sand.

Reach **EC-3** consisted of a large wetland feature that began at the southwest extent of the subject lands. The southwest corner of the feature was bound by a retaining wall adjacent to Mayfield Road and the stormwater management (SWM) pond at the corner of Kennedy Road and Mayfield Road. Recorded velocity measurements showed that the wetland slowly drained eastwards into the pond feature (**EC-2**). Vegetation within the wetland consisted of cattails, deciduous trees, shrubs and grasses.

Reach **EC-3a** began at the property line of a landowner in the northwest corner of the subject lands. The reach was unconfined, and consisted of a low gradient channelized feature that was moderately entrenched. Burnside identified the upstream portion of this reach as a headwater drainage feature. The riparian buffer zone was wide and mainly comprised of grasses. Average bankfull width and depth were 1.4 m and 0.3 m, respectively. Bank angles ranged from 60 – 90 degrees and the reach showed minimal signs of erosion. Bank materials consisted of clay, silt, and sand. Riffle-pool morphology was not present. Bed materials were comprised of sand and gravel.

	Average	Average	Subs	trate				
Reach	Bankfull Width (m)	Bankfull Depth (m)	Bed	Bank	Riparian Vegetation	Notes		
EC-1	17.95	0.32	Organic material, clay, silt, Find Sand	Clay, silt, sand	Mature trees	Wetland-like channel; confined valley; wide, shallow channel; no evidence of channel widening		

Table 1. General channel characteristics



	Average	Average	Subs	trate			
Reach	Bankfull Width (m)	Bankfull Depth (m)	Bed	Bank	Riparian Vegetation	Notes	
EC-2	N/A-Pond	N/A-Pond Feature		A-Pond Feature N/A		Grasses	Outlets south to steel culvert crossing at Mayfield Road
EC-2a	6.0	0.4	Clay, Silt, Sand	Clay, Silt, Sand	Grasses	Extensive vegetation encroached; large man- made woody debris pile mid-reach	
EC-3	N/A; Wetland Feature		N/A		Grasses	Unconfined; no defined channel; cattails, trees, shrubs, grasses present	
EC-3a	1.4	0.3	Clay, Silt, Sand	Sand, Gravel	Grasses	Channelized feature; moderately entrenched	

3.2 Detailed Geomorphological Assessment

A detailed geomorphological assessment was completed on May 6, 2019 within Reach **EC-1** as this reach was identified as the most sensitive to erosion. The specific location within the reach was chosen as it had the most defined section of channel. The assessment included a longitudinal survey of the channel bed and water level to determine gradients, and the completion of six detailed cross-section surveys. Two of these cross-sections were monumented and included the installation of erosion pins. At each cross section, bankfull geometry was recorded, as well as riparian conditions, bank material, bank height/angle, the presence of undercutting, and bank root density. Characterization of channel bed material at each cross section was completed using a modified Wolman (1954) pebble count technique or through collection of bed samples, as appropriate. Photographs of each cross section and both channel banks were also collected at the time of the survey. Results from the detailed assessment are summarized in **Table 2**. A complete summary of the detailed assessment is provided in **Appendix D**.

Channel Parameter	EC-1
Measured	
Average bankfull channel width (m)	17.95
Average bankfull channel depth (m)	0.32
Bankfull channel gradient (%)	0.66
D ₅₀ (mm)	< 2.0
Manning's n roughness coefficient	0.050
Computed	
Bankfull discharge (m ³ /s) *	4.30
Average bankfull velocity (m/s)*	0.76

Table 2. Measured and computed channel parameters

* Based on Manning's Equation

4 Erosion Threshold Assessment

4.1 Methodology

Erosion thresholds are used to determine the magnitude of flow required to potentially entrain and transport bed and/or bank materials. As such, they may be used to inform erosion reduction strategies in channels influenced by conceptual flow management plans. The erosion threshold analysis provides a depth, velocity, or discharge at which sediment of a particular size may potentially be entrained. This is then field-validated through sediment transport observations under a range of flows. Due to the variability between bed and bank composition and structure, erosion thresholds are typically determined for both bed and bank materials. Threshold targets are determined using different methods that are dependent on channel and sediment characteristics. For example, thresholds for non-cohesive sediments are commonly estimated using a shear stress approach, similar to that of Miller et al. (1977), which is based on a modified Shield's curve. A velocity approach could also be applied. For non-cohesive materials, a method such as that described by Komar (1987), or empirically-derived values such as those compiled by Fischenich (2001) or Julien (1994), could be applied.

An erosion threshold is quantified based on the bed and bank materials and local channel geometry, in the form of a critical discharge. Theoretically, above this discharge, entrainment and transport of sediment can occur. The velocity, U is calculated at various depths, until the average velocity in the cross section slightly exceeds the critical velocity of the bed material. The velocity is determined using a Manning's approach, where the Manning's n value is visually estimated through a method described by Arcement and Schneider (1989) or calculated using Limerinos's (1970) approach. The velocity is mathematically represented as

 $U = \frac{1}{n} d^{2/3} S^{1/2}$

[Eq.1]

where, d is depth of water, S is channel slope, and n is the Manning's roughness. The discharge is then calculated using the area of a typical cross section at that depth.

For the bank materials, following Chow (1959) in a simplified cross section, 75% of the bed shear stress acts on the channel banks. In a similar approach, the depth of flow is increased until the shear stress acting on the banks exceeds the resisting shear strength of the bank materials.

4.2 Results

Erosion thresholds were determined for the bed and bank materials within **Reach EC-1** of the Tributary of Etobicoke Creek. This reach was deemed to be the most sensitive to erosion of the reaches assessed, although it was still considered to be a low risk environment as it was depositional.

Channel bed and bank materials were considered equivalent, and conservatively estimated to consist of a fairly compact to loose clay. A critical shear stress approach was taken using the criteria of Julien (1994) for this material, which has a critical shear stress of 6.2 N/m². This threshold shear stress was then applied to a representative cross section measured from the detailed assessment to calculate the critical discharge, or the discharge at which it is expected that sediment entrainment will begin to occur. The results of the erosion assessment are provided in **Table 4**. Using the criteria of Chow, the critical discharge to entrain the bed materials within **Reach EC-1**, was determined to be $1.25 \text{ m}^3/\text{s}$.

We note that **Reach EC-1**, as well as the others that may receive stormwater flows in the subject lands, are relatively resilient to potential erosion given their low gradient and wide, oversized bankfull channels. Consequently, we do not advocate for using the erosion threshold assigned to **Reach EC-1** to aid in designing the associated SWM pond and outlet structure given the high volume of water the channel has the capacity to tolerate. Doing so could conceivably cause downstream erosion concerns in other reaches that are more sensitive to erosion. Instead, we suggest using the 24 or 48 hour detention of the 25 mm event to prevent erosion both within the study area, and downstream within Etobicoke Creek.

Table 3. Erosion thresholds and average channel parameters

Channel Parameter	Reach EC-1
Average bankfull channel width (m)	17.95
Maximum bankfull channel depth (m)	0.32
Average channel gradient (%)	0.66
Calculated bankfull discharge (m ³ /s)	4.3
Bankfull shear stress (N/m ²)	20.53
Erosion thresholds for bed and bank m	aterials
Critical shear stress (N/m ²)	6.2
Critical discharge (m ³ /s)	1.25

5 Flow Monitoring

During 2019, flow monitoring was conducted at four (4) locations on the subject lands to assess water quantity characteristics. A map of monitoring locations is provided for reference in **Appendix A. Table 4**, below, summarizes monitoring activities at each location.

Table 4.	Flow	monitoring	sites,	sampling	parameters,	and	sampling	duration	in
2019									

Site	Sampling Parameters	Monitoring Duration	# Visits
W Inlet	Continuous water level & temperature Velocity measurements when possible	April 4 – November 30	8
S Inlet	Continuous water level & temperature Velocity measurements when possible	April 4 – November 30	8
Bridge	Continuous water level & temperature Velocity measurements when possible	April 4 – November 30	8
Outlet	Continuous water level & temperature Velocity & discharge measurements when possible	April 4 – October 30*	8

*Sensor stolen/lost between October 30 visit and sensor removal

Activities at all locations included the following:

• Collect water level and temperature data at 15-minute intervals using a HOBO U20 pressure and temperature logger, with an additional control sensor to measure atmospheric pressure and air temperature on- site

- - Record velocity measurements using Acoustic Doppler Velocimeter (ADV), when possible, to calculate discharge
 - Collect monumented photographs of all sampling activities to verify location and timing

All sampling activities adhere to the Ontario Stream Assessment Protocol outlined by the Ontario Ministry of Natural Resources and Forestry (MNRF, 2017). Daily rainfall data was acquired from a Weather Underground weather station (Climate ID: ICALED1) located approximately 1.5 km west of the subject lands to account for precipitation and climatic conditions.

5.1 Water Level Monitoring

Water level loggers recorded continuous pressure throughout the entire monitoring season (April 4 – November 30). Discrete stilling well measurements were taken during each site visit in order to ensure data quality and data verification.

Baseflow is the portion of streamflow derived from natural storage sources and does not include direct runoff from precipitation. There must not be any evidence in the stage discharge hydrograph of any recent storm events to be considered baseflow. Due to the intermittent/ephemeral nature of these watercourses, all four sites were dry following the spring freshet. During spring, the baseflow levels of the **W** inlet, **S** inlet, Bridge, and **Outlet** sites were approximately 0.02 m, 0.13 m, 0.10 m, and 0.03 m respectively.

Water level responses are dependent on the magnitude of the rainfall event and antecedent conditions. The maximum water levels during 2019 for the **W Inlet** site was observed on May 25 following a 33.53 mm rain event. The maximum water depth at the **W Inlet** site was 0.09 m on this day. Maximum water depths at the **S Inlet**, **Bridge**, and **Outlet** sites were 0.20 m, 0.19 m, and 0.09 m respectively, recorded on April 26, following a 23.37 mm rain event.

Minimum and maximum water levels recorded by monitoring equipment is summarized below in **Table 5.** The full set of continuous water level measurements, as well as discrete measurements, are provided in **Appendix E.**

Sampling Location	2019 Water Depth (m)		
	Minimum	Maximum	
W Inlet	0.00	0.09	
S Inlet	0.00	0.20	
Bridge	0.00	0.19	
Outlet	0.00	0.09	

Table 5. Minimum and maximum water depths at each sampling location

5.2 Velocity and Discharge Monitoring

In addition to continuous water level and temperature monitoring, discrete measurements of velocity (**W Inlet, S Inlet,** and **Bridge** sites) were recorded, when possible. A summary of measured discharge at each sampling location is summarized below in **Table 6**.



Measurement Date (mm-dd-yyyy)	Location	Average Velocity (m/s)	Discharge (m³/s)
	W Inlet	0.0114	0.0002
04.00.2010	S Inlet	0	0
04-09-2019	Bridge	0	0
	Outlet	0.2734	0.0150
	W Inlet	0.0538	0.0009
05 10 2010	S Inlet	0	0
05-10-2019	Bridge	0.0400	0.0023
	Outlet	0.3392	0.0180
	W Inlet	0	0
06 20 2010	S Inlet	N/A*	N/A*
00-20-2019	Bridge	N/A*	N/A*
	Outlet	0.0170	0.0004

Table 6. Average velocity and measured discharge at each sampling location

*Channel dry or too shallow for measurement

Due to the intermittent/ephemeral nature of these sites, velocity measurements were only possible during the spring freshet. A full record of attempted velocity readings is provided in **Appendix E.** Velocity measurements were not possible during monitoring visits at the **S Inlet** site. This is due to the lack of channel definition and wetland characteristics at the sensor location. Maximum discharges at the **W Inlet, Bridge,** and **Outlet** sites were 0.0009 m³/s, 0.0025 m³/s, and 0.0180 m³/s respectively, which occurred on May 10, 2019 following 21.59 mm of rainfall in 24 hours.

6 Summary and Conclusions

GEO Morphix was retained to complete a fluvial geomorphological assessment of the drainage features within the subject lands. This assessment included a background review, reach delineation and rapid field reconnaissance to confirm existing conditions. A detailed geomorphic assessment was completed downstream of the subject lands, along Reach **EC-1**, to determine an appropriate erosion threshold in support of the stormwater management strategy. The critical discharge to entrain the bed materials within **Reach EC-1** was determined to be 1.25 m³/s. Notably, reaches within and downstream of the subject lands are relatively resilient to potential erosion due to their generally low gradients and wide, oversized bankfull channels. Consequently, the erosion threshold assigned to **Reach EC-1** could potentially cause downstream erosion concerns in other reaches that are more sensitive to erosion. Rather, the 24 or 48 hour detention of the 25 mm event is recommended to prevent erosion both within the study area, and downstream within Etobicoke Creek.

Water level and temperature data were collected at 15-minute intervals at 4 sites within the subject lands. Monumented cross sections were installed at each site to collect periodic velocity measurements to determine discharge. Monitoring results revealed that these drainage features are ephemeral, as they only contained water during the spring freshet. Due to a lack of channel definition, discharge could not be calculated for the **S Inlet** site. Maximum discharges at the **W**



Inlet, Bridge, and **Outlet** sites were 0.0009 m³/s, 0.0025 m³/s, and 0.0180 m³/s respectively, which occurred on May 10, 2019 following 21.59 mm of rainfall in 24 hours.

We trust this report meets your requirements. Should you have any questions please contact the undersigned.

Respectfully submitted,

Paul Villard, Ph.D., P.Geo., CAN-CISEC, EP, CERP Director, Principal Geomorphologist

yanne St. Onge

Suzanne St. Onge, M.Sc. Senior Environmental Scientist

7 References

Arcement, G. J., & Schneider, V. R. 1989. Guide for selecting Manning's roughness coefficients for natural channels and flood plains.

Brierley, G. J. and Fryirs, K. A. 2005. Geomorphology and River Management: Applications of the River Styles Framework. Blackwell Publishing, Oxford, UK, 398pp. ISBN 1-4051-1516-5.

Chapman, L.J. and Putnam, D.F. 2007. Physiography of Southern Ontario. Ontario Geological Survey Miscellaneous Release –- Data 228.

Chow, V.T. 1959. Open channel hydraulics. McGraw Hill, New York.

Fischenich, C. 2001. Stability Thresholds for Stream Restoration Materials. EMRRP Technical Notes Collection (ERDC TN-EMRRP-SR-29), U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Galli, J. 1996. Rapid Stream Assessment Technique, Field Methods. Metropolitan Washington Council of Governments.

Julien, P. Y. 1994. Erosion and Sedimentation (1st ed.). Cambridge University Press.

Komar, P.D. 1987. Selective gravel entrainment and the empirical evaluation of flow competence. Sedimentology, 34: 1165-1176

Limerinos, J.T. 1970: Determination of the Manning coefficient from measured bed roughness in natural channels. United States Geological Survey Water-Supply Paper 1898B.

Miller, M.C., McCave, I.N. and Komar, P.D. 1977. Threshold of sediment erosion under unidirectional currents. Sedimentology, 24: 507-527.

Ministry of Natural Resources and Forestry (MNRF). 2017. Ontario Stream Assessment Protocol Version 10.

Ministry of the Environment (MOE). 2003. Ontario Ministry of the Environment. Stormwater Management Guidelines.

Montgomery, D.R. and J.M. Buffington. 1997. Channel-reach morphology in mountain drainage basins. Geological Society of America Bulletin, 109 (5): 596-611.

Ontario Geological Survey (OGS). 2010. Surficial geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128-REV

Richards, C., Haro, R.J., Johnson, L.B. and Host, G.E. 1997. Catchment and reach-scale properties as indicators of macroinvertebrate species traits. Freshwater Biology, 37: 219-230.

Toronto and Region Conservation Authority. 2004. Belt Width Delineation Procedures.

Wolman, M.G. 1954. A method of sampling coarse river-bed material. Transactions of the American Geophysical Union, 35: 951-956.





Legend

- Reach break
 Watercourse
 Wetland
 Contour (1 m)
 Secondary Plan Area
- Atmospheric sensor
 Pressure logger
 Detailed assessment
 Top of bank*

 *Staked by TRCA (Oct. 23, 2018) and Biason Surveying Inc. (Sept. 20, 2011)

Reach Delineation and Monitoring Station Locations

Tributary of Etobicoke Creek

Snell's Hollow Secondary Plan Area

V2

GEO MORPHIX™

0 100 LLLL Metres

Imagery: Google Earth Pro, 2018. Top of bank: GSAI, 2019. Reach break, Monitoring Jocations, and Detailed assessment: GEO Morphix Ltd., 2019. Watercourse and Wetland: MNRF and GEO Morphix Ltd., 2019. Contour: J.H. Gelbloom Surveying Limited and GEO Morphix Ltd., 2019.

Appendix B Photographic Record
































Photo taken facing upstream showing baseline conditions.





Appendix C Field Observations

Reach Chara	cteristics		Project Co	de: PM	1903	32	GEC	M O Geomorpholo Earth Science	R P H	IX	
Date:	2019-05-10	Stream/Reach:			Pond Uls Maufie				eld Rd. / FC-Z		
Weather:	overcast 8°C	Locatio	on:	May	Pipld	Rd +	Ferr	redu	RN		
Field Staff:	LG + KIM	Waters	shed/Subwatershed:	Etab	icor	e C	(F)	and a state of the		
UTM (Upstream)			Downstream)		1 Se Se Ine	- Star	- There				
Land Use (Table 1)	(Table 2) Channel Type (Table 3) Channel (Table 3)	Zone	JA Flow Type (Table 5)	IA □Gro	undwater	E	vidence: _	Nor	R		
Riparian Vegetation			Aquatic/Instream Ve	getation			Water Qu	ality			
Dominant Type: Cov (Table 6) 3 1 Species: 1	Channel widths Age Class (yrs): Encroachmen None 1-4 Immature (<5) (Table Fragmented 4-10 Established (5-30) 1 Continuous > 10 Mature (>30) 1	nt: 7)]	Type (Table8) N(Woody Debris Present in Cutbank Present in Channel Not Present	Coverage o Density o Low Mode	Reach (%) of WD: WDJ/ rate	50m:		Odour (1 / Turbidity	ʿable 16) (Table 17)		
Channel Characteristic	CS										
Sinuosity (Type)	Sinuosity (Degree) Gradient Num	ber of Cl	hannels	Clay/Silt	Sand	Gravel	Cobble	Boulder	Parent	Rootlets	
(Table 9) NF	(Table 10) $N \beta$ (Table 11) $N \beta$ (Tab	le 12)	NA Riffle Substra	ate Nd (A							
Entrenchment	Type of Bank Failure Downs's Classification	-	Pool Substra	te ND/P							
(Table 13) NR	(Table 14) NA (Table 15) NA		Bank Material	×							
Bankfull Width (m) Bankfull Depth (m)	NA Wetted Width (m)	NA		Ba	nk Angle 0 – 30 30 – 60	Bank Er 2 < 5% 3 5 - 3	osion 0%	Notes:		· · · · · · · · · · · · · · · · · · ·	
Riffle/Pool Spacing (m) $N \cap \%$ Riffles: $N \cap \%$ Pools: N	A Mea	nder Amplitude:	JA D	60 – 90 Undercut	□ 30 – □ 60 –	60% 100%		÷		
Pool Depth (m)	NA Riffle Length (m) NA Undercuts (m)	NA	Comments: PO	nd.							
Velocity (m/s) Wiffle ball / ADV / Estimated											
			n gan in angin in an tao a da a sa a sa s	Comp	leted by:	CH	C	hecked by	:		

Reach Characteristics		Project Code	PN1903	3	GEO	M O Geomorpholog Earth Science Observations	R P H	I X
Date: 7019-05-16	Stream	n/Reach:	Niglet	of We)	Tand	TEC	- 2.0	_
Weather: arefeast, 8.C	Locatic	on:	Mayfield	Rd @	Kenned	dy Ro	rend	
Field Staff: LG + WM	Waters	shed/Subwatershed:	tabiloke	Crt.		1.0		
UTM (Upstream) 595897.89 mE 4845049.02		Downstream)	595954.9/n	.E 4841	1971.78 v	N		
Land Use Valley Type Channel Type (Table 1) (Table 2) (Table 3)	Channel Zone (Table 4)	C Flow Type 3 (Table 5)	Groundwa	ter	Evidence:			
Riparian Vegetation		Aquatic/Instream Vege	tation		Water Qua	lity		
Dominant Type: Coverage: Channel widths Age Class (yrs): (Table 6) Immature (<5) Immature (<5) Species: Fragmented 4-10 Established (5- Immature (>30) Immature (>30) Immature (>30)	Encroachment:) (Table 7) 30)	Type (Table8) 1 Woody Debris Present in Cutbank Present in Channel Not Present	Coverage of Reacl Density of WD Cov V Cov V Cov Moderate High	(%) 100 (DJ/50m:		Odour (T	able 16) Table 17)	
Channel Characteristics								
Sinuosity (Type) Sinuosity (Degree) Gradient	Number of Ci	hannels	Clay/Silt Sa	nd Gravel	Cobble	Boulder	Parent	Rootlets
(Table 9) (Table 10) (Table 11)	(Table 12)	2 Riffle Substrate	pirc					
Entrenchment Type of Bank Failure Downs's Clas	ssification	Pool Substrate	X E					
(Table 13) (Table 14) (Table 15)	d	Bank Material						
Bankfull Width (m) 6 N/A N/A With Wett Bankfull Depth (m) 6.4 N/A N/A Wett Riffle/Pool Spacing (m) N/A % Riffles: N/A % Pool Depth (m) N/A Riffle Length (m) N/A	ed Width (m)	NIA NIA NIA NIA NIA NIA NIA NIA	Bank An $\Box 0 - 30$ $\Box (30 - 6)$ $\Box (60 - 5)$ $\Box Under \Delta ge - fc$	$\begin{array}{c} \text{gle} & \text{Bank E} \\ & & & & \\ & & & \\ \hline & & & \\ \hline & & \\ 0 & & & \\ 0 & & & \\ 0 & & & \\ 0 & & \\ $	rosion 6 30% - 60% - 100%	Notes: L WPJ dow No rif	hal hal hres this o	Man-no fway ach.
	/iffle ball / ADV / Estimat	ted Hom	Ag. tiel	k		900	15	
BFW and BFD taken at DS	end of re	ach	Completed	by: _6	Cł	necked by:		

Reach Characteristics		Project Co	de: PN1ª	1033		GEO	M O George pholog Earth Science Observations	крн "	IX
Date: 2019-05-10	Stream/	Reach:	Wet	land	USI	May fie	ld Rd	./E	$\overline{-3}$
Weather: Overcast 8°C	Location	1:	Marfiel	d Kd	. 0	Kenne	ly Roc	d	
Field Staff: $(G + h)M$	Watersh	ned/Subwatershed:	Etobica	the (CCK.		1		
UTM (Upstream) 595371.06 mE 4844455.82 mN	UTM (Do	ownstream)	59606:	2.82 m	E Y	84484	7.98m	N	
Land Use Valley Type Channel Type Channel Type (Table 1) (Table 2) (Table 3) (Table 3)	Zone ble 4)	A Flow Type (N (Table 5)	IA □Grou	ndwater	E	vidence: _			
Riparian Vegetation		Aquatic/Instream Ve	getation			Water Qu	ality		
Dominant Type: Coverage: Channel widths Age Class (yrs): Encroachmer (Table 6) 3 None 1-4 Immature (<5) (Table Species: Immature Fragmented 4-10 Established (5-30) 1 Immature Immature (>30) Immature 1 Cattails, burd deciduous frees in wetland. Immature	nt: : 7)	Type (Table8) I Woody Debris I Present in Cutbanl I Present in Channe I Not Present I	Coverage of Density of Coverage of Low Moder High	Reach (%) WD: WDJ/5 ate	100 om: A		Odour (T 1 Turbidity (able 16) (Table 17)	
Channel Characteristics									
Sinuosity (Type) Sinuosity (Degree) Gradient Num	nber of Ch	annels	Clay/Silt	Sand	Gravel	Cobble	Boulder	Parent	Rootlets
(Table 9) 11/A (Table 10) N/A (Table 11) N/A (Tab	ble 12)	I A Riffle Substra	ate NAR						
Entrenchment Type of Bank Failure Downs's Classification		Pool Substra	ate NIA						
(Table 13) N/A (Table 14) N/A (Table 15) N/A		Bank Material	D.						
Bankfull Width (m) NIA Wetted Width (m) Bankfull Depth (m) NIA Wetted Depth (m) Riffle/Pool Spacing (m) NIA % Riffles: NIA % Pools: NI Pool Depth (m) NIA Riffle Length (m) NIA Undercuts (m) Velocity (m/s) NIA Wiffle ball / ADV	NIA NIA Mean NIA	der Amplitude:	Valley Ban C MA Davd DAD	Slope k Angle) - 30 :0 - 60 :0 - 90 Indercut takey	No 80 Bank Er 2 < 5% 30 - 30 - 60 -	osion osion 60% 100% North	Notes: U No de throug Docum	let lav fined gh we ented	d, channel chand. flow
North in let, South in let, West in let, and or ave separate XS surveys and velocity	otlet da	outh, as channels ta	Compl	eted by:	LG	C	Swa Swa hecked by	all Po	nd.
during WQM visits.									

GEO MORPHIX Project Code: PN19033 **Reach Characteristics** Earth Science Observations of FC-3a -05-10 wetland 0 Date: Stream/Reach: inlet Weather: Location: overrast Kennedy house Field Staff: Watershed/Subwatershed: 010140 CAL 4844452.99 m N 4844513.44 m N UTM (Upstream) 69 mE UTM (Downstream) 33 F Land Use Valley Type Channel Type **Channel Zone** Flow Type Groundwater Evidence: (Table 1) (Table 2) (Table 3) (Table 4) (Table 5) **Riparian Vegetation** Aquatic/Instream Vegetation Water Quality Coverage of Reach (%) 100 Channel Dominant Type: Coverage: Age Class (yrs): **Encroachment:** Type (Table8) Odour (Table 16) widths Minimature (<5) (Table 6) None 1-4 (Table 7) Woody Debris Density of WD: □ Fragmented 4-10 Established (5-30) Species: □ Present in Cutbank 3 Low WDJ/50m: Turbidity (Table 17) Continuous $\square > 10$ Mature (>30) Present in Channel □ Moderate Not Present 🗌 High **Channel Characteristics** Sinuosity (Type) Sinuosity (Degree) Clay/Silt Gradient Number of Channels Sand Gravel Cobble Boulder Parent Rootlets (Table 9) (Table 10) (Table 11) (Table 12) M X **Riffle Substrate** Type of Bank Failure X Ň Entrenchment Downs's Classification Pool Substrate (Table 13) (Table 14) X (Table 15) **Bank Material** V \square **Bank Angle Bank Erosion** N:tch Bankfull Width (m) Wetted Width (m) Notes: IN $\Box 0 - 30$ ▼ < 5% 3 □ 30 - 60 5 - 30% Bankfull Depth (m) Wetted Depth (m) ☑ 60 – 90 \Box 30 - 60% \Box 60 - 100% Riffle/Pool Spacing (m) 17 % Riffles: % Pools: Meander Amplitude: Undercut MA Pool Depth (m) Riffle Length (m) Undercuts (m) A Comments: 51100 Wiffle ball (ADV) Estimated Velocity (m/s) - XS surveyed in RTK unit at pressure logger - velocity and wetted reasurements will be taken during Completed by: Checked by: each WQM visit

Reach Characteristics Key



Appendix D Detailed Geomorphological Assessment Summary

				GEO	MORPHIX
Gene	eral Site Cha	racteristics	Project Code:	PH190	33
Date:		Ma16 20	() Stream/Reach:	NI/A	
Weath	er:	5110 + 15	C Location:	Heart	areca
Field S	itaff:	CH+KI	Watershed/Subwatershed:	Etobico	ke cric
Field S Featur X Featur X X Featur S Flow T H1 H2 H3 H4 H5 H6 H7 H8 H9 Substr S1 S2 S3 S4 S5 Other BM BS DS WDJ VWC	staff: es Reach break Cross-section Flow direction Riffle Pool Medial bar Eroded bank Undercut bank Rip rap/stabilization Leaning tree Fence Culvert/outfall Swamp/wetland Grasses Tree Instream log/tree Woody debris Station location Vegetated Island ype Standing water Scarcely perceptible Smooth surface flow Upwelling Rippled Unbroken standing Broken standing water Scarcely perceptible Smooth surface flow Upwelling Rippled Unbroken standing water Silt Sand Gravel Small cobble Large cobble Benchmark Backsight Downstream Woody debris jam Valley wall contact	<pre>//gabion //gabion //gabio</pre>	Watershed/Subwatershed:	Etobico	Ke Crik N N N N N N N N N N N N N N N N N N N
BOS TOS	Bottom of slope Top of slope	FP Flood plainKP Knick point	Additional Notes:	Dawnstre	on
* 11	nis orea l	was chosed	sen as it is the long.	most	narrow
	Der ter		Completed by	. Che Che	ecked by:

Completed by: _____ Checked by: _____

GEO

Detailed Geomorphological Assessment Summary

Reach EC-1

Project Number:	PN19033	Date:	May 10, 2016
Client:	Snell's Hollow Landowner Group	Length Surveyed (m):	105.6
Location:	Heart Lake Conservation Park	# of Cross-Sections:	6

Reach Characteristics								
Drainage Area:	Not measured	Dominant Riparian Vegetation Type:	Trees					
Geology/Soils:	Clay to silt-textured till	ay to silt-textured till Extent of Riparian Cover:						
Surrounding Land Use:	Forest	Width of Riparian Cover:	>10 channel widths					
Valley Type:	Confined	Age Class of Riparian Vegetation:	Mature (>30 years)					
Dominant Instream Vegetation Ty	pe: Rooted submergent	Extent of Encroachment into Channel:	Minimal					
Portion of Reach with Vegetation:	20%	Density of Woody Debris:	Moderate					

Hydrology								
Measured Discharge (m ³ /s):	Not measured	Calculated Bankfull Discharge (m ³ /s):	4.30					
Modelled 2-year Discharge (m ³ /s):	Not modelled	Calculated Bankfull Velocity (m/s):	0.76					
Modelled 2-year Velocity (m/s):	Not modelled							

Profile Characteristics		Planform Characteristics	
Bankfull Gradient (%):	0.66	Sinuosity:	1.13
Channel Bed Gradient (%):	0.26	Meander Belt Width (m):	Not measured
Riffle Gradient (%):	N/A: no riffles	Radius of Curvature (m):	Not measured
Riffle Length (m):	N/A: no riffles	Meander Amplitude (m):	Not measured
Riffle-Pool Spacing (m):	N/A: no riffle and pools	Meander wavelength (m):	Not measured

Longitudinal Profile



Bank Characteristics

	Minimum	Maximum	Average		Minimum	Maximum	Average
Bank Height (m):	0.2	0.70	0.45				
Bank Angle (deg):	10	45	24	Torvane Value (kg/cm²):		Not measured	
Root Depth (m):	0.05	0.20	0.10	Penetrometer Value (kg/cm ³):		Not measured	
Root Density (%):	10	70	42	Bank Material (range):		Clay, silt, sand	
Bank Undercut (m):		No undercuts					

Cross-Sectional Characteristics

	Minimum	Maximum	Average
Bankfull Width (m):	12.70	27.90	17.95
Average Bankfull Depth (m):	0.18	0.49	0.32
Bankfull Width/Depth (m/m):	29	108	61
Wetted Width (m):	4.90	18.50	11.95
Average Water Depth (m):	0.04	0.25	0.13
Wetted Width/Depth (m/m):	48	175	108
Entrenchment (m):		Not measured	
Entrenchment Ratio (m/m):		Not measured	
Maximum Water Depth (m):	0.09	0.54	0.26
Manning's <i>n</i> :		0.050	



Photograph at cross section 4 (left bank)





Channel Thresholds								
Flow Competency (m/s):		Tractive Force at Bankfull (N/m ²):	20.53					
for D ₅₀ :	0.00	Tractive Force at 2-year flow (N/m ²):	Not modelled					
for D ₈₄ :	0.00	Critical Shear Stress (D ₅₀) (N/m ²):	0.00					
Unit Stream Power at Bankfull (W/m ²):	15.50							

General Field Observations

Channel Description

Reach EC-1 consisted of a fairly straight and low gradient channel through a confined valley. The continuous and wide riparian buffer zone consisted of mature trees. The average bankfull width and depth were 17.95 m and 0.32 m. Bank materials ranged from clay to sand. Little to no bank erosion was observed. There were no riffles or pools. Bed materials consisted of organic material, clay, silt, and fine sand. Two trail crossings were present across the channel and valley. Woody debris was present within the channel but not due to the channel widening.

Cross Section 4 - Facing Downstream



Appendix E Flow Monitoring Data























Bridge Water Temperature






























































ADV Discharge Measurement Summary

Measurement Date (mm-dd- yyyy)	Location	Average Velocity (m/s)	Measured Discharge (m³/s)
	W Inlet	0.0114	0.0002
04 00 2010	S Inlet	0	0
04-09-2019	Bridge	0	0
	Outlet	0.2734	0.0150
	W Inlet	0.0538	0.0009
05 10 2010	S Inlet	0	0
05-10-2019	Bridge	0.0400	0.0023
	Outlet	0.3392	0.0180
	W Inlet	0	0
06 20 2010	S Inlet	N/A	N/A
06-20-2019	Bridge	N/A	N/A
	Outlet	0.0170	0.0004
	W Inlet	N/A	N/A
07 16 2010	S Inlet	N/A	N/A
07-10-2019	Bridge	N/A	N/A
	Outlet	N/A	N/A
	W Inlet	N/A	N/A
09 12 2010	S Inlet	N/A	N/A
08-13-2019	Bridge	N/A	N/A
	Outlet	N/A	N/A
	W Inlet	N/A	N/A
08 20 2010	S Inlet	N/A	N/A
08-30-2019	Bridge	N/A	N/A
	Outlet	N/A	N/A
	W Inlet	N/A	N/A
10 01 2010	S Inlet	N/A	N/A
10-01-2019	Bridge	N/A	N/A
	Outlet	N/A	N/A
	W Inlet	N/A	N/A
10-20 2010	S Inlet	N/A	N/A
10-30-2019	Bridge	N/A	N/A
	Outlet	N/A	N/A

N/A - Channel dry/too shallow, unable to complete measurement



REPORT

Preliminary Geotechnical Investigation, Coscorp Inc. In Trust

Proposed Residential Development, Snell's Hollow Secondary Plan, Caledon, Ontario

Submitted to:

Coscorp Inc. In Trust

Tom Basekerville Vice President Development 6625 Kitimat Road, #58 Mississauga, On

Submitted by:

Golder Associates Ltd.

6925 Century Avenue, Suite #100, Mississauga, Ontario, L5N 7K2, Canada

+1 905 567 4444

19115264 Phase 3000

June 17, 2019

Distribution List

- 1 e-copy: Golder Associates Ltd.
- 1 e-copy: Coscorp Inc. In Trust
- 1 e-copy: Snell's Hollow Developers Group
- 1 e-copy: Glen Schnarr & Associates Inc.

Table of Contents

1.0	INTR	ODUCTION	1
2.0	SITE	DESCRIPTION AND BACKGROUND	1
3.0	ADJA	ACENT GEOTECHNICAL SITE INFORMATION	2
4.0	REGI	ONAL GEOLOGY	2
5.0	INVE	STIGATION PROCEDURE	3
6.0	SUBS	SURFACE CONDITIONS	3
	6.1	Topsoil and Reworked/Disturbed Materials	4
	6.2	(CL) Silty Clay to sandy Silty Clay (Upper Glacial Till)	4
	6.3	(ML) gravelly sandy SILT	4
	6.4	(CL-ML) Clayey Silt (Lower Glacial Till)	5
	6.5	Groundwater Conditions	5
7.0	GEO	TECHNICAL ENGINEERING DISCUSSION	5
	7.1	Site Preparation	6
	7.1.1	Subgrade Preparation	6
	7.1.2	Engineered Fill Requirements	6
	7.2	Installation of Underground Services	7
	7.2.1	Temporary Excavations	7
	7.2.2	Pipe Bedding and Cover	8
	7.2.3	Trench Backfill	8
	7.3	Building Foundations	9
	7.3.1	Below Grade Walls1	0
	7.4	Pavement Design within the Proposed Development1	0
	7.4.1	Subgrade Drainage1	1
8.0	SEIS	MIC SITE CLASSIFICATION1	1
9.0	INSP	ECTION AND TESTING1	2
10.0	CLOS	SING1	2

TABLES

Table 1: Approximate Topsoil Thickness	4
Table 2: Groundwater Level Measurements	5
Table 3: Pavement Design	.10

FIGURES

Figure 1 – Site and Borehole Location Plan

APPENDICES

APPENDIX A Record of Boreholes

APPENDIX B Geotechnical Laboratory Figures

APPENDIX C Adjacent Properties and Previous Geotechnical Borehole Logs

APPENDIX D Important Information and Limitations of This Report



1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by Coscorp Inc. In Trust (Coscorp) to provide preliminary geotechnical consulting services to support a draft plan approval for a future residential subdivision development located north east of Heart Lake Road and Mayfield Road in Caledon, Ontario (the Site), as shown in the Site and Borehole Location Plan, *Figure 1.*

The terms of reference for the geotechnical consulting services are included in Golder's proposal No. P19115264 Rev 1, dated March 8, 2019.

The purpose of the investigation is to obtain information on the general subsurface soil and shallow groundwater conditions at the site by means of a limited number of boreholes and geotechnical laboratory tests. Based on our interpretation of the factual information collected as part of the preliminary geotechnical investigation carried out at this site, a general description of the subsurface conditions across the site is presented herein. The interpreted subsurface conditions and available project details were used to develop preliminary engineering parameters and recommendations on the geotechnical design aspects of the project, including construction considerations which could influence design decisions.

This report provides the results of the preliminary geotechnical investigation and should be read in conjunction with the *"Important Information and Limitations of This Report"* in *Appendix D*. The reader's attention is specifically drawn to this information, as it is essential for the proper use and interpretation of this report. The factual data, interpretations and recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. If the project is modified in concept, location or elevation, or if the project is not initiated within twelve months of the date of the report, Golder should be given an opportunity to confirm that the recommendations in this report are still valid.

2.0 SITE DESCRIPTION AND BACKGROUND

The subject property is located north east of Kennedy Road and Mayfield Road and is part of the Snell's Hollow Secondary Plan, which is a proposed residential development to be located in the southern part of the Town of Caledon. The site is bounded by Kennedy Road to the west, adjacent agricultural properties with a valley creek to the east and south, which further connects to Mayfield Road and Heart Lake Road and Highway 410 to the north, as shown in Figure 1.

The site has a total area of approximately 7.4 hectares (18.3 acres) of predominantly flat land which slightly slopes at the property limit next to Highway 410. The site consists of agricultural land as noted by the presence of previous farming activities (crops). There are two residential dwellings outside the property boundaries located to the south-west of the site which has a municipal address of 12097 and 12141 Kennedy Road, Caledon, Ontario.

Based on our understanding, the Site is to be developed into a residential development, with associated underground services and supporting roads. For the purposes of this report, we have assumed that the future residential houses will be constructed utilizing shallow strip/spread footings, with an interior slab-on-grade, and one-level of underground basement. We have also assumed cuts and/or fills required for site grading purposes will not exceed 2.0 m and that the invert of the site servicing will be no greater than 3.0 m below existing site grades.

3.0 ADJACENT GEOTECHNICAL SITE INFORMATION

Additional geotechnical investigations consisting of seventeen boreholes were also carried out as part of the Snell's Hollow Secondary Plan on the southwest, south and east adjacent properties (Golder, 2019). Also, a previous geotechnical investigation consisting of five boreholes was carried out by Edward Wong and Associates, 2017 (Wong, 2017), on the south property.

The following is a summary of subsurface conditions obtained from boreholes located adjacent to the site (BH/MW19-02 and BH19-10 to BH/MW19-13) from Golder 2019, and (BH1 and BH5) from Wong, 2017 as shown on the Site and Borehole Location Plan, *Figure 1.*

In general, the subsurface conditions encountered typically consist of a surficial topsoil ranging in thickness from about 200 mm to over 610 mm overlying a disturbed/reworked dark to light brown silty clay layer, which contains various amounts organics, underlain by glacial till composed of stiff to hard brown silty clay to a depth ranging from 4.0 m to 6.7 m below ground surface. A 4.5 m clayey silt fill deposit was indicated in BH5 (Wong, 2017), however the fill material was not encountered in BH/MW19-02.

A stiff to hard grey clayey silt till or very dense silty sand to sand was generally found below the brown silty clay till layer. These subsurface conditions were found to be similar to the subsurface conditions encountered in the boreholes located on Coscorp site (discussed in detail in subsequent sections).

Groundwater was encountered in BH/MW19-02 at approximately Elev. 244.5 m, BH5 at approximately Elev. 262.2 m and BH19-10 at approximately Elev. 263.7 m, upon the completion of drilling and ranged from 2.8 m to 12.7 m below existing ground surface, whereas Borehole BH19-11, BH/MW19-13 and BH1, were found to be dry upon the completion of drilling.

Four, 50 mm diameter monitoring wells were installed at Boreholes BH5, BH/MW19-02 and BH/MW19-13 to permit further monitoring of the groundwater levels. The groundwater levels measured at Borehole BH/MW19-02 within the shallow 50 mm diameter monitoring well on April 17, 2019 were recorded to be 0.25 m below existing ground surface. (Elev. 257 m) and at 6.3 m below existing ground surface (Elev. 250.9 m) within the deep monitoring well. The groundwater level measured at Borehole BH/MW19-13 on April 17, 2019, was measured at 9.4 m below ground surface (Elev. 258.2 m).

The record of borehole logs from the adjacent properties are enclosed in *Appendix C*. The approximate locations of the boreholes drilled at these sites are shown on the Site and Borehole Location Plan, *Figure 1*.

4.0 **REGIONAL GEOLOGY**

The surficial geology aspects of the general site area were reviewed from the following publication:

 Chapman, L.J., and Putnam, D.F., 2007, "The Physiography of Southern Ontario"; 4th Edition, Ontario Geological Survey.

Physiographic mapping in the area according to the above noted reference indicates that the site lies within the physiographic region of southern Ontario known as the South Slope. The South Slope region slopes gradually downward towards Lake Ontario. The overburden immediately below ground surface within the South Slope generally consists of clayey silt till and silty clay till and at depth, consists of alternating deposits of dense lacustrine sands and silts and overconsolidated lacustrine clays and clay tills overlying the bedrock.

The subsurface conditions encountered during the investigation are generally consistent with the physiographic mapping.

5.0 INVESTIGATION PROCEDURE

The field work for the preliminary geotechnical investigation was carried out on April 4, 2019, during which time two boreholes (designated as Boreholes BH/MW19-01 and BH/MW19-03) were advanced at the site to depths between about 8.2 m and 9.8 m below existing ground surface at the approximate locations shown on the Site and Borehole Location Plan, *Figure 1*, attached.

The boreholes were advanced using a track-mounted drill rig supplied and operated by a specialist drilling contractor, subcontracted to Golder. Standard Penetration Testing (SPT) and sampling was carried out at regular intervals of depth in the boreholes using conventional 35 mm internal diameter split spoon sampling equipment advanced using an automatic hammer, in accordance with ASTM D1586 (99). Two, 50 mm diameter monitoring wells were installed to permit further monitoring of the groundwater levels at each borehole location. Groundwater level measurements were recorded immediately following drilling procedures for all boreholes and on the monitoring wells on April 17, 2019. The well installation and water level readings are presented on the Record of Borehole sheets in **Appendix A**.

The field work for this investigation was directed by members of our engineering staff who located the boreholes in the field, directed the sampling and in-situ testing operation, logged the boreholes and cared for the samples obtained. The samples were identified in the field, placed in appropriate containers, labelled and transported to Golder's Mississauga geotechnical laboratory for further examination and laboratory testing. Index and classification tests, consisting of water content determinations, Atterberg limits and grain size distribution, were carried out on selected soil samples. The results of the geotechnical laboratory tests are included in **Appendix B** and on the Record of Borehole sheets in **Appendix A**.

The borehole locations were determined in the field using a GPS instrument based on UTM coordinates. Geodetic ground surface elevations at the borehole locations were derived from the site grading plan provided by GSAI, "Snell's Hollow Contour Plan, Town of Caledon" dated December 2018. and as such, the elevations and borehole locations given on the Record of Borehole sheets and referred to herein should be considered as approximate.

6.0 SUBSURFACE CONDITIONS

The subsurface soil and shallow groundwater conditions encountered in the boreholes and the results of the field and laboratory testing, are shown on the Record of Boreholes sheets, in **Appendix A**. Method of Soil Classification and Symbols and Terms Used on Records of Boreholes are provided to assist in the interpretation of the borehole logs. It should be noted that the boundaries between the strata have been inferred from drilling observations and non-continuous samples. They generally represent a transition from one soil type to another and should not be inferred to represent an exact plane of geological change. Further, conditions will vary between and beyond the boreholes. The following is a summary of the subsurface conditions of the boreholes advanced during this investigation followed by a more detailed description of the major soil strata and groundwater conditions.

In general, the subsurface conditions encountered at the boreholes advanced at the site typically consist of a surficial topsoil/silty clay layer underlain by native soil deposits of glacial till composed of silty clay to clayey silt containing varying amounts of sand and gravel. A gravelly sandy silt deposit was encountered in between the brown silty clay till and grey clayey silt till, about 4 m in thickness.

Details of the observations of the groundwater conditions during and upon completion of drilling are included on the Record of Borehole sheets. Shallow ground water was encountered at depths ranging from 4.0 m to 7.3 m

below existing ground surface upon the completion of drilling activities. Shallow groundwater levels measured in the 50 mm diameter monitoring wells installed at the site are also presented below.

6.1 Topsoil and Reworked/Disturbed Materials

Topsoil materials were encountered in all the boreholes and extended to depths ranging from 0.25 m to 0.35 m. A summary of topsoil thickness in each of the boreholes is outlined in the table below.

Borehole No.	Approximate Topsoil Thickness (m)
BH/MW19-01	0.25
BH/MW19-03	0.35

Table 1: Approximate	Topsoil	Thickness
----------------------	---------	-----------

Materials identified as topsoil in this report were classified based on visual and textural evidence as no other testing for organic content or other nutrients was carried out. As such, the ability for these materials to support vegetation has not been assessed.

Reworked/disturbed silty clay material was encountered in both boreholes below the surficial topsoil. Reworked material thickness was observed to be approximately 0.45 m to 1.0 m. The reworked material consisted of silty clay with various amounts of sand and gravel and traces of organics. SPT 'N' values within the cohesive reworked material ranged from about 5 blows to 10 blows per 0.3 m of penetration indicating a firm to stiff consistency.

The natural water content of the reworked material was measured at 19 percent.

6.2 (CL) sandy Silty Clay (Upper Glacial Till)

A glacial till deposit consisting of cohesive sandy silty clay was generally encountered directly underneath the topsoil/reworked till deposits to depths of about 5.8 m below existing ground surface (Elev. 261 m). The till deposit is light brown to brown mottled with oxidation staining, about 2.7 m to 5 m in thickness, with various amounts of sand and gravel. The silty clay till increases in sand content in both boreholes at depth. The till is believed to contain cobbles and/or possible boulders which have been inferred as a result of auger grinding observed in boreholes BH/MW19-03.

The SPT 'N' values measured in these till materials range from 11 blows per 0.3 m of penetration to 32 blows per 0.3 m of penetration, indicating that the silty clay till is generally stiff to hard in consistency.

The results of grain size distribution tests carried out on selected samples from this deposit are presented in **Figure B1.** Atterberg limits tests that were carried out on the same samples from this deposit measured liquid limit values ranging from about 23 to 24 and plastic limit values ranging from about 13 to 15; yielding corresponding plasticity index values ranging from about 10, which suggests that the upper till is a clay of low plasticity. These results are plotted on the plasticity chart as shown in **Figure B2**.

The water content of selected samples ranged from about 9 percent to 17 percent.

6.3 (ML) gravelly sandy SILT

A non-cohesive gravelly sandy silt was encountered underneath the brown cohesive silty clay till, in BH/MW19-03. The sandy silt deposit, is light brown, has slight plasticity, contains various amount of gravel, with cobbles/boulders being inferred from auger grinding and is about 3 m in thickness.

The SPT 'N' values measured in this deposit ranged from 75 blows per 0.3 m to 100 blows per 0.3 m of penetration. These SPT 'N' values indicate a very dense compactness.

The water content of selected samples ranged from about 8 percent.

6.4 (CL-ML) Clayey Silt (Lower Glacial Till)

A clayey silt till deposit was encountered directly underneath the sandy silty clay till and/or sandy silt from a depth of about 5.8 m and 7.0 m below existing ground surface. The boreholes were terminated in this layer at a depth of about 8.2 m and 9.8 m below existing ground surface. The cohesive till deposit contains various amounts of sand and gravel and is grey in colour.

The SPT 'N' values of this till deposit was 12 blows to 100 per 0.3 m of penetration indicating stiff to hard consistency.

6.5 Groundwater Conditions

Groundwater level measurements were recorded immediately following drilling procedures. Monitoring wells were installed in both boreholes to permit monitoring of the groundwater level at the site. Details of the monitoring well installation and the measured groundwater levels are shown on the Record of Borehole sheets in *Appendix A*. The groundwater level measurements in the drilled boreholes and in the monitoring wells are summarized in Table 2, below.

Borehole No.	Measurements Upon Completion of Drilling		Measurements in Monitoring Wells	
	Approximate Groundwater Depth (begs)*	Date	Approximate Groundwater Depth (begs)*	Date
BH/MW19-01	Dry	April 4, 2019	4.0 m (Elev. 262.8 m)	April 17, 2019
BH/MW19-03	9.1 m (Elev. 257.8 m)	April 4, 2019	7.3 m (Elev. 259.5 m)	April 17, 2019

Table 2: Groundwater Level Measurements

*begs- below existing ground surface.

It should be noted that the groundwater level in the area is subject to seasonal fluctuations and precipitation events and should be expected to be higher during wet periods of the year.

7.0 GEOTECHNICAL ENGINEERING DISCUSSION

This section of the report provides preliminary geotechnical engineering recommendations on the geotechnical aspects of the proposed development based on our interpretation of the limited borehole information and on our understanding of the project scope and requirements. The information in this portion of the report is provided for the guidance of the design engineers and professionals.

Based on the results of this investigation, the subsurface soil conditions encountered at the site are considered to be generally suitable for the proposed residential development.

As noted above, at the time of this report, proposed design grades (i.e. footing elevation, pavement subgrade and utility invert levels) were not available for the proposed development. The following engineering

recommendations regarding the geotechnical design aspects of the project including underground services, pavements and building foundations should be considered as preliminary only, and should be reviewed when the design grades and utility invert levels have been finalized.

Where comments are made on construction, they are provided only in order to highlight aspects of construction which could affect the design of the project. Contractors bidding on or undertaking any work at the site should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction and make their own interpretation of the factual data as it affects their proposed construction techniques, schedule, equipment capabilities, costs, sequencing and the like.

This report addresses only the geotechnical (physical) aspects of the subsurface conditions at this site. The geo-environmental (chemical) aspects, including the consequences of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources, are outside of the terms of reference for this report.

7.1 Site Preparation

7.1.1 Subgrade Preparation

The existing site vegetation, surficial topsoil/organics and other near-surface soils containing significant amounts of organic matter are not considered to be suitable for the subgrade support of engineered fill, building foundations, floor slabs, or other settlement sensitive structures. These materials should be completely stripped prior to placing any engineered fill or construction of foundations or interior or exterior slab-on-grade(s).

Disturbed/reworked materials containing excessive amounts of construction debris or organic material should be disposed of following appropriate environmental procedures. Furthermore; excessively-wet soils should be suitably dried before reuse as engineered fill.

Following the stripping of the surficial topsoil and soils containing significant amounts of organics and/or soft/disturbed surficial soils, the exposed subgrade should be heavily proof-rolled with suitable equipment, in conjunction with inspection by qualified geotechnical personnel to confirm that the exposed soils are competent and have been adequately stripped of ponded water and all disturbed, loosened, softened, organic and other deleterious material. Remedial work (i.e., further subexcavation and replacement) should be carried out on poorly-performing areas identified during the proof-rolling activities, as directed by Golder.

Any filling carried out at the site in conjunction with regrading should be carried out as under engineered fill procedures. Recommendations for the placement of engineered fill are outlined in Section 7.1.2 of this report.

7.1.2 Engineered Fill Requirements

As described above, the anticipated site grading activities may include both cutting and raising (filling) the original grade to meet the final design site grades. At the time of this report, the design cut and fill depths were not available for review. As such, for the purposes of this report, it has been assumed that cuts will not exceed 2 m and grade raises will not exceed more than 2 m.

In general, the existing native material is considered to be acceptable for reuse as engineered fill. Based on the laboratory test results, the water content of soils present at the site are considered to be generally near or above their optimum water contents for compaction, and therefore may require minor drying prior to placement, in general.

It should be noted that the native materials at the site are silty in nature, and as such are susceptible to overwetting and subsequent freezing during inclement weather. Therefore, it is recommended that site grading activities not be carried out during late fall, winter, early spring seasons or any periods of inclement weather conditions. All oversized cobbles (i.e., greater than 150 mm in size) and boulders, if present, should be removed from excavated material that will be used as engineered fill material.

If imported material is required for the engineered fill process, the material that is proposed for use as engineered fill should be approved by the geotechnical engineer at its source, prior to importing the material to the site. Suitable soils, free of topsoil, organic matter or other deleterious materials can be used as engineered fill provided that the water content of the soil at the time of placement does not vary by more than 2 percent above or below its optimum water content for compaction. Otherwise, the soils may require treatment (i.e., drying or wetting) prior to placement.

Following the inspection and approval of the subgrade as described previously in this report, engineered fill materials should be placed in maximum 300 mm-thick loose lifts and uniformly compacted to 98 percent of the Standard Proctor maximum dry density (SPMDD). Filling should continue until the design elevations are achieved.

Full-time monitoring and in-situ density testing should be carried out by Golder during placement of engineered fill.

The final surface of the engineered fill should be protected as necessary from construction traffic and should be sloped to provide positive drainage for surface water during the construction period. If the engineered fill materials will be left exposed (i.e. uncovered) during periods of freezing weather, additional soil cover should be placed above final subgrade to provide some level of frost protection. Prior to placing the granular subbase and/or base courses within pavement areas, the surface of the engineered fill/subgrade should be inspected by Golder.

7.2 Installation of Underground Services

7.2.1 Temporary Excavations

Details of the underground servicing for the proposed development are unknown at the time of this investigation; as such, for the purpose of this report, the maximum depth of the underground services was assumed to be about 3 m below the existing ground surface. Once detailed design is completed, review of the underground services should be completed by this office for compliance with the recommendations contained herein.

The founding soils are anticipated to generally consist of the native sandy silty clay or engineered fill. These materials are considered to be suitable for supporting the underground services provided that the integrity of the base of the trench excavations is maintained during construction. Where softened or disturbed native soils or other deleterious materials are encountered at the base of excavations for settlement-sensitive services, these materials should be subexcavated and replaced with compacted fills approved by the geotechnical engineer.

Care should be taken to direct surface water away from any open excavations and all temporary excavations should be carried out in accordance with the Occupational Health and Safety Act (OHSA) and Regulations for Construction Projects.

In general, the groundwater level in the open boreholes, upon completion of drilling, was measured to be at depths ranging from being dry to 9.1 m below existing ground surface or elevation 257.8 m. Whereas, the groundwater level in the monitoring wells, one month after drilling, was measured to be at depths ranging from 4.0 m to 7.0 m below existing ground surface, (Elev. 259.5 m to Elev. 262.8 m).

The groundwater in the excavations within the native deposits, are likely to be handled by collection via properly constructed and filtered sumps, located within the excavations, and then pumping and discharging the water to a suitable discharge point. However, should excavations deeper than 3-4m below existing ground surface be

required, the following recommendations will need to be review and revised to determine if some form of active dewatering, such as well points, may have to be implemented.

Excavations for the site servicing would generally extend through the native sandy silty clay deposit. Conventional excavation equipment should be suitable to excavate through these materials.

The stiff to hard native clayey till soils are classified as a "Type 2" soils under the OH&S Act. As such, all conventional temporary trench excavations should consist of open cuts with side slopes not steeper than 1 horizontal to 1 vertical in the overburden soils to within 1.2 m of the base of the excavation and then may be made vertical to the base. Where engineered fill (based on silty clay material) is used or the native sandy silt/silty clay exhibits signs of water seepage, the soil is classified as a "Type 3", as such all conventional temporary trench excavations should consist of 1 horizontal to 1 vertical.

Where the side slopes of excavations are required to be steepened to limit the extent of the excavation, then some form of trench support may be required. Some trench excavations could be carried out using a vertically-excavated, unsupported excavation (using a properly-engineered trench liner box for protection, certified by an experienced engineer); or by a supported (sheeted) excavation if conditions warrant so; such as in wet areas and/or in close proximity to adjacent underground services

7.2.2 Pipe Bedding and Cover

The bedding for the sewers and watermains should be compatible with the size, type and class of pipe and the surrounding subsoil and the requirements of the Town of Caledon. If granular bedding is deemed to be acceptable, then Ontario Provincial Standard Specifications (OPSS) Granular A should be used from at least 150 mm below invert of the pipe to the springline. Clear stone should not be used as bedding material. From springline to 300 mm above the obvert of the pipe, sand cover could be used. All bedding and cover material should be placed in 150 mm loose lifts and uniformly compacted to at least 100 percent of SPMDD. Where variable fill materials, softened or disturbed native soils or other deleterious materials are encountered at the base of excavations for settlement-sensitive services, these materials should be subexcavated and replaced with compacted fills approved by the geotechnical engineer.

7.2.3 Trench Backfill

The excavated materials from the site will consist predominantly of silty clay till materials. Based on the measured water contents, in general, the native materials encountered at the site are estimated to be near or below their optimum water contents for compaction, and therefore, will probably require only minor wetting prior to placement.

Care should be taken to maintain the water content of the soils close to/at the optimum water content for compaction during the construction operations, as difficulties with compaction and/or backfill performance would be anticipated with fine-grained soils where the water content is significantly above the optimum for compaction purposes. Soils that contain significant quantities of organics or debris are also not suitable for use as trench backfill within settlement-sensitive areas. In addition, all boulders and cobbles greater than 150 mm in size should be removed from the trench backfill materials. If there is a shortage of suitable in-situ material, an approved imported material such as Ontario Provincial Standard Specifications Select Subgrade Material should be used for trench backfill. Again, as noted above, the trench backfill materials are silty in nature and are very susceptible to wetting/freezing temperatures. Backfilling trenches during cold or wet weather is not recommended.

Trench backfill should be placed in maximum 300 mm loose lift thickness and uniformly compacted to at least 98 percent of the SPMDD of the material. Soil that is frozen should not be used as backfill.

Normal post-construction settlement of the compacted trench backfill should be anticipated with the majority of such settlement taking place within about 12 months following the completion of trench backfilling operations. If the trench backfill operations are completed during the winter months, post-construction settlements may increase beyond typical anticipated values. These settlements will be reflected at the ground surface. If the asphalt binder course is laid shortly following the completion of the trench backfilling operations, any settlement that may be reflected by subsidence of the surface of the binder asphalt should be compensated for by placing an additional thickness of binder asphalt or by padding. If possible, the surface course asphalt should not be placed over the binder course asphalt for about 12 months. Where scheduling requires that the surface course be placed over the binder course asphalt before this period, trench backfill settlement would be reflected by subsidence of the finished pavement surface in these areas which, depending upon the extent and magnitude, may require local repairs.

7.3 Building Foundations

As previously indicated, the existing site vegetation, surficial topsoil/organics and other near-surface soils containing significant amounts of organic matter are not considered to be suitable for the subgrade support of engineered fill, building foundations, floor slabs, or other settlement sensitive structures. These materials should be completely stripped prior to placing any engineered fill or construction of foundations or interior or exterior slab-on-grades.

Based on the subsurface conditions encountered in the boreholes, strip and spread footings that may be used, provided that the footings are founded on the native sandy silty clay deposit or on engineered fill (based on existing site soils) placed in accordance with the recommendation outlined in Section 7.1, and maintained a minimum depth of soil embedment below finished adjacent ground surface and top of slab of 1.2 m.

For such strip and spread footings, a factored geotechnical resistance at Ultimate Limit States (ULS) of 225 kPa and a geotechnical reaction at Serviceability Limit States (SLS) of 150 kPa may be assumed for design purposes, provided that the strip footings dimensions of 0.45 m in width and 10 m in length or spread footings have a minimum width of 0.60 m and a maximum width of 1.0 m.

Where spread footings are constructed at different elevations, the difference in elevation between the individual footings should not be greater than one half the clear distance 650 mm between the footings. In addition, the lower footings should be constructed first so that if it is necessary to construct the lower footings at a greater depth than anticipated, the elevation of the upper footings can be adjusted accordingly. Stepped strip footings should be constructed in accordance with the Ontario Building Code (2012), Section 9.15.3.9.

The maximum total and differential settlements are expected to be less than 25 mm and 20 mm; respectively, for footings designed, constructed and inspected as outlined above.

All exterior footings, and interior footings in unheated areas, should be founded at a minimum depth of 1.2 m below finished grade level in order to provide adequate protection against frost penetration.

The native soils are susceptible to disturbance from construction activity, especially during wet or freezing weather. Care should be taken to preserve the integrity of the materials as bearing strata. It is essential that the founding surface for the footings be inspected by qualified geotechnical personnel prior to placing concrete. If the concrete for the footings cannot be placed immediately after excavation and inspection of the subgrade, it is recommended that a working mat of lean concrete be placed in the excavation to protect the integrity of the bearing stratum.

Resistance to lateral forces/sliding resistance between the concrete footings and the subgrade should be calculated in accordance with Section 6.7.5 of the CHBDC. The unfactored coefficient of friction, tan δ , for the

interface between the cast-in-place concrete footing and the properly-prepared subgrade can be assumed to be 0.35.

7.3.1 Below Grade Walls

The exterior perimeter of all housing basement walls should be backfilled with an imported free draining, non-frost susceptible granular material approved by a geotechnical engineer, carefully placed and compacted in 200 mm thick loose lifts. The design of the foundation walls for the below-grade walls should take into account the horizontal soil loads as well as surcharge loads that may occur during or after construction and should be designed using a lateral (at-rest) earth pressure coefficient of 0.5 and a unit weight of backfill of 20 kN/m³.

The wall backfill layers should be compacted to at least 95 per cent of the materials' standard Proctor maximum dry density. Light compaction equipment should be used immediately adjacent to the foundation wall, otherwise compaction stresses on the wall may be greater than that imposed by the backfill material. With the exception of the driveway area, the upper 0.3 m of backfill should consist of clayey material to provide a low permeability cap and the exterior grade should also be shaped to slope away from the building.

Provided that the excavations adjacent to foundation/basement walls are backfilled with free-draining granular materials and a drainage collection system is provided around the perimeter of the building, the design of below-grade walls does not need to take into account hydrostatic forces acting on the walls. However, it is recommended that the exterior of the below-grade walls be damp-proofed.

7.4 Pavement Design within the Proposed Development

Following site grading operations, as noted previously, the proposed pavement subgrade will generally consist of either re-compacted engineered fill or native silty clay till. These materials are considered to be frost susceptible, and as such, the pavement design provided in *Table 3* below has taken this condition into consideration.

Based on the proposed pavement usage, (i.e. residential development type traffic and loads/frequencies) frost susceptibility and strength of the subgrade soils, the following pavement component given are recommended for the proposed development of access roads and streets, however the Town of Caledon/Region of Peel design standards should be followed:

Material		Minimum Thickness of Pavement Components (mm)		
		Local Road (8.5m Roadway)	Neighbourhood Collector (9.5 m Roadway)	
Asphaltic Concrete (OPSS 1150)	HL 3 Surface Course	40	40	
	HL 8 Binder Course	65	90	
Granular Materials	Granular A Base	150	150	
(OPSS.MUNI 1010)	Granular B Type II Subbase	350	500	
Total Pavement Thickr	iess (mm)	605	780	
		Prepared and Appro	oved Subgrade	

Table 3: Pavement Design

As part of the subgrade preparation, proposed access roads should be stripped of topsoil and other obviously unsuitable fill or organic materials. Fill required to raise the grades to design elevations should conform to the engineered fill requirements outlined previously in the report. Soft or spongy trench backfill areas should be sub-excavated and properly replaced with suitable approved backfill compacted to 98 percent SPMDD. Prior to placing pavement subbase and/or base materials, the exposed soil subgrade should be heavily proof-rolled in conjunction with an inspection by Golder. The granular subbase and base materials should be placed in loose layers no thicker than 200 mm and uniformly compacted to 100 percent of their SPMDD. The binder course and surface course asphalt materials should be compacted to minimum 92.0 percent of their Marshall Maximum Relative Density according to OPSS 310, as measured in the field using a nuclear density gauge.

Where new pavement abuts existing pavement (e.g. at the development limits), proper longitudinal lap joints should be constructed to key the new asphalt into the existing asphalt surface. The existing asphalt edges should be provided with a proper sawcut edge prior to keying-in the new asphalt. It should be ensured that any undermining or broken edges resulting from the construction activities are removed by the sawcut.

It should be noted that in some cases, even though the compaction requirements have been met, the subgrade strength may not be adequate to support heavy construction loading especially during wet weather or where backfill materials wet of optimum have been placed. In this regard, the design subbase thickness may not be sufficient for a construction haul road and additional subbase (in the order of 450 mm) may be required. In any event, the subgrade should be proofrolled and inspected by Golder prior to placing the subbase and any additional material, as required, consistent with the prevailing weather conditions and anticipated use by construction traffic.

7.4.1 Subgrade Drainage

In order to preserve the integrity of the pavement, continuous subdrains should be placed at the concrete curb lines along both sides of the proposed streets. The invert of the subdrains should be at least 300 mm below the bottom of the Granular "B" subbase and should be sloped to drain to catchbasins. The subdrains should consist of perforated pipe wrapped in a suitable geotextile and surrounded on all sides with a minimum thickness of 150 mm of OPSS.PROV 1002 Concrete Fine Aggregate (i.e. concrete sand).

8.0 SEISMIC SITE CLASSIFICATION

Seismic hazard is defined in the 2012 Ontario Building Code (OBC) by uniform hazard spectra (UHS) at spectral coordinates of 0.2 second, 0.5 second, 1.0 second and 2.0 seconds and a probability of exceedance of 2% in 50 years. The OBC method uses a site classification system defined by the average soil/bedrock properties (e.g. shear wave velocity, Standard Penetration Test (SPT) resistance, undrained soil shear strength, etc.) in the 30 m below the foundation level. There are six site classes from A to F, decreasing in ground stiffness from A, hard rock, to E, soft soil; with site class F used to denote problematic soils (e.g. sites underlain by thick peat deposits and/or liquefiable soils). The site class is then used to obtain acceleration and velocity-based site coefficients F_a and F_v ; respectively, used to modify the UHS to account for the effects of site-specific soil conditions in design.

Based on the results of the preliminary geotechnical investigation and assuming soils below the maximum depth investigated exhibit similar properties / strengths, a **Site Class D** is estimated for planning purposes. The Site Class will need to be verified, and adjusted as necessary, during detail design.

9.0 INSPECTION AND TESTING

During construction, full-time observation should be carried out during engineered fill and site servicing backfill placement, and sufficient foundation inspections, subgrade inspections and in-situ materials testing should be carried out to confirm that the conditions exposed are consistent with those encountered in the boreholes and to monitor conformance to the pertinent project specifications.

10.0 CLOSING

We trust that this preliminary report provides enough preliminary geotechnical engineering information to proceed with the detailed design of the proposed development. If you have any questions regarding the contents of this report or require additional information, please do not hesitate to contact this office.



Signature Page

Golder Associates Ltd.

Erti Mansaku, P.Eng. *Geotechnical Engineer*

JD/EM/JET/sm

11

Jeff Tolton, C.E.T. Associate, Senior Geotechnical Technologist

Golder and the G logo are trademarks of Golder Associates Corporation

https://golderassociates.sharepoint.com/sites/102461/technical work/phase 3000 - coscorp in trust/19115264 (3000) draft georeport coscorp in trust.docx



- \oplus Approximate Borehole and Monitoring Well Location
- Approximate Previous and Adjacent Properties Geotechnical Borehole (Edward Wong, 2017, Golder 2019) \bigoplus
- Watercourse
- Waterbody
- 🗄 🗄 Wetland
- Site Boundary
- Coscorp Inc. In Trust Site Boundary

0	75	150
1:3,000	MET	TRES

CLIENT COSCORP INC. IN TRUST

	YYYY-MM-DD	2019-04-16
	DESIGNED	MM
	PREPARED	MM
	REVIEWED	EM
	APPROVED	-

REFERENCE(S) 1. IMAGERY: ESRI, HERE, DELORME, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY © 2019 MICROSOFT CORPORATION © 2019 DIGITALGLOBE ©CNES (2019) DISTRIBUTION AUDILIO DE

AIRBUS DS 2. BASE DATA: LIO MNRF 2019 3. PROJECTION: TRANSVERSE MERCATOR NAD 1983 UTM ZONE 17N

PRELIMINARY GEOTECHNICAL INVESTIGATION, PROPOSED RESIDENTIAL DEVELOPMENT, COSCORP INC. IN TRUST, CALEDON, ON

TITLE SITE AND BOREHOLE LOCATION PLAN

19115264 3000 -	_	PROJECT NO.	CONTROL	REV.
		19115264	3000	-

FIGURE 1

APPENDIX A

Method of Soil Classification Abbreviations and Terms used on Record of Borehole List of Symbols Record of Boreholes
Organic or Inorganic	Soil Group	Туре	of Soil	Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$			$Cc = \frac{(D)}{D_{10}}$	$(xD_{60})^2$	Organic Content	USCS Group Symbol	Group Name	
		s of is mm)	Gravels with ≤12%	Poorly Graded		<4		≤1 or ≧	:3		GP	GRAVEL	
(ss)	5 mm	/ELS / mass action 14.75	fines (by mass)	Well Graded		≥4		1 to 3	3		GW	GRAVEL	
by ma	SOILS an 0.07	GRA 50% by oarse fr	Gravels with >12%	Below A Line			n/a				GM	SILTY GRAVEL	
GANIC nt ≤30%	AINED arger th	<) or or or or or or	fines (by mass)	Above A Line			n/a			≤30%	GC	CLAYEY GRAVEL	
INOR Conter	SE-GF Iss is la	is mm)	Sands with ≤12%	Poorly Graded		<6		≤1 or ≩	≥3		SP	SAND	
rganic	COAR by ma	NDS y mass raction in 4.75	fines (by mass)	Well Graded		≥6		1 to 3	3		SW	SAND	
0)	(>50%	SAI 50% b oarse f iller tha	Sands with >12%	Below A Line			n/a				SM	SILTY SAND	
		(≥ sme	fines (by mass)	Above A Line			n/a				SC	CLAYEY SAND	
Organic	Soil	Type	of Soil	Laboratory		F	Field Indica	ators	Toughness	Organic	USCS Group	Primary	
Inorganic	Group	. , po	0.00	Tests	Dilatancy	Strength	Test	Diameter	(of 3 mm thread)	Content	Symbol	Name	
				Liquid Limit	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT	
(sst	15 mm	S and L	Line icity low)	<50	Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT	
by me	OILS 1an 0.0	SILTS tic or P	n Plast nart be		Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT	
GANIC it ≤30%	NED S naller ti	Plas	0° 5	Liquid Limit	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	МН	CLAYEY SILT	
INOR	E-GRAI ss is sr	Ň		≥50	None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	ОН	ORGANIC SILT	
rganic	FINE by ma		hart	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0%	CL	SILTY CLAY	
0)	(≥50%	CLAYS	ticity C below)	Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium	30%	CI	SILTY CLAY	
			Plas	Liquid Limit ≥50	None	High	Shiny	<1 mm	High	(see Note 2)	СН	CLAY	
× S ° S	30% ss)	Peat and mix	mineral soil tures							30% to 75%		SILTY PEAT, SANDY PEAT	
HIGHL SOL	by mas	Predomir may con	nantly peat, Itain some							75%	PT	DEAT	
40	ö	mineral so amorph	oil, fibrous or nous peat							100%			
-	Low	Plasticity		Medium Plasticity	- Hig	h Plasticity		a hyphen,	bol — A dual for example,	GP-GM, S	two symbols : SW-SC and Cl	separated by ML.	
					CLAY	Sta Tall 2		For non-co	hesive soils,	the dual s	ymbols must b	e used when	
30					СН			the soil h	as between I material b	5% and atween "c	12% fines (i.e lean" and "di	e. to identify	
~					/			gravel.				ity sand of	
ex (PI)				SILTY CLAY	CLAYEY SI ORGANIC S	IT MH		For cohes	ive soils, the	dual symb	ol must be us	ed when the	
pul 20 -				ne /				liquid limit and plasticity index values plot in the CL-ML area					
Plasti				Alle				or the plas	ucity chart (s	ee Plastici	ty Chart at len	.).	
		SILTY CI	LAY	/				Borderlin	e Symbol —	A borderl	ine symbol is	two symbols	
10			/	LAYEY SILT ML				separated	by a slash, fo	or example	e, CL/CI, GM/S	SM, CL/ML.	
7 5	ILTY CLAY-CLAY	EY SILT, CL-ML	OF	RGANIC SILT OL				A borderlin	ne symbol sh identified as	ould be us	sed to indicate	that the soil	
4	SILT ML (See Note 1)						transition	between simil	ar materia	ls. In addition.	a borderline	
0	10	20	25.5 30	40 5	0 60	70	80	symbol ma	ay be used to	indicate a	range of simi	lar soil types	
Note 1 – Fir	ne grained	materials wi	ں ith PI and LL	that plot in this a	area are nameo	I (ML) SILT w	ith	within a st	ratum.				
slight plast	icity. Fine-	grained mat	terials which	are non-plastic (i.e. a PL canno	ot be measure	ed) are						

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

named SILT. Note 2 – For soils with <5% organic content, include the descriptor "trace organics" for soils with between 5% and 30% organic content include the prefix "organic" before the Primary name.

💊 GOLDER

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)						
BOULDERS	Not Applicable	>300	>12						
COBBLES	Not Applicable	75 to 300	3 to 12						
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75						
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)						
SILT/CLAY	Classified by plasticity	<0.075	< (200)						

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (<i>i.e.</i> , SAND and GRAVEL)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_i), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d: The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

- PH: Sampler advanced by hydraulic pressure
- PM: Sampler advanced by manual pressure
- WH: Sampler advanced by static weight of hammer
- WR: Sampler advanced by weight of sampler and rod

	· · · · · · · · · · · · · · · · · · ·
Cor	npactness ²
Term	SPT 'N' (blows/0.3m) ¹
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Verv Dense	>50

NON-COHESIVE (COHESIONLESS) SOILS

1. SPT 'N' in accordance with ASTM D1586, uncorrected for the effects of overburden pressure.

Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic 2. trip hammers), overburden pressure, groundwater conditions, and grainsize. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

Field Moisture Condition

Term	Description						
Dry	Soil flows freely through fingers.						
Moist	Soils are darker than in the dry condition and may feel cool.						
Wet	As moist, but with free water forming on hands when handled.						

SAMPLES	
AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
GS	Grab Sample
MC	Modified California Samples
MS	Modified Shelby (for frozen soil)
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
ТО	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample

SOIL TESTS

w	water content
PL, w _p	plastic limit
LL, WL	liquid limit
С	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test ¹
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement ¹
D _R	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
М	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO ₄	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1 Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

COHESIVE SOILS									
	Consistency								
Term	Undrained Shear Strength (kPa)	SPT 'N' ^{1,2} (blows/0.3m)							
Very Soft	<12	0 to 2							
Soft	12 to 25	2 to 4							
Firm	25 to 50	4 to 8							
Stiff	50 to 100	8 to 15							
Very Stiff	100 to 200	15 to 30							
Hard	>200	>30							

SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure 1

SPT 'N' in accordance with ASTM D 1900, unconceded to overballed processes effects; approximate only. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations. 2.

Water Content										
Term Description										
w < PL	Material is estimated to be drier than the Plastic Limit.									
w ~ PL	Material is estimated to be close to the Plastic Limit.									
w > PL	Material is estimated to be wetter than the Plastic Limit.									

Unless otherwise stated, the symbols employed in the report are as follows:

I.	GENERAL	(a) w	Index Properties (continued)
π	3.1416	w or LL	liquid limit
ln x	natural logarithm of x	w₀ or PL	plastic limit
log ₁₀	x or log x, logarithm of x to base 10	l₀ or PI	plasticity index = $(w_1 - w_p)$
q	acceleration due to gravity	ŃP	non-plastic
ť	time	Ws	shrinkage limit
		۱L	liquidity index = $(w - w_p) / I_p$
		lc	consistency index = $(w_l - w) / I_p$
		emax	void ratio in loosest state
		emin	void ratio in densest state
		ID	density index = $(e_{max} - e) / (e_{max} - e_{min})$
II.	STRESS AND STRAIN		(formerly relative density)
γ	shear strain	(b)	Hydraulic Properties
Δ	change in, e.g. in stress: $\Delta \sigma$	n	nydraulic nead or polenilai
3		q	
εv	volumetric strain	V	
η		1	
υ	Poisson's ratio	K	hydraulic conductivity
σ	total stress		(coefficient of permeability)
σ'	effective stress ($\sigma' = \sigma - u$)	J	seepage force per unit volume
σ'_{vo}			
σ1, σ2, σ3	principal stress (major, intermediate,		Concelidation (one dimensional)
	minor)	(0)	comprossion index
	mean stress or octahedral stress	Uc	(normally consolidated range)
Goct	$= (a_1 \pm a_2 \pm a_3)/2$	C	(normally consolidated range)
_	$-(\sigma_1 + \sigma_2 + \sigma_3)/3$	Ur	(over consolidated range)
τ	sileal siless	C	(over-consolidated range)
u F	modulus of deformation	Cs Ca	secondary compression index
G	shear modulus of deformation	m _v	coefficient of volume change
ĸ	bulk modulus of compressibility	Cv	coefficient of consolidation (vertical
			direction)
		Ch	coefficient of consolidation (horizontal direction)
		Tv	time factor (vertical direction)
III.	SOIL PROPERTIES	U	degree of consolidation
		σ'_{P}	pre-consolidation stress
(a)	Index Properties	OCR	over-consolidation ratio = σ'_p / σ'_{vo}
ρ(γ)	bulk density (bulk unit weight)*		
ρd(γd)	dry density (dry unit weight)	(d)	Shear Strength
ρω(γω)	density (unit weight) of water	τ_p, τ_r	peak and residual shear strength
ρs(γs)	density (unit weight) of solid particles	φ ′	effective angle of internal friction
γ'	unit weight of submerged soil	δ	angle of interface friction
	$(\gamma' = \gamma - \gamma_w)$	μ	coefficient of friction = tan δ
D _R	relative density (specific gravity) of solid	c′	effective cohesion
	particles ($D_R = \rho_s / \rho_w$) (formerly G_s)	Cu, Su	undrained shear strength (ϕ = 0 analysis)
е	void ratio	р	mean total stress (σ_1 + σ_3)/2
n	porosity	p'	mean effective stress ($\sigma'_1 + \sigma'_3$)/2
S	degree of saturation	q	(σ1 - σ3)/2 or (σ′1 - σ′3)/2
		\mathbf{q}_{u}	compressive strength (σ_1 - σ_3)
		St	sensitivity
* Densi	ty symbol is a Unit weight symbol is v	Notes: 1	$\tau = C' + \sigma' \tan \phi'$
where	$\gamma = \rho q$ (i.e. mass density multiplied by	2	shear strength = (compressive strength)/2
accele	eration due to gravity)	-	



RECORD OF BOREHOLE: BH/MW19-01

LOCATION: Lat. 43.747371 Long. -79.818742 (See Figure 1)

BORING DATE: April 4, 2019

SHEET 1 OF 1 DATUM: Geodetic

METRES	RING METHOD		SOIL PROFILE	ATA PLOT	ELEV.	IUMBER	TYPE	DWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m \ 20 40 60 80 SHEAR STRENGTH Cu, kPa nat V. + Q- rem V. ⊕ U-	$\begin{array}{c c} & \text{HYDRAULIC CONDUCTIVITY,} \\ & \text{k, cm/s} \\ & 10^5 & 10^4 & 10^3 \\ \hline \\ & \text{WATER CONTENT PERCENT} \\ & \text{Wo} = & \hline \\ & \text{Wo} = & \text{W} \\ \end{array}$	ADDITIONAL AB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	ß			STF	(m)	2		BL(20 40 60 80	10 20 30 40		
0		_	GROUND SURFACE		266.80							
			TOPSOIL (250 mm)		266,55	1A	ss					
			(CL) SILTY CLAY, trace sand, trace gravel, trace organics; brown; cohesive, w~PL, stiff		0.25	1B	ss	10				
1			(CL) sandy SILTY CLAY, trace gravel; light brown with oxidation staining, (TILL); cohesive, w <pl, hard<="" stiff="" td="" to="" very=""><td></td><td>0.70</td><td>2</td><td>ss</td><td>16</td><td></td><td>0</td><td>МН</td><td></td></pl,>		0.70	2	ss	16		0	МН	
2			- Some to trace sand below depth of 1.6 m			3	ss	21		0		Bentonite
2						4	SS	23				bonomo
3												
	er Auger					5	SS	32		0		
4	1E 75 Track Mount Pow	100 mm Solid Stem										⊥ 17/04/2019 Sand
5	5		- Silty sand layers/seams encountered below depth of 4.9 m			6	SS	21				
6		-	(CI/CL-ML) SILTY CLAY to CLAYEY SILT, trace to some sand, trace gravel, with inferred cobbles; grey, (TILL); cohesive, w~PL to w>PL, stiff to hard		261.01 5.79							Screen and Sand
7						7	SS	12				
8						8	SS	48		0		Bentonite
-		+	- Sand layer, approximately 70 mm thick, encountered at a depth of 8.1 m END OF BOREHOLE.		258 <u>.57</u> 8.23							
			Notes: 1. Borehole dry upon completion of drilling.									
9			2. Water level measured in monitoring well as follows:									
			Date Depth Elev. (m) April 17, 2019 3.95 mbgs 262.85 m									
10												
DEF	этн	I S	CALE						GOLDER			DGGED: JD

RECORD OF BOREHOLE: BH/MW19-03

LOCATION: Lat. 43.750098 Long. -79.814418 (See Figure 1)

BORING DATE: April 4, 2019

SHEET 1 OF 2 DATUM: Geodetic

D D H	2	SOIL PROFILE	1.		SA	MPL	ES	DYNAMIC PENETRATION HYDRAULIC RESISTANCE, BLOWS/0.3m k, cm		NG F	PIEZOMETER
BORING MET		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	20 40 60 80 10 ⁻⁶ SHEAR STRENGTH nat V. + Q - € WATER Cu, kPa rem V. ⊕ U - ○ Wp I— 20 40 60 90	$\frac{10^{5} 10^{4} 10^{3} \bot}{2000000000000000000000000000000000000$	ADDITION LAB. TESTI	OR STANDPIPE INSTALLATION
		GROUND SURFACE	0,	266.99							
		TOPSOIL (350 mm)	EEE	200.00							
				266.53	1A	SS	5				
1		(CL) SILTY CLAY, some sand, trace gravel, trace organics; brown with oxidation staining; cohesive, w <pl, firm<="" td=""><td></td><td>0.35</td><td>1B 2</td><td>SS</td><td>7</td><td></td><td>0</td><td></td><td></td></pl,>		0.35	1B 2	SS	7		0		
2		(CL) sandy SILTY CLAY, trace gravel, contains inferred cobbles; light brown with oxidation staining, (TILL); cohesive, w <pl, hard<="" stiff="" td="" to=""><td></td><td><u>265.51</u> 1<u>.</u>37</td><td>3</td><td>SS</td><td>11</td><td>o</td><td></td><td></td><td></td></pl,>		<u>265.51</u> 1 <u>.</u> 37	3	SS	11	o			
3					4	ss	24				Bentonite
					5	ss	30	ο⊢		мн	
4 Auger	lid Stem	(ML) gravelly sandy SILT, with slight plasticity, contains inferred cobbles; light brown; non-cohesive, moist, very dense - Inferred cobbles/boulders from auger grindings at a depth of 2 m and 7.3 m		262.89							
ں CME 75 Track Mo	100 mm So				6	SS	75	0			Sand
6					7	SS	100	0			
7		(CL-ML) CLAYEY SILT, some to trace sand; grey, (TILL); cohesive, w <pl, hard<="" td=""><td></td><td>259.88 7.00</td><td>8</td><td>ss</td><td>100</td><td>O</td><td></td><td></td><td>17/04/2019</td></pl,>		259.88 7.00	8	ss	100	O			17/04/2019
8		- Cobbles/boulders inferred from auger grinding at a depth of 8.4 m	A A A A A A A A A A A A A A A A A A A								
					9	ss	77	o			<u>~ 목상 (</u> 4/04/2019
\vdash		END OF BOREHOLE.	[18]4	257.13 9.75	\vdash				+ $+$ $+$ $+$		
10	_		-	+	┣	┣ —	-	+++	+		
		CONTINUED NEXT PAGE									
DEPTH	нs	CALE					ľ	GOLDER		LC	DGGED: JD
1 . 50										CH	ECKED: EM

RECORD OF BOREHOLE: BH/MW19-03

LOCATION: Lat. 43.750098 Long. -79.814418 (See Figure 1)

BORING DATE: April 4, 2019

SHEET 2 OF 2 DATUM: Geodetic

┟	ш	Q	SOIL PROFILE			SAN	N PLE	s [ON /0.3m	\ \	HYDRAL		ONDUCT	IVITY,	Т	. 0	
	SCAL	METH		LOT		<u>к</u>		m ² .	20	4	0 6	50 8	80	10-6	3 1(⁵ 10) ⁻⁴ 1∣	_{p³} ⊥	IONAL ESTINC	
	EPTH MET	RING	DESCRIPTION	ATA F	ELEV. DEPTH	UMBE	TYPE	o/SMC	SHEAR Cu, kPa	STREN	IGTH I	natV. + remV.⊕	Q - • U - O	WA ⁻			PERCE	NT	ADDIT AB. TE	INSTALLATION
		BOI		STR	(m)	z			20	4	0 6	<u>50 8</u>	80	10 vvp	2	0 3	0 4	.0	ר א	
F	- 10		CONTINUED FROM PREVIOUS PAGE Notes:				_													
-			 Water level measured at 9.1 mbgs upon completion of drilling. 																	
E			2. Water level measured in monitoring																	
Ē			Date Depth Elev. (m)																	
F	- 11		April 17, 2019 7.34 mbgs 259.54 m																	
E																				
Ē																				
E	- 12																			
E																				-
E																				
-	- 12																			
F	13																			-
JMC																				-
7/6/19																				-
11	- 14																			-
MIS.G																				
GAL																				
S.GPJ	- 15																	-		
1106																				-
W B																				-
ELLS	- 16																			-
54-SN																		-		
91152																				
NT/1	- 17																			-
M2 G																				-
EDON																				
SICAL																				-
MENT	- 18																			-
ELOPI																				
KDEV.																				
3R00	- 19																			- -
LEARE																				
ITS/CI																				
CLEY																				
;j	- 20																			-
-00 SH	DE	םדנו ל									•	·						1		
GTA-B	1:	50					ļ			O ز)EF	ł						CH	ECKED: EM

APPENDIX B

Geotechnical Laboratory Figures



LEGEND

SYMBOL	Borehole	SAMPLE	DEPTH(m)	
•	BH/MW 19-01	2	0.76 - 1.37	
•	BH/MW 19-03	5	3.05 - 3.66	



APPENDIX C

Adjacent Properties and Previous Geotechnical Borehole Logs PROJECT: 19115264-1000/2000

RECORD OF BOREHOLE: BH/MW19-02

LOCATION: Lat. 43.747664 Long. -79.814643 (See Figure 1)

BORING DATE: April 2, 2019

SHEET 1 OF 2 DATUM: Geodetic

PIEZOMETER		ONAL STING	10 ⁻³	UCTIVITY, 10 ⁻⁴	ONDUC	LIC C , cm/s 1	HYDRAU k 10 ⁻⁶	, ,	TION 'S/0.3m 60	NETRA E, BLOV 40	AMIC F ISTANC 20	DYN RES	LES	AMP	S L		LOT	SOIL PROFILE		ИЕТНОD	, í
STANDPIPE INSTALLATION		ADDITI LAB. TE	ENT I WI 40	NT PERC		ER C	WAT Wp H 10	Q-● U-○	nat V. + rem V. ∉ 60	ENGTH	AR STF Pa	SHE Cu, ł	BLOWS/0.	ТҮРЕ		ELEV. DEPTH (m)	STRATA PI	ESCRIPTION	DE	BORING N	
								-			T				20	257.20		ACE	GROUND SURFA		_
	 ⊮2019	17/0											4	SS	10 1 19	0.00 256.59		mm)	TOPSOIL (610 n		
	Bent- onite	þ	59.7		þ	С							8	<u>∖</u> ss ₃ss	1 15 2A 15 2B	0.6 [°] 256.3 0.8		Y, some to trace sand, ice organics; brown/dark ation staining; w>PL, firm, TY CLAY, trace gravel; oxidation staining, e, w~PL, firm to stiff	(CL)SILTY CLAY trace gravel, trac brown with oxida (CL) sandy SILT light brown with o (TILL); cohesive,		1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Sand				0								8	ss	3			ns/layers below 1.7 m	- Silt/sand seams		2
	Screen and Sand												13	ss	4						3
					ρ	(9	ss	5						
															24	253.24 3.90	a a la a la l	EY SILT, some to trace vel; grey, (TILL); , very stiff to stiff to hard	(CL-ML) CLAYE sand, trace grave cohesive, w>PL,	under and the second se	4
nite	Bentor					0							15	ss	6		X X X X X X X X X X X X X X X X X X X			100 mm Solid Ste	5 Te Ten Month
∑ 17/04/2019)	c						13	ss	7		a to the to the to the to the to				7
													17	ss	8		A HA A HA A HA A HA A HA				8
							ρ						57	ss	9		A & & & & & & & & & & & & & & & & & & &	dy at 9.1 m	- Becoming sand		9
					 											 			11 m		
																		NUED NEXT PAGE	CONTIN		
	DGGEI	 					0	2	D E 1	DL	G		17 57	ss	9			dy at 9.1 m g at a depth of 9.5 m to 	- Becoming sance - Auger grinding 11 m 	TH SS	7 8 9 10 DEP

PROJECT: 19115264-1000/2000

RECORD OF BOREHOLE: BH/MW19-02

LOCATION: Lat. 43.747664 Long. -79.814643 (See Figure 1)

BORING DATE: April 2, 2019

SHEET 2 OF 2 DATUM: Geodetic

	щ,	ДОН	SOIL PROFILE			SA	MPL	ES	DYNAMIC PEN RESISTANCE,	BLOWS	ON 5/0.3m	~	HYDRAULIC C k, cm/s		IVITY,	Ţ	^L	
	H SCA TRES	3 METI		PLOT	ELEV.	BER	ш	/0.3m		40	60 E			0 ⁻⁵ 10) ⁻⁴ 1(<u>)</u> ₃⊥ ∟	TESTIN	OR STANDPIPE
	DEPTI	ORING	DESCRIPTION	RATA	DEPTH	NUME	ΤYΡ	LOWS	Cu, kPa	NGTH	nat V. + rem V.⊕	Q-● U-O	WATER C			M	ADDI LAB. 7	INSTALLATION
		â		ST	(11)			8	20	10	<u>50</u> ε	80	10	20 3	0 4	0		
	10 		(SVV-SM) SAND to SILTY SAND, medium grained, contains inferred cobbles/boulders; light brown; non-cohesive, wet, compact to very dense		2 <u>47.14</u>													Bentonite
	- - - - - - - -	ck Mount Power Auger nm Solid Stem				10	SS	26										Sand
	- - - - - - - - - - -	CME 75 Tra 100 r	- Cobbles/boulders inferred from auger grinding at a depth of 12 m			11	SS	52										Screen and Sand
	-	\vdash	END OF BOREHOLE.		244.40	\vdash												2/04/2019
JMC	— 13 - - -		Notes: 1. Water level measured in monitoring well as follows:															
AL-MIS GDT 17/6/19	- - - - - - - - -		Deep Well Date Depth Elev. (m) April 2, 2019 12.67 mbgs 244.53 m April 17, 2019 6.27 mbgs 250.93 m Shallow Well Date Depth Elev. (m) April 17, 2019 0.25 mbgs 256.95 m															
H LOGS GPJ G/	- - - - - 15 - -																	
SNELLSHOLLOW B	- - - - - - - -																	
12 GINT\19115264-9	- - - - - - - - - - - - -																	
PMENTS/CALEDON/	- - - - - - - - - - -																	
RBROOKDEVELO	- - - - - - - - - - - - - -																	
CLIENTS/CLEAI	-																	
<u>[</u>]	20																	_
GTA-BHS 00	DE 1 :	EPTH 8 50	SCALE						GC		DEF	ર					L(CH	DGGED: JD ECKED: EM

RECORD OF BOREHOLE: BH19-10

LOCATION: Lat. 43.74607 Long. -79.817117 (See Figure 1)

BORING DATE: April 3, 2019

SHEET 1 OF 1 DATUM: Geodetic

ш		0		SOIL PROFILE			SA	MPL	.ES	DYNAMIC PE		ION S/0.3m	\	HYDR.			IVITY,	Т	. (1)	
H SCALI		3 METH			PLOT	ELEV	ïER	щ	/0.3m	20	40 1	60 (30 `	1		- 10 ⁻⁵ 10 		0 ⁻³	TESTINC	PIEZOMETER OR STANDPIPE
DEPTI	M	BORING		DESCRIPTION	TRATA	DEPT (m)		TYP	BLOWS	Cu, kPa	ENGTH	nat V. + rem V. ⊕	U-0					W	ADDI LAB. 7	INSTALLATION
-		_		GROUND SURFACE	0	267.8	0		-	20	40	60 8	30	1		20 3	50 4	10		
-	0		1	TOPSOIL (230 mm)		267	0 7 1A	SS												
-				(CL-ML) CLAYEY SILT, some sand, trace gravel; dark brown to brown, mottled; cohesive, w~PL, firm		267.0	3 1B	ss	5							0				
	1		-	(CL) sandy SILTY CLAY, some sand, trace gravel, contains inferred cobbles/boulders; light brown with oxidation staining, (TILL); cohesive, w <pl, hard<="" stiff="" td="" to="" very=""><td></td><td>0.7</td><td>2</td><td>ss</td><td>18</td><td></td><td></td><td></td><td></td><td></td><td></td><td>0</td><td></td><td></td><td></td><td></td></pl,>		0.7	2	ss	18							0				
-	2						3	ss	29						0H	1			МН	
	3	wer Auger	E	Augos grinding an informad aphylica at a			4	ss	35											-
		E 75 Track Mount Po	100 mm Solid Ste	epth of 3 m			5	ss	31						0					
HILLITI	4	CMB					6A	ss												∑ - 2/04/2019
	5			(CL-ML) CLAYEY SILT, some sand, some gravel; grey, (TILL); cohesive, w~PL to w>PL, stiff to very stiff		262.8 4.9	6 4 6B	ss	25						o					- - -
	6						7A 7B	ss	10											-
						261.0	8	SS	22						0					L
	7			END OF BOREHOLE. Notes: 1. Water level measured at 4.1 mbgs upon completion of drilling.		6.7	1													-
	8																			-
	9																			-
	10																			
	DEF 1:5	PTH	-1 S	CALE						G		DEI	 ר						LC)GGED: JD ECKED: EM

RECORD OF BOREHOLE: BH19-11

LOCATION: Lat. 43.74736 Long. -79.816608 (See Figure 1)

BORING DATE: April 3, 2019

SHEET 1 OF 1

DATUM: Geodetic

щ.	Τ	QO	SOIL PROFILE			SA	MPL	ES	DYNAMIC PENETRATION	HYDRAULIC CONDUCTIVITY, k, cm/s	T	
SCAL		METH		LOT		<u>к</u>		.3m	20 40 60 80	10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³		PIEZOMETER OR
MFTH		ING I	DESCRIPTION	ATA P	ELEV.	JMBE	ГҮРЕ	WS/0	SHEAR STRENGTH nat V + Q - € Cu, kPa rem V, ⊕ U - C			STANDPIPE INSTALLATION
ä		BOF		STR/	(m)	N		BLO	20 40 60 80	Wp W W 10 20 30 40	< <	
			GROUND SURFACE		265.00							
-	۲		TOPSOIL (230 mm)		0.00 264.77	1A	SS					
-			(CL) sandy SILTY CLAY, trace gravel; brown, mottled brown/light brown;		0.23	1B	SS	10				
F			cohesive, w <pl, firm="" stiff<br="" to="">- Cobbles/boulders inferred from auger</pl,>									
E			grinding at 6 m									
F	1					2	SS	4			мн	
F					263.60							-
E			(CL) sandy SILTY CLAY, trace gravel; mottled light brown to brown. (TILL):		1.40							
-			cohesive, w <pl, hard<="" stiff="" td="" to="" very=""><td></td><td></td><td>3</td><td>ss</td><td>10</td><td></td><td></td><td></td><td></td></pl,>			3	ss	10				
-	2					-						-
E												-
-												
-	100	Jahr				4	55	28				
F	3	u m										-
Ē		hid Ste										
	of A do	mm Sc				5	SS	29		0		
6/19	76 T 52	100										-
14	4											-
GD												
- GA												-
- CD	5					6	SS	33		0		
- 100												
V BH												-
SHO	6											
	Ĩ											-
						7	ss	30				
91152					258.29							
	,				6./1							
- C	1		1. Borehole dry upon completion of									
			arming.									:
LED -												
S/C/												
	8											-
LOP												
RBR(9											-
ן – 1 ט	٥											-
1001				I								
-BHS	DEP	TH S	SCALE						GOLDER		L	-OGGED: JD
1 1	: 5	0									CI	HECKED: EM

RECORD OF BOREHOLE: BH19-12

LOCATION: Lat. 43.748408 Long. -79.813559 (See Figure 1)

BORING DATE: April 4, 2019

SHEET 1 OF 2 DATUM: Geodetic

ų	8		SOIL PROFILE			SA	MPL	ES	DYNAMIC PENETF RESISTANCE, BIO	RATION DWS/0.3m	ì	HYDRAULIC CO	NDUCTIVITY,	Τ	
METRES	30RING METH		DESCRIPTION	TRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	3LOWS/0.3m	20 40 SHEAR STRENGT Cu, kPa	60 H nat V. + rem V. ⊕	80 • Q - ● 9 U - ○	10 ⁵ 10 WATER CO	⁵ 10 ⁻⁴ 10 ⁻³ NTENT PERCENT ⊖ ^W I WI		PIEZOMETER OR STANDPIPE INSTALLATION
		+	GROUND SURFACE	S I	266.22				20 40	60	80	10 20	30 40	_	
0		╡	TOPSOIL (380 mm)		0.00	10								+	
		-	(CL) sandy SILTY CLAY, trace gravel, trace organics; brown with oxidation staining; w <pl, firm<br="">(CL) sandy SILTY CLAY, trace gravel; brown with oxidation staining. (TILL):</pl,>		265.95 0.38 265.57 0.76	1B	SS	5				C	D I I I I I I I I I I I I I I I I I I I	PP = 25 kF	, 'a
1			cohesive, w <pl, hard<="" stiff="" td="" to=""><td></td><td></td><td>2</td><td>SS</td><td>10</td><td></td><td></td><td></td><td>F⊖-</td><td>-1</td><td>PP = 220 kl MH</td><td> 2a</td></pl,>			2	SS	10				F⊖-	-1	PP = 220 kl MH	 2a
2						3	SS	9				0		PP = 220 kl	ζ 2a
3			- Cobbles inferred from auger grinding at 3 m			4	SS	30				0		PP = 440 kl	- 2a
4						5	SS	33				o		PP = 345 kl	: 2e
•	Power Auger	Stem	(SM) gravelly SILTY SAND, trace clay nodules, slight plasticity; light brown; non-cohesive, moist, dense to very dense		262.23 4.10	6A	ss								
5	CME 75 Track Mount	100 mm Solid S	- Cobbles/boulders inferred from auger grinding at 5.3 m			6B	SS	113				0		МН	
6			- Becoming silty sand, some gravel below a depth of 6.2 m			7	SS	150				0		мн	
8						8	SS	32				0			
9															
			- Contains layers of fine sand and silt, some clay below depth of 9.2 m			9	SS	47				0		мн	
10	_ L	-		-falafé 	+	<u>10</u>	SS	<u>42</u>	+	-+		+ +		-	
				I	1						1				
DE 1 : :	PT⊦ 50	I S	CALE						S GOL	DE	R			C	LOGGED: JD HECKED: EM

RECORD OF BOREHOLE: BH19-12

LOCATION: Lat. 43.748408 Long. -79.813559 (See Figure 1)

BORING DATE: April 4, 2019

SHEET 2 OF 2 DATUM: Geodetic

┢						<u> </u>	MD	F 0	DYNAM	IC PEN	ETRATIC	ON								
	SALE	THOL		F			MPL	.ES ~	RESIST	ANCE,	BLOWS	0.3m	Ľ,		k, cm/s	~5	o-4		ING	PIEZOMETER
	ETRE	G ME	DECODIDITION	A PLO	ELEV.	BER	Щ	3/0.3n		STRFN	U 6	8 LatV +	30 	10 	ATER CO	J [∞] 1 L ONTENT		0 [™] — 1 NT	TEST	OR STANDPIPE
	M	ORIN	DESCRIPTION	RAT/	DEPTH (m)	MUN	Σ	DW	Cu, kPa	OTTE	n	em V. 🕀	ũ- õ	Wp		W		wi	ADC LAB.	INSTALLATION
_		â		ST				m	20	4	06	0 E	30 	1	0 2	0 3	30 ∠	10		
-	- 10		CONTINUED FROM PREVIOUS PAGE (SM) gravelly SILTY SAND, trace clay																	
-			nodules, slight plasticity; light brown; non-cohesive, moist, dense to very dense		255.81	10	SS	42						0						-
-			END OF BOREHOLE.	- 6.1	10.52															
-	- 11		Notes: 1. Borehole dry upon completion of drilling.																	· · · · · · · · · · · · · · · · · · ·
-			2. PP= unconfined compressive strength measured with pocket penetrometer in the field																	
-																				
-	12																			-
E																				-
-																				
-																				-
-	- 13																			-
ЧC																				
1 1 1 I																				
17/6	44																			-
GDT	14																			
-MIS																				
I GAI																				
GP.	- 15																			
LOG																				
V BH																				
SHO	- 16																			
SNEL																				
264-8																				
19115																				
	- 17																			
112 0																				
DON																				
CALE																				
NTS/	- 18																			-
PME																				
VELO																				
NADE H																				
BROC	- 19																			-
EAR																				
TS/CL																				
LEN																				
G:\ C	- 20																			_
1S 001			1	1	I	L	L						<u> </u>					I	I	
GTA-BI	DE 1:	50	SUALE					Ì		GO	LD	E	2						CH	ECKED: EM

PROJECT: 19115264-1000/2000

RECORD OF BOREHOLE: BH/MW19-13

LOCATION: Lat. 43.749709 Long. -79.812182 (See Figure 1)

BORING DATE: April 4, 2019

SHEET 1 OF 2 DATUM: Geodetic

ES	ETHO	-	SOIL PROFILE	ы		SA	MPLI	ΞS E	20 40 60 80	k, cm/s 10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³	NAL	
MEIR	BORING M		DESCRIPTION	TRATA PL	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3	HEAR STRENGTH nat V. + Q - ● cu, kPa rem V. ⊕ U - ○		ADDITIC LAB. TES	STANDPIPE INSTALLATIO
		GRO	OUND SURFACE	ίο Ο	207.04			-	20 40 60 80	10 20 30 40		
0		ТОГ	PSOIL (300 mm)	EEE	0.00	1Δ	22					
		(CL orga firm	.) SILTY CLAY, some sand, trace anics; dark brown; cohesive, w <pl, 1</pl, 		267.31 0.30	1B	SS	5		0		
1		(CL grav mot very) SILTY CLAY and SAND, trace vel, inferred cobbles/boulders; ttled light brown/brown, (TILL); w <pl, y stiff to hard</pl, 		<u>266.65</u> 0.96	2	SS	17		0	PP = 320 kPa	
2		- Co grin	obbles/boulders inferred from auger Iding at 1.7 m			3	SS	19		0	PP = 320 kPa	
						4	SS	22		0	PP = 340 kPa	
3						5	SS	33		Ф н	PP = 440 kPa MH	Bentonite
4	wer Auger	(SM cob grin to n	 gravelly SILTY SAND, bles/boulders inferred from auger ding; light brown; non-cohesive, dry noist, very dense 		263.61 4.00	-						
5	CME 75 Track Mount Pc	900 mm 001 - He 5.4	eavy auger grinding below depth of m			6	SS	154		о н	МН	
6						7	SS	115		0		
8		(ML trac den	.) sandy SILT, with slight plasticity, se gravel; light brown; moist, very se		259.99 7.62	8	SS	138		•	МН	Sand
9												Screen and Sand
10						9 10	ss s <u>s</u>	137 1 <u>46</u>				
			CONTINUED NEXT PAGE									

PROJECT: 19115264-1000/2000

RECORD OF BOREHOLE: BH/MW19-13

LOCATION: Lat. 43.749709 Long. -79.812182 (See Figure 1)

BORING DATE: April 4, 2019

SHEET 2 OF 2

DATUM: Geodetic

ł		Q	<u>,</u>	SOIL PROFILE			SA	MPL	.ES	DYNA			ON	>	HYDR.		ONDUCT	IVITY,	Т	(1)	
	SCALE				Ō		~		Зm	2	20	40	, o. on 60 t	30	1	r, uni/s	0 ⁻⁵ 1	0 ⁻⁴ 10	₀₋₃ ⊥	STING	PIEZOMETER OR
	PTH S METR	M DN		DESCRIPTION	TA PL	ELEV.	MBEF	ΥPE	VS/0.	SHEA	R STRE	NGTH	nat V. +	Q-•	w N	ATER C	ONTENT	PERCE	NT	SDITIC 3. TES	STANDPIPE
	DEF	BOR	Ś		TRA	DEPTH (m)	N.	Γ́⊢	BLOV	Cu, KP	a	10	rem v. 🕁	0-0	W	p	W	I	WI	LAE	
ŀ				CONTINUED FROM PREVIOUS PAGE	0				-	2	20	40	50 8	30	1		20 3	30 4	0		
	- 10 - -			(ML) sandy SILT, with slight plasticity, trace gravel; light brown; moist, very dense		057.00	10	SS	146							চন				мн	Screen and Sand
ŀ			+	END OF BOREHOLE.	<u>titel</u>	10.52															- h.4=h.1 -
	- - - 11			Notes: 1. Borehole dry upon completion of drilling.																	-
				2. Water level measured in monitoring well as follows:																	-
-				Date Depth Elev. (m) April 17, 2019 9.45 mbgs 258.16 m																	-
	- 12 - -			3. PP= unconfined compressive strength measured with pocket penetrometer in the field.																	
																					-
	- 13 -																				-
/19 JMC	-																				
DT 17/6	- 14																				-
AL-MIS.G	- - -																				-
S.GPJ G	- - - 15																				-
BH LOG																			-		
MOTTOH																		-			
SNELLS	— 16 -																				
9115264-																					-
GINTU	- 17 -																				
EDON/12																					-
NTS/CAL																				-	
ELOPME																		-			
DOKDEV																					
LEARBR(- 19 -																				
ENTS/CI	- - -																				
1 G:\ CL	- - 20																				_
A-BHS 00	DE	PTH	- I S(CALE	<u> </u>		-	1			GC		DEI	R		1		1		L	DGGED: JD
GT/	1:	50																		СН	ECKED: EM

E EDWARD WONG		BORING NUMBER * PAGE 1 OF
CLIENT _ Dilip Kumar Jain PROJECT NUMBER _ Ma00;	2995a	PROJECT NAME 3278 Mayfield Road PROJECT LOCATION Town of Caledon
DATE STARTED <u>10/19/17</u> DRILLING CONTRACTOR <u>I</u> DRILLING METHOD <u>Solid S</u> LOGGED BY <u>J.J.</u> NOTES	COMPLETED Fadroy Enterprise Stem Augers CHECKED BY	10/19/17 GROUND ELEVATION 270 m HOLE SIZE 150 mm GROUND WATER LEVELS:
DEPTH (m) (m) SAMPLE TYPE NUMBER NUMBER BLOW COUNTS (N VALUE)	TESTS CAPHIC	MATERIAL DESCRIPTION
SS 3-4-5-7 1 (9)	MC = 17%	D.20 TOPSOIL - ~200 mm thick. 269.8 CLAYEY SILT - some sand, occasional gravel, brown, very moist, hard.
SS 5-6-10 2 (16)	PP = 400 kPa	
SS 4-6-10 3 (16)	PP >450 kPa MC = 15%	
SS 6-10-14 4 (24)	PP >450 kPa	
3 SS 5-10-12 (22) 4	PP >450 kPa MC = 11%	SAND TILL - trace clay, trace gravel, brown, very moist, compact.
SS 6-16-20 5 	PP >450 kPa MC = 13%	-becoming dense below ~4.5 m depth
6 SS 50-0-0/- 7 0.15	PP >450 kPa	-becoming very dense below ~6.0 m depth 263.8 Bottom of hole at 6.15 m.

E	EDWA	RD WONG				WELL	PAGE 1 OF 1
CLIEN	NT Dilip	Kumar Jain BER <u>Ma00</u>)2995a		PROJECT NAME 3278 Mayfield F	Road	
DATE DRILL DRILL LOGG NOTE	STARTEI	D <u>10/18/17</u> TRACTOR <u></u> HOD <u>Solid</u> J.J.	COMPL Fadroy Enterprise Stem Augers CHECK	ETED <u>10/18/17</u> ED BY <u>E.W.</u>	GROUND ELEVATION <u>265 m</u> GROUND WATER LEVELS: AT TIME OF DRILLING <u>Dry</u> AT END OF DRILLING <u>2.85 m / Elev</u> AFTER DRILLING <u>2.85 m / Elev</u>	_ HOLE SIZE _ 150 Elev 262.15 m 262.15 m	mm
DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WEL	L DIAGRAM
	SS 1	1-3-3-3 (6)	MC = 23%	1/2 1/2 TOPS	SOIL - ~600 mm thick.	264.40	
 - 	SS 2	3-4-5 (9)	MC = 16%	FILL brown	- clayey slit, rootlets, topsoil inclusions, dark n and brown, very moist.		Bentonite
2	SS 3	2-4-5 (9)	MC = 22%				
	SS 4	4-7-10 (17)	MC = 19%	¥.			50 mm dia. PVC Riser, Filter Sand
	SS 5	2-5-9 (14)	MC = 21%				
	SS 6	3-6-8 (14)	PP = 400 kPa MC = 16%	SILTY	/ CLAY - trace gravel, grey, very moist, hard.	260.50	50 mm dia. PVC Slotted Pipe, Filter Sand
 	SS 7	4-6-8 (14)	PP = 250 kPa MC = 16%	-beco	ming very stiff below ~6.0 m depth Bottom of hole at 6.45 m.	258.55	

APPENDIX D

Important Information and Limitations of This Report



IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder cannot be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Ground Water Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.



golder.com



REPORT

Preliminary Geotechnical Investigation, Mayfield Kennedy Investment Corp.

Proposed Residential Development, Snell's Hollow Secondary Plan, Caledon, Ontario

Submitted to:

Mayfield Kennedy Investment Corp.

Marco Benigno, President 7050 Weston Road, Suite 230 Woodbridge, On

Submitted by:

Golder Associates Ltd.

6925 Century Avenue, Suite #100, Mississauga, Ontario, L5N 7K2, Canada

+1 905 567 4444

19115264 Phase 4000

June 24, 2019

Distribution List

1 e-copy: Golder Associates Ltd.

1 e-copy: Mayfield Kennedy Investment Corp.

1 e-copy: Snell's Hollow Developers Group

1 e-copy: Glen Schnarr & Associates Inc.

Table of Contents

1.0	INTRODUCTION1			
2.0	SITE DESCRIPTION AND BACKGROUND			
3.0	ADJACENT GEOTECHNICAL SITE INFORMATION			
4.0	REGIONAL GEOLOGY			
5.0	INVESTIGATION PROCEDURE			
6.0	SUBSURFACE CONDITIONS			
	6.1	Topsoil and Reworked/Disturbed Materials4		
	6.2	(CL) sandy Silty Clay (Upper Glacial Till)4		
	6.3	(CL-ML) Clayey Silt (Lower Glacial Till)5		
	6.4	Groundwater Conditions		
7.0	GEO	TECHNICAL ENGINEERING DISCUSSION		
	7.1	Site Preparation6		
	7.1.1	Subgrade Preparation6		
	7.1.2	Engineered Fill Requirements6		
	7.2	Installation of Underground Services7		
	7.2.1	Temporary Excavations7		
	7.2.2	Pipe Bedding and Cover8		
	7.2.3	Trench Backfill		
	7.3	Building Foundations9		
	7.3.1	Below Grade Walls10		
	7.4	Pavement Design within the Proposed Development10		
	7.4.1	Subgrade Drainage11		
8.0	INSPECTION AND TESTING11			
9.0	CLOSING12			

TABLES

Table 1: Groundwater Level Measurements (Adjacent Properties)	2
Table 2: Approximate Topsoil Thickness	4
Table 3: Groundwater Level Measurements (MKIC Property)	5

FIGURES

Figure 1: Site and Borehole Location Plan

APPENDICES

APPENDIX A Record of Boreholes

APPENDIX B Geotechnical Laboratory Figures

APPENDIX C Previous Geotechnical Borehole Logs

APPENDIX D Important Information and Limitations of This Report



1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by Mayfield Kennedy Investment Corp. (MKIC) to provide preliminary geotechnical consulting services to support a draft plan approval for a future residential subdivision development located north east of Kennedy Road and Mayfield Road in Caledon, Ontario (the Site), as shown in the Site and Borehole Location Plan, *Figure 1.*

The terms of reference for the geotechnical consulting services are included in Golder's proposal No. P19115264 Rev 1, dated March 8, 2019.

The purpose of the investigation is to obtain information on the general subsurface soil and shallow groundwater conditions at the site by means of a limited number of boreholes and geotechnical laboratory tests. Based on our interpretation of the factual information collected as part of the preliminary geotechnical investigation carried out at this site, a general description of the subsurface conditions across the site is presented herein. The interpreted subsurface conditions and available project details were used to develop preliminary engineering parameters and recommendations on the geotechnical design aspects of the project, including construction considerations which could influence design decisions.

This report provides the results of the preliminary geotechnical investigation and should be read in conjunction with the *"Important Information and Limitations of This Report"* **Appendix D**. The reader's attention is specifically drawn to this information, as it is essential for the proper use and interpretation of this report. The factual data, interpretations and recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. If the project is modified in concept, location or elevation, or if the project is not initiated within twelve months of the date of the report, Golder should be given an opportunity to confirm that the recommendations in this report are still valid.

2.0 SITE DESCRIPTION AND BACKGROUND

The subject property is located north east of Kennedy Road and Mayfield Road and is part of the Snell's Hollow Secondary Plan, which is a proposed residential development to be located in the southern part of the Town of Caledon. The site is bounded by Kennedy Road to the west, adjacent agricultural properties to the east, south and west, which further connects to Mayfield Road to the south and Heart Lake Road to the west and Highway 410 to the north, as shown in *Figure 1.*

The site has a total area of approximately 4.5 hectares (11.2 acres) of predominantly flat land which slightly slopes towards Highway 410. The site consists of small agricultural land with a small pond, a two-storey residential house with three metal framed sheds, a previously demolished building, remaining concrete foundations, construction vehicles and trailers, with gravel road and localized asphalt/concrete pads. The property has a municipal address of 12141 Kennedy Road, Caledon, Ontario.

Based on our understanding, the Site is to be developed into a residential development with associated underground services and supporting roads. For the purposes of this report, we have also assumed that the future residential houses will be constructed utilizing shallow strip/spread footings, with an interior slab-on-grade, and one-level of underground basement. We have also assumed cuts and/or fills required for site grading purposes will not exceed 2.0 m and that the invert of the site servicing will be no greater than 3.0 m below existing site grades.

3.0 ADJACENT GEOTECHNICAL SITE INFORMATION

Additional geotechnical investigations consisting of seventeen boreholes were also carried out as part of the Snell's Hollow Secondary Plan on the north and southeast adjacent properties (Golder, 2019). Also, previous geotechnical investigation consisting of five boreholes was also carried out by Edward Wong and Associates, 2017 (Wong, 2017), to the property to the southeast.

The following is a summary of subsurface conditions obtained from boreholes located adjacent to the site (BH/MW19-01, BH/MW19-02 and BH/MW19-09) from Golder 2019, and (BH5 and BH6) from Wong, 2017 as shown on the Site and Borehole Location Plan, *Figure 1*.

In general, the subsurface conditions encountered typically consist of a surficial topsoil ranging in thickness from about 250 mm to over 600 mm overlying a disturbed/reworked dark to light brown silty clay layer or a silty sand, which contains various amounts of organics, underlain by glacial till composed of very stiff to hard brown silty clay which extends to depths ranging from about 5.8 m to about 10.6 m below ground surface. A silty sand to sand was generally found below the brown/grey silty clay till layer. These subsurface conditions were found to be similar to the subsurface conditions encountered in the recently completed boreholes located on the MKIC site (discussed in detail in subsequent sections).

The record of borehole logs from these reports are enclosed in *Appendix C*. The approximate locations of the boreholes drilled at these sites are shown on the Site and Borehole Location Plan, *Figure 1*.

The groundwater level measurements in the drilled boreholes are summarized in *Table 1*, below.

	Measurements Upon Completion of Drilling		Measurements in Monitoring Wells	
Borehole No.	Approximate Groundwater Depth (begs)*	Date	Approximate Groundwater Depth (begs)*	Date
BH/MW19-01	Dry	April 4, 2019	4.0 m (Elev. 262.8 m)	April 17, 2019
BH/MW19-02 (Shallow)	N/A	April 4, 2019	0.3 m (Elev. 257.0 m)	April 17, 2019
BH/MW19-02 (Deep)	12.7 m (Elev. 244.5 m)	April 4, 2019	6.3 m (Elev. 244.5 m)	April 17, 2019
BH/MW19-09	6.6 m (Elev. 250.0 m)	April 4, 2019	6.5 m (Elev. 250.4 m)	April 17, 2019
BH5	2.85 m (Elev. 262.2 m)	October 18, 2017	N/A	N/A
BH6	Dry	Dry	N/A	N/A

Table 1: Groundwater Level Measurements (Adjacent Properties)

*begs- below existing ground surface.

4.0 REGIONAL GEOLOGY

The surficial geology aspects of the general site area were reviewed from the following publication:

Chapman, L.J., and Putnam, D.F., 2007, "The Physiography of Southern Ontario"; 4th Edition, Ontario Geological Survey. Physiographic mapping in the area according to the above noted reference indicates that the site lies within the physiographic region of southern Ontario known as the South Slope. The South Slope region slopes gradually downward towards Lake Ontario. The overburden immediately below ground surface within the South Slope generally consists of clayey silt till and silty clay till and at depth consists of alternating deposits of dense lacustrine sands and silts and over consolidated lacustrine clays and clay tills overlying the bedrock.

The subsurface conditions encountered during the investigation are generally consistent with the physiographic mapping.

5.0 INVESTIGATION PROCEDURE

The field work for the preliminary geotechnical investigation was carried out on April 3, 2019, during which time two boreholes (designated as Boreholes BH19-10 and BH19-11) were advanced at the site to depths between about 6.7 m below existing ground surface at the approximate locations shown on the Site and Borehole Location Plan, *Figure 1*, attached.

The boreholes were advanced using a track-mounted drill rig supplied and operated by a specialist drilling contractor, subcontracted to Golder. Standard Penetration Testing (SPT) and sampling was carried out at regular intervals of depth in the boreholes using conventional 35 mm internal diameter split spoon sampling equipment advanced using an automatic hammer, in accordance with ASTM D1586 (99). Groundwater level measurements were recorded immediately following completion of drilling for all boreholes.

The field work for this investigation was directed by members of our engineering staff who located the boreholes in the field, directed the sampling and in-situ testing operation, logged the boreholes and cared for the samples obtained. The samples were identified in the field, placed in appropriate containers, labelled and transported to Golder's Mississauga geotechnical laboratory for further examination and laboratory testing. Index and classification tests, consisting of water content determinations, Atterberg limits and grain size distribution, were carried out on selected soil samples. The results of the geotechnical laboratory tests are included in **Appendix B** and on the Record of Borehole sheets in **Appendix A**.

The borehole locations were determined in the field using a GPS instrument based on UTM coordinates. Geodetic ground surface elevations at the borehole locations were derived from the site grading plan provided by GSAI, "Snell's Hollow Contour Plan, Town of Caledon" dated December 2018. and as such, the elevations and borehole locations given on the Record of Borehole sheets and referred to herein should be considered as approximate.

6.0 SUBSURFACE CONDITIONS

The subsurface soil and shallow groundwater conditions encountered in the boreholes and the results of the field and laboratory testing, are shown on the Record of Boreholes sheets, in **Appendix A**. Method of Soil Classification and Symbols and Terms Used on Records of Boreholes are provided to assist in the interpretation of the borehole logs. It should be noted that the boundaries between the strata have been inferred from drilling observations and non-continuous samples. They generally represent a transition from one soil type to another and should not be inferred to represent an exact plane of geological change. Further, conditions will vary between and beyond the boreholes. The following is a summary of the subsurface conditions of the boreholes advanced during this investigation followed by a more detailed description of the major soil strata and groundwater conditions.

In general, the subsurface conditions encountered at the boreholes advanced at the site typically consist of a surficial topsoil/silty clay layer underlain by native soil deposits of glacial till composed of silty clay to clayey silt containing varying amounts of sand and gravel.

Details of the observations of the groundwater conditions during and upon completion of drilling are included on the Record of Borehole sheets. Shallow groundwater was encountered at depth of 4.1 m below existing ground surface in Borehole BH19-10, and Borehole BH19-11 was dry upon the completion of drilling activities.

6.1 Topsoil and Reworked/Disturbed Materials

Topsoil materials were encountered in all the boreholes and extended to depths ranging from 0.23 m. A summary of topsoil thickness in each of the boreholes is outlined in the table below.

Borehole No.	Approximate Topsoil Thickness (m)
BH/MW19-10	0.23
BH/MW19-11	0.23

opsoil Thickness

Materials identified as topsoil in this report were classified based on visual and textural evidence as no other testing for organic content or other nutrients was carried out. As such, the ability for these materials to support vegetation has not been assessed.

Reworked/disturbed silty clay material was encountered in both boreholes below the surficial topsoil. Reworked material thickness was observed to be approximately 0.8 m to 1.4 m. The reworked material consisted of silty clay with various amounts of sand and gravel and traces of organics. SPT 'N' values within the reworked material was found to be about 4 blows to 10 blows per 0.3 m of penetration indicating a firm to stiff consistency.

The natural water content of the reworked material was measured at 17 to 22 percent.

The results of grain size distribution tests carried out on one selected sample from this deposit is presented in **Figure B1.** Atterberg limits tests that were carried out on the same sample from this deposit measured a liquid limit value of about 28 and a plastic limit value of about 17; yielding a corresponding plasticity index value of about 11. These results are plotted on the plasticity chart as shown in **Figure B2**.

6.2 (CL) sandy Silty Clay (Upper Glacial Till)

A glacial till deposit consisting of cohesive sandy silty clay was encountered directly underneath the topsoil/reworked till deposit at depths ranging from about 0.8 m to 1.4 m below existing ground surface. This deposit extended to a depth of about 5 m below ground surface in Borehole BH19-10 and Borehole BH19-11 was terminated within this deposit. The till deposit is described to be light brown to brown mottled with oxidation staining, with various amounts of sand and gravel. The till is believed to contain cobbles and/or possible boulders which have been inferred as a result of auger grinding observed in both boreholes.

The SPT 'N' values measured in these till materials range from 10 blows per 0.3 m of penetration to 35 blows per 0.3 m of penetration, indicating that the silty clay till is generally stiff to hard in consistency.

The results of grain size distribution tests carried out on a selected sample from this deposit is presented in **Figure B1.** An Atterberg limit test was carried out on a single sample obtained from this deposit, which measured a liquid limit value of about 23 and a plastic limit value of about 15; yielding a corresponding plasticity index value of about 8. These results are plotted on the plasticity chart as shown in **Figure B2**.

The water content of the selected samples ranged from about 11 percent to 14 percent.

6.3 (CL-ML) Clayey Silt (Lower Glacial Till)

A clayey silt till deposit was encountered directly underneath the sandy silty clay till at Borehole BH19-10 from a depth of 4.9 m below existing ground surface. The borehole was terminated in this layer at a depth of 6.7 m below existing ground surface. The cohesive till deposit contains various amounts of sand and gravel and is grey in colour.

The SPT 'N' values of this till deposit was 10 to 22 blows per 0.3 m of penetration indicating stiff to very stiff consistency.

6.4 Groundwater Conditions

Groundwater level measurements were recorded immediately following drilling procedures. The groundwater level measurements in the drilled boreholes are summarized in *Table 3*, below.

	Measurements Upon Completion of Drilling			
Borehole No.	Approximate Groundwater Depth (mbegs)*	Date		
BH19-10	4.1	April 3, 2019		
BH19-11	dry	April 3, 2019		

Table 3: Groundwater Level Measurements (MKIC Property)

*mbegs- metres below existing ground surface.

It should be noted that the groundwater level in the area is subject to seasonal fluctuations and precipitation events and should be expected to be higher during wet periods of the year.

7.0 GEOTECHNICAL ENGINEERING DISCUSSION

This section of the report provides preliminary geotechnical engineering recommendations on the geotechnical aspects of the proposed development based on our interpretation of the limited borehole information and on our understanding of the project scope and requirements. The information in this portion of the report is provided for the guidance of the design engineers and professionals.

Based on the results of this investigation, the subsurface soil conditions encountered at the site are considered to be generally suitable for the proposed residential development.

As noted above, at the time of this report, proposed design grades (i.e., finished floor slab elevation, pavement subgrade and utility invert levels) were not available for the proposed development. The following engineering recommendations regarding the geotechnical design aspects of the project including underground services, pavements and building foundations should be considered as preliminary only, and should be reviewed when the final design grades and utility invert levels have been finalized.

Where comments are made on construction, they are provided only in order to highlight aspects of construction which could affect the design of the project. Contractors bidding on or undertaking any work at the site should

examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction and make their own interpretation of the factual data as it affects their proposed construction techniques, schedule, equipment capabilities, costs, sequencing and the like.

This report addresses only the geotechnical (physical) aspects of the subsurface conditions at this site. The geo-environmental (chemical) aspects, including the consequences of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources, are outside of the terms of reference for this report.

7.1 Site Preparation

7.1.1 Subgrade Preparation

Based on the existing site topography, it is assumed that only minor cut and/or fill site grading operations of less than 2.0 m will be required to establish subgrade levels and permit the construction of the proposed residential development. However, in the area of the existing residential dwellings, fills of up to 2.5 m may be required once the former underground structures/basement are removed during the redevelopment.

Any filling carried out at the site in conjunction with regrading (with the exception of future green spaces) should be carried out as engineered fill. Recommendations for the placement of engineered fill are outlined in **Section 7.1.2** of this report, titled "Engineered Fill Requirements".

In general, the existing site vegetation, surficial topsoil/organics, surficial asphalt/concrete or any other near-surface soils containing significant amounts of organic matter or construction debris are not considered to be suitable for the subgrade support of engineered fill, building foundations, floor slabs, or other settlement sensitive structures. These materials should be completely stripped prior to placing any engineered fill or construction of foundations or interior or exterior slab-on-grade(s), following appropriate environmental procedures. Furthermore, excessively wet soils should be dried before reuse as engineered fill.

Furthermore; excessively-wet soils should be suitably dried before reuse as engineered fill.

The thicknesses of the concrete slabs within the footprint of the existing buildings and the condition of any fill underneath the slab or around the existing residential houses, was not assessed during this investigation. Therefore, when the granular fill and the underlying subgrade material is encountered underneath the existing structures or concrete slabs during construction activities, the acceptance of such fill as suitable for reuse on the site should be assessed by a qualified geotechnical engineer.

Former structures (existing buildings, sewers, etc.) located on site, will have to be removed or decommissioned. Remedial actions, such as removal of existing foundations or re-compaction of backfill will be required, as directed by the geotechnical engineer and the recommendations contained in the report.

Following the stripping of the surficial topsoil and soils containing significant amounts of organics and/or soft/disturbed surficial soils, the exposed subgrade should be heavily proof-rolled with suitable equipment, in conjunction with inspection by qualified geotechnical personnel to confirm that the exposed soils are competent and have been adequately stripped of ponded water and all disturbed, loosened, softened, organic and other deleterious material. Remedial work (i.e., further subexcavation and replacement) should be carried out on poorly-performing areas identified during the proof-rolling activities, as directed by Golder.

7.1.2 Engineered Fill Requirements

As described above, the anticipated site grading activities may include both cutting and raising (filling) the original grade to meet the final design site grades. At the time of this report, the design cut and fill depths were not available for review. As such, for the purposes of this report, it has been assumed that cuts will not exceed 2 m and grade raises will not exceed more than 2 m.

In general, the existing native material is considered to be acceptable for reuse as engineered fill. Based on the laboratory test results, the water content of soils present at the site are considered to be generally near or above their optimum water contents for compaction, and therefore may require minor drying prior to placement, in general.

It should be noted that the native materials at the site are silty in nature, and as such are susceptible to over-wetting and subsequent freezing during inclement weather. Therefore, it is recommended that site grading activities not be carried out during late fall, winter, early spring seasons or any periods of inclement weather conditions. All oversized cobbles (i.e., greater than 150 mm in size) and boulders, if present, should be removed from excavated material that will be used as engineered fill material.

If imported material is required for the engineered fill process, the material that is proposed for use as engineered fill should be approved by the geotechnical engineer at its source, prior to importing the material to the site. Suitable soils, free of topsoil, organic matter or other deleterious materials can be used as engineered fill provided that the water content of the soil at the time of placement does not vary by more than 2 percent above or below its optimum water content for compaction. Otherwise, the soils may require treatment (i.e., drying or wetting) prior to placement.

Following the inspection and approval of the subgrade as described previously in this report, engineered fill materials should be placed in maximum 300 mm-thick loose lifts and uniformly compacted to 98 percent of the Standard Proctor maximum dry density (SPMDD). Filling should continue until the design elevations are achieved.

Full-time monitoring and in-situ density testing should be carried out by Golder during placement of engineered fill.

The final surface of the engineered fill should be protected as necessary from construction traffic and should be sloped to provide positive drainage for surface water during the construction period. If the engineered fill materials will be left exposed (i.e. uncovered) during periods of freezing weather, additional soil cover should be placed above final subgrade to provide some level of frost protection. Prior to placing the granular subbase and/or base courses within pavement areas, the surface of the engineered fill/subgrade should be inspected by Golder.

7.2 Installation of Underground Services

7.2.1 Temporary Excavations

Details of the underground servicing for the proposed development are unknown at the time of this investigation; as such, for the purpose of this report, the maximum depth of the underground services was assumed to be about 3 m below the existing ground surface. Once detailed design is completed, review of the underground services should be completed by this office for compliance with the recommendations contained herein.

The founding soils are anticipated to generally consist of the native sandy silty clay or engineered fill. These materials are considered to be suitable for supporting the underground services provided that the integrity of the base of the trench excavations is maintained during construction. Where softened or disturbed native soils or other deleterious materials are encountered at the base of excavations for settlement-sensitive services, these materials should be subexcavated and replaced with compacted fills approved by the geotechnical engineer.

Care should be taken to direct surface water away from any open excavations and all temporary excavations should be carried out in accordance with the Occupational Health and Safety Act (OHSA) and Regulations for Construction Projects.
The groundwater level in the open boreholes, upon completion of drilling, was measured to be at a depth 4 m below existing ground surface. Whereas, the groundwater level in the monitoring wells within close proximity, was measured to be at depths ranging from 0.4 m to 6.3 m below existing ground surface, (Elev. 245 m to Elev. 263 m).

In general, groundwater in the excavations within the native deposits, are likely to be handled by collection via properly constructed and filtered sumps, located within the excavations, and then pumping and discharging the water to a suitable discharge point. However, should excavations deeper than 3-4m below existing ground surface be required, the following recommendations will need to be review and revised to determine if some form of active dewatering, such as well points, may have to be implemented.

Excavations for the site servicing would generally extend through the native sandy silty clay deposit. Conventional excavation equipment should be suitable to excavate through these materials.

The stiff to hard native silt clay till soils are classified as a "Type 2" soils under the OH&S Act. As such, all conventional temporary trench excavations should consist of open cuts with side slopes not steeper than 1 horizontal to 1 vertical in the overburden soils to within 1.2 m of the base of the excavation and then may be made vertical to the base. Where engineered fill (based on silty clay material) is used or the native silty clay exhibits signs of water seepage, the soil is classified as a "Type 3", as such all conventional temporary trench excavations should consist of 1 vertical.

Where the side slopes of excavations are required to be steepened to limit the extent of the excavation, then some form of trench support may be required. Some trench excavations could be carried out using a vertically-excavated, unsupported excavation (using a properly-engineered trench liner box for protection, certified by an experienced engineer); or by a supported (sheeted) excavation if conditions warrant so; such as in wet areas and/or in close proximity to adjacent underground services

7.2.2 Pipe Bedding and Cover

The bedding for the sewers and watermains should be compatible with the size, type and class of pipe and the surrounding subsoil and the requirements of the Town of Caledon. If granular bedding is deemed to be acceptable, then Ontario Provincial Standard Specifications (OPSS) Granular A should be used from at least 150 mm below invert of the pipe to the springline. Clear stone should not be used as bedding material. From springline to 300 mm above the obvert of the pipe, sand cover could be used. All bedding and cover material should be placed in 150 mm loose lifts and uniformly compacted to at least 100 percent of SPMDD. Where variable fill materials, softened or disturbed native soils or other deleterious materials are encountered at the base of excavations for settlement-sensitive services, these materials should be subexcavated and replaced with compacted fills approved by the geotechnical engineer.

7.2.3 Trench Backfill

The excavated materials from the site will consist predominantly of silty clay till materials. Based on the measured water contents, in general, the native materials encountered at the site are estimated to be near or below their optimum water contents for compaction, and therefore, will probably require only minor wetting prior to placement.

Care should be taken to maintain the water content of the soils close to/at the optimum water content for compaction during the construction operations, as difficulties with compaction and/or backfill performance would be anticipated with fine-grained soils where the water content is significantly above the optimum for compaction purposes. Soils that contain significant quantities of organics or debris are also not suitable for use as trench backfill within settlement-sensitive areas. In addition, all boulders and cobbles greater than 150 mm in size should be removed from the trench backfill materials. If there is a shortage of suitable in-situ material, an approved imported material such as Ontario Provincial Standard Specifications Select Subgrade Material should

be used for trench backfill. Again, as noted above, the trench backfill materials are silty in nature and are very susceptible to wetting/freezing temperatures. Backfilling trenches during cold or wet weather is not recommended.

Trench backfill should be placed in maximum 300 mm loose lift thickness and uniformly compacted to at least 98 percent of the SPMDD of the material. Soil that is frozen should not be used as backfill.

Normal post-construction settlement of the compacted trench backfill should be anticipated with the majority of such settlement taking place within about 12 months following the completion of trench backfilling operations. If the trench backfill operations are completed during the winter months, post-construction settlements may increase beyond typical anticipated values. These settlements will be reflected at the ground surface. If the asphalt binder course is laid shortly following the completion of the trench backfilling operations, any settlement that may be reflected by subsidence of the surface of the binder asphalt should be compensated for by placing an additional thickness of binder asphalt or by padding. If possible, the surface course asphalt should not be placed over the binder course asphalt for about 12 months. Where scheduling requires that the surface course be placed over the binder course asphalt before this period, trench backfill settlement would be reflected by subsidence of the finished pavement surface in these areas which, depending upon the extent and magnitude, may require local repairs.

7.3 Building Foundations

As previously indicated, the existing site vegetation, surficial topsoil/organics and other near-surface soils containing significant amounts of organic matter are not considered to be suitable for the subgrade support of engineered fill, building foundations, floor slabs, or other settlement sensitive structures. These materials should be completely stripped prior to placing any engineered fill or construction of foundations or interior or exterior slab-on-grades.

Based on the subsurface conditions encountered in the boreholes, strip and spread footings that may be used, provided that the footings are founded on the native sandy silty clay deposit or on engineered fill (based on existing site soils) placed in accordance with the recommendation outlined in **Section 7.1**, and maintained a minimum depth of soil embedment below finished adjacent ground surface and top of slab of 1.2 m.

For such strip and spread footings, a factored geotechnical resistance at Ultimate Limit States (ULS) of 225 kPa and a geotechnical reaction at Serviceability Limit States (SLS) of 150 kPa may be assumed for design purposes, provided that the strip footings dimensions of 0.45 m in width and 10 m in length or spread footings have a minimum width of 0.60 m and a maximum width of 1.0 m.

Where spread footings are constructed at different elevations, the difference in elevation between the individual footings should not be greater than one half the clear distance 650 mm between the footings. In addition, the lower footings should be constructed first so that if it is necessary to construct the lower footings at a greater depth than anticipated, the elevation of the upper footings can be adjusted accordingly. Stepped strip footings should be constructed in accordance with the Ontario Building Code (2012), Section 9.15.3.9.

The maximum total and differential settlements are expected to be less than 25 mm and 20 mm; respectively, for footings designed, constructed and inspected as outlined above.

All exterior footings, and interior footings in unheated areas, should be founded at a minimum depth of 1.2 m below finished grade level in order to provide adequate protection against frost penetration.

The native soils are susceptible to disturbance from construction activity, especially during wet or freezing weather. Care should be taken to preserve the integrity of the materials as bearing strata. It is essential that the founding surface for the footings be inspected by qualified geotechnical personnel prior to placing concrete. If the concrete for the footings cannot be placed immediately after excavation and inspection of the subgrade,

it is recommended that a working mat of lean concrete be placed in the excavation to protect the integrity of the bearing stratum.

Resistance to lateral forces/sliding resistance between the concrete footings and the subgrade should be calculated in accordance with Section 6.7.5 of the CHBDC. The unfactored coefficient of friction, tan δ , for the interface between the cast-in-place concrete footing and the properly-prepared subgrade can be assumed to be 0.35.

7.3.1 Below Grade Walls

The exterior perimeter of all housing basement walls should be backfilled with an imported free draining, non-frost susceptible granular material approved by a geotechnical engineer, carefully placed and compacted in 200 mm thick loose lifts. The design of the foundation walls for the below-grade walls should take into account the horizontal soil loads as well as surcharge loads that may occur during or after construction and should be designed using a lateral (at-rest) earth pressure coefficient of 0.5 and a unit weight of backfill of 20 kN/m3.

The wall backfill layers should be compacted to at least 95 per cent of the materials' standard Proctor maximum dry density. Light compaction equipment should be used immediately adjacent to the foundation wall, otherwise compaction stresses on the wall may be greater than that imposed by the backfill material. With the exception of the driveway area, the upper 0.3 m of backfill should consist of clayey material to provide a low permeability cap and the exterior grade should also be shaped to slope away from the building.

Provided that the excavations adjacent to foundation/basement walls are backfilled with free-draining granular materials and a drainage collection system is provided around the perimeter of the building, the design of below-grade walls does not need to take into account hydrostatic forces acting on the walls. However, it is recommended that the exterior of the below-grade walls be damp-proofed.

7.4 Pavement Design within the Proposed Development

Following site grading operations, as noted previously, the proposed pavement subgrade will generally consist of either re-compacted engineered fill or native silty clay till. These materials are considered to be frost susceptible, and as such, the pavement design provided in *Table 4*, below has taken this condition into consideration.

Based on the proposed pavement usage, (i.e. residential development type traffic and loads/frequencies) frost susceptibility and strength of the subgrade soils, the following pavement component given are recommended for the proposed development of access roads and streets, however the Town of Caledon/Region of Peel design standards should be followed:

		Minimum Thickness of Pa	avement Components (mm)
Material		Local Road (7.9m Road Pavement Width)	9.5 m Neighbourhood Collector (8.9 m Road Pavement Width)
Asphaltic Concrete	HL 3 Surface Course	40	40
(OPSS 1150)	HL 8 Binder Course	65	90
	Granular A Base	150	150

Table 4: Pavement Design

		Minimum Thickness of Pa	avement Components (mm)
Material		Local Road (7.9m Road Pavement Width)	9.5 m Neighbourhood Collector (8.9 m Road Pavement Width)
Granular Materials (OPSS.MUNI 1010)	Granular B Type II Subbase	350	500
Total Pavement Thickne	ess (mm)	605	780
		Prepared and Approved Su	bgrade

As part of the subgrade preparation, proposed access roads should be stripped of topsoil and other obviously unsuitable fill or organic materials. Fill required to raise the grades to design elevations should conform to the engineered fill requirements outlined previously in the report. Soft or spongy trench backfill areas should be sub-excavated and properly replaced with suitable approved backfill compacted to 98 percent SPMDD. Prior to placing pavement subbase and/or base materials, the exposed soil subgrade should be heavily proof-rolled in conjunction with an inspection by Golder. The granular subbase and base materials should be placed in loose layers no thicker than 200 mm and uniformly compacted to 100 percent of their SPMDD. The binder course and surface course asphalt materials should be compacted to minimum 92.0 percent of their Marshall Maximum Relative Density according to OPSS 310, as measured in the field using a nuclear density gauge.

Where new pavement abuts existing pavement (e.g. at the development limits), proper longitudinal lap joints should be constructed to key the new asphalt into the existing asphalt surface. The existing asphalt edges should be provided with a proper sawcut edge prior to keying-in the new asphalt. It should be ensured that any undermining or broken edges resulting from the construction activities are removed by the sawcut.

It should be noted that in some cases, even though the compaction requirements have been met, the subgrade strength may not be adequate to support heavy construction loading especially during wet weather or where backfill materials wet of optimum have been placed. In this regard, the design subbase thickness may not be sufficient for a construction haul road and additional subbase (in the order of 450 mm) may be required. In any event, the subgrade should be proofrolled and inspected by Golder prior to placing the subbase and any additional material, as required, consistent with the prevailing weather conditions and anticipated use by construction traffic.

7.4.1 Subgrade Drainage

In order to preserve the integrity of the pavement, continuous subdrains should be placed at the concrete curb lines along both sides of the proposed streets. The invert of the subdrains should be at least 300 mm below the bottom of the Granular "B" subbase and should be sloped to drain to catchbasins. The subdrains should consist of perforated pipe wrapped in a suitable geotextile and surrounded on all sides with a minimum thickness of 150 mm of OPSS.PROV 1002 Concrete Fine Aggregate (i.e. concrete sand).

8.0 SEISMIC SITE CLASSIFICATION

Seismic hazard is defined in the 2012 Ontario Building Code (OBC) by uniform hazard spectra (UHS) at spectral coordinates of 0.2 second, 0.5 second, 1.0 second and 2.0 seconds and a probability of exceedance of 2% in 50 years. The OBC method uses a site classification system defined by the average soil/bedrock properties

(e.g. shear wave velocity, Standard Penetration Test (SPT) resistance, undrained soil shear strength, etc.) in the 30 m below the foundation level. There are six site classes from A to F, decreasing in ground stiffness from A, hard rock, to E, soft soil; with site class F used to denote problematic soils (e.g. sites underlain by thick peat deposits and/or liquefiable soils). The site class is then used to obtain acceleration and velocity-based site coefficients F_a and F_v ; respectively, used to modify the UHS to account for the effects of site-specific soil conditions in design.

Based on the results of the preliminary geotechnical investigation and assuming soils below the maximum depth investigated exhibit similar properties / strengths, a **Site Class D** is estimated for planning purposes. The Site Class will need to be verified, and adjusted as necessary, during detail design.

9.0 INSPECTION AND TESTING

During construction, full-time observation should be carried out during engineered fill and site servicing backfill placement, and sufficient foundation inspections, subgrade inspections and in-situ materials testing should be carried out to confirm that the conditions exposed are consistent with those encountered in the boreholes and to monitor conformance to the pertinent project specifications.

10.0 CLOSING

We trust that this preliminary report provides enough preliminary geotechnical engineering information to proceed with the detailed design of the proposed development. If you have any questions regarding the contents of this report or require additional information, please do not hesitate to contact this office.

Signature Page

Golder Associates Ltd.

Erti Mansaku, P.Eng. *Geotechnical Engineer*

JD/EM/JET/sm

qu

Jeff Tolton, C.E.T. Associate, Senior Geotechnical Technologist

Golder and the G logo are trademarks of Golder Associates Corporation

https://golderassociates.sharepoint.com/sites/102461/technical work/phase 4000 - kenndy mayfield investement/19115264 (4000) draft georeport mayfield kennedy.docx



 \oplus

- Watercourse
- Waterbody
- 🗄 🗄 Wetland
- Site Boundary
- Mayfield Investment Corp. Site Boundary

Approximate Previous and Adjacent Properties Geotechnical Borehole (Edward Wong 2017, Golder 2019)

0	75	150
1:3,000	ME	TRES

CLIENT MAYFIELD KENNEDY INVESTMENT CORP.

CONSULTANT		YYYY-MM-DD	2019-04-16
		DESIGNED	MM
	GOLDER	PREPARED	MM
	OOLDEN	REVIEWED	EM
		APPROVED	-

REFERENCE(S) 1. IMAGERY: ESRI, HERE, DELORME, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY © 2019 MICROSOFT CORPORATION © 2019 DIGITALGLOBE ©CNES (2019) DISTRIBUTION AIRPLIE DE

AIRBUS DS 2. BASE DATA: LIO MNRF 2019 3. PROJECTION: TRANSVERSE MERCATOR NAD 1983 UTM ZONE 17N

PROJECT PRELIMINARY GEOTECHNICAL INVESTIGATION, PROPOSED RESIDENTIAL DEVELOPMENT, MAYFIELD KENNEDY INVESTMENT CORP., CALEDON, ON

TITLE

SITE AND BOREHOLE LOCATION PLAN

CONTROL PROJECT NO. 19115264 4000

REV. -

APPENDIX A

Method of Soil Classification Abbreviations and Terms used on Record of Borehole List of Symbols Record of Boreholes

Organic or Inorganic	Soil Group	Туре	of Soil	Gradation or Plasticity	Cu	$=\frac{D_{60}}{D_{10}}$		$Cc = \frac{(D)}{D_{10}}$	$(xD_{60})^2$	Organic Content	USCS Group Symbol	Group Name
		s of mm)	Gravels with ≤12%	Poorly Graded		<4		≤1 or ≥	:3		GP	GRAVEL
(ss	5 mm	VELS / mass action	fines (by mass)	Well Graded		≥4		1 to 3	3		GW	GRAVEL
by ma	SOILS an 0.07	GRA 50% by oarse fr	Gravels with >12%	Below A Line			n/a				GM	SILTY GRAVEL
GANIC it ≤30%	AINED arger th		fines (by mass)	Above A Line			n/a			≤30%	GC	CLAYEY GRAVEL
INOR Conter	SE-GF Iss is k	is mm)	Sands with ≤12%	Poorly Graded		<6		≤1 or ≩	≥3		SP	SAND
rganic	COAR by ma	NDS y mass iraction an 4.75	fines (by mass)	Well Graded		≥6		1 to 3	3		SW	SAND
0)	(>50%	SA SA Soarse f soarse f	Sands with >12%	Below A Line			n/a				SM	SILTY SAND
		(i)	fines (by mass)	Above A Line			n/a				SC	CLAYEY SAND
Organic or	Soil	Type	of Soil	Laboratory		F	ield Indica	tors	Toughness	Organic	USCS Group	Primary
Inorganic	Group	21		Tests	Dilatancy	Strength	Test	Diameter	(of 3 mm thread)	Content	Symbol	Name
				Liquid Limit	Rapid	None	None	>6 mm	N/A (can′t roll 3 mm thread)	<5%	ML	SILT
(ss)	75 mm	() pue	city low)	<50	Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
by ma	OILS 1an 0.0	SILTS bic or P	n Plasti n Plasti nart be		Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
GANIC it ≤30%	NED S naller th	Place		Liquid Limit	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	МН	CLAYEY SILT
INOR	E-GRAI	- NO		≥50	None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	ОН	ORGANIC SILT
rganic	FINE by mas	to c	hart	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0%	CL	SILTY CLAY
0	(≥50%	CLAYS	e A-Lin ticity C below)	Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium	30%	CI	SILTY CLAY
			Plas	Liquid Limit ≥50	None	High	Shiny	<1 mm	High	(see Note 2)	СН	CLAY
S NIC	nıc >30% ss)	Peat and mix	mineral soil tures		iii			30% to 75%		SILTY PEAT, SANDY PEAT		
HIGH ORGAI SOIL	(Orga Content : by ma	Predomir may cor mineral sc	nantly peat, ntain some pil, fibrous or					75% to 100%	PT	PEAT		
40	20000	amorph	nous peat					Dual Svm	bol — A dual	svmbol is	two symbols :	separated by
-	LOW	Plasticity		Medium Plasticity	- Hig	h Plasticity	-	a hyphen,	for example,	GP-GM, S	SW-SC and CI	ML.
					CLAY	Sta Tat		For non-co	hesive soils, as_between	the dual s	ymbols must b 12% fines (i e	e used when
30					СН			transitiona	I material be	etween "c	lean" and "di	rty" sand or
(14				SILTY CLAY	CLAYEY SI	LT MH		gravel.				
Index (a	ORGANIC S	ILT OH		For cones	and plasticity	/ index val	ues plot in the	CL-ML area
asticity				Aline				of the plas	ticity chart (s	ee Plastici	ty Chart at left	t).
•		SILTY C	LAY	/				Dordorlin	a Cumphal	A bordori	ina aumhal ia	two overbolo
10		cL	/					separated	by a slash, fo	or example	e, CL/CI, GM/S	SM, CL/ML.
7	SILTY CLAY-CI AV	EY SILT, CL-MI	C	LAYEY SILT ML RGANIC SILT OL				A borderlin	ne symbol sh	ould be us	sed to indicate	that the soil
4								has been	identified as	s having p ar materia	properties that Is In addition	are on the
0	51LT ML (20	25.5 30	40 5	0 60	70	80	symbol ma	ay be used to	indicate a	range of simi	lar soil types
Note 1 – Fi	ne grained	materials w	ند ith PI and LL t	quid Limit (LL) that plot in this a	area are nameo	I (ML) SILT w	ith	within a st	ratum.			
slight plast	icity. Fine-	grained mat	terials which	are non-plastic (i.e. a PL canno	t be measure	ed) are					

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

named SILT. Note 2 – For soils with <5% organic content, include the descriptor "trace organics" for soils with between 5% and 30% organic content include the prefix "organic" before the Primary name.

💊 GOLDER

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)	
BOULDERS	Not Applicable	>300	>12	
COBBLES	Not Applicable	75 to 300	3 to 12	
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75	
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)	
SILT/CLAY	Classified by plasticity	<0.075	< (200)	

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (<i>i.e.</i> , SAND and GRAVEL)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_i), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d: The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

- PH: Sampler advanced by hydraulic pressure
- PM: Sampler advanced by manual pressure
- WH: Sampler advanced by static weight of hammer
- WR: Sampler advanced by weight of sampler and rod

Compactness ²			
Term	SPT 'N' (blows/0.3m) ¹		
Very Loose	0 to 4		
Loose	4 to 10		
Compact	10 to 30		
Dense	30 to 50		
Very Dense	>50		

NON-COHESIVE (COHESIONLESS) SOILS

1. SPT 'N' in accordance with ASTM D1586, uncorrected for the effects of overburden pressure. 2.

Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic trip hammers), overburden pressure, groundwater conditions, and grainsize. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

SAMPLES	
AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
GS	Grab Sample
MC	Modified California Samples
MS	Modified Shelby (for frozen soil)
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
ТО	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample

SOIL TESTS

w	water content
PL, w _p	plastic limit
LL, w _L	liquid limit
С	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test ¹
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement ¹
DR	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
М	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO ₄	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1 Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

	COHESIVE SOILS			
Consistency				
Term	Undrained Shear Strength (kPa)	SPT 'N' ^{1,2} (blows/0.3m)		
Very Soft	<12	0 to 2		
Soft	12 to 25	2 to 4		
Firm	25 to 50	4 to 8		
Stiff	50 to 100	8 to 15		
Very Stiff	100 to 200	15 to 30		
Hard	>200	>30		

SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure 1

SPT 'N' in accordance with ASTM D 1900, unconceded to overballed processes effects; approximate only. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations. 2.

	Water Content												
Term	Description												
w < PL	Material is estimated to be drier than the Plastic Limit.												
w ~ PL	Material is estimated to be close to the Plastic Limit.												
w > PL	Material is estimated to be wetter than the Plastic Limit.												

Unless otherwise stated, the symbols employed in the report are as follows:

I.	GENERAL	(a) w	Index Properties (continued)
π	3.1416	w or LL	liquid limit
ln x	natural logarithm of x	w₀ or PL	plastic limit
log ₁₀	x or log x, logarithm of x to base 10	l₀ or PI	plasticity index = $(w_1 - w_p)$
q	acceleration due to gravity	ŃP	non-plastic
ť	time	Ws	shrinkage limit
		۱L	liquidity index = $(w - w_p) / I_p$
		lc	consistency index = $(w_l - w) / I_p$
		emax	void ratio in loosest state
		emin	void ratio in densest state
		ID	density index = $(e_{max} - e) / (e_{max} - e_{min})$
II.	STRESS AND STRAIN		(formerly relative density)
γ	shear strain	(b)	Hydraulic Properties
Δ	change in, e.g. in stress: $\Delta \sigma$	n	nydraulic nead or polenilai
3		q	
εv	volumetric strain	V	
η		1	
υ	Poisson's ratio	K	hydraulic conductivity
σ	total stress		(coefficient of permeability)
σ'	effective stress ($\sigma' = \sigma - u$)	J	seepage force per unit volume
σ'_{vo}			
σ1, σ2, σ3	principal stress (major, intermediate,		Concelidation (one dimensional)
	minor)	(0)	comprossion index
	mean stress or octahedral stress	Uc	(normally consolidated range)
Goct	$= (a_1 \pm a_2 \pm a_3)/2$	C	(normally consolidated range)
_	$-(\sigma_1 + \sigma_2 + \sigma_3)/3$	Ur	(over consolidated range)
τ	sileal siless	C	(over-consolidated range)
u F	modulus of deformation	Cs Ca	secondary compression index
G	shear modulus of deformation	m _v	coefficient of volume change
ĸ	bulk modulus of compressibility	Cv	coefficient of consolidation (vertical
			direction)
		Ch	coefficient of consolidation (horizontal direction)
		Tv	time factor (vertical direction)
III.	SOIL PROPERTIES	U	degree of consolidation
		σ΄ρ	pre-consolidation stress
(a)	Index Properties	OCR	over-consolidation ratio = σ'_p / σ'_{vo}
ρ(γ)	bulk density (bulk unit weight)*		
ρd(γd)	dry density (dry unit weight)	(d)	Shear Strength
ρω(γω)	density (unit weight) of water	τ_p, τ_r	peak and residual shear strength
ρs(γs)	density (unit weight) of solid particles	φ ′	effective angle of internal friction
γ'	unit weight of submerged soil	δ	angle of interface friction
	$(\gamma' = \gamma - \gamma_w)$	μ	coefficient of friction = tan δ
D _R	relative density (specific gravity) of solid	c′	effective cohesion
	particles ($D_R = \rho_s / \rho_w$) (formerly G_s)	Cu, Su	undrained shear strength (ϕ = 0 analysis)
е	void ratio	р	mean total stress (σ_1 + σ_3)/2
n	porosity	p'	mean effective stress ($\sigma'_1 + \sigma'_3$)/2
S	degree of saturation	q	(σ1 - σ3)/2 or (σ′1 - σ′3)/2
		\mathbf{q}_{u}	compressive strength (σ_1 - σ_3)
		St	sensitivity
* Densi	ty symbol is a Unit weight symbol is v	Notes: 1	$\tau = C' + \sigma' \tan \phi'$
where	$\gamma = \rho q$ (i.e. mass density multiplied by	2	shear strength = (compressive strength)/2
accele	eration due to gravity)	-	



PROJECT: 19115264-4000

RECORD OF BOREHOLE: BH19-10

LOCATION: Lat. 43.74607 Long. -79.817117 (See Figure 1)

BORING DATE: April 3, 2019

SHEET 1 OF 1 DATUM: Geodetic

ш		Q	SOIL PROFILE			SA	MPL	ES	DYNAMIC PENETRATION RESISTANCE. BLOWS/0.3m	HYDRAULIC CONDUCTIVITY,	. (7)	
SCAL		METH		LOT		<u>к</u>		.3m	20 40 60 80		IONAL	
ЕРТН МЕТ		RING	DESCRIPTION	ATA P	ELEV.	UMBE	TYPE	0/S/VC	SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O		ABDIT AB. TE	INSTALLATION
		BOI		STR	(m)	z		BLO	20 40 60 80	10 20 30 40	<u>د ۲</u>	
_	₀┝		GROUND SURFACE	===	267.80							
-					267.57	1A	SS	~				
-			trace gravel; dark brown to brown, mottled; cohesive, w~PL, firm		267.04	1B	ss	5		0		
-			(CL) sandy SILTY CLAY, some sand, trace gravel contains inferred		0.76							
_	1		cobbles/boulders; light brown with oxidation staining, (TILL); cohesive,			2	SS	18		φ		-
-			w <pl, hard<="" stiff="" td="" to="" very=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>									
-												
-	2					3	SS	29			мн	_
-	-											
-												
-		lger				4	SS	35				
-	3	wer Au										-
Ē	4	Nid Stel	depth of 3 m									
		ack Mo				5	SS	31				
1 1 1	H L	100										
	4											▽ -
												2/04/2019
9_ -						6A	ss					
C 	5		(CL-ML) CLAYEY SILT, some sand,		4.94	6B	ss	25				
Ч Н Г			w~PL to w>PL, stiff to very stiff									
						7A	ss					
					2 A	70		10				
	6				à	/В	55					-
						8	ss	22		0		
9761					261.09		-					
			END OF BOREHOLE.		6.71							
2	7		Notes: 1. Water level measured at 4.1 mbgs									-
			upon completion of drilling.									
												_
				1								
				1								
	9											-
L L L												
	0											-
р Н Л П	DEP	тн	SCALE								LC	DGGED: JD
<u>ا</u> ا	: 5	0									СН	ECKED: EM

PROJECT: 19115264-4000

RECORD OF BOREHOLE: BH19-11

LOCATION: Lat. 43.74736 Long. -79.816608 (See Figure 1)

BORING DATE: April 3, 2019

SHEET 1 OF 1

DATUM: Geodetic

		Q	SOIL PROFILE			SA	MPL	ES)	HYDR.			NDUCT	IVITY,	Т	(7)	
CALE	ŝ	ETHC		Ы				۳	20	40	60 8	30	1	к, с 0 ⁻⁶	10 ⁻¹	⁵ 1(0-4 1	0-3 ⊥	STING	PIEZOMETER OR
TH S	AETR	βM	DESCRIPTION	A PL	ELEV.	1BER	ĥ	/S/0.3	SHEAR STR	ENGTH	nat V. +	Q - ●		I /ATEF	ت 2 CO	NTENT	PERCE	NT	DITIC	
DEP	≥	ORIN		RAT	DEPTH	NUN	Ţ	ΓΟΛ	Cu, kPa		rem V. ⊕	U- O	w	p ┣─		-0 ^W		W	ADI	INSTALLATION
	_	ä		ST				ā	20	40	60 8	30	1	10	20	3	i0 ⊿	10		
\vdash	0			222	265.00	-				-			-		+					
E			(CL) sandy SILTY CLAY trace gravel:		264.77	1A	SS	10												
E			brown, mottled brown/light brown;		0.23	1B	SS	10							9					
F			- Cobbles/boulders inferred from auger																	
-			grinding at 6 m																	
-	1					2	SS	4							◍┼				мн	-
-					263.60															
-			(CL) sandy SILTY CLAY, trace gravel;		1.40	1														
Ē			cohesive, w <pl, hard<="" stiff="" td="" to="" very=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>																	
F	2					3	55	10												_
-																				
_																				
E		-				4	ss	28						0						
E		Auge																		
F	3	Power tem			1	\vdash														-
sÈ		lount				_	20	20												- - -
Ĕ Ĕ		ack M				5	55	29						Γ						
6/19		75 Tr	3																	
12		GME																		
GDT	4																			
- <u>N</u>																				
BAL																				
- Г-							~~	22												
	5					ľ	55	33												-
ĕ																				
- ∧ BH																				
	6					\vdash														
NN NN						7	55	30												
526					1	[]	55	50												
1911	ł		END OF BOREHOLE.	KXX	258.29	\vdash									+					· · · · · · · · · · · · · · · · · · ·
	7		Notes:																	-
			1. Borehole dry upon completion of drilling.																	
s/C/																				· · ·
	8																			-
MHO																				
Ĭ																				
N N																				
ROC -	9																			-
AKB																				
- I																				
S L																				
5	10																			-
5																				
3HS (DEF	этн	SCALE							`		h							L	DGGED: JD
TA	1:5	50								ר ר		≺							СН	ECKED: EM
o.	113	JU						-											сH	LUNED. ENI

APPENDIX B

Geotechnical Laboratory Figures



Project Number: 19115264

(4000) Checked By:EM



APPENDIX C

Previous Geotechnical Borehole Logs PROJECT: 19115264-3000

RECORD OF BOREHOLE: BH/MW19-01

LOCATION: Lat. 43.747371 Long. -79.818742 (See Figure 1)

BORING DATE: April 4, 2019

SHEET 1 OF 1 DATUM: Geodetic

METHOD		SOIL PROFILE DESCRIPTION	ATA PLOT	ELEV.	SAN	APLE JAP	WS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m 20 40 60 80 SHEAR STRENGTH nat V. + Q - 0 Cu, kPa rem V, ⊕ U - 0	HYDRAULIC CONDUCTIVITY, k, cm/s 10 ⁻⁶ 10 ⁻⁵ 10 ⁻¹ 10 ⁻³ WATER CONTENT PERCENT	DDITIONAL B. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
BOR	Ś		STR/	(m)	z		BLO	20 40 60 80	Wp → → ^W I WI 10 20 30 40	₹ ¶	
		GROUND SURFACE		266.80							
Ĭ		TOPSOIL (250 mm)		0.00	1A	ss					
		(CL) SILTY CLAY, trace sand, trace gravel, trace organics; brown; cohesive, w~PL, stiff		0.25	1B	ss	10				
1		(CL) sandy SILTY CLAY, trace gravel; light brown with oxidation staining, (TILL); cohesive, w <pl, hard<="" stiff="" td="" to="" very=""><td></td><td>0.70</td><td>2</td><td>SS</td><td>16</td><td></td><td>011</td><td>мн</td><td></td></pl,>		0.70	2	SS	16		011	мн	
2		- Some to trace sand below depth of 1.6 m			3	SS	21		0		Bentonite
					4	ss	23				
3											
ver Auger	E				5	SS	32		0		
AE 75 Track Mount Pov	100 mm Solid Ster										∑ 17/04/2019 Sand
5 5		- Silty sand layers/seams encountered below depth of 4.9 m			6	SS	21				
6	-	(CI/CL-ML) SILTY CLAY to CLAYEY SILT, trace to some sand, trace gravel, with inferred cobbles; grey, (TILL); cohesive, w~PL to w>PL, stiff to hard		261.01 5.79							Screen and Sand
7					7	SS	12				
					8	SS	48		0		Bentonite
8		- Sand layer, approximately 70 mm thick, encountered at a depth of 8.1 m END OF BOREHOLE.		258.57 8.23							
		Notes: 1. Borehole dry upon completion of drilling.									
9		2. Water level measured in monitoring well as follows:									
		Date Depth Elev. (m) April 17, 2019 3.95 mbgs 262.85 m									
10											
DEPTH	H S	CALE				ĺ		GOLDER		L	DGGED: JD

PROJECT: 19115264-1000/2000

RECORD OF BOREHOLE: BH/MW19-02

LOCATION: Lat. 43.747664 Long. -79.814643 (See Figure 1)

BORING DATE: April 2, 2019

SHEET 1 OF 2 DATUM: Geodetic

KES	IETHOD		SOIL PROFILE	TO.		SA ~	MPL	ES mg	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m 20 40 60 80	HYDRAULIC CONDUCTIVITY, k, cm/s 10 ⁻⁵ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³	STING	PIEZOMETER OR
METR	BORING M		DESCRIPTION	STRATA PL	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3	I I I SHEAR STRENGTH Cu, kPa nat V. + Q. ● rem V. ⊕ U- C 20 40 60 80	WATER CONTENT PERCENT	ADDITIO LAB. TES	STANDPIPE INSTALLATION
		+	GROUND SURFACE	0,	257 20							
0			TOPSOIL (610 mm)		0.00							∇
1		-	(CL)SILTY CLAY, some to trace sand, trace gravel, trace organics; brown/dark brown with oxidation staining; w>PL, firm, (CL) sandy SILTY CLAY, trace gravel; light brown with oxidation staining, (TILL); cohesive, w~PL, firm to stiff - Silt/sand seams/layers below 1.7 m		256.59 0.61 256.35 0.85	1 2A 2B 3	ss ss ss ss	4 8 8			17/04/2C	Image: Second
3		-	(CL-ML) CLAYEY SILT, some to trace sand, trace gravel; grey, (TILL); cohesive, w>PL, very stiff to stiff to hard		253.24 3.96	5	SS	9		Φ	Sc an Sa	reen,
5	CME 75 Track Mount Power Auge	100 mm Solid Stem				6	SS	15		0	Be	entonite
7				A PARA PARA PARA PARA		7	SS	13		0		∑ 17/04/2019
8				A A A A A A A A A A A A A A A A A A A		8	SS	17				
9			 Becoming sandy at 9.1 m Auger grinding at a depth of 9.5 m to 11 m 	A A A A A A A A A A A A A A A A A A A		9	ss	57		0		
10		-			4			-		┟──├──┼──├──┼──	-	
10 DEI			CALE		4				GOLDER			GED: JD

PROJECT: 19115264-1000/2000

RECORD OF BOREHOLE: BH/MW19-02

LOCATION: Lat. 43.747664 Long. -79.814643 (See Figure 1)

BORING DATE: April 2, 2019

SHEET 2 OF 2 DATUM: Geodetic

	щ,	ДОН	SOIL PROFILE			SA	MPL	ES	DYNAMIC PEN RESISTANCE,	ETRATI BLOWS	ON /0.3m	7	HYDRAULIC C k, cm/s		IVITY,	Ţ	⁴ G ⁴	PIEZOMETER
	EPTH SCA METRES	RING METI	DESCRIPTION	ATA PLOT	ELEV.	JMBER	гүре	WS/0.3m	20 SHEAR STREI Cu, kPa	io IGTH	50 8 ⊔ nat V. + rem V. ⊕	Q - ● U - ○	10 ⁻⁶ 1 WATER C	0 ⁻⁵ 10 CONTENT	P ⁻⁴ 10 PERCEI	D ⁻³ ⊥ L	DDITIONA B. TESTIN	OR STANDPIPE INSTALLATION
	B	BOF		STR/	(m)	Ñ		BLO	20	10 (50 E	80	10 Vp	 203	0 4	0 0	A	
	- 10	\vdash	CONTINUED FROM PREVIOUS PAGE	12K	247.14													
	-		(SVI-SWI) SAIND to SIL I SAIND, medium grained, contains inferred cobbles/boulders; light brown; non-cohesive, wet, compact to very dense		10.06													Bentonite
	- - - 11 -	it Power Auger I Stem				10	SS	26										Sand 2 2 2
	- - - - - - - - - - -	CME 75 Track Mour 100 mm Solid	- Cobbles/boulders inferred from auger grinding at a depth of 12 m			11	SS	52										Screen and Sand
	-				244.40													2/04/2019
с U	- - 13 -		END OF BOREHOLE. Notes: 1. Water level measured in monitoring well as follows:		12.80													-
J GAL-MIS GDT 17/6/19 JN	- - - - - - - - - - - - - - - - - - -		Deep Well Date Depth Elev. (m) April 2, 2019 12.67 mbgs 244.53 m April 17, 2019 6.27 mbgs 250.93 m Shallow Well Date Depth Elev. (m) April 17, 2019 0.25 mbgs 256.95 m															
HOLLOW BH LOGS G	- - - - - - - - -																	
INT/19115264-SNELLS	- 16 - - - - - - - - - - - - - - - - - - -																	
IENTS/CALEDON/12 G	- - - - - - - - - - - - - - - - - - -																	
RBROOKDEVELOPM	- - - - - - - - - - - -																	
G:\ CLIENTS\CLEA																		-
GTA-BHS 001	DE 1 :	I :РТН 8 50	I SCALE						GC) E F	ַ ג		<u> </u>			LC CH	DGGED: JD ECKED: EM

PROJECT: 19115264-1000/2000

RECORD OF BOREHOLE: BH/MW19-09

LOCATION: Lat. 43.745322 Long. -79.814288 (See Figure 1)

BORING DATE: April 3, 2019

SHEET 1 OF 2 DATUM: Geodetic

ES	ETHO	┢	SUIL PROFILE	ы		SA	MPL	ES ES	RESISTANCE, BLOWS/0.3m 20 40 60 80	k, cm/s		PIEZOMETEI OR
MEIR	BORING M		DESCRIPTION	STRATA PL	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3	SHEAR STRENGTH nat V. + Q Cu, kPa rem V. ⊕ U	WATER CONTENT		
0			GROUND SURFACE		256.95							
1			(CL) sandy SILTY CLAY, trace organics, trace gravel; light brown mottled with oxidation staining; cohesive, w <pl, <br="" soft="">(CL) SILTY CLAY, some sand, trace gravel, inferred cobbles; brown mottled with oxidation staining, (TILL); cohesive, w<pl, stiff<="" td="" very=""><td></td><td>0.00 256.52 0.43 256.34 0.61</td><td>1A 1B 2</td><td>ss ss ss</td><td>3</td><td></td><td></td><td>РР 125 РР 440 </td><td>= Pa = Pa</td></pl,></pl,>		0.00 256.52 0.43 256.34 0.61	1A 1B 2	ss ss ss	3			РР 125 РР 440	= Pa = Pa
2						3	SS	22		0	PP 440 I	= Pa
			 sand and sity day encountered at a depth of 2.3 m to 5.5 m 			4	SS	23		0	PP 420 F	= ^{Pa} Bentonite
3	rer Auger		 Cobbles/boulders inferred from auger grinding at a depth of 3 m 			5	SS	23			PP 245 I	= Pa
4	CME 75 Track Mount Pov	100 mm solid ster	(CL-ML/CL) CLAYEY SILT to SILTY CLAY, trace sand, trace gravel; grey, (TILL); cohesive, w~PL, stiff		252 <u>.99</u> 3.96							
5					251.16	6	SS	9			PP 125 F	= Pa
6			(SM-SW) SILTY SAND to sand, medium grained, some silt, trace gravel; light brown; non-cohesive, wet, compact		5.79	7	SS	27		0		Sanu V 17/04/2019 Screen and Sand
8						8	SS	16				Bentonite
		+	END OF BOREHOLE.		248.72 8.23							
9			Notes: 1. Water level measured at 6.57 mbgs upon completion of drilling. 2. Water level measured in monitoring well as follows: Date Depth Elev. (m) April 17, 2019 6.54 mbgs 250.41 m 3. PP= unconfined compressive strength measured with pocket penetrometer in									
10				-	+			-	+	-++	+	_

PF LC	ROJEC	 T: 19115264-1000/2000 DN: Lat. 43.745322 Long79.814288 (See Figure 1) 	RE	COF	RD	0 E) F BOR	BOF	REH	OLE ril 3, 201	: E	3H/N	/ W1	9-09				Sł D/	HEET 2 OF 2 ATUM: Geodetic
S	тнор	SOIL PROFILE	1-		SA	MPL	ES	DYNAM RES I ST	IC PEN ANCE,	ETRATIC BLOWS/	DN 0.3m	<u>```</u>	HYDR	AULIC Co k, cm/s		TIVITY,		IAL ING	PIEZOMETER
DEPTH SC METRE:	BORING ME	DESCRIPTION	STRATA PLO	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	20 I SHEAR Cu, kPa 20) 4 STREN	0 6 IGTH n 0 6	0 ε atV.+ emV.⊕ 0 ε	Q - ● U - ○ 80	1 W W W	0 ⁻⁰ 11 ATER CO	D ^o 1 DNTENT <u>O</u> W 0 3	0 ⁻⁴ 10 I PERCEI I' 30 4	NT WI 0	ADDITION LAB. TEST	OR STANDPIPE INSTALLATION
- 10		CONTINUED FROM PREVIOUS PAGE the field.																	
-																			
- 11 - 11 																			
- - - 12 - - -																			
- - - - - - - - - - -																			
1																			
16 16																			
- 20 – 20																			-
	EPTH :	I SCALE	<u> </u>	<u> </u>					GO		EF	ר א	<u> </u>					L LC СН	DGGED: JD ECKED: EM

ΞE	EDWA	RD WONG				WELL	PAGE 1 OF 1
CLIEN	NT Dilip	Kumar Jain BER <u>Ma00</u>)2995a		PROJECT NAME 3278 Mayfield F	Road	
DATE DRILL DRILL LOGG NOTE	STARTEI	D <u>10/18/17</u> TRACTOR <u></u> HOD <u>Solid</u> J.J.	COMPL Fadroy Enterprise Stem Augers CHECK	ETED <u>10/18/17</u> ED BY <u>E.W.</u>	GROUND ELEVATION <u>265 m</u> GROUND WATER LEVELS: AT TIME OF DRILLING <u>Dry</u> AT END OF DRILLING <u>2.85 m / Elev</u> AFTER DRILLING <u>2.85 m / Elev</u>	_ HOLE SIZE _ 150 Elev 262.15 m 262.15 m	mm
DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WEL	L DIAGRAM
	SS 1	1-3-3-3 (6)	MC = 23%	1/2 1/2 TOPS	SOIL - ~600 mm thick.	264.40	
 - 	SS 2	3-4-5 (9)	MC = 16%	FILL brown	- clayey slit, rootlets, topsoil inclusions, dark n and brown, very moist.		Bentonite
2	SS 3	2-4-5 (9)	MC = 22%				
	SS 4	4-7-10 (17)	MC = 19%	¥.			50 mm dia. PVC Riser, Filter Sand
	SS 5	2-5-9 (14)	MC = 21%				
	SS 6	3-6-8 (14)	PP = 400 kPa MC = 16%	SILTY	/ CLAY - trace gravel, grey, very moist, hard.	260.50	50 mm dia. PVC Slotted Pipe, Filter Sand
 	SS 7	4-6-8 (14)	PP = 250 kPa MC = 16%	-beco	ming very stiff below ~6.0 m depth Bottom of hole at 6.45 m.	258.55	

E EDW/	ARD WONG					BORING NUMBE PAGE 1	OF 1
CLIENT Dilip	Kumar Jain MBER <u>Ma00</u>	2995a			PROJECT NAME <u>3278 Mayfield</u> PROJECT LOCATION Town of	l Road Caledon	
DATE STARTI DRILLING CO DRILLING ME LOGGED BY NOTES	ED <u>10/18/17</u> NTRACTOR _ THOD <u>Solid</u> _J.J.	COMPL Fadroy Enterprise Stem Augers CHECK	ETED <u>10</u>	/18/17 .W.	GROUND ELEVATION _260 m GROUND WATER LEVELS: AT TIME OF DRILLING _Dry AT END OF DRILLING _Dry AFTER DRILLING	HOLE SIZE mm	
DEPTH (m) SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG		MATERIAL DESCRIPTION	ON	
ss 1	4-5-5-5 (10)	MC = 17%	<u>34 3</u> 0.2	0 TOPSOIL - SILTY SAM	~200 mm thick. ID - scattered clay seams, brown, loose	Э.	259.80
1 SS 2	6-13-20 (33)	PP >450 kPa MC = 14%	0.9	0 CLAYEY S	ILT - some sand, trace gravel, oxidized	, brown, very moist, hard.	259.10
	6-16-24 (40)	PP >450 kPa MC = 13%	111111 111111 111111				
SS 4	12-17-27 (44)	PP >450 kPa MC = 14%	1744741 1744741 1744741				
3 55 	6-11-21 (32)	PP >450 kPa MC = 15%	, , , , , , , , , , , , , , , , , , ,				
	7-24-15 (39)	PP >450 kPa MC = 13%	17477777777777777777777777777777777777				
6 SS 7	10-20-33 (53)	PP >450 kPa MC = 12%	6.00 0 0 0 6.4	5 SAND TILL	- brown, very moist, very dense.	46	254.00
					Bottom of noie at 6.4	₽9 m.	

APPENDIX D

Important Information and Limitations of This Report

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

N.

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder can not be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Ground water Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.



IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.





golder.com



REPORT

Preliminary Geotechnical Investigation, Clearbrook Developments Limited

Proposed Residential Development, Snells Hollow Secondary Plan, Caledon, Ontario

Submitted to:

Clearbrook Developments Limited

Jane Deighton, President 506 - 80 Front Street East Toronto, ON M5E 1T4

Submitted by:

Golder Associates Ltd.

6925 Century Avenue, Suite #100, Mississauga, Ontario, L5N 7K2, Canada

+1 905 567 4444

19115264 Phase 5000

June 24, 2019

Distribution List

1 e-copy: Golder Associates Ltd.

1 e-copy: Clearbrook Developments Limited

1 e-copy: Snells Hollow Developers Group

1 e-copy: Glen Schnarr & Associates Inc.

Table of Contents

1.0	INTR	ODUCTION	.1
2.0	SITE	DESCRIPTION AND BACKGROUND	.1
3.0	ADJA	CENT GEOTECHNICAL SITE INFORMATION	.2
4.0	REGI	ONAL GEOLOGY	.3
5.0	INVE	STIGATION PROCEDURE	.3
6.0	SUBS	SURFACE CONDITIONS	.3
	6.1	Topsoil and (CL-ML) Silty Clay / Clayey Silt (possibly re-worked)	.4
	6.2	(CL) Silty Clay to sandy Silty Clay (Upper Glacial Till)	.5
	6.3	(SM to ML) SILTY SAND to sandy SILT	.5
	6.4	(CL-ML) Clayey Silt (Lower Glacial Till)	.6
	6.5	Groundwater Conditions	.6
7.0	GEO	FECHNICAL ENGINEERING DISCUSSION	.7
	7.1	Site Preparation	.7
	7.1.1	Subgrade Preparation	.7
	7.1.2	Engineered Fill Requirements	.8
	7.2	Installation of Underground Services	.8
	7.2.1	Temporary Excavations	.8
	7.2.2	Pipe Bedding and Cover	.9
	7.2.3	Trench Backfill	10
	7.3	Building Foundations	10
	7.3.1	Below Grade Walls	11
	7.4	Pavement Design within the Proposed Development	11
	7.4.1	Subgrade Drainage	13
8.0	SEIS	MIC SITE CLASSIFICATION	13
9.0	INSP	ECTION AND TESTING	13
10.0	CLOS	SING	13

TABLES

Table 4: Pavement Design 12

FIGURES Figure 1 - Site and Borehole Location Plan

APPENDICES

APPENDIX A Record of Boreholes

APPENDIX B Geotechnical Laboratory Figures

APPENDIX C Previous Geotechnical Borehole Logs

APPENDIX D Important Information and Limitations of This Report



1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by Clearbrook Development Limited (CDL) to provide preliminary geotechnical consulting services to support a draft plan approval for a future residential subdivision development located north east of Kennedy Road and Mayfield Road in Caledon, Ontario (the Site), as shown in the Site and Borehole Location Plan, *Figure 1.*

The terms of reference for the geotechnical consulting services are included in Golder's proposal No. P19115264 Rev 1, dated March 8, 2019.

The purpose of the investigation is to obtain information on the general subsurface soil and shallow groundwater conditions at the site by means of a limited number of boreholes and geotechnical laboratory tests. Based on our interpretation of the factual information collected as part of the preliminary geotechnical investigation carried out at this site, a general description of the subsurface conditions across the site is presented herein. The interpreted subsurface conditions and available project details were used to develop preliminary engineering parameters and recommendations on the geotechnical design aspects of the project, including construction considerations which could influence design decisions.

This report provides the results of the preliminary geotechnical investigation and should be read in conjunction with the *"Important Information and Limitations of This Report"* **Appendix D**. The reader's attention is specifically drawn to this information, as it is essential for the proper use and interpretation of this report. The factual data, interpretations and recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. If the project is modified in concept, location or elevation, or if the project is not initiated within twelve months of the date of the report, Golder should be given an opportunity to confirm that the recommendations in this report are still valid.

2.0 SITE DESCRIPTION AND BACKGROUND

The subject property is located north west of Heart Lake Road and Mayfield Road and is part of the Snells Hollow Secondary Plan, which is a proposed residential development to be located in the southern part of the Town of Caledon. The site is bounded by Heart Lake Road to the east, Mayfield Road to the south, adjacent agricultural properties to the west and Highway 410 to the north, as shown in **Figure 1**.

The site has a total area of approximately 24 hectares (61 acres) of agricultural land, a pond and a valley creek lands. The valley and watercourse / wetland running through the southern portion of the Site, understood to be a tributary to Heart Lake and Etobicoke Creek. The site is predominantly flat land which slopes towards the north to Highway 410 and towards the pond and creek to the south.

Based on our understanding, the Site is to be developed into a residential development with associated underground services and associated roads. For the purposes of this report, we have assumed that the future residential houses will be constructed utilizing shallow strip/spread footings, with an interior slab-on-grade, and one-level of underground basement. We have also assumed cuts and/or fills required for site grading purposes will not exceed 2.0 m and that the invert of the site servicing will be no greater than 3.0 m below existing site grades.

A separate geotechnical slope stability assessment report is carried out as part of the development setback of the property and documented in report titled, "Geotechnical Setback Assessment For Erosion Hazard Limit, Snell's Hollow Secondary Plan, Caledon, Ontario" dated June 2019, by Golder Associated.

3.0 ADJACENT GEOTECHNICAL SITE INFORMATION

An additional geotechnical investigation consisting of ten boreholes were also carried out as part of the Snells Hollow Secondary Plan to the east and west adjacent properties (Golder, 2019). Also, a previous geotechnical investigation consisting of three boreholes was also carried out by Edward Wong and Associates, 2017 (Wong, 2017), to the west property.

The following is a summary of subsurface conditions obtained from boreholes located adjacent to the site (BH/MW19-03, BH/MW19-13, BH/MW19-07 and BH19-18 to BH19-19) from Golder, 2019, and (BH1, BH2 and BH4) from Wong, 2017 as shown on the Site and Borehole Location Plan, *Figure 1*.

In general, the subsurface conditions encountered typically consist of a surficial topsoil ranging in thickness from about 200 mm to over 350 mm overlying a disturbed/reworked dark to light brown silty clay layer, which contains various amounts organics, underlain by glacial till composed of very stiff to hard brown silty clay to sandy silty clay/clayey silt (which in BH4 is possible considered as clayey silty fill) extending to depth ranging from 4 m to 6.1 m below ground surface. A stiff to hard grey clayey silt till was generally found below the brown silty clay till layer. A deposit of gravelly silty sand was found between the brow silty clay till and grey clayey silt till. These subsurface conditions were found to be similar to the subsurface conditions encountered in the boreholes located on CDL site (discussed in detail in subsequent sections).

The record of borehole logs from these reports are enclosed in *Appendix C*. The approximate locations of the boreholes drilled at these sites are shown on the Site and Borehole Location Plan, *Figure 1*.

The groundwater level measurements in the drilled boreholes are summarized in Table 1, below.

Borehole No.	Measurements Upon Completion of Drilling		Measurements in Monitoring Wells	
	Approximate Groundwater Depth (mbegs)*	Date	Approximate Groundwater Depth (mbegs)*	Date
BH/MW19-03	9.1 m (Elev. 257.8 m)	April 4, 2019	7.3 m (Elev. 259.5 m)	April 17, 2019
BH/MW19-07 (Shallow)	N/A	March 27, 2019	6.9 m	April 17, 2019
BH/MW19-07 (Deep)	12.8 m	March 27, 2019	12.8 m	April 17, 2019
BH/MW19-13	Dry	April 4, 2019	9.5 m (Elev. 258.2 m)	April 17, 2019
BH19-18	2.7 m	March 27, 2019	N/A	N/A
BH19-19	Dry	March 28, 2019	N/A	N/A
BH1	Dry	Oct 19, 2018	N/A	N/A
BH2	Dry	Oct 19, 2018	N/A	N/A
BH4	Dry	Oct 18, 2018	N/A	N/A

Table 1: Groundwater Level Measurements (Adjacent Properties)

*mbegs- meters below existing ground surface.

4.0 REGIONAL GEOLOGY

The surficial geology aspects of the general site area were reviewed from the following publication:

 Chapman, L.J., and Putnam, D.F., 2007, "The Physiography of Southern Ontario"; 4th Edition, Ontario Geological Survey.

Physiographic mapping in the area according to the above noted reference indicates that the site lies within the physiographic region of southern Ontario known as the South Slope. The South Slope region slopes gradually downward towards Lake Ontario. The overburden immediately below ground surface within the South Slope generally consists of clayey silt till and silty clay till and at depth consists of alternating deposits of dense lacustrine sands and silts and overconsolidated lacustrine clays and clay tills overlying the bedrock.

The subsurface conditions encountered during the investigation are generally consistent with the physiographic mapping.

5.0 INVESTIGATION PROCEDURE

The field work for the preliminary geotechnical investigation was carried out between March 28, 2019 and on April 5, 2019, during which time seven boreholes (designated as Boreholes BH/MW19-04 to BH/MW19-06, BH19-14 to BH19-17) were advanced at the site to depths between about 6.7 m to 17.4 m below existing ground surface at the approximate locations shown on the Site and Borehole Location Plan, *Figure 1*, attached.

The boreholes were advanced using a track-mounted drill rig supplied and operated by a specialist drilling contractor, subcontracted to Golder. Standard Penetration Testing (SPT) and sampling was carried out at regular intervals of depth in the boreholes using conventional 35 mm internal diameter split spoon sampling equipment advanced using an automatic hammer, in accordance with ASTM D1586 (99).

The shallow groundwater conditions were noted in the open boreholes during and immediately following the drilling operations. Three of the boreholes advanced at the site were equipped with 50 mm diameter monitoring wells to permit further monitoring of the groundwater levels on April 17, 2019. The well installation details and water level readings are presented on the Record of Borehole sheets in *Appendix A*.

The field work for this investigation was directed by members of our engineering staff who located the boreholes in the field, directed the sampling and in-situ testing operation, logged the boreholes and cared for the samples obtained. The samples were identified in the field, placed in appropriate containers, labelled and transported to Golder's Mississauga geotechnical laboratory for further examination and laboratory testing. Index and classification tests, consisting of water content determinations, Atterberg limits and grain size distribution, were carried out on selected soil samples. The results of the geotechnical laboratory tests are included in **Appendix B** and on the Record of Borehole sheets in **Appendix A**.

The borehole locations were determined in the field using a GPS instrument based on UTM coordinates. Geodetic ground surface elevations at the borehole locations were derived from the site grading plan provided by GSAI, "Snell's Hollow Contour Plan, Town of Caledon" dated December 2018. And as such, the elevations and borehole locations given on the Record of Borehole sheets and referred to herein should be considered as approximate.

6.0 SUBSURFACE CONDITIONS

The subsurface soil and shallow groundwater conditions encountered in the boreholes and the results of the field and laboratory testing, are shown on the Record of Boreholes sheets, in **Appendix A**. Method of Soil

Classification and Symbols and Terms Used on Records of Boreholes are provided to assist in the interpretation of the borehole logs. It should be noted that the boundaries between the strata have been inferred from drilling observations and non-continuous samples. They generally represent a transition from one soil type to another and should not be inferred to represent an exact plane of geological change. Further, conditions will vary between and beyond the boreholes. The following is a summary of the subsurface conditions of the boreholes advanced during this investigation followed by a more detailed description of the major soil strata and groundwater conditions.

In general, the subsurface conditions encountered at the boreholes advanced at the site typically consist of a surficial topsoil/silty clay layer underlain by native soil deposits of glacial till composed of silty clay to clayey silt containing varying amounts of sand and gravel. Deposits of silty sand to sand were found below and in between the till deposits in one of the boreholes. The presence of cobbles and/or boulders in the till deposit are inferred from auger grinding, effective refusal of the SPT, and/or rock fragments collected within the SPT sampler.

Details of the observations of the groundwater conditions during and upon completion of drilling are included on the Record of Borehole sheets. Shallow ground water was encountered at depths ranging from 0.4 m to 14.5 m below existing ground surface or between Elev. 252 m to Elev. 262.8 m upon the completion of drilling activities.

6.1 Topsoil and (CL-ML) Silty Clay / Clayey Silt (possibly re-worked)

Topsoil materials were encountered in all the boreholes and extended to depths ranging from 0.23 m to 0.41 m. A summary of topsoil thickness in each of the boreholes is outlined in the table below.

Borehole No.	Approximate Topsoil Thickness (m)
BH/MW19-04	0.20
BH/MW19-05	0.28
BH/MW19-06	0.41
BH19-14	0.30

Table 2: Approximate Topsoil Thickness

Borehole No.	Approximate Topsoil Thickness (m)
BH19-15	0.30
BH19-16	0.33
BH19-17	0.33

Materials identified as topsoil in this report were classified based on visual and textural evidence as no other testing for organic content or other nutrients was carried out. As such, the ability for these materials to support vegetation has not been assessed.

A layer of silty clay/clayey silt soil was encountered in the relevant boreholes (with exception of BH19-14 and BH19-17) below the surficial topsoil. The silty clay / clayey silt resembled a disturbed till or reworked soil, likely the result of past agricultural or re-grading activities, with an interpreted thickness ranging from about 0.3 m to 1.0 m. Variable amounts of organics (rootlets), sand and gravel were observed in the silty clay / clayey silt soils.

SPT 'N' values within the reworked material was found to be 4 blows to 12 blows per 0.3 m of penetration indicating a firm to stiff consistency.

The natural water content of the reworked material was measured at 19 to 21 percent.

The results of grain size distribution tests carried out on one selected sample from this deposit is presented in **Figure B1.** Atterberg limits tests that were carried out on the same sample from this deposit measured liquid
limit value of about 25 and plastic limit value of about 15; yielding corresponding plasticity index value at about 10. These results are plotted on the plasticity chart as shown in **Figure B2**.

6.2 (CL) Silty Clay to sandy Silty Clay (Upper Glacial Till)

A till deposit consisting of cohesive silty clay to sandy silty clay was generally encountered directly underneath the topsoil and clayey (reworked till) deposit to depths ranging from about 0.3 m to 6.7 m below ground surface (Elev. 259.8 m to Elev. 269.7m). The upper till deposit is mottled light brown to brown with oxidation staining, about 1.6 m to 4 m in thickness and contains various amounts of sand and gravel. Silt and sand seams / layers were encountered within the till and a strata of silty sand (about 3 m thick) was found within the till in BH19-14 (as described in section 6.3). Based on previous experience with glacial tills in this area and frequent auger grinding during the advancement of the augers during this investigation, the presence of cobbles and/or possible boulders are inferred within the till deposit.

The SPT 'N' values measured in these till materials range from 6 blows to 44 blows per 0.3 m of penetration, but typically are greater than 7 blows and less than 30 blows, suggesting that the silty clay till is firm to hard in consistency, but generally stiff to very stiff.

The results of grain size distribution tests carried out on three samples of the silty clay till are presented in *Figure B2.*

Three Atterberg Limits tests carried out on selected samples of this till deposit measured liquid limits ranging between 21 and 27, and plastic limits between 14 and 15; yielding a corresponding plasticity index between 8 and 11. These results are plotted on the plasticity chart as shown in *Figure B3.*

The water content measured on selected samples of the upper till ranged from about 7 percent to 19 percent.

6.3 (SM to ML) SILTY SAND to sandy SILT

A deposit of silty sand to sandy silt was encountered within and below the silty clay till deposit in Boreholes BH/MW19-04 and BH19-14 and within the clayey silt till deposit in borehole BH19-15. In Borehole BH/MW19-04, the gravelly silty sand to sand deposit was encountered at depths ranging from 10.7 m to 17 m, and Borehole BH/MW19-04 was terminated within this deposit. In Borehole BH/MW19-14 the silty sand deposit was encountered at depths ranging from 4 m to 7 m below ground surface and about 8 m to 10 m below ground surface. Borehole BH/MW19-14 was terminated within this deposit. In Borehole BH19-15, the silty sand was about 1 m in thickness, found at a depth of about 10 m to 11 m below ground surface. The silty sand to sand to gravelly sandy silt contains various amounts of gravel, clay nodules, is light brown to grey in colour, and is considered non-cohesive in nature with slight plasticity. Similar layers/seems were also found in other boreholes.

The SPT 'N' values measured in the silty sand to sandy silt deposit range from 19 to over 120 blows per 0.15 m of penetration; however, most of the SPT 'N' values measured were greater then 30 blows per 0.3 m of penetration, indicating a compact to very dense, but generally dense to very dense compactness.

The results of grain size distribution tests carried out on selected samples from this deposit are presented in *Figure B5.* Atterberg Limits tests that were carried out on one sample of this deposit measured a liquid limit value about 19, a plastic limit value about 15; yielding a corresponding plasticity index value about 3. These results are plotted on the plasticity chart as shown in *Figure B6, Appendix B.*

The water content of selected samples ranged from about 4 percent to 19 percent.

6.4 (CL-ML) Clayey Silt (Lower Glacial Till)

A clayey silt to sandy clayey silt till deposit was generally encountered directly underneath the silty clay till in all boreholes (with exception of BH19-14) between a depth of 2.1 m to 14.3 m below existing ground surface. The till deposit is cohesive and contains various amounts of sand and gravel, is grey in colour and is believed to contain cobbles and/or possible boulders which have been inferred in this deposit as a result of auger grinding and limestone fragments within the SPT sampler. Silt/sand layers were encountered within BH/MW19-05, BH19-15 and BH19-16 at depths of 6.1 m to 7.6 m below ground surface as noted above.

The SPT 'N' values measured in the of this till deposit range from 14 blows per 0.3 m of penetration to 100 blows per 0.3 m of penetration; however, most of the SPT 'N' values measured within the till were greater between 13 blow to about 34 blows per 0.3 m of penetration, suggesting a stiff to hard consistency. The higher blow counts are possibly attributed to the presents of the cobbles/boulders within the till deposit.

The results of grain size distribution tests carried out on a sample of this till deposit are presented in *Figure B7*. One Atterberg Limit test was carried out on a selected sample of clayey silt till deposit and measured a liquid limit of about 15, plastic limit of about 10; yielding a corresponding plasticity index of 4. These results are plotted on the plasticity chart as shown in *Figure B8, Appendix B*.

The water content of selected samples ranged from about 4 percent to 18 percent.

6.5 Groundwater Conditions

Groundwater level measurements were recorded immediately following drilling procedures. The groundwater level measurements in the drilled boreholes are summarized in *Table 3*, below.

	Measurements Upor Drillin	n Completion of g	Measurements in Mon	itoring Wells
Borehole No.	Approximate Groundwater Depth (begs)*	Date	Approximate Groundwater Depth (begs)*	Date
BH/MW19-04 (Shallow)	N/A	March 29, 2019	3.8 m (Elev. 262.8 m)	April 17, 2019
BH/MW19-04 (Deep)	14.8 m (Elev. 251.7 m)	March 29, 2019	14.5 m (Elev. 252 m)	April 17, 2019
BH/MW19-05	Dry	March 28, 2019	8.3 m (Elev. 262.2 m)	April 17, 2019
BH/MW19-06	2.5 m (Elev. 259. 5 m)	March 28, 2019	0.4 m (Elev. 262.4 m)	April 17, 2019
BH19-14	Dry	April 5, 2019	N/A	N/A
BH19-15	6.0 m (Elev. 257.5 m)	April 1, 2019	N/A	N/A
BH19-16	1.4 m (Elev. 257.0 m)	March 26, 2019	N/A	N/A

Table 3: Groundwater Level Measurements (CDL Property)

*begs- below existing ground surface.

It should be noted that the groundwater level in the area is subject to seasonal fluctuations and precipitation events and should be expected to be higher during wet periods of the year.

7.0 GEOTECHNICAL ENGINEERING DISCUSSION

This section of the report provides preliminary geotechnical engineering recommendations on the geotechnical aspects of the proposed development based on our interpretation of the limited borehole information and on our understanding of the project scope and requirements. The information in this portion of the report is provided for the guidance of the design engineers and professionals.

Based on the results of this investigation, the subsurface soil conditions encountered at the site are considered to be generally suitable for the proposed residential development.

As noted above, at the time of this report, proposed design grades (i.e., finished floor slab elevation, pavement subgrade and utility invert levels) were not available for the proposed development. The following engineering recommendations regarding the geotechnical design aspects of the project including underground services, pavements and building foundations should be considered as preliminary only, and should be reviewed when the final design grades and utility invert levels have been finalized.

Where comments are made on construction, they are provided only in order to highlight aspects of construction which could affect the design of the project. Contractors bidding on or undertaking any work at the site should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction and make their own interpretation of the factual data as it affects their proposed construction techniques, schedule, equipment capabilities, costs, sequencing and the like.

This report addresses only the geotechnical (physical) aspects of the subsurface conditions at this site. The geo-environmental (chemical) aspects, including the consequences of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources, are outside of the terms of reference for this report.

7.1 Site Preparation

7.1.1 Subgrade Preparation

Based on the existing site topography, it is assumed that only minor cut and/or fill site grading operations of less than 2.0 m will be required to establish subgrade levels and permit the construction of the proposed residential development.

Any filling carried out at the site in conjunction with regrading (with the exception of future green spaces) should be carried out as engineered fill. Recommendations for the placement of engineered fill are outlined in **Section 7.1.2** of this report, titled "Engineered Fill Requirements".

In general, the existing site vegetation, surficial topsoil/organics, surficial asphalt/concrete or any other nearsurface soils containing significant amounts of organic matter or construction debris are not considered to be suitable for the subgrade support of engineered fill, building foundations, floor slabs, or other settlement sensitive structures. These materials should be completely stripped prior to placing any engineered fill or construction of foundations or interior or exterior slab-on-grade(s), following appropriate environmental procedures. Furthermore, excessively wet soils should be dried before reuse as engineered fill.

Furthermore; excessively-wet soils should be suitably dried before reuse as engineered fill.

Following the stripping of the surficial topsoil and soils containing significant amounts of organics and/or soft/disturbed surficial soils, the exposed subgrade should be heavily proof-rolled with suitable equipment, in conjunction with inspection by qualified geotechnical personnel to confirm that the exposed soils are competent



and have been adequately stripped of ponded water and all disturbed, loosened, softened, organic and other deleterious material. Remedial work (i.e., further subexcavation and replacement) should be carried out on poorly-performing areas identified during the proof-rolling activities, as directed by Golder.

7.1.2 Engineered Fill Requirements

As described above, the anticipated site grading activities may include both cutting and raising (filling) the original grade to meet the final design site grades. At the time of this report, the design cut and fill depths were not available for review. As such, for the purposes of this report, it has been assumed that cuts will not exceed 2 m and grade raises will not exceed more than 2 m.

In general, the existing native material is considered to be acceptable for reuse as engineered fill. Based on the laboratory test results, the water content of soils present at the site are considered to be generally near or above their optimum water content for compaction, and therefore may require minor drying prior to placement, in general.

It should be noted that the native materials at the site are silty in nature, and as such are susceptible to overwetting and subsequent freezing during inclement weather. Therefore, it is recommended that site grading activities not be carried out during late fall, winter, early spring seasons or any periods of inclement weather conditions. All oversized cobbles (i.e., greater than 150 mm in size) and boulders, if present, should be removed from excavated material that will be used as engineered fill material.

If imported material is required for the engineered fill process, the material that is proposed for use as engineered fill should be approved by the geotechnical engineer at its source, prior to importing the material to the site. Suitable soils, free of topsoil, organic matter or other deleterious materials can be used as engineered fill provided that the water content of the soil at the time of placement does not vary by more than 2 percent above or below its optimum water content for compaction. Otherwise, the soils may require treatment (i.e., drying or wetting) prior to placement.

Following the inspection and approval of the subgrade as described previously in this report, engineered fill materials should be placed in maximum 300 mm-thick loose lifts and uniformly compacted to 98 percent of the Standard Proctor maximum dry density (SPMDD). Filling should continue until the design elevations are achieved.

Full-time monitoring and in-situ density testing should be carried out by Golder during placement of engineered fill.

The final surface of the engineered fill should be protected as necessary from construction traffic and should be sloped to provide positive drainage for surface water during the construction period. If the engineered fill materials will be left exposed (i.e. uncovered) during periods of freezing weather, additional soil cover should be placed above final subgrade to provide some level of frost protection. Prior to placing the granular subbase and/or base courses within pavement areas, the surface of the engineered fill/subgrade should be inspected by Golder.

7.2 Installation of Underground Services

7.2.1 Temporary Excavations

Details of the underground servicing for the proposed development are unknown at the time of this investigation; as such, for the purpose of this report, the maximum depth of the underground services was assumed to be about 3 m below the existing ground surface. Once detailed design is completed, review of the underground services should be completed by this office for compliance with the recommendations contained herein.

The founding soils are anticipated to generally consist of the native sandy silty clay or engineered fill. These materials are considered to be suitable for supporting the underground services provided that the integrity of the base of the trench excavations is maintained during construction. Where softened or disturbed native soils or other deleterious materials are encountered at the base of excavations for settlement-sensitive services, these materials should be subexcavated and replaced with compacted fills approved by the geotechnical engineer.

Care should be taken to direct surface water away from any open excavations and all temporary excavations should be carried out in accordance with the Occupational Health and Safety Act (OHSA) and Regulations for Construction Projects.

In general, the groundwater level in the open boreholes, upon completion of drilling, was measured to be at depths ranging from about 1.4 m to 14.8 m below existing ground surface (Elev. 251.7 m to 261.6 m)Whereas, the groundwater level in the monitoring wells within close proximity, was measured to be at depths ranging from 0.4 m to 14.5 m below existing ground surface, (Elev. 252.0 m to Elev. 262.8 m).

In general, groundwater in the excavations within the native deposits, are likely to be handled by collection via properly constructed and filtered sumps, located within the excavations, and then pumping and discharging the water to a suitable discharge point. However, should excavations deeper than 3m below existing ground surface be required, the following recommendations will need to be review and revised to determine if some form of active dewatering, such as well points, may have to be implemented.

Excavations for the site servicing would generally extend through the native sandy silty clay deposit. Conventional excavation equipment should be suitable to excavate through these materials.

The stiff to hard native silt clay till soils are classified as a "Type 2" soils under the OH&S Act. As such, all conventional temporary trench excavations should consist of open cuts with side slopes not steeper than 1 horizontal to 1 vertical in the overburden soils to within 1.2 m of the base of the excavation and then may be made vertical to the base. Where engineering fill (based on silty clay material) is used or the native silty clay exhibits signs of water seepage, the soil is classified as a "Type 3", as such all conventional temporary trench excavations should consist of 1 horizontal to 1 vertical.

Where the side slopes of excavations are required to be steepened to limit the extent of the excavation, then some form of trench support may be required. Some trench excavations could be carried out using a vertically-excavated, unsupported excavation (using a properly-engineered trench liner box for protection, certified by an experienced engineer); or by a supported (sheeted) excavation if conditions warrant so; such as in wet areas and/or in close proximity to adjacent underground services

7.2.2 Pipe Bedding and Cover

The bedding for the sewers and watermains should be compatible with the size, type and class of pipe and the surrounding subsoil and the requirements of the City of Caledon. If granular bedding is deemed to be acceptable, then Ontario Provincial Standard Specifications (OPSS) Granular A should be used from at least 150 mm below invert to springline. Clear stone should not be used as bedding material. From springline to 300 mm above the obvert of the pipe, sand cover could be used. All bedding and cover material should be placed in 150 mm loose lifts and uniformly compacted to at least 100 percent of SPMDD. Where variable fill materials, softened or disturbed native soils or other deleterious materials are encountered at the base of excavations for settlement-sensitive services, these materials should be subexcavated and replaced with compacted fills approved by the geotechnical engineer.

7.2.3 Trench Backfill

The excavated materials from the site will consist predominantly of silty clay till materials. Based on the measured water contents, in general, the native materials encountered at the site are estimated to be near or above their optimum water contents for compaction, and therefore, will probably require only minor drying prior to placement.

Care should be taken to maintain the water content of the soils close to/at the optimum water content for compaction during the construction operations, as difficulties with compaction and/or backfill performance would be anticipated with fine-grained soils where the water content is significantly above the optimum for compaction purposes. Soils that contain significant quantities of organics or debris are also not suitable for use as trench backfill within settlement-sensitive areas. In addition, all boulders and cobbles greater than 150 mm in size should be removed from the trench backfill materials. If there is a shortage of suitable in-situ material, an approved imported material such as Ontario Provincial Standard Specifications Select Subgrade Material should be used for trench backfill. Again, as noted above, the trench backfill materials are silty in nature and are very susceptible to wetting/freezing temperatures. Backfilling trenches during cold or wet weather is not recommended.

Trench backfill should be placed in maximum 300 mm loose lift thickness and uniformly compacted to at least 98 percent of the SPMDD of the material. Soil that is frozen should not be used as backfill.

Normal post-construction settlement of the compacted trench backfill should be anticipated with the majority of such settlement taking place within about 12 months following the completion of trench backfilling operations. If the trench backfill operations are completed during the winter months, post-construction settlements may increase beyond typical anticipated values. These settlements will be reflected at the ground surface. If the asphalt binder course is laid shortly following the completion of the trench backfilling operations, any settlement that may be reflected by subsidence of the surface of the binder asphalt should be compensated for by placing an additional thickness of binder asphalt or by padding. If possible, the surface course asphalt should not be placed over the binder course asphalt for about 12 months. Where scheduling requires that the surface course be placed over the binder course asphalt before this period, trench backfill settlement would be reflected by subsidence of the finished pavement surface in these areas which, depending upon the extent and magnitude, may require local repairs.

7.3 Building Foundations

As previously indicated, the existing site vegetation, surficial topsoil/organics and other near-surface soils containing significant amounts of organic matter are not considered to be suitable for the subgrade support of engineered fill, building foundations, floor slabs, or other settlement sensitive structures. These materials should be completely stripped prior to placing any engineered fill or construction of foundations or interior or exterior slab-on-grades.

Based on the subsurface conditions encountered in the boreholes, strip and spread footings that may be used, provided that the footings are founded on the native sandy silty clay deposit or on engineered fill (based on existing site soils) placed in accordance with the recommendation outlined in **Section 7.1**, and maintained a minimum depth of soil embedment below finished adjacent ground surface and top of slab of 1.2 m.

For such strip and spread footings, a factored geotechnical resistance at Ultimate Limit States (ULS) of 225 kPa and a geotechnical reaction at Serviceability Limit States (SLS) of 150 kPa may be assumed for design purposes, provided that the strip footings dimensions of 0.45 m in width and 10 m in length or spread footings have a minimum width of 0.60 m and a maximum width of 1.0 m.

Where spread footings are constructed at different elevations, the difference in elevation between the individual footings should not be greater than one half the clear distance 650 mm between the footings. In addition, the

lower footings should be constructed first so that if it is necessary to construct the lower footings at a greater depth than anticipated, the elevation of the upper footings can be adjusted accordingly. Stepped strip footings should be constructed in accordance with the Ontario Building Code (2012), Section 9.15.3.9.

The maximum total and differential settlements are expected to be less than 25 mm and 20 mm; respectively, for footings designed, constructed and inspected as outlined above.

All exterior footings, and interior footings in unheated areas, should be founded at a minimum depth of 1.2 m below finished grade level in order to provide adequate protection against frost penetration.

The native soils are susceptible to disturbance from construction activity, especially during wet or freezing weather. Care should be taken to preserve the integrity of the materials as bearing strata. It is essential that the founding surface for the footings be inspected by qualified geotechnical personnel prior to placing concrete. If the concrete for the footings cannot be placed immediately after excavation and inspection of the subgrade, it is recommended that a working mat of lean concrete be placed in the excavation to protect the integrity of the bearing stratum.

Resistance to lateral forces/sliding resistance between the concrete footings and the subgrade should be calculated in accordance with Section 6.7.5 of the CHBDC. The unfactored coefficient of friction, tan δ , for the interface between the cast-in-place concrete footing and the properly-prepared subgrade can be assumed to be 0.35.

7.3.1 Below Grade Walls

The exterior perimeter of all housing basement walls should be backfilled with an imported free draining, non-frost susceptible granular material approved by a geotechnical engineer, carefully placed and compacted in 200 mm thick loose lifts. The design of the foundation walls for the below-grade walls should take into account the horizontal soil loads as well as surcharge loads that may occur during or after construction and should be designed using a lateral (at-rest) earth pressure coefficient of 0.5 and a unit weight of backfill of 20 kN/m³.

The wall backfill layers should be compacted to at least 95 per cent of the materials' standard Proctor maximum dry density. Light compaction equipment should be used immediately adjacent to the foundation wall, otherwise compaction stresses on the wall may be greater than that imposed by the backfill material. With the exception of the driveway area, the upper 0.3 m of backfill should consist of clayey material to provide a low permeability cap and the exterior grade should also be shaped to slope away from the building.

Provided that the excavations adjacent to foundation/basement walls are backfilled with free-draining granular materials and a drainage collection system is provided around the perimeter of the building, the design of below-grade walls does not need to take into account hydrostatic forces acting on the walls. However, it is recommended that the exterior of the below-grade walls be damp-proofed.

All foundation elements in unheated areas must be provided with at least 1.2 meter of earth cover for frost protection purposes. In addition, the bearing soil and fresh concrete should be protected from freezing during cold weather construction.

7.4 Pavement Design within the Proposed Development

Following site grading operations, as noted previously, the proposed pavement subgrade will generally consist of either re-compacted engineered fill or native silty clay till. These materials are considered to be frost susceptible, and as such, the pavement design provided in *Table 4*, below has taken this condition into consideration.

Based on the proposed pavement usage, (i.e. residential development type traffic and loads/frequencies) frost susceptibility and strength of the subgrade soils, the following pavement component given are recommended for the proposed development of access roads and streets, however the Town of Caledon/Region of Peel design standards should be followed:

Table 4: Pavement Design

		Minimum Thickness of Pa	vement Components (mm)
Material		Local Road (7.9m Road Pavement Width)	9.5 m Neighbourhood Collector (8.9 m Road Pavement Width)
Asphaltic Concrete	HL 3 Surface Course	40	40
(OPSS 1150)	HL 8 Binder Course	65	90
Granular Materials	Granular A Base	150	150
(OPSS.MUNI 1010)	Granular B Type II Subbase	350	500
Total Pavement Thickn	ess (mm)	605	780
		Prepared and Approved Su	bgrade

As part of the subgrade preparation, proposed access roads should be stripped of topsoil and other obviously unsuitable fill or organic materials. Fill required to raise the grades to design elevations should conform to the engineered fill requirements outlined previously in the report. Soft or spongy trench backfill areas should be sub-excavated and properly replaced with suitable approved backfill compacted to 98 percent SPMDD. Prior to placing pavement subbase and/or base materials, the exposed soil subgrade should be heavily proof-rolled in conjunction with an inspection by Golder. The granular subbase and base materials should be placed in loose layers no thicker than 200 mm and uniformly compacted to 100 percent of their SPMDD. The binder course and surface course asphalt materials should be compacted to minimum 92.0 percent of their Marshall Maximum Relative Density according to OPSS 310, as measured in the field using a nuclear density gauge.

Where new pavement abuts existing pavement (e.g. at the development limits), proper longitudinal lap joints should be constructed to key the new asphalt into the existing asphalt surface. The existing asphalt edges should be provided with a proper sawcut edge prior to keying-in the new asphalt. It should be ensured that any undermining or broken edges resulting from the construction activities are removed by the sawcut.

It should be noted that in some cases, even though the compaction requirements have been met, the subgrade strength may not be adequate to support heavy construction loading especially during wet weather or where backfill materials wet of optimum have been placed. In this regard, the design subbase thickness may not be sufficient for a construction haul road and additional subbase (in the order of 450 mm) may be required. In any event, the subgrade should be proofrolled and inspected by Golder prior to placing the subbase and any additional material, as required, consistent with the prevailing weather conditions and anticipated use by construction traffic.

7.4.1 Subgrade Drainage

In order to preserve the integrity of the pavement, continuous subdrains should be placed at the concrete curb lines along both sides of the proposed streets. The invert of the subdrains should be at least 300 mm below the bottom of the Granular "B" subbase and should be sloped to drain to catchbasins. The subdrains should consist of perforated pipe wrapped in a suitable geotextile and surrounded on all sides with a minimum thickness of 150 mm of OPSS.PROV 1002 Concrete Fine Aggregate (i.e. concrete sand).

8.0 SEISMIC SITE CLASSIFICATION

Seismic hazard is defined in the 2012 Ontario Building Code (OBC) by uniform hazard spectra (UHS) at spectral coordinates of 0.2 second, 0.5 second, 1.0 second and 2.0 seconds and a probability of exceedance of 2% in 50 years. The OBC method uses a site classification system defined by the average soil/bedrock properties (e.g. shear wave velocity, Standard Penetration Test (SPT) resistance, undrained soil shear strength, etc.) in the 30 m below the foundation level. There are six site classes from A to F, decreasing in ground stiffness from A, hard rock, to E, soft soil; with site class F used to denote problematic soils (e.g. sites underlain by thick peat deposits and/or liquefiable soils). The site class is then used to obtain acceleration and velocity-based site coefficients F_a and F_v ; respectively, used to modify the UHS to account for the effects of site-specific soil conditions in design.

Based on the results of the preliminary geotechnical investigation and assuming soils below the maximum depth investigated exhibit similar properties / strengths, a **Site Class D** is estimated for planning purposes. The Site Class will need to be verified, and adjusted as necessary, during detail design.

9.0 INSPECTION AND TESTING

During construction, full-time observation should be carried out during engineered fill and site servicing backfill placement, and sufficient foundation inspections, subgrade inspections and in-situ materials testing should be carried out to confirm that the conditions exposed are consistent with those encountered in the boreholes and to monitor conformance to the pertinent project specifications.

10.0 CLOSING

We trust that this preliminary report provides enough preliminary geotechnical engineering information to proceed with the detailed design of the proposed development. If you have any questions regarding the contents of this report or require additional information, please do not hesitate to contact this office.

Signature Page

Golder Associates Ltd.

Erti Mansaku, P.Eng. *Geotechnical Engineer*

JD/EM/JET/sm

qu

Jeff Tolton, C.E.T. Associate, Senior Geotechnical Technologist

Golder and the G logo are trademarks of Golder Associates Corporation

https://golderassociates.sharepoint.com/sites/102461/technical work/phase 5000 - clearbrook developments Itd/19115264 (5000) final georeport clearbrook.docx



- \oplus Approximate Borehole and Monitoring Well Location Approximate Previous and Adjacent Properties Geotechnical Borehole (Edward Wong 2017, Golder 2019) $\mathbf{\Phi}$ Watercourse Waterbody Wetland Site Boundary
- Clearbrook Developments Ltd. Site Boundary

METRE

CLIENT CLEARBROOK DEVELOPMENTS LTD.

CONSULTANT	YYYY-MM-DD	2019-04-16
	DESIGNED	MM
GOLDER	PREPARED	MM
	REVIEWED	EM
	APPROVED	-

AIRBUS DS 2. BASE DATA: LIO MNRF 2019 3. PROJECTION: TRANSVERSE MERCATOR NAD 1983 UTM ZONE 17N

PROJECT PRELIMINARY GEOTECHNICAL INVESTIGATION, PROPOSED RESIDENTIAL DEVELOPMENT, CLEARBROOK DEVELOPMENTS, CALEDON, ON

TITLE SITE AND BOREHOLE LOCATION PLAN

PROJECT NO.	CONTROL	REV.	FIGURE
19115264	5000	-	1

1

APPENDIX A

Method of Soil Classification Abbreviations and Terms used on Record of Borehole List of Symbols Record of Boreholes

Organic or Inorganic	Soil Group	Туре	of Soil	Gradation or Plasticity	Cu	$=\frac{D_{60}}{D_{10}}$		$Cc = \frac{(D)}{D_{10}}$	$(xD_{60})^2$	Organic Content	USCS Group Symbol	Group Name
		s of is mm)	Gravels with ≤12%	Poorly Graded	<4		≤1 or ≥3			GP	GRAVEL	
(ss)	5 mm	/ELS / mass action 14.75	fines (by mass)	Well Graded		≥4 1 to 3			GW	GRAVEL		
by ma	SOILS an 0.07	GRA 50% by oarse fr	Gravels with >12%	Below A Line	n/a		n/a			GM	SILTY GRAVEL	
GANIC it ≤30%	AINED urger th	arc c (>	fines (by mass)	Above A Line			n/a	n/a		<30%	GC	CLAYEY GRAVEL
INOR	SE-GR ass is la	s of mm)	Sands with ≤12%	Poorly Graded		<6		≤1 or 2	≥3		SP	SAND
rganic	COAR by ma	NDS y mass fraction	fines (by mass)	Well Graded		≥6		1 to 3			SW	SAND
0)	(>50%	SA SD% b coarse ∶ aller tha	Sands with >12%	Below A Line			n/a				SM	SILTY SAND
		s us	fines (by mass)	Above A Line			n/a				SC	CLAYEY SAND
Organic or	Soil	Type	of Soil	Laboratory		F	ield Indica	Throad	Toughness	Organic	USCS Group	Primary
Inorganic	Group			lests	Dilatancy	Strength	Test	Diameter	(of 3 mm thread)	Content	Symbol	Name
				Liquid Limit	Rapid	None	None	>6 mm	roll 3 mm thread)	<5%	ML	SILT
lss)	75 mm	and l	icity low)	<50	Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
6 by ma	iOILS han 0.0	SILTS dic or P	n Plast hart b€		Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
GANIC nt ≤30%	INED S naller ti	seld-uc	ă ° Ū	Liquid Limit	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	МН	CLAYEY SILT
INOR	E-GRA ss is sr	Ž		250	None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	ОН	ORGANIC SILT
Organic	FINI by ma		chart Chart	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to	CL	SILTY CLAY
0)	(≥50%	CLAY:	sticity 0 below	Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium	30%	CI	SILTY CLAY
		a)	Pla	Liquid Limit ≥50	None	High	Shiny	<1 mm	High	Note 2)	СН	CLAY
× S S S	nic >30% ss)	Peat and mix	mineral soil tures							30% to 75%		SILTY PEAT, SANDY PEAT
HIGHI ORGAN SOIL	ontent : by ma	Predomir may con	nantly peat, Itain some							75% to	PT	PEAT
40	0	amorph	ious peat				_	D 10		100%		
-	Low	Plasticity	N	fedium Plasticity	∢ Hig	h Plasticity	-	a hyphen,	bol — A dual for example,	GP-GM, S	two symbols s SW-SC and Cl	separated by ML.
					CLAY	Pro Tale		For non-co	hesive soils,	the dual sy	ymbols must b 12% fines (i e	e used when
30					СН	11°		transitiona	I material be	etween "c	lean" and "di	rty" sand or
¢.				SILTY CLAY				gravel.				
ndex (F				a	ORGANICS	ILT OH		For cohes	ive soils, the	dual symb	ol must be us	ed when the
sticity 1				Nine				of the plas	ticity chart (s	ee Plastici	ty Chart at left).
14		SILTY C	AY	/								
10		α	/					Borderlin separated	e Symbol — by a slash_fe	A borderl	INE SYMBOL IS	two symbols
7	1		C	LAYEY SIL T ML RGANIC SILT OL				A borderlin	ne symbol sh	ould be us	sed to indicate	that the soil
4 5	ILTY CLAY-CLAY	EY SILT, CL-ML						has been	identified as	having p	properties that	are on the
0	SILT ML (See Note 1)	nie m	40		÷		transition t	between simil	ar materia	is. In addition,	a borderline
×	10	20	25.5 30 Li	quid Limit (LL)	60	70	80	within a st	ratum.	indicate a	Tange of Silli	iai son types
Note 1 – Fir slight plast	ne grained icity. Fine-	materials wi grained mat	th PI and LL terials which a	that plot in this a are non-plastic (rea are nameo i.e. a PL canno	I (ML) SILT w ot be measure	ith ed) are					

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

named SILT. Note 2 – For soils with <5% organic content, include the descriptor "trace organics" for soils with between 5% and 30% organic content include the prefix "organic" before the Primary name.

ら GOLDER

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (<i>i.e.</i> , SAND and GRAVEL)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_i) , porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d: The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

- PH: Sampler advanced by hydraulic pressure
- PM: Sampler advanced by manual pressure
- WH: Sampler advanced by static weight of hammer
- WR: Sampler advanced by weight of sampler and rod

(
Com	npactness ²
Term	SPT 'N' (blows/0.3m) ¹
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

NON-COHESIVE (COHESIONLESS) SOILS

1. SPT 'N' in accordance with ASTM D1586, uncorrected for the effects of overburden pressure.

Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic 2. trip hammers), overburden pressure, groundwater conditions, and grainsize. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

SAMPLES	
AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
GS	Grab Sample
MC	Modified California Samples
MS	Modified Shelby (for frozen soil)
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
ТО	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample

SOIL TESTS

w	water content
PL, w _p	plastic limit
LL, WL	liquid limit
С	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test ¹
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement ¹
DR	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
М	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO ₄	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1 Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

COHESIVE SOILS Consistency				
Very Soft	<12	0 to 2		
Soft	12 to 25	2 to 4		
Firm	25 to 50	4 to 8		
Stiff	50 to 100	8 to 15		
Very Stiff	100 to 200	15 to 30		
Hard	>200	>30		

1 SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure

SPT 'N' in accordance with ASTM D 1900, unconceded to overballed processes effects; approximate only. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations. 2.

	Water Content
Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.

Unless otherwise stated, the symbols employed in the report are as follows:

I.	GENERAL	(a) w	Index Properties (continued)
π	3.1416	w or LL	liquid limit
ln x	natural logarithm of x	w₀ or PL	plastic limit
log ₁₀	x or log x, logarithm of x to base 10	l₀ or PI	plasticity index = $(w_1 - w_p)$
q	acceleration due to gravity	ŃP	non-plastic
ť	time	Ws	shrinkage limit
		۱L	liquidity index = $(w - w_p) / I_p$
		lc	consistency index = $(w_l - w) / I_p$
		emax	void ratio in loosest state
		emin	void ratio in densest state
		ID	density index = $(e_{max} - e) / (e_{max} - e_{min})$
II.	STRESS AND STRAIN		(formerly relative density)
γ	shear strain	(b)	Hydraulic Properties
Δ	change in, e.g. in stress: $\Delta \sigma$	n	nydraulic nead or polenilai
3		q	
εv	volumetric strain	V	
η		1	
υ	Poisson's ratio	K	hydraulic conductivity
σ	total stress		(coefficient of permeability)
σ'	effective stress ($\sigma' = \sigma - u$)	J	seepage force per unit volume
σ'_{vo}			
σ1, σ2, σ3	principal stress (major, intermediate,		Concelidation (one dimensional)
	minor)	(6)	comprossion index
	mean stress or octahedral stress	Uc	(normally consolidated range)
Goct	$= (a_1 \pm a_2 \pm a_3)/2$	C	(normally consolidated range)
_	$-(\sigma_1 + \sigma_2 + \sigma_3)/3$	Ur	(over consolidated range)
τ	sileal siless	C	(over-consolidated range)
u F	modulus of deformation	Cs Ca	secondary compression index
G	shear modulus of deformation	m _v	coefficient of volume change
ĸ	bulk modulus of compressibility	Cv	coefficient of consolidation (vertical
			direction)
		Ch	coefficient of consolidation (horizontal direction)
		Tv	time factor (vertical direction)
III.	SOIL PROPERTIES	U	degree of consolidation
		σ΄ρ	pre-consolidation stress
(a)	Index Properties	OCR	over-consolidation ratio = σ'_p / σ'_{vo}
ρ(γ)	bulk density (bulk unit weight)*		
ρd(γd)	dry density (dry unit weight)	(d)	Shear Strength
ρω(γω)	density (unit weight) of water	τ_p, τ_r	peak and residual shear strength
ρs(γs)	density (unit weight) of solid particles	φ ′	effective angle of internal friction
γ'	unit weight of submerged soil	δ	angle of interface friction
	$(\gamma' = \gamma - \gamma_w)$	μ	coefficient of friction = tan δ
D _R	relative density (specific gravity) of solid	c′	effective cohesion
	particles ($D_R = \rho_s / \rho_w$) (formerly G_s)	Cu, Su	undrained shear strength (ϕ = 0 analysis)
е	void ratio	р	mean total stress (σ_1 + σ_3)/2
n	porosity	p'	mean effective stress ($\sigma'_1 + \sigma'_3$)/2
S	degree of saturation	q	(σ1 - σ3)/2 or (σ′1 - σ′3)/2
		\mathbf{q}_{u}	compressive strength (σ_1 - σ_3)
		St	sensitivity
* Densi	ty symbol is a Unit weight symbol is v	Notes: 1	$\tau = C' + \sigma' \tan \phi'$
where	$\gamma = \rho q$ (i.e. mass density multiplied by	2	shear strength = (compressive strength)/2
accele	eration due to gravity)	-	



RECORD OF BOREHOLE: BH/MW19-04

LOCATION: Lat. 43.750748 Long. -79.810026 (See Figure 1)

BORING DATE: March 28, 2019

SHEET 1 OF 2 DATUM: Geodetic

METRES	BORING METHOD	SOIL PROFILE	() () () () () () () () () () () () () (NUMBER	MPLE	BLOWS/0.3m 0	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s 10^{-6} 10^{-5} 10^{-4} 10^{-3} WATER CONTENT PERCENT Wp $- \qquad $	ADDITIONAL LAB. TESTING	PIEZOMETEF OR STANDPIPE INSTALLATIO
0 -	B	GROUND SURFACE TOPSOIL (200 mm) (CL) SILTY CLAY, some sand, trace organics; dark brown; cohesive, w <pl, firm (CL) gravelly sandy SILTY CLAY; light brown with oxidation staining, (TILL); cohesive, w<pl, stiff="" stiff<="" th="" to="" very=""><th>Log (III) 266.5 0.0 266.5 0.0 266.7 0.2 265.7 0.2 265.7 0.7 265.7 0.7 265.7 0.7 265.8 0.7 265.7 0.7</th><th>0 0 1A 0 1B 4 6 2 3</th><th>SS SS SS SS SS</th><th>8 8 16 12</th><th>20 40 60 80</th><th></th><th>PP = 150 kPa PP = 245 kPa</th><th></th></pl,></pl, 	Log (III) 266.5 0.0 266.5 0.0 266.7 0.2 265.7 0.2 265.7 0.7 265.7 0.7 265.7 0.7 265.8 0.7 265.7 0.7	0 0 1A 0 1B 4 6 2 3	SS SS SS SS SS	8 8 16 12	20 40 60 80		PP = 150 kPa PP = 245 kPa	
3				4	SS	12		а <u></u> і	MH PP = 290 kPa (345 kPa	Bent- onite 2019
4 5	UNIT TO TRACK MOUTH OWER AUGO			6	SS	28		0	PP = 390 kPa	Sand No. 10
7		 Cobble/boulders inferred from auger grinding at a depth of 6 m Silty sand seam at a depth of 6.2 m (CL-ML) sandy CLAYEY SILT, trace gravel; grey, (TILL); cohesive, w>PL, stiff to hard 	259.7 259.7 259.7	9 7 1 8	SS	30		0	PP = 340 kPa	Screen - A
8				9	SS	37		0	PP = 440 kPa	Bentonite
10 —		CONTINUED NEXT PAGE								

PROJECT:	19115264-1000/5000

RECORD OF BOREHOLE: BH/MW19-04

LOCATION: Lat. 43.750748 Long. -79.810026 (See Figure 1)

BORING DATE: March 28, 2019

SHEET 2 OF 2

Ē	ш	6	3	SOIL PROFILE			SA	MPL	.ES	DYNAMIC P		TION VS/0.3m	Ì	HYDR.		ONDUCT	IVITY,	Т	. (7)	
	SCAL				-OT		~		Зm	20	40	60	80	1	0 ⁻⁶ 1	0 ⁻⁵ 1	0 ⁻⁴ 10	_{p³} ⊥	STING	PIEZOMETER OR
	AETR		2	DESCRIPTION	A PL	ELEV.	ABEF	ΡE	/S/0.:	SHEAR STR	RENGTH	nat V. +	Q-•	w	I /ATER C	I ONTENT	PERCE	i NT	DITIO	STANDPIPE
	DEP				TRAT	DEPTH (m)	Ñ	ŕ	SLOW	Cu, kPa		rem V. ∉	• U- O	W	p		— I	W	AD	
-			-		ίΩ.				ш	20	40	60	80	1	10 2	20 3	60 4 	0		
	- 10			(CL-ML) sandy CLAYEY SILT, trace	H.Y	1														
				gravel; grey, (TILL); cohesive, w>PL, stiff to hard																-
_																				-
				(SW//SM) gravelly SILTY SAND coarse	11 4	255.76	11A	ss	120/										PP = 150 kPa	-
E	- 11			to fine; light brown to brown;			11B	ss	6"											-
_				very dense																-
																				-
þ																				-
	- 12					,														-
																				-
Ē							12		62											
							12	33	02											-
																				-
Ē	- 13	Auger																		-
Я		ower	tem																	-
19		fount F	Solid S																	-
17/6/		rack N	um (-
105	- 14	E 75 T	<u>ē</u>			-	13	SS	19					0						
MIS.0		СM																		-
GAL						054 75														 17/04/2019 ເລັ
ΓdΒ				(SP) SAND, some silt, trace clay; light		14.75														
CGS.(- 15			grey; wet, compact to dense																Sand Sand
ЯН ГО																				
MO							14	ss	31						0				мн	(11) (11) (11) (11) (11) (11) (11) (11)
Ę																				1
ILLS	- 16																			Screen and Sand
-SNE																				() - () - () - () - () () - () - () - ()
5264																				
11911							15	SS	22											12 I I I I I I I I I I I I I I I I I I I
	- 17																			
112						249.13														
EDO				END OF BOREHOLE.		17.37														
CALI				Notes: 1. Water level measured in monitoring																-
NTS	- 18			well as follows:																-
PME				Deep Well Date Depth Elev. (m)																-
FEL				March 29, 2019 14.8 mbgs 251.7 m April 17, 2019 14.55 mbgs 251.95 m																-
KDE				Shallow Well																-
3ROC	- 19			Date Deptn Elev. (m) April 17, 2019 3.75 mbgs 262.75 m																-
EARE				2. PP = unconfined compressive																-
S/CL				penetrometer on sample in the field.																-
ENT																				-
ا ت ::	- 20																			-
010																				
BHS (DE	PTI	нs	CALE						S G			R						LC	OGGED: JD
GTA	1:	50									~ L		•						СН	ECKED: EM

RECORD OF BOREHOLE: BH/MW19-05

LOCATION: Lat. 43.75409 Long. -79.807715 (See Figure 1)

BORING DATE: March 28, 2019

SHEET 1 OF 2 DATUM: Geodetic

METRES	ORING METHOD	SOIL PROFILE DESCRIPTION	FRATA PLOT	ELEV. DEPTH (m)	NUMBER	MPLE Bd/T	tLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m ↓ 20 40 60 80 SHEAR STRENGTH nat V. + Q.● ↓ ○ Cu, kPa rem V. ⊕ U.○ ○	HYDRAULIC CONDUCTIVITY, k, cm/s 10 ⁻⁵ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³ WATER CONTENT PERCENT Wp I → O ^W I WI	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	ä	GROUND SURFACE	ST	070.50		_	m	20 40 60 80	10 20 30 40		
0		TOPSOIL (280 mm)		270.50	1A	SS					
		(CL) SILTY CLAY, trace gravel, trace organics; dark to light brown; cohesive, w~PL, stiff		270.22 0.28 269.74	1B	ss	12		Φ		
1		(CL) SILTY CLAY, some sand, trace gravel; light brown with oxidation staining, (TILL); w <pl, stiff<="" td="" very=""><td>A P A P A P A</td><td>0.76</td><td>2</td><td>ss</td><td>24</td><td></td><td>0</td><td></td><td></td></pl,>	A P A P A P A	0.76	2	ss	24		0		
2					3	SS	26				
3					4	SS	23		0		Bentonite
Ū					5	SS	26		0		
4	CME 75 Track Mount Power Auger	(CL-ML) CLAYEY SILT, trace sand to sandy, trace gravel; grey, (TILL); cohesive, w <pl, hard<="" th=""><th></th><th>265.64 4.86</th><th>6A 6B</th><th>SS SS</th><th>44</th><th></th><th>0</th><th></th><th>Sand</th></pl,>		265.64 4.86	6A 6B	SS SS	44		0		Sand
6 7		- Becoming sandy, with sand seams below a depth of 6.1 m			7	ss	77				Screen and Sand
8		- Silty sand layer/stratum encountered at a depth of 7.6 m			8	SS	94		0		↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓
9			A A A A A A A A	260.75	9	SS 1	100				Bentonite
10					$\lfloor \downarrow$		_		┟──┝──┼──┝──┼──	.	
		CONTINUED NEXT PAGE									
9 10 DE	 	END OF BOREHOLE. CONTINUED NEXT PAGE SCALE		<u>260.75</u> 9.75 - — —	9	SS 1	100	GOLDER		Lu CH	Bentonite DGGED: JD IECKED: EM

GTA-BHS 001 G.1 CLIENTSICLEARBROOKDEVELOPMENTSICALEDON/12 GINT/19/15/264-SNELLSHOLLOW BH LOGS.GPJ GAL-MIS.GDT 17/6/19 JMC

RECORD OF BOREHOLE: BH/MW19-05

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m

40

60

80

LOCATION: Lat. 43.75409 Long. -79.807715 (See Figure 1)

SOIL PROFILE

BORING DATE: March 28, 2019

20

SAMPLES

SHEET 2 OF 2 DATUM: Geodetic

PIEZOMETER

OR

HYDRAULIC CONDUCTIVITY, k, cm/s

10⁻⁵

10⁻³

10⁻⁶

BORING METHOD DEPTH SCALE METRES ADDITIONAL LAB. TESTING STRATA PLOT 10-4 BLOWS/0.3m NUMBER STANDPIPE ТҮРЕ ELEV. SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - ○ WATER CONTENT PERCENT DESCRIPTION **INSTALLATION** DEPTH -0W Wp 🛏 - W (m) 60 10 30 40 20 40 80 20 --- CONTINUED FROM PREVIOUS PAGE ---10 Notes: 1. Borehole dry upon completion of drilling. 2. Water level measured in monitoring well as follows:
 Date
 Depth
 Elev. (m)

 March 28, 2019
 Dry
 Dry

 April 17, 2019
 8.32 mbgs
 262.18 m
 11 12 13 14 15 16 17 18 19 20 \Diamond DEPTH SCALE GOLDER LOGGED: JD 1 : 50 CHECKED: EM

RECORD OF BOREHOLE: BH/MW19-06

LOCATION: Lat. 43.752469 Long. -79.804999 (See Figure 1)

BORING DATE: March 2, 2019

SHEET 1 OF 1 DATUM: Geodetic

Щ	Τ	<u>р</u>	SOIL PROFILE	· · ·		SA	MPLI	ES	DYNAMIC PENETRA RESISTANCE, BLO	ATION	HYDRAU k	ILIC CONDU , cm/s	ICTIVITY,	ت آ	
DEPTH SCA METRES		BORING METI	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	20 40 SHEAR STRENGTH Cu, kPa	60 80 I nat V. + Q - ● rem V. ⊕ U - ○ 60 80	10 ⁶ WA ⁻ Wp		10 ⁻⁴ 10 ⁻³ NT PERCENT W 1 W 30 40	ADDITIONA LAB. TESTIN	OR STANDPIPE INSTALLATION
	-		GROUND SURFACE		262.00				20 40				30 40		
- (- -			TOPSOIL (410 mm)		0.00 261.59	1A	ss	9							Ϋ́
	1		(CL) SILTY CLAY, trace organics, some to trace sand, trace gravel; dark brown; cohesive, w>PL, firm		0.41	1B 2	SS SS	5							17/04/2019
	2		(CL) SILTY CLAY, some sand to sandy, trace gravel; light brown, (TILL); cohesive, w>PL, stiff to very stiff		260.55 1.45	3	SS	14							Bentonite –
	3				258.88	4 5A	SS SS	28							∑ 28/03/2019 -
	t Power Auger	Stem	(CL-ML) CLAYEY SILT, trace sand and gravel; grey, (TILL); cohesive, w>PL, very stiff to hard	A A A A A A A A A A A A A A A A A A A	3 <u>.</u> 12	5B	SS	39							78 271
	t + CME 75 Track Mount	100 mm Solid			-	6	SS	15							Sand X X
	7				-	7	ss	27							Screen and Sand
	в				253.68 8 32	8	SS	36							Bentonite
	9		END OF BOREHOLE. Notes: 1. Water level measured in monitoring well as follows: Date Depth Elev. (m) March 28, 2019 2.54 mbgs 259.46 m April 17, 2019 0.38 mbgs 261.62 m		8.32										-
D D)EP : 50	TH S	I SCALE	1 1					GOL	DER	<u> </u>			L(CH	DGGED: JD ECKED: EM

RECORD OF BOREHOLE: BH19-14

LOCATION: Lat. 43.749015 Long. -79.809338 (See Figure 1)

BORING DATE: April 5, 2019

SHEET 1 OF 2

	DOH-		SOIL PROFILE	т	1	SA	MPLI	ES	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	
METRES	ORING MET		DESCRIPTION	RATA PLO	ELEV. DEPTH	NUMBER	ТҮРЕ	_OWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O	10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³ WATER CONTENT PERCENT Wp I → → W I WI	
	ă		GROUND SURFACE	ST	(11)			B	20 40 60 80	10 20 30 40	
0		+	TOPSOIL (300 mm)	EEE	269.00	10					
			(CL) sandy SILTY CLAY, trace to some gravel; brown with oxidation staining, (TILL); cohesive, w <pl, firm="" hard<="" td="" to=""><td></td><td>268.70 0.30</td><td>1B</td><td>SS</td><td>6</td><td></td><td></td><td></td></pl,>		268.70 0.30	1B	SS	6			
1						2	SS	19		011	PP = 320 kPa MH
2			- Cobbles/boulders inferred from auger			3	SS	21		0	РР = 320 кРа
3			grinaing at 2.3 m			4	SS	23			PP = 245 kPa
					265.00	5	SS	36		0	РР = 340 КРа
4	unt Power Auger	alid Stem	(SM) SILTY SAND, trace gravel; light brown; moist, compact to dense		4.00	-					
5	CME 75 Track Mo	100 mm Sc				6	SS	24		0	
						7	ss	32		0	мн
7			(CL) sandy SILTY CLAY, trace gravel; brown, (TILL); cohesive, w~PL, hard		261.99 7.01						
8			(ML/SM) gravelly sandy SILT to gravelly SILTY SAND, fine grained, trace clay, slight plasticity, trace cobbles inferred from auger grinding; light brown, non-cohesive, moist, very dense		261.00	8A 8B	SS	94		0	PP = 440 kPa
9			END OF BOREHOLE.		259.25 9.75	9	SS	96		0	
10		-			+		\vdash –	-	-+	+	-

RECORD OF BOREHOLE: BH19-14

LOCATION: Lat. 43.749015 Long. -79.809338 (See Figure 1)

BORING DATE: April 5, 2019

SHEET 2 OF 2 DATUM: Geodetic

ľ	ш	Q	SOIL PROFILE			SA	MPLE	s			m	HYDRAUL		- 0	
	SCALI	1ETHC		Ъ.				ш	20 4	0 60	80	к, 10 ⁻⁶	10 ⁻⁵ 10 ⁻⁴ 10 ⁻³	STING	PIEZOMETER OR
	OTH S	M DN	DESCRIPTION	TA PL	ELEV.	MBEF	ЧРЕ 	VS/0.:	SHEAR STREE	IGTH nat \	/. + Q-•	WATE	ER CONTENT PERCENT	TEG.	STANDPIPE INSTALLATION
	DEP	BOR		TRAT	DEPTH (m)	INN	́н	BLOV	Cu, kPa	rem	v.⊕ U-O	Wp 🛏	——————————————————————————————————————	LAE	
┟			CONTINUED FROM PREVIOUS PAGE	w v			+	-	20 4	10 60	80	10	20 30 40		
Ē	- 10		Notes:												-
			drilling.												-
			2. PP= unconfined compressive strength												-
E			the field.												-
ŀ	- 11														
															-
ŀ															-
															-
	- 12														-
															-
ŀ															-
ŀ															-
ŀ	- 13														
ę															
1 1 1 1 1															
17/6/															-
Ц	- 14														-
MIS.0															-
GAL															-
GPJ															-
OGS.	- 15														-
BHLO															-
NO															-
Н															-
ELLS	- 16														-
4-SN															-
11526															-
T/19															-
5 S	- 17														
11NC															-
ĻED															
S\CA															-
MENT	- 18														
LOPA															-
90KI															-
RBR	- 19														
CLEA															:
NTS															-
ULE C															-
б Ю	- 20														_
S 001		I								<u> </u>	I	1		-	I
A-BH	DE	PTH S	SCALE					X	S GO	LDI	ER			L	OGGED: JD
5	1:	50												CH	ECKED: EM

RECORD OF BOREHOLE: BH19-15

LOCATION: Lat. 43.751797 Long. -79.80950 (See Figure 1)

BORING DATE: April 1, 2019

SHEET 1 OF 2

Τ	дo	Ţ	SOIL PROFILE		. <u> </u>	SA	MPL	.ES		HYDRAULIC CONDUCTIV k, cm/s	
METRES	ORING METH		DESCRIPTION	RATA PLOT	ELEV. DEPTH	NUMBER	ТҮРЕ	LOWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + Q- Cu, kPa rem V. ⊕ U-	10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ WATER CONTENT Pr Wp → W	
+	à	+		ST		\vdash	\square		20 40 60 80	10 20 30	40
∘⊦	Τ	+	TOPSOIL (300 mm)	ESF	263.50	; '		\vdash			
1		-	(CL) SILTY CLAY, trace organics, trace gravel; brown; cohesive, w>PL, firm (CL) SILTY CLAY and SAND, trace gravel; mottled light brown to brown, (TILL); cohesive, w <pl, firm="" stiff<="" td="" to=""><td></td><td>263.20 0.30 262.89 0.61</td><td>1A 1B 2</td><td>SS SS SS</td><td>7</td><td></td><td>0</td><td></td></pl,>		263.20 0.30 262.89 0.61	1A 1B 2	SS SS SS	7		0	
2		_	(CL-ML) CLAYEY SILT, some sand to sandy, trace gravel; grey, (TILL); cohesive, w <pl, hard<="" stiff="" td="" to=""><td></td><td>261.52 1.98</td><td>3A 2 3 3B</td><td>ss</td><td>13</td><td></td><td>0</td><td>РР = 250 кРа</td></pl,>		261.52 1.98	3A 2 3 3B	ss	13		0	РР = 250 кРа
3						4	ss	14			PP = 345 KPa MH
4						5	SS	15		o l	РР = 250 КРа
5	CME 75 Track Mount Power Auger	100 mm Solid Stem				6	ss	31		0	PP = 300 kPa
7					× × × × × × × × ×	7	ss	15		0	РР = 320 кРа
8			- Contains sand layers at 7.8 m		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	8	ss	17		0	PP = 320 kPa
9		_	(SM) SILTY SAND to SILT, trace to some clay; grey; wet, compact	A A A A A A A A A A A A A A A A A A A	253.84 9.66	9A 4 3 9B	ss	27		о он	PP = 320 kPa MH
			CONTINUED NEXT FAGE								

RECORD OF BOREHOLE: BH19-15

LOCATION: Lat. 43.751797 Long. -79.80950 (See Figure 1)

BORING DATE: April 1, 2019

SHEET 2 OF 2

ŀ		6	5				SA	MPI	ES	DYNAN	IC PEN	ETRAT	NC	1	HYDR.		ONDUCT	IVITY,	-		
	SALE				۲					RESIST	TANCE,	BLOWS	/0.3m	×,		k, cm/s	0- 5	-4 : - 3	\downarrow	ING ^R	PIEZOMETER
	H SC TRE		1 1 1	_	PLO	ELEV.	ЗËR	щ	:/0.3n			ICTU ·	bU 8				U 10 L ONITENIT		-	TEST	OR STANDPIPE
	MEPT			DESCRIPTION	RATA	DEPTH	NUME	ΤΥF	SMO	Cu, kPa	a a likeli	igin i	em V. ⊕	ŭ- Ö						ABD	INSTALLATION
					STF	(m)	Ĺ		Ē	20	D 4	οε	50 E	80		0 2	0 3	0 40			
	- 10			CONTINUED FROM PREVIOUS PAGE																	
	-			(SM) SILTY SAND to SILT, trace to some clay; grey; wet, compact																	
	-					253.01															-
	-			(CL-ML) CLAYEY SILT, some sand to		10.49															-
	-			cohesive, w <pl, hard<="" td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>																	
F	- 11						10	SS	45						C					PP = 440 kPa	-
E	-																				
	-	er																			
	-	er Aug																			
-	-	Powe	Stem		1																
	- 12 -	Mount	Solid																		-
ŀ	-	rack N	mm																		
ŀ	-	E 75 T	9	- Increased sand content below 12.5 m			11	SS	41						0	н			4	PP = 440 kPa	
	-	GM		depth																мн	
ŀ	- - 13	1																			
	-																				-
Ϋ́	-																				:
5/19	-																				
17/(-																				-
GDT	- 14 - -						12	SS	31							0			4	PP = 420 kPa	
MIS	-			END OF BOREHOLE.	14	249.17															
GAL	-	1		Notes:																	-
G	-			1. Water level measured at 6.0 mbgs upon completion of drilling.																	
GS.C	— 15 -			2 PP= unconfined compressive strength																	-
의 도	-			measured with pocket penetrometer in the field																	-
МВ	-																				-
3	-																				
<u>S</u>	- 16																				
NEL	-																				
64-S	-																				
1152	-																				
T/19	-	1																			
U U	- 17 -	1																			-
N/12	-	1																			
БО	-	1																			
CALI	-	1																			
NTS/	- - 18																				_
PME	-																				
ΪĮ	-	1																			
DEV	-	1																			
Х ОО	-	1																			
RBR	- 19 - -																				-
ΪĘ	-																				
ITS/C	-																				
Z	-																				
0 ;;	- 20																				-
5																					
D SH	DF	рт	ня	CALE							~ ~		. – -	`						IC	GGED: .ID
TA-B	1 ·	50								> (O و) E F	ĸ						СНІ	ECKED EM
с		50																		0.11	

RECORD OF BOREHOLE: BH19-16

LOCATION: Lat. 43.751797 Long. -79.80950 (See Figure 1)

BORING DATE: March 26, 2019

SHEET 1 OF 1

	ц	G	3	SOIL PROFILE			SA	MPL	ES	DYNAMIC PEN RESISTANCE,	ETRAT BLOW	ON 6/0.3m	~	HYDR	AULIC C k, cm/s	ONDUC	FIVITY,	T		
	TRES	METL			PLOT		ШШ	D1	0.3m	20	10	60 E	i0 ``	10	D ⁻⁶ 1	0 ⁻⁵ 1	0 ⁻⁴ 1	0 ⁻³ ⊥	TIONA	OR STANDPIPE
H L	MET		צוא	DESCRIPTION	ATA F	DEPTH	IUMBE	ТҮРЕ)/S//C	SHEAR STREI Cu, kPa	IGTH	nat V. + rem V. ⊕	Q - O U - O	W			PERCE	NT	ADDIT AB. TI	INSTALLATION
_	2	a	2		STR	(m)	2		BLO	20 4	10	<u>60 8</u>	0	1	0 2	20 3	30 4	40		
-	0			GROUND SURFACE TOPSOIL (330 mm)	eee	257.00					-					-				
				(CL-ML) sandy CLAYEY SILT, trace to some gravel, trace organics; brown to grey; cohesive, w>PL, soft		256.67 0.33 256.39 0.61	1A 1B	SS SS	4						F	-10			мн	
	1			(CL) sandy SILTY CLAY, trace sand, trace gravel; light brown, (TILL); cohesive, w <pl, stiff="" stiff<="" td="" to="" very=""><td></td><td></td><td>2</td><td>SS</td><td>12</td><td></td><td></td><td></td><td></td><td></td><td>0</td><td></td><td></td><td></td><td></td><td>-</td></pl,>			2	SS	12						0					-
	2						3	SS	25						0					⊻26/03/2019
		er Auger					4	SS	21						0					
	3	75 Track Mount Powe	100 mm Solid Stem				5	SS	17						0					-
	4	CME		(CL-ML) CLAYEY SILT, trace gravel;		252.35 4.65	6A	SS	14											-
	5			grey, (TILL); cohesive, w≺PL, štiff to very stiff - Silt/sand layer at a depth of 4.9 m	A A A A A A A A A A A A A A A A A A A															-
	6			- Silty sand/sandy silt layer at a depth of 6 m - 6.2 m	X T X T X T X T X T X T X T X T X T X T		7A 7B 7C	SS SS SS	27						C					
	7			END OF BOREHOLE Notes: 1. Water level measured at 1.4 mbgs upon completion of drilling.	X (#1	250.29 6.71														-
	8																			
	9																			-
	10																			-
· · · · · · · · · · · · · · · · · · ·	DE 1 :	PT 50	нs	CALE	<u> </u>					S G C			ר א	<u> </u>		<u> </u>			L.C. CH	DGGED: JD ECKED: EM

RECORD OF BOREHOLE: BH19-17

LOCATION: Lat. 43.753061 Long. -79.806846 (See Figure 1)

BORING DATE: March 28, 2019

SHEET 1 OF 1

ц	i	QO		SOIL PROFILE			SAMPL	MPL	ES	DYNAMIC PEN RESISTANCE.	ETRATIC BLOWS	0N 0.3m	ì	HYDF	RAULI k. c	C CO cm/s	NDUCT	IVITY,	T	0	
SCA.	METRES	METH		DESCRIPTION	LOTA ATA EFEA DEbuth		нц		0.3m	20 40 60 80		10 ⁻⁵ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³ WATER CONTENT PERCENT Wo → W ↓ W			0 ⁻³ ⊥						
НТА		RING				1UMBE	TYPE	0/S/IO	SHEAR STREI Cu, kPa	SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - ○					ADDIT AB. TE	INSTALLATION					
Ľ		BC			STF	(m)			BL	20	40 €	о в	0	ļ'	10	20	3	0 4	 IO		
-	0		+	TOPSOIL (330 mm)	EEE	269.50 0.00															
-				(CL) SILTY CLAY and SAND to sandy SILTY CLAY, trace gravel; light brown with oxidation staining, (TILL); cohesive,		269.17 0.33	1B	SS	12							0					-
-	1			W <pl, sum="" sum<="" td="" to="" very=""><td></td><td></td><td>2A</td><td>ss</td><td>18</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>- -</td></pl,>			2A	ss	18												- -
							2B	ss	10						a		I			мн	-
-																					
-	2						3	SS	29						0						-
-																					-
-		rger					4	ss	14												
F	3	Power Ai	Stem				Ħ														-
MC		k Mount	m Solid S				5	ss	29												
/6/19		: 75 Trac	100 m																		20/03/2019 -
11 17	4	CME																	- -		
- MIS.G																			-		
J GAL				(CL-ML) CLAYEY SILT, some sand, trace gravel; grey, (TILL); cohesive,		264.93 4.57															-
GS.GF	5			w <pl, hard<="" td=""><td></td><td></td><td>6</td><td>SS</td><td>34</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td></pl,>			6	SS	34												-
																					-
ELLSH	6																				
64-SNE							7	ss	46												
191152			+	END OF BOREHOLE.		262.79 6.71	\square									+					
	7			Notes: 1. Water level measured at 3.4 mbos																	
0N/12				upon completion of drilling.																	-
CALED																					-
ENTS/	8																				-
KDEVE																					-
KBROO	9																				
CLEAR																					
ENTS																					-
3:/ CL	10																				-
001 (<u> </u>											
FA-BHS	DE 1 ·		H S	CALE						🖻 G C		EF	R							LC	DGGED: JD
5	1:50 CHECKED: EM																				

APPENDIX B

Geotechnical Laboratory Figures







LEGEND

SYMBOL	Borehole	SAMPLE	DEPTH(m)	
•	BH 19-14	2	0.76 - 1.37	
•	BH 19-17	2B	1.13 - 1.37	
♦	BH/MW 19-04	4	2.29 - 2.90	





LEGEND

SYMBOL	Borehole	SAMPLE	DEPTH(m)	
•	BH 19-14	7 08	6.10 - 6.71	
-	DH 19-10	9D	9.09 - 9.75	





Project Number: 19115264 (5000)

Checked By: EM

Golder Associates




APPENDIX C

Previous Geotechnical Borehole Logs

RECORD OF BOREHOLE: BH/MW19-03

LOCATION: Lat. 43.750098 Long. -79.814418 (See Figure 1)

BORING DATE: April 4, 2019

DATUM: Geodetic

	ДОН-	SOIL PROFILE	1.	1	SA	MPL	ES	DYNAMIC PENI RESISTANCE,	ETRAT BLOWS	ON 5/0.3m	<u>\</u>	HYDR	AULIC C k, cm/s	ONDUC	TIVITY,	Ţ	RGAL	PIEZOMETER
NETRES	NG MET	DESCRIPTION	LOT PLOT	ELEV.	MBER	ΥΡΕ	VS/0.3m	20 4 SHEAR STREN	0 IGTH	50 a	30 Q-•	1 	0 ⁻⁶ 1 I /ATER C	0 ⁵ 1 ONTEN	IO ⁻⁴ 1	0 ⁻³ I NT	DITION	OR STANDPIPE INSTALLATION
	BOR		STRAI	DEPTH (m)	NN	Ţ	BLOW	Си, кРа 20 4	0	rem V. ⊕ 30 a	30 30	w,	p I ;	O W	30 4	WI IO	AD	
		GROUND SURFACE		266.88														
Ű		TOPSOIL (350 mm)		0.00	1A	SS												
		(CL) SILTY CLAY, some sand, trace		266.53	1B	55	5											
		gravel, trace organics; brown with oxidation staining; cohesive, w <pl, firm<="" td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>																
'					2	SS	7						C	>				
		(CL) sandy SILTY CLAY, trace gravel,		265.51 1.37														
		contains inferred cobbles; light brown with oxidation staining, (TILL); cohesive,																
2		w <pl, hard<="" stiff="" td="" to=""><td></td><td></td><td>3</td><td>SS</td><td>11</td><td></td><td></td><td></td><td></td><td></td><td>0</td><td></td><td></td><td></td><td></td><td></td></pl,>			3	SS	11						0					
2																		
					4	SS	24											Poptonito
2																		Dentonite
3																		
					5	SS	30						o⊢–	+-			мн	
4				262.89														
	ger	plasticity, contains inferred cobbles; light		. 3.99														
	ver Aug	- Inferred cobbles/boulders from auger		2 2														
	unt Pov																	
5	ck Mou				6	SS	75					0						-
	75 Tra																	
	GME																	<u>م</u>
																		Sand Sand
6																		1
					7	ss	100					0						(고) 성무성
				2 - 2														(사망) (사망) (사망) (사망) (사망) (사망) (사망) (사망) (사망) (사망)
7		(CL-ML) CLAYEY SILT, some to trace		259.88 7.00														
		sand; grey, (TILL); cohesive, w <pl, hard<="" td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>																
																		17/04/2019
					8	SS	100					0						
8																		
																		· · · · · · · · · · · · · · · · · · ·
		 Cobbles/boulders inferred from auger grinding at a depth of 8.4 m 																a de la companya de la compan
9																		
																		4/04/2019
				257 13	9	55												
10				9.75			_			<u> </u>								
		CONTINUED NEXT PAGE																
DE	тн	SCALE								יםי	- -						L	OGGED: JD
1:5	50										٦						СН	ECKED: EM

SHEET 1 OF 2

RECORD OF BOREHOLE: BH/MW19-03

LOCATION: Lat. 43.750098 Long. -79.814418 (See Figure 1)

BORING DATE: April 4, 2019

SHEET 2 OF 2 DATUM: Geodetic

	щ	9	SOIL PROFILE			SA	MPL	ES	DYNAMIC PE RESISTANCE		ION 6/0.3m	ì	HYDRA	AULIC Co k, cm/s	ONDUCT	IVITY,	T	ں.	
	SCAL RES	METH		LOT		۲		.3m	20	40	60 8	0	10	, 2 ⁻⁶ 1∣) ⁻⁵ 10) ^{_4} 10	0-3 ⊥	IONAL STIN	PIEZOMETER OR
	EPTH MET	SING	DESCRIPTION	ATA P	ELEV.	JMBE	ТҮРЕ	0/S/V	SHEAR STRE Cu, kPa	NGTH	nat V. + rem V.⊕	Q - O	w	ATER C		PERCE	NT	B. TE	INSTALLATION
	DE	BOF		STR/	(m)	ž		BLO	20	40	60 8	0	Wp 1	0 2	 0 3	.0 4	WI IO	۲Ą	
	- 10		CONTINUED FROM PREVIOUS PAGE																
			Notes: 1. Water level measured at 9.1 mbgs upon completion of drilling.																-
			2. Water level measured in monitoring well as follows:																-
	- 11		Date Depth Elev. (m) April 17, 2019 7.34 mbgs 259.54 m																-
																			-
																			-
-	- 12																		-
																			-
																			-
	- 13																		-
19 JMC																			-
T 17/6/	- 14																		-
MIS.GD																			-
J GAL-																			-
GS.GP.	- 15																		-
V BH LO																			-
NOTTON																			-
VELLSH	- 16																		-
5264-S1																			-
JT/1911																		-	
V12 GIN	- 17																		
LEDON																			
NTS/CA	- 18																		-
OPME																			-
KDEVE																			
RBR00.	- 19																		
SICLEA																			-
CLIENTS																			
1 G:\ (- 20																		
GTA-BHS 00	DE 1 :	:PTH 8 50	SCALE						G		DEF	ર						LC CH	DGGED: JD ECKED: EM

RECORD OF BOREHOLE: BH/MW19-07

LOCATION: Lat. 43.755372 Long. -79.802724 (See Figure 1)

BORING DATE: March 27, 2019

SHEET 1 OF 2

DATUM: Existing Ground Surface

		0	SOIL PROFILE		SA	MPL	ES	DYNAMIC PENETRATION	HYDRAULIC CONDUCTIVITY,	
	METRES	DRING METH	DESCRIPTION	RATA PLOT	L I.	ТҮРЕ	_OWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + Q - € Cu, kPa rem V. ⊕ U - C	$\begin{array}{c} 10^{6} & 10^{5} & 10^{4} & 10^{3} \\ 10^{6} & 10^{5} & 10^{4} & 10^{3} \\ \end{array}$ $\begin{array}{c} WATER CONTENT PERCENT \\ Wp $	↓ ₹₹ PIEZOMETER OR OR ↓ STANDPIPE ↓ INSTALLATION
	_	ы		5 (m)	+		В	20 40 60 80	10 20 30 40	
1 - COUNTRY CLAY: Note and C a leady. - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2	0		TOPSOIL (230 mm)	0.0	0 1A	SS				
2 3 4 5 6 6 7 7 6 6 7 7 6 6 7 7 6 8 7 7 8 7 7 8 8 7 8 8 8 7 7 8 8 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8	1		(CL) sandy CLAY, trace gravel, trace organics; dark brown; cohesive, w <pl, very stiff (CL) SILTY CLAY, some sand to sandy, trace gravel; light brown with oxidation staining, (TILL); cohesive, w<pl, very<br="">stiff to hard</pl,></pl, 	0.2 0.2 0.6 0.6 0.6 0.6 0.6	3 1B 11 2	ss	19		0	
3 -	2				3	ss	11		o	
• •	3		- Becoming sandy at a depth of 3 m		4	ss	24			Eent- onite
a b	4	ler			5	ss	45			
6 (SMML) sandy SILT to SILT, trace to some clay, slight plasticity, light brown; non-cohesive, wet, dense to very dense 7 5.50 7 7 5.50 7 7 5.50 7 7 5.50 7 7 5.50 7 7 5.50 7 7 5.50 7 7 5.50 7 7 5.50 7 7 5.50 7 7 5.50 7	5	CME 75 Track Mount Power Aug			6	SS	44		0	Sand
7 - Cobble/boulder inferred from auger grinding at a depth of 7.3 m 8 8 1000000000000000000000000000000000000	6		(SM/ML) sandy SILT to SILT, trace to some clay, slight plasticity; light brown; non-cohesive,wet, dense to very dense	5.5	7	ss	36		Φ	Screen,
Bent-onite Bent-onite Bent-onite Bent-onite Bent-onite DEPTH SCALE DEPTH SCALE	7		- Cobble/boulder inferred from auger grinding at a depth of 7.3 m		8	ss	100/ 2"		0	17/04/2019
DEPTH SCALE	8 9		(SM) SILTY SAND, fine to medium grained, some to trace gravel; light brown; non-cohesive, moist, dense to very dense		2					Bent- onite
CONTINUED NEXT PAGE Image: Control of the second	10 -				9	ss	131			
DEPTH SCALE LOGGED: JD			CONTINUED NEXT PAGE							
	DEF	PTH	SCALE					GOLDER		LOGGED: JD

RECORD OF BOREHOLE: BH/MW19-07

LOCATION: Lat. 43.755372 Long. -79.802724 (See Figure 1)

BORING DATE: March 27, 2019

SHEET 2 OF 2

DATUM: Existing Ground Surface

ſ	щ	6	3	SOIL PROFILE			SA	MPL	.ES	DYNAI RESIS	MIC PEN	ETRAT	ON 5/0.3m	ì	HYDR,	AULIC Co k. cm/s	ONDUCT	IVITY,	Т	.0	
	SCAL	NETH			-OT		r a		Зm	2	0 4	10	50 E	80 `	1	0 ⁻⁶ 1	<u>)</u> 5 10	Ç ^{_4} 1	_{p³} ⊥	STIN	PIEZOMETER OR
	METH	C N		DESCRIPTION	IA PI	ELEV.	MBEF	ΥΡΕ	VS/0	SHEAF	RSTREM	IGTH	nat V. +	Q- •	w	ATER C	ONTENT	PERCE	NT	DITIO	STANDPIPE INSTALLATION
	E C	a Ce			TRA ⁻	DEPTH (m)	NN N	Ĥ.	BLOV	Cu, KP	а		rem v. ⊕	0-0	W	p	-0 ^W		W	LAE	
ŀ		-	-		S				-	2	0 4	10 (<u>50 ε</u>	80	1	0 2	03	0 4	.0		
	— 10 -			(SM) SILTY SAND, fine to medium		1															
	-			grained, some to trace gravel; light brown; non-cohesive, moist, dense to																	-
Ē	-			very dense																	-
	-																				-
	- - 11						10	ss	94						0						-
						1															-
Ē	-																				-
	-	- Auge																			
	-	Power	Stem																		Sand Sand
-	- 12	Aount	Solid :																		
	-	rack M	0 mm	- Contains wet sandy silt layer at a depth of 12.2 m																	
	-	E 75 1	9				11	SS	40							0					Screen and Sand
	-	S																			17/04/2019
	— 13 -																				
ы	-																				
ML 0	-																				
7/6/1	-																				<u> </u>
1 1	- - 14						12	ss	38							0					Bentonite -
IS.GI	-																				-
AL-N	-			END OF BOREHOLE.		14.55															-
P G	-			1. Water level measured at 12.8 mbgs																	-
GS.G	- - 15			upon completion of aniling.																	-
BH LOC	-			well as follows:																	-
MO	-			Deep Well Date Depth Elev. (m)																	-
HOL	-			Shallow Well																	-
ELLS	— 16 -			April 17, 2019 6.9 mbgs N/A																	
4-SN	-																				-
1526	-																				-
TV191	-																				-
ЛIJ	- 17 -																				
N/12	-																				-
EDC	-																				-
S\CAI	-																				-
ENT	— 18 -																				
OPM.	-																				-
EVEL	-																				-
OKD	-																				-
RBRO	— 19 -																				
LEAF	-																				-
ITS/C	-																				-
CLEP	-																				
G:/ (- 20																				-
IS 001		<u> </u>			1	1	L	L	_		I	I	1	I	I	I	I	I	1		
A BH	DE	PTI	HS	CALE							GΟ) E F	2						LC	DGGED: JD
5	11	υU							-											υH	LUKEU, ENI

PROJECT: 19115264-1000/2000

RECORD OF BOREHOLE: BH/MW19-13

LOCATION: Lat. 43.749709 Long. -79.812182 (See Figure 1)

BORING DATE: April 4, 2019

SHEET 1 OF 2 DATUM: Geodetic

ES	ETHO	-	SOIL PROFILE	ы		SA	MPLI	ΞS E	20 40 60 80	k, cm/s 10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³	NAL	
MEIR	BORING M		DESCRIPTION	TRATA PL	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3	HEAR STRENGTH nat V. + Q - ● cu, kPa rem V. ⊕ U - ○		ADDITIC LAB. TES	STANDPIPE INSTALLATIO
		GRO	OUND SURFACE	ίο Ο	207.04			-	20 40 60 80	10 20 30 40		
0		ТОГ	PSOIL (300 mm)	EEE	0.00	1Δ	22					
		(CL orga firm	.) SILTY CLAY, some sand, trace anics; dark brown; cohesive, w <pl, 1</pl, 		267.31 0.30	1B	SS	5		0		
1		(CL grav mot very) SILTY CLAY and SAND, trace vel, inferred cobbles/boulders; ttled light brown/brown, (TILL); w <pl, y stiff to hard</pl, 		<u>266.65</u> 0.96	2	SS	17		0	PP = 320 kPa	
2		- Co grin	obbles/boulders inferred from auger Iding at 1.7 m			3	SS	19		0	PP = 320 kPa	
						4	SS	22		0	PP = 340 kPa	
3						5	SS	33		Ф н	PP = 440 kPa MH	Bentonite
4	wer Auger	(SM cob grin to n	 gravelly SILTY SAND, bles/boulders inferred from auger ding; light brown; non-cohesive, dry noist, very dense 		263.61 4.00	-						
5	CME 75 Track Mount Pc	900 mm 001 - He 5.4	eavy auger grinding below depth of m			6	SS	154		о н	МН	
6						7	SS	115		0		
8		(ML trac den	.) sandy SILT, with slight plasticity, se gravel; light brown; moist, very se		259.99 7.62	8	SS	138		•	МН	Sand
9												Screen and Sand
10						9 10	ss s <u>s</u>	137 1 <u>46</u>				
			CONTINUED NEXT PAGE									

PROJECT: 19115264-1000/2000

RECORD OF BOREHOLE: BH/MW19-13

LOCATION: Lat. 43.749709 Long. -79.812182 (See Figure 1)

BORING DATE: April 4, 2019

SHEET 2 OF 2

DATUM: Geodetic

ł		Q	<u>,</u>	SOIL PROFILE			SA	MPL	.ES	DYNA			ON	>	HYDR.		ONDUCT	IVITY,	Т	(1)	
	SCALE				ŌŢ		~		Зm	2	20	40	, o. on 60 t	30	1	r, uni/s	0 ⁻⁵ 1	0 ⁻⁴ 10	₀₋₃ ⊥	STING	PIEZOMETER OR
	PTH S METR	M DN		DESCRIPTION	TA PL	ELEV.	MBEF	ΥPE	VS/0.	SHEA	R STRE	NGTH	nat V. +	Q-•	w N	ATER C	ONTENT	PERCE	NT	SDITIC 3. TES	STANDPIPE
	DEF	BOR	Ś		TRA	DEPTH (m)	N.	Γ́⊢	BLOV	Cu, KP	a	10	rem v. 🕁	0-0	W	p	W	I	WI	LAE	
ŀ				CONTINUED FROM PREVIOUS PAGE	0				-	2	20	40	50 8	30	1		20 3	30 4	0		
	- 10 - -			(ML) sandy SILT, with slight plasticity, trace gravel; light brown; moist, very dense		057.00	10	SS	146							চন				мн	Screen and Sand
ŀ			+	END OF BOREHOLE.	<u>titel</u>	10.52															- [*=h*] -
	- - - 11			Notes: 1. Borehole dry upon completion of drilling.																	
				2. Water level measured in monitoring well as follows:																	-
-				Date Depth Elev. (m) April 17, 2019 9.45 mbgs 258.16 m																	-
	- 12 - -			3. PP= unconfined compressive strength measured with pocket penetrometer in the field.																	
																					-
	- 13 -																				-
/19 JMC	-																				
DT 17/6	- 14																				-
AL-MIS.G	- - -																				-
S.GPJ G	- - - 15																				-
BH LOG																					-
MOTTOH																					-
SNELLS	— 16 -																				
9115264-																					-
GINTU	- 17 -																				
EDON/12																					-
NTS/CAL	- - - 18																				-
ELOPME																					-
DOKDEV																					
LEARBR(- 19 -																				
ENTS/CI	- - -																				
1 G:\ CL	- - 20																				_
A-BHS 00	DE	PTH	- I S(CALE	<u> </u>		-	1			GC		DEI	R		1		1		L	DGGED: JD
GT/	1:	50																		СН	ECKED: EM

RECORD OF BOREHOLE: BH19-18

LOCATION: Lat. 43.753587 Long. -79.803241 (See Figure 1)

BORING DATE: March 27, 2019

SHEET 1 OF 1

DATUM: Existing Ground Surface

F	щ	Ę	3	SOIL PROFILE			SA	MPL	ES	DYNAMIC P RESISTANC	ENETRA E, BLO\	TION VS/0.3m	ì	HYDRA	ULIC C k, cm/s	ONDUC	TIVITY,	T		
	I SCAI TRES	μΞΜ			PLOT		н		0.3m	20	40	60	80	10	⁻⁶ 1	0 ⁻⁵ 1	0 ⁻⁴ 1	0 ⁻³ ⊥	TIONA	OR STANDPIPE
	ME ⁻			DESCRIPTION	RATA I	DEPTH	IUMBI	ТҮРЕ	0WS/	SHEAR STR Cu, kPa	ENGTH	nat V. rem V. 6	⊢ Q-● ₽ U-0	W/ Wp	ATER C			NT	ADDI AB. T	INSTALLATION
		a			STF	(m)	~		BL	20	40	60	80	10		20 :	30 4	40		
F	- 0	\vdash		GROUND SURFACE TOPSOIL (200 mm)	EEE	0.00	1.0	50				_								
F				(CL) sandy SILTY CLAY, trace to some		0.20		55	11											-
Ē				gravel with cobbles/boulders inferred from auger grinding; brown to light brown			1B	SS												-
-				with oxidation staining, (TILL); conesive, w <pl, hard<="" stiff="" td="" to=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td></pl,>																-
E	- 1						2	ss	22						C					_
F																				-
E																				-
Ē							3	ss	38					0	,					-
-	- 2																			
E																				-
E		-					4	ss	35					0	· —	4			мн	Σ.
F		er Auge																		27/03/2019
F	- 3	nt Powe	d Stem																	-
ğ		sk Moui	im Soli				5	SS	35											-
3/19		75 Trac	100 n																	-
11/2	- 4	CME																		-
SGD																				-
																				-
<u>0</u>																				-
GS.G	- 5						6	ss	52											-
H LO																				-
M NO																				-
HOLE																				-
ELLS	- 6			(CL/ML) CLAYEY SILT, trace sand;		6.10														-
54-SN				grey, (TILL); cohesive, w>PL, hard		2	7	ss	33											-
1152						0.74														
NT/15	- 7			END OF BOREHULE		б./1														-
12 G				1. Water level measured at 2.7 mbgs upon completion of drilling.																-
DON																				-
CALE																				-
NTS/	- 8																			-
OPME																				-
																				-
																				-
RBRC	- 9																			-
CLEA																				-
NTS/																				-
	- 10																			-
1 G I	.0																			
HS OC	DE	рт	HS	CALE							~ ·		<u> </u>							
GTA-B	1:	50	0							₽ G (JL	υE	к						СН	ECKED: EM

RECORD OF BOREHOLE: BH19-19

LOCATION: Lat. 43.754896 Long. -79.804943 (See Figure 1)

BORING DATE: March 26, 2019

SHEET 1 OF 1

DATUM: Existing Ground Surface

┟	ш	Ę	3	SOIL PROFILE			SA	MPL	.ES		PENE		ON /0.3m	ì	HYDF		CONDUC	TIVITY,	T	.0	
	SCAL.				LOT		æ		<u>3</u> m	20	4 ⁽	0 6	50 E	80		10 ⁻⁶	10 ⁻⁵	10 ⁻⁴ 1	o-₃ ⊥	STINC	PIEZOMETER OR
	METR		2	DESCRIPTION	TA PI	ELEV.	MBE	ΥPE	NS/0.	SHEAR S	TREN	GTH I	⊥ natV.+ remV⊕	Q-0	\ \	VATER	CONTEN	T PERCE	NT	B. TE	STANDPIPE INSTALLATION
	B				STRA	(m)	NN	F	BLO	20, Ki a	4	n ú		20-0	V	/p	ON	20	WI 10	I AR	
F		L		GROUND SURFACE							-40										
-	- 0			TOPSOIL (610 mm)		0.00															-
F							1	SS	4								C				-
E				(CL) sandy SILTY CLAY, some sand		0,61															-
E				trace gravel with cobbles/boulders																	-
F	- 1			oxidation staining, (TILL); w <pl, hard<="" stiff="" td="" to="" very=""><td></td><td></td><td>2</td><td>SS</td><td>26</td><td></td><td></td><td></td><td></td><td></td><td></td><td>o⊢</td><td>+-1</td><td></td><td></td><td>мн</td><td>-</td></pl,>			2	SS	26							o⊢	+-1			мн	-
E																					-
F																					-
E							3	ss	40												-
F	- 2																				
E																					-
F							4	ss	49							9					-
E		Auger																			-
F	- 3	Power	Stem																		-
ęĒ		Mount	Solid				5	SS	54												-
۹۲ – ۱		Track	00 mm																		-
17/6/1		AE 75	≓																		-
L L L L	- 4	õ					6	SS	55							0					
																					-
BAL-				- Increased sand content at a depth of																	-
- LdS				4.0 11			7	SS	86												-
0.05S.(- 5																				
BH LO				(SM) SILTY SAND, fine grained, inferred cobbles/boulders; light brown;		5.18															-
				non-cohesive, moist, very dense			8	SS	95						0						-
																					-
	- 6																				
4-SN							9	SS	100						0						-
11526		L																			
1191				END OF BOREHOLE.		6.71															
2 5	- 7			Notes: 1. Borehole dry upon completion of																	-
				drilling.																	-
Ĭ																					-
S/CA																					-
	- 8																				
NHO_																					-
																					-
NOKI SOKI																					-
RBR	- 9																				
CLEA																					-
NTS/																					-
																					-
ΰ	- 10																				_
S 001		L			1	1							<u> </u>	I	L				1		
P-BH;	DE	PT	нs	CALE						🔓 G	0	LD) E F	2						LC)GGED: JD
15	1:	50											-							CH	ECKED: EM

E EDWARD WONG		BORING NUMBER * PAGE 1 OF
CLIENT _ Dilip Kumar Jain PROJECT NUMBER _ Ma00;	2995a	PROJECT NAME 3278 Mayfield Road PROJECT LOCATION Town of Caledon
DATE STARTED <u>10/19/17</u> DRILLING CONTRACTOR <u>I</u> DRILLING METHOD <u>Solid S</u> LOGGED BY <u>J.J.</u> NOTES	COMPLETED Fadroy Enterprise Stem Augers CHECKED BY	10/19/17 GROUND ELEVATION 270 m HOLE SIZE 150 mm GROUND WATER LEVELS:
DEPTH (m) (m) SAMPLE TYPE NUMBER NUMBER BLOW COUNTS (N VALUE)	TESTS CAPHIC	MATERIAL DESCRIPTION
SS 3-4-5-7 1 (9)	MC = 17%	D.20 TOPSOIL - ~200 mm thick. 269.8 CLAYEY SILT - some sand, occasional gravel, brown, very moist, hard.
SS 5-6-10 2 (16)	PP = 400 kPa	
SS 4-6-10 3 (16)	PP >450 kPa MC = 15%	
SS 6-10-14 4 (24)	PP >450 kPa	
3 SS 5-10-12 (22) 4	PP >450 kPa MC = 11%	SAND TILL - trace clay, trace gravel, brown, very moist, compact.
SS 6-16-20 5 	PP >450 kPa MC = 13%	-becoming dense below ~4.5 m depth
6 SS 50-0-0/- 7 0.15	PP >450 kPa	-becoming very dense below ~6.0 m depth 263.8 Bottom of hole at 6.15 m.

	WUNG						W	ELL	PAGE 1 (
LIENT Dilip Ku	mar Jain					PROJECT NAME _3278 Mayfield F	Road		
ROJECT NUMBE	R Ma002	995a				PROJECT LOCATION Town of Ca	aledon		
ATE STARTED RILLING CONTR RILLING METHO DGGED BY <u>J.J</u> DTES	10/19/17 ACTOR <u>F</u> D <u>Solid S</u>	compl adroy Enterprise tem Augers CHECK	ETED	10/19/ E.W.	17	GROUND ELEVATION 270 m GROUND WATER LEVELS: AT TIME OF DRILLING Dry AT END OF DRILLING Dry AFTER DRILLING	_ HOLE S	IZE <u>15</u>	0 mm
(m) SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG			MATERIAL DESCRIPTION		WE	LL DIAGRAM
SS 3	-7-10-7	MC - 15%	<u>24</u> 20	.20	TOPSOIL -	~200 mm thick.	269.80		
1	(17)	10 - 13%			loose.	- scallered clay seams, brown, moist,			
1 SS 2	2-2-3 (5)	MC = 5%			-becoming	loose below ~0.75 m depth			Bentonite
2 SS 3	2-4-5 (9)	MC = 20%			-becoming	wet below ~1.5 m depth			
SS 8	-11-14 (25)	PP >450 kPa MC = 14%	2++++++	.25	CLAYEY S	ILT - trace sand, brown, very moist, hard.	267.75		50 mm dia. PVC Riser Pipe, Filter Sand
3 - SS 5 - 5 - 4	-10-15 (25)	PP >450 kPa MC = 14%	・ナートトートトトトトト ・ナートトナートトナート ・ナートトナートトナートト						
- - - - - - - - - - - - - - - - - - -	-10-11 (21)	PP = 400 kPa MC = 14%		50	SILTY CLA hard.	Y - mottled brown and grey, very moist,	265.50		50 mm dia. PVC Slottec Pipe, Filter Sand
- - - - - - - - - - - - - - - - - - -	-8-11 (19)	PP = 300 kPa MC = 12%	6	45	-becoming	grey and stiff below ~6.0 m depth	263.55		
SS 4	-8-11 (19)	PP = 300 kPa MC = 12%	6	45	-becoming	grey and stiff below ~6.0 m depth Bottom of hole at 6.30 m.	263.55 -		

ŧ

ΞE E	EDWA	RD WONG						BORIN	G NUM	BER 4
CLIENT	CT NUN	Kumar Jain IBER Ma00	2995a			PROJECT NAME	3278 Mayfield Ro	oad ledon	1	
DATE S DRILLIM DRILLIM LOGGE	STARTE NG COM NG MET	D _10/18/17 NTRACTOR _ THOD _Solid : J.J.	COMPL Fadroy Enterprise Stem Augers CHECK	ETED 10/	18/17 N.	GROUND ELEVATION GROUND WATER LEVE AT TIME OF DRILL AT END OF DRILL	270 m LS: LING <u>Dry</u>	HOLE SIZE	_150 mm	
DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG		MATERIAL	DESCRIPTION			
	SS 1	3-11-13-12 (24)	MC = 8%	0.20	TOPSOIL FILL - ~ 1 clayey silt,	 ~200 mm thick. m of brown sandy silt with rootlets, organic inclusion 	rootlets, very mo s, very moist.	oist over ~3,3	m of brown	269.8
	SS 2	8-6-6 (12)	MC = 11%							
2	SS 3	4-4-6 (10)	MC = 11%							
	SS 4	4-7-8 (15)	MC = 14%							
3	SS 5	4-7-7 (14)	MC = 17%							
4	8			4.50	OLAVEY O	11 9				265.5
5	SS 6	8-14-20 (34)	PP >450 kPa MC = 10%	4444444 44444444 44444444	CLATETS	ILI - some sand, trace gra	ivei, brown, very	r moist, hard.		
6	SS 7	20-50-	PP >450 kPa							
22	N.	0/0.00	MC = 8%	<u>XIXINI6.30</u>		Bottom	of hole at 6.30 r	n.		263.7

APPENDIX D

Important Information and Limitations of This Report



IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder cannot be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Ground Water Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.



golder.com



REPORT

Preliminary Geotechnical Investigation, Coscorp HL Developments Inc.

Proposed Residential Development, Snell's Hollow Secondary Plan, Caledon, Ontario

Submitted to:

Coscorp HL Developments Inc.

Tom Basekerville Vice President Development 6625 Kitimat Road, #58 Mississauga, On

Submitted by:

Golder Associates Ltd.

6925 Century Avenue, Suite #100, Mississauga, Ontario, L5N 7K2, Canada

+1 905 567 4444

19115264 Phase 6000

June 24, 2019

Distribution List

- 1 e-copy: Golder Associates Ltd.
- 1 e-copy: Coscorp HL Developments Inc.
- 1 e-copy: Snell's Hollow Developers Group
- 1 e-copy: Glen Schnarr & Associates Inc.

Table of Contents

1.0	INTR	ODUCTION	3
2.0	SITE	DESCRIPTION AND BACKGROUND	3
3.0	ADJ	ACENT GEOTECHNICAL SITE INFORMATION	3
4.0	REG	IONAL GEOLOGY	4
5.0	INVE	STIGATION PROCEDURE	4
6.0	SUB	SURFACE CONDITIONS	5
	6.1	Topsoil and Reworked/Disturbed Materials	5
	6.2	(CL) Silty Clay to sandy Silty Clay (Upper Glacial Till)	6
	6.3	(SM to SM/ML) Silty Sand to sandy Silt	6
	6.4	(CL/ML) Clayey Silt (Lower Glacial Till)	6
	6.5	Groundwater Conditions	7

TABLES

Table 1: Approximate Topsoil Thickness	5
Table 2: Groundwater Level Measurements	7
Table 3: Pavement Design	12

FIGURES

Figure 1: Site and Borehole Location Plan

APPENDICES

APPENDIX A Record of Boreholes

APPENDIX B Geotechnical Laboratory Figures

APPENDIX C Adjacent Properties Borehole Logs

APPENDIX D Important Information and Limitations of This Report



1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by Coscorp HL Developments Inc. (Coscorp) to provide preliminary geotechnical consulting services to support a draft plan approval for a future residential subdivision development located north east of Heart Lake Road and Mayfield Road in Caledon, Ontario (the Site), as shown in the Site and Borehole Location Plan, *Figure 1*.

The terms of reference for the geotechnical consulting services are included in Golder's proposal No. P19115264 Rev 1, dated March 8, 2019.

The purpose of the investigation is to obtain information on the general subsurface soil and shallow groundwater conditions at the site by means of a limited number of boreholes and geotechnical laboratory tests. Based on our interpretation of the factual information collected as part of the preliminary geotechnical investigation carried out at this site, a general description of the subsurface conditions across the site is presented herein. The interpreted subsurface conditions and available project details were used to develop preliminary engineering parameters and recommendations on the geotechnical design aspects of the project, including construction considerations which could influence design decisions.

This report provides the results of the preliminary geotechnical investigation and should be read in conjunction with the *"Important Information and Limitations of This Report"* **Appendix D**. The reader's attention is specifically drawn to this information, as it is essential for the proper use and interpretation of this report. The factual data, interpretations and recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. If the project is modified in concept, location or elevation, or if the project is not initiated within twelve months of the date of the report, Golder should be given an opportunity to confirm that the recommendations in this report are still valid.

2.0 SITE DESCRIPTION AND BACKGROUND

The subject property is located north east of Heart Lake Road and Mayfield Road and is part of the Snell's Hollow Secondary Plan, which is a proposed residential development to be located in the southern part of the Town of Caledon. The site is bounded by Heart Lake Road to the west, Mayfield Road to the south and Highway 410 to the north and east as shown in *Figure 1.*

The site has a total area of approximately 6.3 hectares (15.6 acres) of predominantly flat land which slightly slopes at the property limit next to Highway 410. The site consists of agricultural land as noted by the presence of previous farming activities (crops). There is one residential dwelling located to the north of the site which has a municipal address of 12109 Heart Lake Road Caledon, Ontario.

Based on our understanding, the Site is to be developed into a residential development, with associated underground services and supporting roads. For the purposes of this report, we have assumed that the future residential houses will be constructed utilizing shallow strip/spread footings, with an interior slab-on-grade, and one-level of underground basement. We have also assumed cuts and/or fills required for site grading purposes will not exceed 2.0 m and that the invert of the site servicing will be no greater than 3.0 m below existing site grades.

3.0 ADJACENT GEOTECHNICAL SITE INFORMATION

An additional geotechnical investigation consisting of sixteen boreholes was also carried out as part of the Snell's Hollow Secondary Plan on the properties adjacent too and west side of Heart Lake Road. The following

is a summary of subsurface conditions obtained from boreholes located adjacent to the site (BH/MW19-05, BH/MW19-06, and BH19-17) as shown on the Site and Borehole Location Plan, *Figure 1*.

In general, the subsurface conditions encountered in Boreholes BH/MW19-05, BH/MW19-06, BH19-17 typically consist of a surficial topsoil ranging in thickness from about 280 mm to over 400 mm overlying a disturbed/reworked dark to light brown silty clay layer, which contains various amounts organics, underlain by glacial till composed of stiff to very stiff brown silty clay to a depth ranging from 0.3 m to 4.86 m below ground surface. A very stiff to hard grey clayey silt till was generally found below the brown silty clay till layer. These subsurface conditions were found to be similar to the subsurface conditions encountered in the boreholes located on Coscorp HL Developments Inc. site (discussed in detail in subsequent sections).

The record of borehole logs from these reports are enclosed in *Appendix C*. The approximate locations of the boreholes drilled at these sites are shown on the Site and Borehole Location Plan, *Figure 1*.

Groundwater was encountered in BH/MW19-06 and BH19-17 upon the completion of drilling and ranged from 2.5 m to 3.4 m below existing ground surface, whereas Borehole BH/MW19-05 was found to be dry upon the completion of drilling. Two 50 mm diameter monitoring wells were installed at Boreholes BH/MW19-05 and BH/MW19-06 to permit further monitoring of the groundwater levels. Shallow groundwater levels measured in the 50 mm diameter monitoring wells on April 17, 2019 ranged from 0.34 m (BH/MW19-06) to 8.32 m (BH/MW19-05) below existing ground surface.

4.0 REGIONAL GEOLOGY

The surficial geology aspects of the general site area were reviewed from the following publication:

 Chapman, L.J., and Putnam, D.F., 2007, "The Physiography of Southern Ontario"; 4th Edition, Ontario Geological Survey.

Physiographic mapping in the area according to the above noted reference indicates that the site lies within the physiographic region of southern Ontario known as the South Slope. The South Slope region slopes gradually downward towards Lake Ontario. The overburden immediately below ground surface within the South Slope generally consists of clayey silt till and silty clay till and at depth consists of alternating deposits of dense lacustrine sands and silts and overconsolidated lacustrine clays and clay tills overlying the bedrock.

The subsurface conditions encountered during the investigation are generally consistent with the physiographic mapping.

5.0 INVESTIGATION PROCEDURE

The field work for the preliminary geotechnical investigation was carried out between March 26 and March 27, 2019, during which time three boreholes (designated as Boreholes BH19-18, BH19-19 and BH/MW19-07) were advanced at the site to depths between about 6.7 m and 14.4 m below existing ground surface at the approximate locations shown on the Site and Borehole Location Plan, *Figure 1*, attached. One additional borehole was advanced to about 7.0 m below existing ground surface adjacent to BH/MW19-07 for the purpose of installing a shallow monitoring well, adjacent to the deep monitoring well which was installed in the BH/MW19-07 borehole.

The boreholes were advanced using a track-mounted drill rig supplied and operated by a specialist drilling contractor, subcontracted to Golder. Standard Penetration Testing (SPT) and sampling was carried out at regular intervals of depth in the boreholes using conventional 35 mm internal diameter split spoon sampling

equipment advanced using an automatic hammer, in accordance with ASTM D1586 (99). Two, 50 mm diameter monitoring wells were installed at BH/MW19-07 to permit further monitoring of the groundwater levels. Groundwater level measurements were recorded immediately following drilling procedures for all boreholes and on the monitoring wells on April 17, 2019. The well installation and water level readings are presented on the Record of Borehole sheets in **Appendix A**.

The field work for this investigation was directed by members of our engineering staff who located the boreholes in the field, directed the sampling and in-situ testing operation, logged the boreholes and cared for the samples obtained. The samples were identified in the field, placed in appropriate containers, labelled and transported to Golder's Mississauga geotechnical laboratory for further examination and laboratory testing. Index and classification tests, consisting of water content determinations, Atterberg limits and grain size distribution, were carried out on selected soil samples. The results of the geotechnical laboratory tests are included in **Appendix B** and on the Record of Borehole sheets in **Appendix A**.

6.0 SUBSURFACE CONDITIONS

The subsurface soil and shallow groundwater conditions encountered in the boreholes and the results of the field and laboratory testing, are shown on the Record of Boreholes sheets, in **Appendix A**. Method of Soil Classification and Symbols and Terms Used on Records of Boreholes are provided to assist in the interpretation of the borehole logs. It should be noted that the boundaries between the strata have been inferred from drilling observations and non-continuous samples. They generally represent a transition from one soil type to another and should not be inferred to represent an exact plane of geological change. Further, conditions will vary between and beyond the boreholes. The following is a summary of the subsurface conditions of the boreholes advanced during this investigation followed by a more detailed description of the major soil strata and groundwater conditions.

In general, the subsurface conditions encountered at the boreholes advanced at the site typically consist of a surficial topsoil/silty clay layer underlain by native soil deposits of glacial till composed of silty clay to clayey silt containing varying amounts of sand and gravel, underlain by sandy silt to silty sand deposits.

Details of the observations of the groundwater conditions during and upon completion of drilling are included on the Record of Borehole sheets. Shallow ground water was encountered at depths ranging from 2.7 m to 12.8 m below existing ground surface upon the completion of drilling activities. Shallow groundwater levels measured in the 50 mm diameter monitoring wells installed at the site are also presented below.

6.1 Topsoil and (CL) sandy Silty Clay (possibly re-worked)

Topsoil materials were encountered in all the boreholes and extended to depths ranging from 0.20 m to 0.61 m. A summary of topsoil thickness in each of the boreholes is outlined in the table below.

Borehole No.	Approximate Topsoil Thickness (m)
BH/MW19-07	0.23
BH19-18	0.20
BH19-19	0.61

Table 1: Approximate Topsoil Thickness

Materials identified as topsoil in this report were classified based on visual and textural evidence as no other testing for organic content or other nutrients was carried out. As such, the ability for these materials to support vegetation has not been assessed.

Reworked/disturbed sandy silty clay material was encountered in borehole BH/MW19-07 below the surficial topsoil. Reworked material thickness was observed from 0.23 m to 0.61 m below existing ground surface. The reworked material consisted of sandy silty clay with trace amounts of gravel. SPT 'N' values within cohesive the reworked material was found to be 19 blows per 0.3 m penetration indicating a very stiff consistency.

The natural water content of the reworked material was measured at 20 percent.

6.2 (CL) Silty Clay to sandy Silty Clay (Upper Glacial Till)

A glacial till deposit consisting of cohesive silty clay to sandy silty clay was generally encountered directly underneath the topsoil/reworked till deposits to depths about 6.10 m below existing ground surface. The till deposit is light brown to brown mottled with oxidation staining, about 4.5 m to 6.7 m in thickness, with various amounts of sand and gravel. The silty clay till increases in sand content in borehole BH/MW19-07 at a depth of 3 m below ground surface and in borehole BH19-19 at a depth of 4.6 m below ground surface. The till is believed to contain cobbles and/or possible boulders which have been inferred as a result of auger grinding observed in boreholes BH19-18 and BH19-19.

The SPT 'N' values measured in these till materials range from 11 blows per 0.3 m of penetration to 86 blows per 0.3 m of penetration, but typically greater than 22 blows per 0.3 m of penetration, indicating that the silty clay till is generally stiff to hard in consistency.

The results of grain size distribution tests carried out on selected samples from this deposit are presented in **Figure B1**. Atterberg limits tests that were carried out on the same samples from this deposit measured liquid limit values ranging from about 20 to 24 and plastic limit values ranging from about 13 to 15; yielding corresponding plasticity index values ranging from about 7 to 10. These results are plotted on the plasticity chart as shown in **Figure B2**.

The water content of selected samples ranged from about 9 percent to 17 percent.

6.3 (ML/SM to SM) sandy Silt to Silty Sand

A non-cohesive sandy silt to silty sand deposit was encountered underneath the cohesive silty clay till, in BH/MW19-07 and BH19-19. The sandy silt to silty sand deposit, is light brown, contains various amount of gravel, with cobbles/boulders being inferred from auger grinding. Both boreholes were terminated in the silty sand deposit.

The SPT 'N' values measured in this deposit ranged from 36 blows per 0.3 m to 131 blows per 0.3 m of penetration. These SPT 'N' values indicated a dense to very dense compactness.

The water content of selected samples ranged from about 3 percent and 20 percent.

6.4 (CL/ML) Clayey Silt (Lower Glacial Till)

A clayey silt till deposit was encountered directly underneath the sandy silty clay till in borehole BH19-18 from a depth of 6.10 m below existing ground surface. The borehole was terminated in this layer at a depth of 6.7 m below existing ground surface. The cohesive till deposit contains various amounts of sand and gravel and is grey in colour.

The SPT 'N' values of this till deposit was 33 blows per 0.3 m of penetration indicating hard consistency.

6.5 Groundwater Conditions

Groundwater level measurements were recorded immediately following drilling procedures. Monitoring wells were installed (one deep and one shallow) in borehole BH/MW19-07 to permit monitoring of the groundwater level at the site. Details of the monitoring well installation and the measured groundwater levels are shown on the Records of Borehole in *Appendix A*. The groundwater level measurements in the drilled boreholes and in the monitoring wells are summarized in Table 2, below.

	Measurements Upon Completion of Drilling		Measurements in Mon	itoring Wells
Borehole No.	Approximate Groundwater Depth (begs)*	Date	Approximate Groundwater Depth (begs)*	Date
BH/MW19-07 (Shallow Well)	N/A		6.9 m	
BH/MW19-07 (Deep Well)	12.8 m	March 27, 2019	12.8 m	April 17, 2019
BH19-18	2.7 m	March 27, 2019	arch 27, 2019 No monitoring well installed	
BH19-19	Dry	March 26, 2019	No monitoring well installed	

Table 2: Groundwater Level Measurement	Table 2:	2: Groundwate	r Level	Measurements
--	----------	---------------	---------	--------------

*begs- below existing ground surface.

It should be noted that the groundwater level in the area is subject to seasonal fluctuations and precipitation events and should be expected to be higher during wet periods of the year.

7.0 GEOTECHNICAL ENGINEERING DISCUSSION

This section of the report provides preliminary geotechnical engineering recommendations on the geotechnical aspects of the proposed development based on our interpretation of the limited borehole information and on our understanding of the project scope and requirements. The information in this portion of the report is provided for the guidance of the design engineers and professionals.

Based on the results of this investigation, the subsurface soil conditions encountered at the site are considered to be generally suitable for the proposed residential development.

As noted above, at the time of this report, proposed design grades (i.e., finished floor slab elevation, pavement subgrade and utility invert levels) were not available for the proposed development. The following engineering recommendations regarding the geotechnical design aspects of the project including underground services, pavements and building foundations should be considered as preliminary only, and should be reviewed when the final design grades and utility invert levels have been finalized.

Where comments are made on construction, they are provided only in order to highlight aspects of construction which could affect the design of the project. Contractors bidding on or undertaking any work at the site should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for

construction and make their own interpretation of the factual data as it affects their proposed construction techniques, schedule, equipment capabilities, costs, sequencing and the like.

This report addresses only the geotechnical (physical) aspects of the subsurface conditions at this site. The geo-environmental (chemical) aspects, including the consequences of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources, are outside of the terms of reference for this report.

7.1 Site Preparation

7.1.1 Subgrade Preparation

The existing site vegetation, surficial topsoil/organics and other near-surface soils containing significant amounts of organic matter are not considered to be suitable for the subgrade support of engineered fill, building foundations, floor slabs, or other settlement sensitive structures. These materials should be completely stripped prior to placing any engineered fill or construction of foundations or interior or exterior slab-on-grade(s).

Disturbed/reworked materials containing excessive amounts of construction debris or organic material should be disposed of following appropriate environmental procedures. Furthermore; excessively-wet soils should be suitably dried before reuse as engineered fill.

Following the stripping of the surficial topsoil and soils containing significant amounts of organics and/or soft/disturbed surficial soils, the exposed subgrade should be heavily proof-rolled with suitable equipment, in conjunction with inspection by qualified geotechnical personnel to confirm that the exposed soils are competent and have been adequately stripped of ponded water and all disturbed, loosened, softened, organic and other deleterious material. Remedial work (i.e., further subexcavation and replacement) should be carried out on poorly-performing areas identified during the proof-rolling activities, as directed by Golder.

Any filling carried out at the site in conjunction with regrading should be carried out as under engineered fill procedures. Recommendations for the placement of engineered fill are outlined in Section 7.1.2 of this report.

7.1.2 Engineered Fill Requirements

As described above, the anticipated site grading activities may include both cutting and raising (filling) the original grade to meet the final design site grades. At the time of this report, the design cut and fill depths were not available for review. As such, for the purposes of this report, it has been assumed that cuts will not exceed 2 m and grade raises will not exceed more than 2 m.

In general, the existing native material is considered to be acceptable for reuse as engineered fill. Based on the laboratory test results, the water content of soils present at the site are considered to be generally near or above their optimum water contents for compaction, and therefore may require minor drying prior to placement, in general.

It should be noted that the native materials at the site are silty in nature, and as such are susceptible to overwetting and subsequent freezing during inclement weather. Therefore, it is recommended that site grading activities not be carried out during late fall, winter, early spring seasons or any periods of inclement weather conditions. All oversized cobbles (i.e., greater than 150 mm in size) and boulders, if present, should be removed from excavated material that will be used as engineered fill material.

If imported material is required for the engineered fill process, the material that is proposed for use as engineered fill should be approved by the geotechnical engineer at its source, prior to importing the material to the site. Suitable soils, free of topsoil, organic matter or other deleterious materials can be used as engineered fill provided that the water content of the soil at the time of placement does not vary by more than 2 percent

above or below its optimum water content for compaction. Otherwise, the soils may require treatment (i.e., drying or wetting) prior to placement.

Following the inspection and approval of the subgrade as described previously in this report, engineered fill materials should be placed in maximum 300 mm-thick loose lifts and uniformly compacted to 98 percent of the Standard Proctor maximum dry density (SPMDD). Filling should continue until the design elevations are achieved.

Full-time monitoring and in-situ density testing should be carried out by Golder during placement of engineered fill.

The final surface of the engineered fill should be protected as necessary from construction traffic and should be sloped to provide positive drainage for surface water during the construction period. If the engineered fill materials will be left exposed (i.e. uncovered) during periods of freezing weather, additional soil cover should be placed above final subgrade to provide some level of frost protection. Prior to placing the granular subbase and/or base courses within pavement areas, the surface of the engineered fill/subgrade should be inspected by Golder.

7.2 Installation of Underground Services

7.2.1 **Temporary Excavations**

Details of the underground servicing for the proposed development are unknown at the time of this investigation; as such, for the purpose of this report, the maximum depth of the underground services was assumed to be about 3 m below the existing ground surface. Once detailed design is completed, review of the underground services should be completed by this office for compliance with the recommendations contained herein.

The founding soils are anticipated to generally consist of the native sandy silty clay or engineered fill. These materials are considered to be suitable for supporting the underground services provided that the integrity of the base of the trench excavations is maintained during construction. Where softened or disturbed native soils or other deleterious materials are encountered at the base of excavations for settlement-sensitive services. these materials should be subexcavated and replaced with compacted fills approved by the geotechnical engineer.

Care should be taken to direct surface water away from any open excavations and all temporary excavations should be carried out in accordance with the Occupational Health and Safety Act (OHSA) and Regulations for Construction Projects.

In general, the groundwater level in the open boreholes, upon completion of drilling, was measured to be at depths ranging from 2.7 m to 12.8 m below existing ground surface. Whereas, the groundwater level in the monitoring wells, one month after drilling, was measured to be at depths ranging from 6.9 m to 12.8 m below existing ground surface. In general, groundwater in the excavations within the native deposits, are likely to be handled by collection via properly constructed and filtered sumps, located within the excavations, and then pumping and discharging the water to a suitable discharge point. However, should excavations deeper than 3 m below existing ground surface be required, some form of active dewatering, such as well points, may have to be implemented.

Excavations for the site servicing would generally extend through the native sandy silty clay deposit. Conventional excavation equipment should be suitable to excavate through these materials.

The hard stiff to very stiff native clayey till soils are classified as a "Type 2" soils under the OH&S Act. As such, all conventional temporary trench excavations should consist of open cuts with side slopes not steeper than 1 horizontal to 1 vertical in the overburden soils to within 1.2 m of the base of the excavation and then may be made vertical to the base. Where engineered fill is used or the native sandy silt/silty clay exhibits signs of water



seepage, the soil is classified as a "Type 3", as such all conventional temporary trench excavations should consist of gradient of 1 horizontal to 1 vertical. Where the side slopes of excavations are required to be steepened to limit the extent of the excavation, then some form of trench support may be required. Some trench excavations could be carried out using a vertically-excavated, unsupported excavation (using a properly-engineered trench liner box for protection, certified by an experienced engineer); or by a supported (sheeted) excavation if conditions warrant so; such as in wet areas and/or in close proximity to adjacent underground services

7.2.2 Pipe Bedding and Cover

The bedding for the sewers and watermains should be compatible with the size, type and class of pipe and the surrounding subsoil and the requirements of the City of Oshawa. If granular bedding is deemed to be acceptable, then Ontario Provincial Standard Specifications (OPSS) Granular A should be used from at least 150 mm below invert to springline. Clear stone should not be used as bedding material. From springline to 300 mm above the obvert of the pipe, sand cover could be used. All bedding and cover material should be placed in 150 mm loose lifts and uniformly compacted to at least 100 percent of SPMDD. Where variable fill materials, softened or disturbed native soils or other deleterious materials are encountered at the base of excavations for settlement-sensitive services, these materials should be subexcavated and replaced with compacted fills approved by the geotechnical engineer.

7.2.3 Trench Backfill

The excavated materials from the site will consist predominantly of silty clay till materials. Based on the measured water contents, in general, the native materials encountered at the site are estimated to be near or above their optimum water contents for compaction, and therefore, will probably require only minor drying prior to placement.

Care should be taken to maintain the water content of the soils close to/at the optimum water content for compaction during the construction operations, as difficulties with compaction and/or backfill performance would be anticipated with fine-grained soils where the water content is significantly above the optimum for compaction purposes. Soils that contain significant quantities of organics or debris are also not suitable for use as trench backfill within settlement-sensitive areas. In addition, all boulders and cobbles greater than 150 mm in size should be removed from the trench backfill materials. If there is a shortage of suitable in-situ material, an approved imported material such as Ontario Provincial Standard Specifications Select Subgrade Material should be used for trench backfill. Again, as noted above, the trench backfill materials are silty in nature and are very susceptible to wetting/freezing temperatures. Backfilling trenches during cold or wet weather is not recommended.

Trench backfill should be placed in maximum 300 mm loose lift thickness and uniformly compacted to at least 98 percent of the SPMDD of the material. Soil that is frozen should not be used as backfill.

Normal post-construction settlement of the compacted trench backfill should be anticipated with the majority of such settlement taking place within about 12 months following the completion of trench backfilling operations. If the trench backfill operations are completed during the winter months, post-construction settlements may increase beyond typical anticipated values. These settlements will be reflected at the ground surface. If the asphalt binder course is laid shortly following the completion of the trench backfilling operations, any settlement that may be reflected by subsidence of the surface of the binder asphalt should be compensated for by placing an additional thickness of binder asphalt or by padding. If possible, the surface course asphalt should not be placed over the binder course asphalt for about 12 months. Where scheduling requires that the surface course be placed over the binder course asphalt before this period, trench backfill settlement would be reflected by subsidence of the finished pavement surface in these areas which, depending upon the extent and magnitude, may require local repairs.

7.3 Building Foundations

As previously indicated, the existing site vegetation, surficial topsoil/organics and other near-surface soils containing significant amounts of organic matter are not considered to be suitable for the subgrade support of engineered fill, building foundations, floor slabs, or other settlement sensitive structures. These materials should be completely stripped prior to placing any engineered fill or construction of foundations or interior or exterior slab-on-grades.

Based on the subsurface conditions encountered in the boreholes, strip and spread footings that may be used, provided that the footings are founded on the native sandy silty clay deposit or on engineered fill (based on existing site soils) placed in accordance with the recommendation outlined in section 7.1, and maintained a minimum depth of soil embedment below finished adjacent ground surface and top of slab of 1.2 m.

For such strip and spread footings, a factored geotechnical resistance at Ultimate Limit States (ULS) of 225 kPa and a geotechnical reaction at Serviceability Limit States (SLS) of 150 kPa may be assumed for design purposes, provided that the strip footings dimensions of 0.45 m in width and 10 m in length or spread footings have a minimum width of 0.60 m and a maximum width of 1.2 m.

Where spread footings are constructed at different elevations, the difference in elevation between the individual footings should not be greater than one half the clear distance 650 mm between the footings. In addition, the lower footings should be constructed first so that if it is necessary to construct the lower footings at a greater depth than anticipated, the elevation of the upper footings can be adjusted accordingly. Stepped strip footings should be constructed in accordance with the Ontario Building Code (2012), Section 9.15.3.9.

The maximum total and differential settlements are expected to be less than 25 mm and 20 mm; respectively, for footings designed, constructed and inspected as outlined above.

All exterior footings, and interior footings in unheated areas, should be founded at a minimum depth of 1.2 m below finished grade level in order to provide adequate protection against frost penetration.

The native soils are susceptible to disturbance from construction activity, especially during wet or freezing weather. Care should be taken to preserve the integrity of the materials as bearing strata. It is essential that the founding surface for the footings be inspected by qualified geotechnical personnel prior to placing concrete. If the concrete for the footings cannot be placed immediately after excavation and inspection of the subgrade, it is recommended that a working mat of lean concrete be placed in the excavation to protect the integrity of the bearing stratum.

Resistance to lateral forces/sliding resistance between the concrete footings and the subgrade should be calculated in accordance with Section 6.7.5 of the CHBDC. The unfactored coefficient of friction, tan δ , for the interface between the cast-in-place concrete footing and the properly-prepared subgrade can be assumed to be 0.35.

7.3.1 Below Grade Walls

The exterior perimeter of all housing basement walls should be backfilled with an imported free draining, nonfrost susceptible granular material approved by a geotechnical engineer, carefully placed and compacted in 200 mm thick loose lifts. The design of the foundation walls for the below-grade walls should take into account the horizontal soil loads as well as surcharge loads that may occur during or after construction and should be designed using a lateral (at-rest) earth pressure coefficient of 0.5 and a unit weight of backfill of 21 kN/m³.

The wall backfill layers should be compacted to at least 95 per cent of the materials' standard Proctor maximum dry density. Light compaction equipment should be used immediately adjacent to the foundation wall, otherwise compaction stresses on the wall may be greater than that imposed by the backfill material. With the exception

of the driveway area, the upper 0.3 m of backfill should consist of clayey material to provide a low permeability cap and the exterior grade should also be shaped to slope away from the building.

Provided that the excavations adjacent to foundation/basement walls are backfilled with free-draining granular materials and a drainage collection system is provided around the perimeter of the building, the design of below-grade walls does not need to take into account hydrostatic forces acting on the walls. However, it is recommended that the exterior of the below-grade walls be damp-proofed.

7.4 Pavement Design within the Proposed Development

Following site grading operations, as noted previously, the proposed pavement subgrade will generally consist of either re-compacted engineered fill or native silty clay till. These materials are considered to be frost susceptible, and as such, the pavement design provided in **Table 3** below has taken this condition into consideration.

Based on the proposed pavement usage, (i.e. residential development type traffic and loads/frequencies) frost susceptibility and strength of the subgrade soils, the following pavement component given are recommended for the proposed development of access roads and streets, however the Town of Caledon and Region of Peel design standards should be followed:

Table	3:	Pavement	Design
-------	----	----------	--------

		Minimum Thickness of Pavement Components (mm)				
Material		Local Road (7.9m Road Pavement Width)	9.5 m Neighbourhood Collector (8.9 m Road Pavement Width)			
Asphaltic Concrete	HL 3 Surface Course	40	40			
(OPSS 1150)	HL 8 Binder Course	65	90			
Granular Materials	Granular A Base	150	150			
(OPSS.MUNI 1010)	Granular B Type II Subbase	350	500			
Total Pavement Thickn	ess (mm)	605	780			
		Prepared and Approved Sul	bgrade			

As part of the subgrade preparation, proposed access roads should be stripped of topsoil and other obviously unsuitable fill or organic materials. Fill required to raise the grades to design elevations should conform to the engineered fill requirements outlined previously in the report. Soft or spongy trench backfill areas should be sub-excavated and properly replaced with suitable approved backfill compacted to 98 percent SPMDD. Prior to placing pavement subbase and/or base materials, the exposed soil subgrade should be heavily proof-rolled in conjunction with an inspection by Golder. The granular subbase and base materials should be placed in loose layers no thicker than 200 mm and uniformly compacted to 100 percent of their SPMDD. The binder course and surface course asphalt materials should be compacted to minimum at 92.0 of their Marshall Maximum Relative Density according to OPSS 310, as measured in the field using a nuclear density gauge.

Where new pavement abuts existing pavement (e.g. at the development limits), proper longitudinal lap joints should be constructed to key the new asphalt into the existing asphalt surface. The existing asphalt edges should be provided with a proper sawcut edge prior to keying-in the new asphalt. It should be ensured that any undermining or broken edges resulting from the construction activities are removed by the sawcut.

It should be noted that in some cases, even though the compaction requirements have been met, the subgrade strength may not be adequate to support heavy construction loading especially during wet weather or where backfill materials wet of optimum have been placed. In this regard, the design subbase thickness may not be sufficient for a construction haul road and additional subbase (in the order of 450 mm) may be required. In any event, the subgrade should be proofrolled and inspected by Golder prior to placing the subbase and any additional material, as required, consistent with the prevailing weather conditions and anticipated use by construction traffic.

7.4.1 Subgrade Drainage

In order to preserve the integrity of the pavement, continuous subdrains should be placed at the concrete curb lines along both sides of the proposed streets. The invert of the subdrains should be at least 300 mm below the bottom of the Granular "B" subbase and should be sloped to drain to catchbasins. The subdrains should consist of perforated pipe wrapped in a suitable geotextile and surrounded on all sides with a minimum thickness of 150 mm of OPSS.PROV 1002 Concrete Fine Aggregate (i.e. concrete sand).

8.0 SEISMIC SITE CLASSIFICATION

Seismic hazard is defined in the 2012 Ontario Building Code (OBC) by uniform hazard spectra (UHS) at spectral coordinates of 0.2 second, 0.5 second, 1.0 second and 2.0 seconds and a probability of exceedance of 2% in 50 years. The OBC method uses a site classification system defined by the average soil/bedrock properties (e.g. shear wave velocity, Standard Penetration Test (SPT) resistance, undrained soil shear strength, etc.) in the 30 m below the foundation level. There are six site classes from A to F, decreasing in ground stiffness from A, hard rock, to E, soft soil; with site class F used to denote problematic soils (e.g. sites underlain by thick peat deposits and/or liquefiable soils). The site class is then used to obtain acceleration and velocity-based site coefficients F_a and F_v ; respectively, used to modify the UHS to account for the effects of site-specific soil conditions in design.

Based on the results of the preliminary geotechnical investigation and assuming soils below the maximum depth investigated exhibit similar properties / strengths, a **Site Class D** is estimated for planning purposes. The Site Class will need to be verified, and adjusted as necessary, during detail design.

9.0 INSPECTION AND TESTING

During construction, full-time observation should be carried out during engineered fill and site servicing backfill placement, and sufficient foundation inspections, subgrade inspections and in-situ materials testing should be carried out to confirm that the conditions exposed are consistent with those encountered in the boreholes and to monitor conformance to the pertinent project specifications.

10.0 CLOSING

We trust that this preliminary report provides enough preliminary geotechnical engineering information to proceed with the detailed design of the proposed development. If you have any questions regarding the contents of this report or require additional information, please do not hesitate to contact this office.

Signature Page

Golder Associates Ltd.

Erti Mansaku, P.Eng. Geotechnical Engineer

JD/EM/JET/sm

42

Jeff Tolton, C.E.T. Associate, Senior Geotechnical Technologist

Golder and the G logo are trademarks of Golder Associates Corporation

https://golderassociates.sharepoint.com/sites/102461/technical work/phase 6000 - coscorp hl developments inc/19115264 (6000) final georeport coscorp hl developments inc. (jet).docx





- ✤ Approximate Borehole Location
- \oplus Approximate Borehole and Monitoring Well Location
- Approximate Geotechnical Borehole from Adjacent Properties (Golder 2018, Clearbrook) \bigoplus
 - Watercourse
- Wetland
- Site Boundary
- Coscorp HL Developments Inc. Site Boundary



CLIENT COSCORP HL DEVELOPMENTS INC.

CONSULTANT	YYYY-MM-DD	2019-04-16
	DESIGNED	MM
GOLDER	PREPARED	MM
	REVIEWED	EM
	APPROVED	-

REFERENCE(S) 1. IMAGERY: ESRI, HERE, DELORME, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY © 2019 MICROSOFT CORPORATION © 2019 DIGITALGLOBE ©CNES (2019) DISTRIBUTION ADDUD OF

AIRBUS DS 2. BASE DATA: LIO MNRF 2019 3. PROJECTION: TRANSVERSE MERCATOR NAD 1983 UTM ZONE 17N

PRELIMINARY GEOTECHNICAL INVESTIGATION, PROPOSED RESIDENTIAL DEVELOPMENT, COSCORP HL DEVELOPMENTS INC.

TITLE

SITE AND BOREHOLE LOCATION PLAN

PROJECT NO. CONTROL REV. FIGURE 19115264 6000 1 -

APPENDIX A

Method of Soil Classification Abbreviations and Terms used on Record of Borehole List of Symbols Record of Boreholes

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity $Cu = \frac{D_{60}}{D_{10}}$ $Cc = \frac{(D_{30})^2}{D_{10}xD_{60}}$			Organic Content	USCS Group Symbol	Group Name			
		s of is mm)	Gravels with ≤12%	Poorly Graded		<4		≤1 or ≧	:3		GP	GRAVEL
(ss)	5 mm	/ELS / mass action 14.75	fines (by mass)	Well Graded		≥4		1 to 3	3		GW	GRAVEL
by ma	SOILS an 0.07	GRA 50% by oarse fr	Gravels with >12%	Below A Line			n/a				GM	SILTY GRAVEL
GANIC nt ≤30%	AINED arger th	<) or or or or or or	fines (by mass)	Above A Line			n/a			≤30%	GC	CLAYEY GRAVEL
INOR Conter	SE-GF Iss is la	is mm)	Sands with ≤12%	Poorly Graded		<6		≤1 or ≩	≥3		SP	SAND
rganic	COAR by ma	NDS y mass raction in 4.75	fines (by mass)	Well Graded	Well Graded ≥6 1 to 3		3		SW	SAND		
0)	(>50%	SAI 50% b oarse f iller tha	Sands with >12%	Below A Line	n/a				SM	SILTY SAND		
		(≥ sme	fines (by mass)	Above A Line			n/a				SC	CLAYEY SAND
Organic	Soil	Type	of Soil	Laboratory		F	Field Indica	ators	Toughness	Organic	USCS Group	Primary
Inorganic	Group	. , po	0.00	Tests	Dilatancy	Strength	Test	Diameter	(of 3 mm thread)	Content	Symbol	Name
				Liquid Limit	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT
(sst	15 mm	S and L	Line icity low)	<50	Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
by me	OILS 1an 0.0	SILTS tic or P	n Plast nart be		Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
GANIC it ≤30%	NED S naller ti	Plas	0° 5	Liquid Limit	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	МН	CLAYEY SILT
INOR	E-GRAI ss is sr	Ň		≥50	None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	ОН	ORGANIC SILT
rganic	FINE by ma		hart	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0%	CL	SILTY CLAY
0)	(≥50%	CLAYS	ticity C below)	Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium	30%	CI	SILTY CLAY
			abov Plas	Liquid Limit ≥50	None	High	Shiny	<1 mm	High	(see Note 2)	СН	CLAY
× S ° S	30% ss)	Peat and mineral soil mixtures							30% to 75%		SILTY PEAT, SANDY PEAT	
HIGHL SOL	by mas	Predomir may con	nantly peat, Itain some	75% PT					PT	DEAT		
40	ö	mineral so amorph	oil, fibrous or nous peat							100%		
-	Low	Plasticity		Medium Plasticity	- Hig	h Plasticity		a hyphen,	bol — A dual for example,	GP-GM, S	two symbols : SW-SC and Cl	separated by ML.
					CLAY	Sta Tall 2		For non-co	hesive soils,	the dual s	ymbols must b	e used when
30					СН			the soil h	as between I material b	5% and atween "c	12% fines (i.e lean" and "di	e. to identify
~					/			gravel.				ity sand of
ex (PI)				SILTY CLAY	CLAYEY SI ORGANIC S	IT MH		For cohes	ive soils, the	dual symb	ol must be us	ed when the
pul 20 -				ne /				liquid limit	and plasticity	/ index val	ues plot in the	CL-ML area
Plasti				Alle				or the plas	ucity chart (s	ee Plastici	ty Chart at len	.).
		SILTY CI	LAY	/				Borderlin	e Symbol —	A borderl	ine symbol is	two symbols
10			/	LAYEY SILT ML				separated	by a slash, fo	or example	e, CL/CI, GM/S	SM, CL/ML.
7 5	ILTY CLAY-CLAY	EY SILT, CL-ML	OF	RGANIC SILT OL				A borderlin	ne symbol sh identified as	ould be us	sed to indicate	that the soil
4	SILT ML (See Note 1)						transition	between simil	ar materia	ls. In addition.	a borderline
0	10	20	25.5 30	40 5	0 60	70	80	symbol ma	ay be used to	indicate a	range of simi	lar soil types
Note 1 – Fir	ne grained	materials wi	ں ith PI and LL	that plot in this a	area are nameo	I (ML) SILT w	ith	within a st	ratum.			
slight plast	icity. Fine-	grained mat	terials which	are non-plastic (i.e. a PL canno	ot be measure	ed) are					

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

named SILT. Note 2 – For soils with <5% organic content, include the descriptor "trace organics" for soils with between 5% and 30% organic content include the prefix "organic" before the Primary name.

💊 GOLDER

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES Not Applicable		75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND Coarse Medium Fine		2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY Classified by plasticity		<0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (<i>i.e.</i> , SAND and GRAVEL)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_i), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d: The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

- PH: Sampler advanced by hydraulic pressure
- PM: Sampler advanced by manual pressure
- WH: Sampler advanced by static weight of hammer
- WR: Sampler advanced by weight of sampler and rod

(
Compactness ²				
Term	SPT 'N' (blows/0.3m) ¹			
Very Loose	0 to 4			
Loose	4 to 10			
Compact	10 to 30			
Dense	30 to 50			
Very Dense	>50			

NON-COHESIVE (COHESIONLESS) SOILS

1. SPT 'N' in accordance with ASTM D1586, uncorrected for the effects of overburden pressure.

Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic 2. trip hammers), overburden pressure, groundwater conditions, and grainsize. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

SAMPLES	
AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
GS	Grab Sample
MC	Modified California Samples
MS	Modified Shelby (for frozen soil)
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
то	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample

SOIL TESTS

w	water content
PL, w _p	plastic limit
LL, w _L	liquid limit
С	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test ¹
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement ¹
DR	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
М	sieve analysis for particle size
МН	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
Ŷ	unit weight

1 Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

COHESIVE SOILS					
Consistency					
Term	Undrained Shear Strength (kPa)	SPT 'N' ^{1,2} (blows/0.3m)			
Very Soft	<12	0 to 2			
Soft	12 to 25	2 to 4			
Firm	25 to 50	4 to 8			
Stiff	50 to 100	8 to 15			
Very Stiff	100 to 200	15 to 30			
Hard	>200	>30			

SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure 1

SPT 'N' in accordance with ASTM D 1900, unconceded to overballed processes effects; approximate only. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations. 2.

Water Content			
Term	Description		
w < PL	Material is estimated to be drier than the Plastic Limit.		
w ~ PL	Material is estimated to be close to the Plastic Limit.		
w > PL	Material is estimated to be wetter than the Plastic Limit.		
Unless otherwise stated, the symbols employed in the report are as follows:

I.	GENERAL	(a) w	Index Properties (continued)
π	3.1416	w or LL	liquid limit
ln x	natural logarithm of x	w₀ or PL	plastic limit
log ₁₀	x or log x, logarithm of x to base 10	l₀ or PI	plasticity index = $(w_1 - w_p)$
q	acceleration due to gravity	ŃP	non-plastic
ť	time	Ws	shrinkage limit
		۱L	liquidity index = $(w - w_p) / I_p$
		lc	consistency index = $(w_l - w) / I_p$
		emax	void ratio in loosest state
		emin	void ratio in densest state
		ID	density index = $(e_{max} - e) / (e_{max} - e_{min})$
II.	STRESS AND STRAIN		(formerly relative density)
γ	shear strain	(b)	Hydraulic Properties
Δ	change in, e.g. in stress: $\Delta \sigma$	n	nydraulic nead or polenilai
3		q	
εv	volumetric strain	V	
η		1	
υ	Poisson's ratio	K	hydraulic conductivity
σ	total stress		(coefficient of permeability)
σ'	effective stress ($\sigma' = \sigma - u$)	J	seepage force per unit volume
σ'_{vo}			
σ1, σ2, σ3	principal stress (major, intermediate,		Consolidation (and dimensional)
	minor)	(0)	comprossion index
	mean stress or octahedral stress	Uc	(normally consolidated range)
Goct	$= (a_1 \pm a_2 \pm a_3)/2$	C	(normally consolidated range)
_	$-(\sigma_1 + \sigma_2 + \sigma_3)/3$	Ur	(over consolidated range)
τ	sileal siless	C	(over-consolidated range)
u F	modulus of deformation	Cs Ca	secondary compression index
G	shear modulus of deformation	m _v	coefficient of volume change
ĸ	bulk modulus of compressibility	Cv	coefficient of consolidation (vertical
			direction)
		Ch	coefficient of consolidation (horizontal direction)
		Tv	time factor (vertical direction)
III.	SOIL PROPERTIES	U	degree of consolidation
		σ΄ρ	pre-consolidation stress
(a)	Index Properties	OCR	over-consolidation ratio = σ'_p / σ'_{vo}
ρ(γ)	bulk density (bulk unit weight)*		
ρd(γd)	dry density (dry unit weight)	(d)	Shear Strength
ρω(γω)	density (unit weight) of water	τ_p, τ_r	peak and residual shear strength
ρs(γs)	density (unit weight) of solid particles	φ ′	effective angle of internal friction
γ'	unit weight of submerged soil	δ	angle of interface friction
	$(\gamma' = \gamma - \gamma_w)$	μ	coefficient of friction = tan δ
D _R	relative density (specific gravity) of solid	c′	effective cohesion
	particles ($D_R = \rho_s / \rho_w$) (formerly G_s)	Cu, Su	undrained shear strength (ϕ = 0 analysis)
е	void ratio	р	mean total stress (σ_1 + σ_3)/2
n	porosity	p'	mean effective stress ($\sigma'_1 + \sigma'_3$)/2
S	degree of saturation	q	(σ1 - σ3)/2 or (σ′1 - σ′3)/2
		\mathbf{q}_{u}	compressive strength (σ_1 - σ_3)
		St	sensitivity
* Densi	ty symbol is a Unit weight symbol is v	Notes: 1	$\tau = C' + \sigma' \tan \phi'$
where	$\gamma = \rho q$ (i.e. mass density multiplied by	2	shear strength = (compressive strength)/2
accele	eration due to gravity)	-	



RECORD OF BOREHOLE: BH/MW19-07

LOCATION: Lat. 43.755372 Long. -79.802724 (See Figure 1)

BORING DATE: March 27, 2019

SHEET 1 OF 2

		0	SOIL PROFILE		SA	MPL	ES	DYNAMIC PENETRATION	HYDRAULIC CONDUCTIVITY,	
	METRES	DRING METH	DESCRIPTION	RATA PLOT	L I.	ТҮРЕ	_OWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + Q - € Cu, kPa rem V. ⊕ U - C	$\begin{array}{c} 10^{6} & 10^{5} & 10^{4} & 10^{3} \\ 10^{6} & 10^{5} & 10^{4} & 10^{3} \\ \end{array}$ $\begin{array}{c} WATER CONTENT PERCENT \\ Wp $	↓ ₹₹ PIEZOMETER OR OR ↓ STANDPIPE ↓ INSTALLATION
	_	ы		5 (m)	+		В	20 40 60 80	10 20 30 40	
1 - COUNTRY CLAY: Note and C a leady. - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2	0		TOPSOIL (230 mm)	0.0	0 1A	SS				
2 3 4 5 6 6 7 7 6 6 7 7 6 6 7 7 6 8 7 7 8 7 7 8 8 7 8 8 8 7 7 8 8 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8	1		(CL) sandy CLAY, trace gravel, trace organics; dark brown; cohesive, w <pl, very stiff (CL) SILTY CLAY, some sand to sandy, trace gravel; light brown with oxidation staining, (TILL); cohesive, w<pl, very<br="">stiff to hard</pl,></pl, 	0.2 0.2 0.6 0.6 0.6 0.6 0.6	3 1B 11 2	ss	19		0	
3 -	2				3	ss	11		o	
• •	3		- Becoming sandy at a depth of 3 m		4	ss	24			Eent- onite
a b	4	ler			5	ss	45			
6 (SMML) sandy SILT to SILT, trace to some clay, slight plasticity, light brown; non-cohesive, wet, dense to very dense 7 5.50 7 7 5.50 7 7 5.50 7 7 5.50 7 7 5.50 7 7 5.50 7 7 5.50 7 7 5.50 7 7 5.50 7 7 5.50 7 7 5.50 7	5	CME 75 Track Mount Power Aug			6	SS	44		0	Sand
7 - Cobble/boulder inferred from auger grinding at a depth of 7.3 m 8 8 1000000000000000000000000000000000000	6		(SM/ML) sandy SILT to SILT, trace to some clay, slight plasticity; light brown; non-cohesive,wet, dense to very dense	5.5	7	ss	36		Φ	Screen,
Bent-onite Bent-onite Bent-onite Bent-onite Bent-onite DEPTH SCALE DEPTH SCALE	7		- Cobble/boulder inferred from auger grinding at a depth of 7.3 m		8	ss	100/ 2"		0	17/04/2019
DEPTH SCALE	8 9		(SM) SILTY SAND, fine to medium grained, some to trace gravel; light brown; non-cohesive, moist, dense to very dense		2					Bent- onite
CONTINUED NEXT PAGE Image: Control of the second	10 -				9	ss	131			
DEPTH SCALE LOGGED: JD			CONTINUED NEXT PAGE							
	DEF	PTH	SCALE					GOLDER		LOGGED: JD

RECORD OF BOREHOLE: BH/MW19-07

LOCATION: Lat. 43.755372 Long. -79.802724 (See Figure 1)

BORING DATE: March 27, 2019

SHEET 2 OF 2

	ц	QO		SOIL PROFILE				SA	MPL	.ES	DYNA RESIS	MIC PEN	IETRATI BLOWS	ON 5/0.3m	ì	HYDR.	AULIC Co k, cm/s	ONDUCT	IVITY,	Т	, O	
	SCAL	ЛЕТН			E C	5		æ		3m	:	20 4	40	50 E	30 `	1	0 ⁻⁶ 1	D ⁵ 10) ^{_4} 1(p-₃ ⊥	STIN	OR
		⊿ UU N		DESCRIPTION	i	I A F	ELEV.	MBEF	ΥΡΕ	VS/0	SHEA		NGTH	nat V. +	Q- •	w	ATER C		PERCE	NT	DITIO	STANDPIPE INSTALLATION
		BOR				RA A	DEPTH (m)	Ñ	Ĥ.	BLOV	Cu, KF	a		rem v. ⊕	0-0	W	p			wi	LAE	
_		-			-	N N				-		20 4	40 ·	50 E	30	1	10 2	0 30	0 4	0		
-	10		(SM) SILTY S/	AND, fine to medium		T																
_			grained, some brown; non-co	to trace gravel; light hesive, moist, dense to)																	-
-			very dense																			-
-																						-
_	• 11							10	ss	94						0						-
F																						-
-		-			5																	-
E		r Auge																				
F		Powe	E																			Sand Sand -
E	12	Mount																				
-		Track	E - Contains wet	sandy silt layer at a de	epth																	(1997) 1997 - 1997 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1
F		E 75 -						11	SS	40							0					Screen and Sand
E		S																				
F	13) (2013) 2014년 -
ΩĒ																						[] [] [] [] [] [] [] [] [] []
2 6																						
7/6/1																						4 4 -
	14							12	ss	38							0					Bentonite
IIS.G							14.00															
AL-N			Notos:	ENOLE.			14.55															
G -			1. Water level	measured at 12.8 mbg	s																	-
GS.C	15		2 Water level	measured in monitoring	a																	-
H LO			well as follows	:	9																	-
MO E			Deep Well Date	Depth Elev. (m)																	-
- 1 1 2			April 17, 2019 Shallow Well	12.8 mbgs N/A																		-
	16		Date April 17, 2019	Depth Elev. (m 6.9 mbgs N/A)																	
-SNE																						-
5264																						
11911																						-
	17																					-
M12																						-
6 E																						-
CALE																						-
NTS	18																					-
PME																						-
KELC																						-
XDE																						-
MR0	- 19																					
EAR																						-
S/CL																						-
EN																						-
	20																					
01 0																						
3HS 0	DE	PTH	SCALE									\sim			r						LC	OGGED: JD
GTA-I	1:	50										90	' L L		۲						СН	ECKED: EM

RECORD OF BOREHOLE: BH19-18

LOCATION: Lat. 43.753587 Long. -79.803241 (See Figure 1)

BORING DATE: March 27, 2019

SHEET 1 OF 1

ŀ			5	SOIL PROFILE			SA	MPI	FS	DYNAMIC PEN	ETRAT	ON	\	HYDR	AULIC	CONDUC	TIVITY,	т		
	SALE		Ē		F	r —	0,			RESISTANCE,	BLOWS	i/0.3m	Υ,		k, cm	ı/s	4	. 1	ING	PIEZOMETER
	T SO	N N	H M		PLO	FLEV	Ш	ш	0.3n	20 4	0	50 E	30	1	0-0	10-0	10 1	0	TION EST	OR STANDPIPE
	μH			DESCRIPTION	ATA	DEPTH	UMB	ТΥР	N/S/	SHEAR STREN Cu, kPa	IGTH	nat V. + rem V. ⊕	Q - O U - O		ATER	CONTEN	T PERCE	NT	AB. T	INSTALLATION
	ö		<u>ה</u>		STR,	(m)	Ī		BLO	20 4	0	30 E	30		р I	20	30	40	47	
ŀ				GROUND SURFACE												1	<u> </u>			
þ	- 0			TOPSOIL (200 mm)	EEE	0.00	1A	SS												-
				(CL) sandy SILTY CLAY, trace to some		0.20			11											-
Ē				gravel with cobbles/boulders inferred from auger grinding; brown to light brown			1B	SS												-
ŀ				with oxidation staining, (TILL); cohesive,																-
ŀ																				-
Ē	- 1						2	SS	22						þ					-
E																				-
																				-
ŀ																				-
							3	SS	38						>					-
	- 2																			
Ē																				-
Ē																				-
		ger					4	SS	35						ר µ	1			мн	27/03/2019
ŀ		er Auç																		-
F	- 3	Pow	Stem																	
പ		Nount	Solid				5	ss	35											-
Š		rack N	m																	-
16/15		75 TI	é																	-
12	- 4	CME																		-
GDT																				-
MIS.																				-
SAL-I																				-
2																				-
S.G	- 5						6	SS	52											-
ő																				-
ВН																				-
8 N																				-
<u> </u>																				-
LST.	- 6																			
NEL NEL				(CL/ML) CLAYEY SILT, trace sand;	M4	6.10														-
64-S				grey, (TILL), conesive, w/TL, hard			7	ss	33											-
1152		L																		
19				END OF BOREHOLE		6.71														
z U	- 7			Notes:																
12				upon completion of drilling.																-
Z Z																				-
ALEI																				-
S/C																				-
EN L	- 8																			
ЫN																				-
ÿ																				-
ЧЧ																				-
õ	- a																			-
RBF	3																			-
,ĽE																				-
TS/C																				-
Z U																				-
ت /	- 10																			-
сі т																				
S 00					•				_			•							•	
-BH	DE	PT	ΉS	CALE						🗟 GO	LC) E F	R						LC	OGGED: JD
GTA	1:	50											-						СН	ECKED: EM

RECORD OF BOREHOLE: BH19-19

LOCATION: Lat. 43.754896 Long. -79.804943 (See Figure 1)

BORING DATE: March 26, 2019

SHEET 1 OF 1

┟	ш	Ę	3	SOIL PROFILE			SA	MPL	.ES		PENE		ON /0.3m	ì	HYDF		CONDUC	TIVITY,	T	.0	
	SCAL.				LOT		æ		<u>3</u> m	20	4 ⁽	0 6	50 E	80		10 ⁻⁶	10 ⁻⁵	10 ⁻⁴ 1	o-₃ ⊥	STINC	PIEZOMETER OR
	METR		2	DESCRIPTION	TA PI	ELEV.	MBE	ΥPE	NS/0.	SHEAR S	TREN	GTH I	⊥ natV.+ remV⊕	Q-0	\ \	VATER	CONTEN	T PERCE	NT	B. TE	STANDPIPE INSTALLATION
	B				STRA	(m)	NN	F	BLO	20, Ki a	4	n ú		20-0	V	/p	ON	20	WI 10	I AR	
F		L		GROUND SURFACE							-40										
-	- 0			TOPSOIL (610 mm)		0.00															-
F							1	SS	4								C				-
E				(CL) sandy SILTY CLAY, some sand		0,61															-
E				trace gravel with cobbles/boulders																	-
F	- 1			oxidation staining, (TILL); w <pl, hard<="" stiff="" td="" to="" very=""><td></td><td></td><td>2</td><td>SS</td><td>26</td><td></td><td></td><td></td><td></td><td></td><td></td><td>o⊢</td><td>+-1</td><td></td><td></td><td>мн</td><td>-</td></pl,>			2	SS	26							o⊢	+-1			мн	-
E																					-
F																					-
E							3	ss	40												-
F	- 2																				
E																					-
F							4	ss	49							9					-
E		Auger																			-
F	- 3	Power	Stem																		-
ęĒ		Mount	Solid				5	SS	54												-
۹۲ – ۱		Track	00 mm																		-
17/6/1		AE 75	₽																		-
L L L L	- 4	õ					6	SS	55							0					
																					-
BAL-				- Increased sand content at a depth of																	-
- LdS				4.0 11			7	SS	86												-
0.05S.(- 5																				
BH LO				(SM) SILTY SAND, fine grained, inferred cobbles/boulders; light brown;		5.18															-
				non-cohesive, moist, very dense			8	SS	95						0						-
																					-
	- 6																				
4-SN							9	SS	100						0						-
11526		L																			
1191				END OF BOREHOLE.		6.71															
2 5	- 7			Notes: 1. Borehole dry upon completion of																	-
				drilling.																	-
Ĭ																					-
S/CA																					-
	- 8																				
NHO_																					-
																					-
NOKI SOKI																					-
RBR																					
CLEA																					
NTS/																					
ΰ	- 10																				_
S 001		L			1	1							<u> </u>	I	L				1		
P-BH;	DE	PT	нs	CALE						G	0	LD) E F	2						LC)GGED: JD
15	1:	50									•		-							CH	ECKED: EM

APPENDIX B

Geotechnical Laboratory Figures





APPENDIX C

Adjacent Properties Borehole Logs

RECORD OF BOREHOLE: BH/MW19-05

LOCATION: Lat. 43.75409 Long. -79.807715 (See Figure 1)

BORING DATE: March 28, 2019

SHEET 1 OF 2 DATUM: Geodetic

METRES	ORING METHOD	SOIL PROFILE DESCRIPTION	FRATA PLOT	ELEV. DEPTH (m)	NUMBER	MPLE Bd/T	tLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m ↓ 20 40 60 80 SHEAR STRENGTH nat V. + Q. ● Cu, kPa rem V. ⊕ U. ○	HYDRAULIC CONDUCTIVITY, k, cm/s 10 ⁻⁵ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³ WATER CONTENT PERCENT Wp I → O ^W I WI	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	ä	GROUND SURFACE	ST	070.50		_	m	20 40 60 80	10 20 30 40		
0		TOPSOIL (280 mm)		270.50	1A	SS					
		(CL) SILTY CLAY, trace gravel, trace organics; dark to light brown; cohesive, w~PL, stiff		270.22 0.28 269.74	1B	ss	12		Φ		
1		(CL) SILTY CLAY, some sand, trace gravel; light brown with oxidation staining, (TILL); w <pl, stiff<="" td="" very=""><td>A P P P P P P</td><td>0.76</td><td>2</td><td>ss</td><td>24</td><td></td><td>0</td><td></td><td></td></pl,>	A P P P P P P	0.76	2	ss	24		0		
2					3	SS	26				
3					4	SS	23		0		Bentonite
Ū					5	SS	26		0		
4	CME 75 Track Mount Power Auger	(CL-ML) CLAYEY SILT, trace sand to sandy, trace gravel; grey, (TILL); cohesive, w <pl, hard<="" th=""><th></th><th>265.64 4.86</th><th>6A 6B</th><th>SS SS</th><th>44</th><th></th><th>0</th><th></th><th>Sand</th></pl,>		265.64 4.86	6A 6B	SS SS	44		0		Sand
6 7		- Becoming sandy, with sand seams below a depth of 6.1 m			7	ss	77				Screen and Sand
8		- Silty sand layer/stratum encountered at a depth of 7.6 m			8	SS	94		0		↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓
9			A A A A A A A A	260.75	9	SS 1	100				Bentonite
10					$\lfloor \downarrow$		_		┟──┝──┼──┝──┼──	.	
		CONTINUED NEXT PAGE									
9 10 DE	 	END OF BOREHOLE. CONTINUED NEXT PAGE SCALE		<u>260.75</u> 9.75 - — —	9	SS 1	100	GOLDER		Lu CH	Bentonite DGGED: JD IECKED: EM

GTA-BHS 001 G.1 CLIENTSICLEARBROOKDEVELOPMENTSICALEDON/12 GINT/19/15/264-SNELLSHOLLOW BH LOGS.GPJ GAL-MIS.GDT 17/6/19 JMC

RECORD OF BOREHOLE: BH/MW19-05

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m

LOCATION: Lat. 43.75409 Long. -79.807715 (See Figure 1)

SOIL PROFILE

BORING DATE: March 28, 2019

SAMPLES

SHEET 2 OF 2 DATUM: Geodetic

PIEZOMETER

HYDRAULIC CONDUCTIVITY, k, cm/s

BORING METHOD DEPTH SCALE METRES ADDITIONAL LAB. TESTING STRATA PLOT 20 40 60 80 10⁻⁶ 10⁻⁵ 10-4 10⁻³ OR BLOWS/0.3m NUMBER STANDPIPE ТҮРЕ ELEV. SHEAR STRENGTH Cu, kPa rem V. ⊕ U- O WATER CONTENT PERCENT DESCRIPTION **INSTALLATION** DEPTH -0W Wp 🛏 - W (m) 60 10 30 40 20 40 80 20 --- CONTINUED FROM PREVIOUS PAGE ---10 Notes: 1. Borehole dry upon completion of drilling. 2. Water level measured in monitoring well as follows:
 Date
 Depth
 Elev. (m)

 March 28, 2019
 Dry
 Dry

 April 17, 2019
 8.32 mbgs
 262.18 m
 11 12 13 14 15 16 17 18 19 20 \Diamond DEPTH SCALE GOLDER LOGGED: JD 1 : 50 CHECKED: EM

RECORD OF BOREHOLE: BH/MW19-06

LOCATION: Lat. 43.752469 Long. -79.804999 (See Figure 1)

BORING DATE: March 2, 2019

SHEET 1 OF 1 DATUM: Geodetic

_																					
ш		QO	SOIL PROFILE			SA	MPL	.ES	DYNAM RESIS	/IC PEN	ETRAT	1ON S/0.3m	Ì	HYDR	RAULIC C	ONDUC	TIVITY,	T	, m		
CAL	S	IETH.		D.		~		ñ	2	.0 4	40	60	80 `		10 ⁻⁶ 1	0 ⁻⁵ 1	0-4	10 ⁻³ ⊥	NAL STINC	PIEZOMETER OR	
THS	н Н Н	ЫM		A PL	ELEV.	BER	Щ	S/0.3	SHEAF	R STREP	I NGTH	nat V.	+ Q-●	v	VATER C	ONTEN	I F PERC	ENT	ĮĔΫ.	STANDPIPE	
DEP	Σ	ORIN		RAT	DEPTH	N	≿	N N	Cu, kP	а		rem V.	⊕ U-O	w	/p ——	W		W	ADI	INSTALLATION	
		ä		ST	(11)			B	2	0 4	10	60	80		10	20 :	30	40			
_	0	_	GROUND SURFACE	====	262.00					┝───		_	_					-			
F					0.00	1A	SS													_	
E			(CL) SILTY CLAY, trace organics, some		261.59	10		9												<u>↓</u> 17/04/2019	
-			to trace sand, trace gravel; dark brown;			H	- 33														
-																					
-	1					2	SS	5													
E					260.55																
-			(CL) SILTY CLAY, some sand to sandy, trace gravel: light brown (TILL):		1.45	-															
-			cohesive, w>PL, stiff to very stiff			3	ss	14													
_	2																			Bentonite	-
-																					
F							0.00													$\overline{\Delta}$	
E						4	55	20												28/03/2019	
-	3																				-
F			(CL-ML) CLAYEY SILT, trace sand and		258.88	5A	SS														
_		<u>ام</u>	gravel; grey, (TILL); cohesive, w>PL, very stiff to hard			5B	ss	39													
-		ir Augi				\vdash															
-		Stem			*																
-	4	Mount Solid																		0.24	
-		0 mm																		Sand	
-		E 75 1 10			*																
-		S			*	6	SS	15													
_	5				4	ľ															<u> </u> -
-					4																
-																					
-					1																
_	6				*																<u>8</u> _
-					*															Screen and Sand	
	7				¥ \$																<u>8</u> -
-					*																
-					4																
-																					
-	8					8	SS	36												Bentonite	
					253.68					L											
			END OF BOREHOLE.		8.32	1															
			Notes: 1. Water level measured in monitoring																		
_	9		well as follows:																		-
			Date Depth Elev (m) March 28, 2019 2.54 mbgs 259.46 m																		
			April 17, 2019 0.38 mbgs 261.62 m																		
-																					
-	10																				_
				_	1	1	I			L	I			1	1		1		1		
	DEF	PTH	SCALE							GO	LI	DE	R						L	OGGED: JD	
	1:5	50																	СН	ECKED: EM	

RECORD OF BOREHOLE: BH19-17

LOCATION: Lat. 43.753061 Long. -79.806846 (See Figure 1)

BORING DATE: March 28, 2019

SHEET 1 OF 1

DATUM: Geodetic

| | DO. | SOIL PROFILE | | | SAN | I PLE | s

 | DYNAMIC PENE
RESISTANCE.

 | TRATIC
 | N
0.3m | ì | HYDF
 | RAULI
k. c | C CO
cm/s
 | NDUCT | IVITY, | Т | ں _ |
 |
|--------------|--|--|--|--|---|---
--
--
--
--
--
--|--|---|---
--
--
--|--|--|---|--|--|
| | METH | | PLOT | | ж | | 0.3m

 | 20 40

 |) 6
 | о в | i0
 |
 | 10 ⁻⁶ | 10
 | ⁵ 10 | 0 ⁻⁴ 1 | 0 ⁻³ ⊥ | FIONAL
ESTIN | PIEZOMETER
OR
STANDPIPE
 |
| | RING | DESCRIPTION | RATA F | DEPTH | NUMBE | TYPE | OWS/

 | SHEAR STREN
Cu, kPa

 | GTH n
 | at V. +
em V. ⊕ | Q - O
U - O |
 | VATE | R CO
 | NTENT | PERCE | NT
WI | ADDIT
AB. TI | INSTALLATION
 |
| \downarrow | B | | STF | (m) | | i |

 | 20 40

 |) 6
 | з а | 0 |
 | 10 | 20
 | 3 | 0 4 |
IO | |
 |
| • | | TOPSOIL (330 mm) | EEE | 269.50
0.00 | | | +

 |

 |
 | | |
 | |
 | | | | |
 |
| | | (CL) SILTY CLAY and SAND to sandy
SILTY CLAY, trace gravel; light brown
with oxidation staining, (TILL); cohesive, | | 269.17
0.33 | 1B | ss | 12

 |

 |
 | | |
 | | 0
 | | | | | -
 |
| 1 | | w <pl, stiff="" stiff<="" td="" to="" very=""><td></td><td></td><td>2A</td><td>ss</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td></pl,> | | | 2A | ss |

 |

 |
 | | |
 | |
 | | | | | -
 |
| | | | | | 2B | ss | 18

 |

 |
 | | |
 | a |
 | | | | мн | -
 |
| | | | | | | |

 |

 |
 | | |
 | |
 | | | | |
 |
| 2 | | | | | 3 | ss : | 29

 |

 |
 | | |
 | 0 |
 | | | | |
 |
| | | | | | | |

 |

 |
 | | |
 | |
 | | | | | -
 |
| | | | | | 4 | ss | 14

 |

 |
 | | |
 | |
 | | | | |
 |
| | er Auger | | | | | |

 |

 |
 | | |
 | |
 | | | | |
 |
| 3 | unt Pow | Nid Ster | | | | |

 |

 |
 | | |
 | |
 | | | | | -
 |
| : | rack Mo | 20 mm 0 | | | 5 | ss i | 29

 |

 |
 | | |
 | |
 | | | | |
28/03/2019
 |
| | ME 75 T | 100 | | | | |

 |

 |
 | | |
 | |
 | | | | |
 |
| 4 | อิ | | | | | |

 |

 |
 | | |
 | |
 | | | | | -
 |
| | | | | 264.93 | | |

 |

 |
 | | |
 | |
 | | | | |
 |
| | | (CL-ML) CLAYEY SILT, some sand, trace gravel; grey, (TILL); cohesive, | | 4.57 | | |

 |

 |
 | | |
 | |
 | | | | | -
 |
| 5 | | w <pl, hard<="" td=""><td></td><td></td><td>6</td><td>ss</td><td>34</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td></pl,> | | | 6 | ss | 34

 |

 |
 | | |
 | |
 | | | | | -
 |
| | | | | | | |

 |

 |
 | | |
 | |
 | | | | |
 |
| | | | | | | |

 |

 |
 | | |
 | |
 | | | | |
 |
| 6 | | | | | | |

 |

 |
 | | |
 | |
 | | | | |
 |
| | | | | | 7 | ss | 46

 |

 |
 | | |
 | |
 | | | | |
 |
| | | | | 262.79 | Ľ | |

 |

 |
 | | |
 | |
 | | | | |
 |
| 7 | | END OF BOREHOLE. | | 6.71 | | |

 |

 |
 | | |
 | |
 | | | | |
 |
| | | 1. Water level measured at 3.4 mbgs upon completion of drilling. | | | | |

 |

 |
 | | |
 | |
 | | | | | -
-
-
 |
| | | | | | | |

 |

 |
 | | |
 | |
 | | | | |
 |
| | | | | | | |

 |

 |
 | | |
 | |
 | | | | |
 |
| ° | | | | | | |

 |

 |
 | | |
 | |
 | | | | | -
 |
| | | | | | | |

 |

 |
 | | |
 | |
 | | | | |
 |
| | | | | | | |

 |

 |
 | | |
 | |
 | | | | |
 |
| 9 | | | | | | |

 |

 |
 | | |
 | |
 | | | | | -
 |
| | | | | | | |

 |

 |
 | | |
 | |
 | | | | |
 |
| | | | | | | |

 |

 |
 | | |
 | |
 | | | | |
 |
| 10 | | | | | | |

 |

 |
 | | |
 | |
 | | | | | _
 |
| | | | | | | |

 |

 |
 | | |
 | |
 | | | | |
 |
| DEF | PTH
in | H SCALE | | | | Į | Ĭ

 | S GO

 | LD
 | EF | R |
 | |
 | | | | LC | OGGED: JD
ECKED: EM
 |
| |);;;
]
1
1
1
2
3
3
4
4
5
5
6
6
7
7
7
8
8
8
9
9
9 | CUHLAN 0 1 2 3 4 5 6 7 8 9 0 DEPTI I 5 0 I I 5 0 I I 1 | OPEN SOIL PROFILE 0 GROUND SURFACE 0 GROUND SURFACE 1 TOPSOIL (330 mm) (CL) SILTY CLAY and SAND to sandy
SILTY CLAY, trace gravel, light brown
w <pl, stiff="" stiff<="" td="" to="" very=""> 1 (CL-ML) CLAYEY SILT, some sand,
trace gravel, grey, (TILL); cohesive,
w<pl, stiff="" stiff<="" td="" to="" very=""> 2 Image: Source of the second statistic of the second statis of the second statistic of the second statistic of the second s</pl,></pl,> | OP SOIL PROFILE 0 GROUND SURFACE 0 GROUND SURFACE 1 TOPSOL (330 mm) 1 (CL) SILTY CLAY and SAND to sandy 1 (CL-ML) CLAYEY SILT, some sand, 2 Notes: 3 Notes: 1 Notes: 1 Notes: 1 Water level measured at 3.4 mbgs 9 (CL SUE) 0 (CL SUE) | OUT SOIL PROFILE DESCRIPTION U Control GROUND SURFACE Control GROUND SURFACE Control CONTROL Contro C | OD SOIL PROFILE SAM 0 GROUND SURFACE 299.30 0.00 1 (CL) SULT/CLAY and SAND to sandy
(CL) SULT/CLAY and SAND to sandy
with oxidation staining. (TILL); cohesive,
w-PL, stiff to very stiff 0.00 1 2 (CL) SULT/CLAY, trace gravel: (ght brows)
with oxidation staining. (TILL); cohesive,
w-PL, stiff to very stiff 0.00 1 3 (CL-ML) CLAYEY SILT, some sand,
trace gravel: grey. (TILL); cohesive,
w-PL, hard 0.00 1 4 (CL-ML) CLAYEY SILT, some sand,
trace gravel: grey. (TILL); cohesive,
w-PL, hard 0 0 0 1 END OF BOREHOLE. 0.77 0.77 0.77 0.77 1 Notes:
1 1. 1. 0.00 0.00 0.00 0 0 0.00 0.00 0.00 0.00 0.00 | ODULY SOIL PROFILE SAMPLE DESCRIPTION 1 <t< td=""><td>OP SOIL PROFILE SAMPLES DESCRIPTION U <tdu< td=""><td>OL SOIL PROFILE SAMPLES CONTINUE VERSITANCE.E DESCRIPTION U <thu< th=""> U <thu< td=""><td>OIL SAUL PROFILE SAULES ENERSTACE BUSISTACE BUSI</td><td>OD SOIL PROFILE SAMPLE DRUSTANCE: BUXYBOUND 0</td><td>OD SOL PROPILE SAMULES DYLMIC PERICIPATION 0 DESCRIPTION 0<</td><td>OP SCH LPECPLE SAMLES DPXMICPEE FRUID() Implementation 0 DESCRIPTION 0</td><td>O SOL PROFILE SAMPLES DEVANCE PROFILE ATTOM MPDANCE 0<td>Bit SOIL PROFILE SAVELSE DEMONSTRATION
(1) Image: Constration of the const</td><td>Image: solut PROFILE SAMUE SOLUTION Image: solut PROFILE SAMUE SOLUTION Image: solut PROFILE Image: solut PROFILE<</td><td>Image: solution of alling. Solution of alling</td><td>Image: solution of alling. Sector (Sector (Sec</td><td>Image: The source of the source of</td></td></thu<></thu<></td></tdu<></td></t<> | OP SOIL PROFILE SAMPLES DESCRIPTION U <tdu< td=""><td>OL SOIL PROFILE SAMPLES CONTINUE VERSITANCE.E DESCRIPTION U <thu< th=""> U <thu< td=""><td>OIL SAUL PROFILE SAULES ENERSTACE BUSISTACE BUSI</td><td>OD SOIL PROFILE SAMPLE DRUSTANCE: BUXYBOUND 0</td><td>OD SOL PROPILE SAMULES DYLMIC PERICIPATION 0 DESCRIPTION 0<</td><td>OP SCH LPECPLE SAMLES DPXMICPEE FRUID() Implementation 0 DESCRIPTION 0</td><td>O SOL PROFILE SAMPLES DEVANCE PROFILE ATTOM MPDANCE 0<td>Bit SOIL PROFILE SAVELSE DEMONSTRATION
(1) Image: Constration of the const</td><td>Image: solut PROFILE SAMUE SOLUTION Image: solut PROFILE SAMUE SOLUTION Image: solut PROFILE Image: solut PROFILE<</td><td>Image: solution of alling. Solution of alling</td><td>Image: solution of alling. Sector (Sector (Sec</td><td>Image: The source of the source of</td></td></thu<></thu<></td></tdu<> | OL SOIL PROFILE SAMPLES CONTINUE VERSITANCE.E DESCRIPTION U <thu< th=""> U <thu< td=""><td>OIL SAUL PROFILE SAULES ENERSTACE BUSISTACE BUSI</td><td>OD SOIL PROFILE SAMPLE DRUSTANCE: BUXYBOUND 0</td><td>OD SOL PROPILE SAMULES DYLMIC PERICIPATION 0 DESCRIPTION 0<</td><td>OP SCH LPECPLE SAMLES DPXMICPEE FRUID() Implementation 0 DESCRIPTION 0</td><td>O SOL PROFILE SAMPLES DEVANCE PROFILE ATTOM MPDANCE 0<td>Bit SOIL PROFILE SAVELSE DEMONSTRATION
(1) Image: Constration of the const</td><td>Image: solut PROFILE SAMUE SOLUTION Image: solut PROFILE SAMUE SOLUTION Image: solut PROFILE Image: solut PROFILE<</td><td>Image: solution of alling. Solution of alling</td><td>Image: solution of alling. Sector (Sector (Sec</td><td>Image: The source of the source of</td></td></thu<></thu<> | OIL SAUL PROFILE SAULES ENERSTACE BUSISTACE BUSI | OD SOIL PROFILE SAMPLE DRUSTANCE: BUXYBOUND 0 | OD SOL PROPILE SAMULES DYLMIC PERICIPATION 0 DESCRIPTION 0< | OP SCH LPECPLE SAMLES DPXMICPEE FRUID() Implementation 0 DESCRIPTION 0 | O SOL PROFILE SAMPLES DEVANCE PROFILE ATTOM MPDANCE 0 <td>Bit SOIL PROFILE SAVELSE DEMONSTRATION
(1) Image: Constration of the const</td> <td>Image: solut PROFILE SAMUE SOLUTION Image: solut PROFILE SAMUE SOLUTION Image: solut PROFILE Image: solut PROFILE<</td> <td>Image: solution of alling. Solution of alling</td> <td>Image: solution of alling. Sector (Sector (Sec</td> <td>Image: The source of the source of</td> | Bit SOIL PROFILE SAVELSE DEMONSTRATION
(1) Image: Constration of the const | Image: solut PROFILE SAMUE SOLUTION Image: solut PROFILE SAMUE SOLUTION Image: solut PROFILE Image: solut PROFILE< | Image: solution of alling. Solution of alling | Image: solution of alling. Sector (Sector (Sec | Image: The source of |

APPENDIX D

Important Information and Limitations of This Report



IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder cannot be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Ground Water Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.



golder.com

Appendix A.2: Pre-development Calculations



**************************************	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
READ STORM Filename: C:\Users\hmilukow\AppD ata\Local\Temp\ 723ccf33-eb30-4ca4-a097-59bcd19a8e77\9bfc2c76	2.25 0.34 5.35 7.07 6.75 1.09 12.00 2.50 3.26 5.75 7.07 9.00 1.09 12.25 2.75 3.26 6.00 7.07 9.25 1.09 12.25 3.00 3.26 6.25 7.07 9.50 0.54 1
Ptotal= 42.00 mm Comments: 2yr/12hr	3.25 3.26 6.50 3.81 9.75 0.54
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	<pre></pre>
<pre></pre>	**************************************
Unit Hyd Qpeak (cms)= 9.610	READ STORM Filename: C:\Users\hmilukow\AppD ata\Local\Temp\ 722-cf22 cb20 4-c4 c007 50bcd10c0c7
TIME TO PEAK $(hrs) = 5.500$ RUNOFF VOLUME $(mm) = 10.045$	Ptotal= 62.71 mm Comments: 10yr/12hr
TOTAL RAINFALL (mm) = 42.000 RUNOFF COEFFICIENT = 0.239 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	TIME RAIN TIME RAIN I TIME RAIN I TIME I I I
**************************************	0.75 0.63 4.00 10.66 7.25 4.39 10.50 1.00 0.63 4.25 10.66 7.50 2.51 10.75 1.25 0.63 4.50 28.84 7.75 2.51 11.00 1.50 0.63 4.75 28.84 8.00 2.51 11.25
	1.75 0.63 5.00 28.84 8.25 2.51 11.50 2.00 0.63 5.25 28.84 8.50 1.25 11.75 2.25 0.63 5.50 8.15 8.75 1.25 12.50
READ STORM Filename: C:\Users\hmilukow\AppD ata\Local\Temp\ 723ccf33-eb30-4ca4-a097-59bcd19a8e77\8b231e31 Ptotal= 54.38 mm Comments: 5yr/12hr	2.50 3.76 5.75 8.15 9.00 1.25 12.25 2.75 3.76 6.00 8.15 9.25 1.25 3.00 3.76 6.25 8.15 9.50 0.63 3.25 3.76 6.50 4.39 9.75 0.63
TIME RAIN TIME RAIN ' TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr 0.25 0.00 3.50 9.25 6.75 3.81 10.00 0.54	
0.50 0.54 3.75 9.25 7.00 3.81 10.25 0.54 0.75 0.54 4.00 9.25 7.25 3.81 10.50 0.54	CALIB NASHYD (0024) Area (ha)= 140.14 Curve Number (CN)= 76

DATE: August 2020

0.54 0.54

1.50 1.75 2.00 2.25 2.50 2.75 3.00 3.25	0.54 0.54 0.54 3.26 3.26 3.26 3.26	4.75 5.00 5.25 5.50 5.75 6.00 6.25 6.50	25.02 25.02 7.07 7.07 7.07 7.07 3.81	8.00 8.25 8.50 8.75 9.00 9.25 9.50 9.75	2.18 2.18 1.09 1.09 1.09 1.09 0.54 0.54	11.25 11.50 11.75 12.00 12.25	0.54 0.54 0.54 0.54 0.54
IB IYD (0024) .DT=15.0 min 	Area Ia U.H. Tp cms) = 2 cms) = 2 hrs) = 2	(ha) = 14 (mm) = (hrs) = 0.610 2.691 (i) 5.500 5.900	10.14 C 8.10 # 0.56	urve Num of Line	oer (C ar Res.(2N)= 76.0 N)= 3.00	
(i) PEAK FLOW DOE	(mm) = 54 T = 0 S NOT INC	1.380).311 CLUDE BAS	SEFLOW IF	' ANY.			
READ STORM al= 62.71 mm	Filenan Comment	ne: C:\Us ata\I 723cc ss: 10yr/	sers\hmil Local\Tem cf33-eb30 /12hr	ukow\App p\ -4ca4-a0) 97-59bcd	19a8e77\;	34fa4c73
TIME hrs 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00 3.25	RAIN mm/hr 0.00 0.63 0.76 0	TIME hrs 3.50 3.75 4.00 4.25 4.50 4.75 5.00 5.25 5.50 5.50 6.00 6.25 6.50	RAIN mm/hr 10.66 10.66 28.84 28.84 28.84 28.84 28.84 8.15 8.15 8.15 8.15 8.15 4.39	' TIME ' hrs 6.75 7.00 7.25 7.50 7.50 8.00 8.25 8.50 8.75 9.00 9.25 9.50 9.75	RAIN mm/hr 4.39 4.39 2.51 2.51 2.51 2.51 1.25 1.25 1.25 1.25 0.63 0.63	TIME hrs 10.00 10.25 10.50 10.75 11.00 11.25 11.50 11.75 12.00 12.25	RAIN mm/hr 0.63 0.63 0.63 0.63 0.63 0.63 0.63 0.63
TB IYD (0024)	Area	(ha)= 14	40.14 C	urve Numl	per (C	EN)= 76.0	

ID= 1 DT=15.0 min Ia (mm)= 8.10 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= 0.56	*********
Unit Hyd Qpeak (cms) = 9.610 PEAK FLOW (cms) = 3.551 (i)	READ STORM Filename: C:\Users\hmilukow\AppD I ata\Local\Temp\ I 723ccf33-eb30-4ca4-a097-59bcd19a8e77\b05838de
TIME TO PEAK (hrs)= 5.500 PUINCEE VOLUME (mm)= 22.064	Ptotal= 80.82 mm Comments: 50yr/12hr
TOTAL RAINFALL (mm) = 62.710 RUNOFF COEFFICIENT = 0.352	TIME RAIN TIME RAIN ' TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr
(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	0.25 0.00 3.30 13.74 6.75 5.66 10.00 0.81 0.50 0.81 3.75 13.74 7.00 5.66 10.25 0.81 0.75 0.81 4.00 13.74 7.25 5.66 10.50 0.81
**************************************	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
READ STORM Filename: C:\Users\hmilukow\AppD ata\Local\Temp\ 23ccf33-eb30-4ca4-a097-59bcd19a8e77\eaee5477 Ptotal= 73.10 mm Comments: 25yr/12hr	2.50 4.85 5.75 10.50 9.00 1.62 12.25 0.81 2.75 4.85 6.00 10.50 9.25 1.62 3.00 4.85 6.25 10.50 9.50 0.81 3.25 4.85 6.50 5.66 9.75 0.81
TIME RAIN TIME	<pre></pre>
CALIB NASHYD (0024) Area (ha)= 140.14 Curve Number (CN)= 76.0 ID= 1 DT=15.0 min Ia (mm)= 8.10 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= 0.56	**************************************
Unit Hyd Qpeak (cms) = 9.610 PEAK FLOW (cms) = 4.713 (i) TIME TO PEAK (hrs) = 5.500 PUNCEE NOLUME (cms) = 20.022	READ STORM Filename: C:\Users\hmilukow\AppD ata\Local\Temp\ 723ccf33-eb30-4ca4-a097-59bcd19a8e77\b4d34ed8 Ptotal= 88.54 mm Comments: 100yr/12hr
TOTAL RAINFALL (mm) = 73.100 RUNOFF COEFFICIENT = 0.397 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	TIME RAIN TIME RAIN <th< td=""></th<>
**************************************	1.000.89 4.2515.05 7.503.54 10.750.891.250.89 4.5040.71 7.753.54 11.000.891.500.89 4.7540.71 8.003.54 11.250.89

1.7 2.0 2.2 2.5 2.5 3.0 3.2	5 0.89 0 0.89 5 0.89 0 5.31 5 5.31 0 5.31 5 5.31 5 5.31	5.00 5.25 5.50 5.75 6.00 6.25 6.50	40.71 40.71 11.51 11.51 11.51 11.51 6.20	8.25 8.50 8.75 9.00 9.25 9.50 9.75	3.54 1 1.77 1 1.77 1 1.77 1 1.77 1 1.77 0.89 0.89	11.50 11.75 12.00 12.25	0.89 0.89 0.89 0.89
CALIB NASHYD (0024) ID= 1 DT=15.0 min Unit Hyd Qpeak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICID (i) PEAK FLOW DO	Area Ia U.H. Tp(1 (cms)= 9 (cms)= 6 (hrs)= 5 (mm)= 40 (mm)= 88 ENT = 0 DES NOT INCI	(ha) = 140 (mm) = 8 hrs) = 0 610 566 (i) 500 175 540 454 LUDE BASE	.14 Cur .10 # c .56	rve Numbe of Linear NY.	r (CN) Res.(N)) = 76.0) = 3.00	



READ STORM Ptotal=212.00 mm	<pre>Filename: C:\Users\hmilukow\AppD</pre>
TIME hrs 1.00 2.00 3.00	RAIN TIME RAIN TIME RAIN TIME RAIN mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr 6.00 4.00 13.00 7.00 23.00 10.00 53.00 4.00 5.00 17.00 8.00 13.00 11.00 38.00 6.00 6.00 13.00 9.00 13.00 12.00 13.00

-----| CALIB | | NASHYD (0024) | Area (ha)= 140.14 Curve Number (CN)= 89.0 |ID= 1 DT=15.0 min | Ia (mm)= 8.10 # of Linear Res.(N)= 3.00 ----- U.H. Tp(hrs)= 0.56

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP.

		TRA	ANSFORMED HYETOGR	APH	
TIME	RAIN	TIME	RAIN ' TIME	RAIN TIME	RAIN
hrs	mm/hr	hrs	mm/hr ' hrs	mm/hr hrs	mm/hr
0.250	6.00	3.250	13.00 6.250	23.00 9.25	53.00
0.500	6.00	3.500	13.00 6.500	23.00 9.50	53.00
0.750	6.00	3.750	13.00 6.750	23.00 9.75	53.00
1.000	6.00	4.000	13.00 7.000	23.00 10.00	53.00
1.250	4.00	4.250	17.00 7.250	13.00 10.25	38.00
1.500	4.00	4.500	17.00 7.500	13.00 10.50	38.00
1.750	4.00	4.750	17.00 7.750	13.00 10.75	38.00
2.000	4.00	5.000	17.00 8.000	13.00 11.00	38.00
2.250	6.00	5.250	13.00 8.250	13.00 11.25	13.00
2.500	6.00	5.500	13.00 8.500	13.00 11.50	13.00
2.750	6.00	5.750	13.00 8.750	13.00 11.75	13.00
3.000	6.00	6.000	13.00 9.000	13.00 12.00	13.00

Unit Hyd Qpeak (cms)= 9.610

 PEAK FLOW
 (cms) =
 17.050
 (i)

 TIME TO PEAK
 (hrs) =
 10.250
 0

 RUNOFF VOLUME
 (mm) =
 176.247
 0

 TOTAL RAINFALL
 (mm) =
 212.000
 0

 RUNOFF COEFFICIENT
 0.831
 0
 0

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

VISUAL OTTHYMO OUTPUT: Snell's Hollow East Secondary Plan



**************************************	1.25 0.54 4.50 25.02 7.75 2.18 11.00 0.54 1.50 0.54 4.75 25.02 8.00 2.18 11.25 0.54
	1.75 0.54 5.00 25.02 8.25 2.18 11.50 0.54 2.00 0.54 5.25 25.02 8.50 1.09 11.75 0.54 2.00 0.54 5.25 25.02 8.50 1.09 11.75 0.54 2.25 0.54 5.50 7.07 8.75 1.09 11.75 0.54
READ STORM Filename: C:\Users\hmilukow\AppD	2.50 3.26 5.75 7.07 9.00 1.09 12.25 0.54
ata\Local\Temp\	2.75 3.26 6.00 7.07 9.25 1.09
Ptotal= 42.00 mm	3.00 3.26 6.25 7.07 9.50 0.54
	5.25 5.26 0.50 5.61 9.75 0.54
TIME RAIN TIME RAIN TIME RAIN TIME RAIN	
hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr	
0.25 0.00 3.50 7.14 6.75 2.94 10.00 0.42	
0.50 0.42 3.75 7.14 7.00 2.94 10.25 0.42	CALIB $
0.75 0.42 $ 4.00$ 7.14 $ 7.25$ 2.54 $ 10.50$ 0.42	NASHID (0041) Afea (hd) = 203.00 Curve Number (CN) = 74.0 ID= 1 DT=15 0 min ID= (mn) = 9.0 # of Lippor Por (N) = 3.00
$1.00 0.42 \mid 4.23 7.14 \mid 7.30 1.00 \mid 10.73 0.42$	1 ID = 1 D = 13.0 min + 12 min + 12 min + 5.50 m of Different Res. (N) = 3.00 min + 5.50 min
	0.11. 12(113) - 0.32
	Unit Hvd Opeak (cms) = 19.468
2.00 0.42 5.25 19.32 8.50 0.84 11.75 0.42	
2.25 0.42 5.50 5.46 8.75 0.84 12.00 0.42	PEAK FLOW (cms) = 4.694 (i)
2.50 2.52 5.75 5.46 9.00 0.84 12.25 0.42	TIME TO PEAK (hrs) = 5.500
2.75 2.52 6.00 5.46 9.25 0.84	RUNOFF VOLUME (mm) = 15.301
3.00 2.52 6.25 5.46 9.50 0.42	TOTAL RAINFALL (mm) = 54.380
3.25 2.52 6.50 2.94 9.75 0.42	RUNOFF COEFFICIENT = 0.281
	(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
CALIB	*********
NASHYD (0041) Area (ha) = 263.00 Curve Number (CN) = 74.0	** SIMULATION:Run 33 **
LD = 1 $DI = 15.0$ min 1a (mm) = 8.90 # 01 Linear Res.(N) = 5.00	
Unit Hyd Qpeak (cms)= 19.468	READ STORM Filename: C:\Users\hmilukow\AppD
	ata\Local\Temp\
PEAK FLOW (cms) = 2.660 (i)	723ccf33-eb30-4ca4-a097-59bcd19a8e77\84fa4c7
TIME TO PEAK (hrs)= 5.500	Ptotal= 62.71 mm Comments: 10yr/12hr
RUNOFF VOLUME (mm) = 8.925	
TOTAL RAINFALL (mm) = 42.000	TIME RAIN TIME RAIN TIME RAIN TIME RAIN
RUNOFF COEFFICIENT = 0.212	hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr
(1) DEAK PLOY DOED NOT THOUSE DAGETON TO SHY	
(1) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	
	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
**************************************	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
**************************************	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
**************************************	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
**************************************	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
**************************************	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
SIMULATION:Run 32 ** ************************************	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
**************************************	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
**************************************	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
<pre>************************************</pre>	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
**************************************	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
<pre>************************************</pre>	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
<pre>************************************</pre>	0.25 0.00 3.50 10.66 6.75 4.39 10.00 0.63 0.50 0.63 3.75 10.66 7.00 4.39 10.25 0.63 0.75 0.63 4.00 10.66 7.25 4.39 10.50 0.63 1.00 0.63 4.25 10.66 7.50 2.51 11.075 0.63 1.25 0.63 4.425 10.66 7.75 2.51 11.00 0.63 1.25 0.63 4.45 28.84 7.75 2.51 11.00 0.63 1.50 0.63 4.75 28.84 8.00 2.51 11.50 0.63 1.75 0.63 5.00 28.84 8.25 2.51 11.50 0.63 2.00 0.63 5.25 28.84 8.50 1.25 11.75 0.63 2.50 3.76 5.50 8.15 9.00 1.25 12.00 0.63 2.50 3.76 6.00 8.15 9.25 1.25 0.63 3.00 3.76 6.25<
<pre>************************************</pre>	0.25 0.00 3.50 10.66 6.75 4.39 10.00 0.63 0.50 0.63 3.75 10.66 7.00 4.39 10.25 0.63 0.75 0.63 4.00 10.66 7.25 4.39 10.50 0.63 1.00 0.63 4.25 10.66 7.50 2.51 10.75 0.63 1.25 0.63 4.50 28.84 7.75 2.51 11.00 0.63 1.25 0.63 4.50 28.84 8.00 2.51 11.25 0.63 1.50 0.63 5.00 28.84 8.25 2.51 11.50 0.63 1.75 0.63 5.00 28.84 8.25 2.51 11.50 0.63 2.00 0.63 5.25 28.84 8.50 1.25 11.75 0.63 2.50 3.76 5.75 8.15 9.00 1.25 12.00 0.63 2.50 3.76 6.50 4.39 9.75 0.63 .325 3.76 .650 4.39 9.75 </td

DATE: August 2020

2.18 | 10.75

0.54

9.25 | 7.50

1.00

0.54 | 4.25

ID= 1 DT=15.0 min Ia (mm)= 8.90 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= 0.52	********
Unit Hyd Qpeak (cms)= 19.468	READ STORM Filename: C:\Users\hmilukow\AppD ata\Local\Temp\
PEAK FLOW (cms) = 6.247 (i) TIME TO PEAK (hrs) = 5.500 RUNOFF VOLUME (mm) = 20 172	723ccf33-eb30-4ca4-a097-59bcd19a8e77\b05838de Ptotal= 80.82 mm Comments: 50yr/12hr
TOTAL RAINFALL (mm) = 62.710 RUNOFF COEFFICIENT = 0.322	TIME RAIN TIME RAIN ' TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr
(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	0.25 0.00 3.50 13.74 6.75 5.66 10.00 0.81 0.50 0.81 3.75 13.74 7.00 5.66 10.25 0.81 0.75 0.81 4.00 13.74 7.25 5.66 10.50 0.81
**************************************	1.00 0.81 4.25 13.74 7.50 3.23 10.75 0.81 1.25 0.81 4.50 37.17 7.75 3.23 11.00 0.81 1.50 0.81 4.75 37.17 7.75 3.23 11.00 0.81 1.50 0.81 4.75 37.17 8.00 3.23 11.25 0.81 1.75 0.81 5.00 37.17 8.25 3.23 11.50 0.81 2.00 0.81 5.25 37.17 8.50 1.62 11.75 0.81 2.25 0.81 5.50 10.50 8.75 1.62 12.00 0.81
READ STORM Filename: C:\Users\hmilukow\AppD ata\Local\Temp\ 23ccf33-eb30-4ca4-a097-59bcd19a8e77\eaee5477 Ptotal= 73.10 mm Comments: 25yr/12hr	2.50 4.85 5.75 10.50 9.00 1.62 12.25 0.81 2.75 4.85 6.00 10.50 9.25 1.62 3.00 4.85 6.25 10.50 9.50 0.81 3.25 4.85 6.50 5.66 9.75 0.81
TIME RAIN I TIME RAIN I TIME RAIN I TIME RAIN I Imm/hr hrs mm/hr I hrs mm/hr I hrs mm/hr I hrs mm/hr I ns mm/hr I<	<pre> CALIB NASHYD (0041) Area (ha)= 263.00 Curve Number (CN)= 74.0 ID= 1 DT=15.0 min Ia (mm)= 8.90 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= 0.52 Unit Hyd Qpeak (cms)= 19.468 PEAK FLOW (cms)= 10.014 (i) TIME TO PEAK (hrs)= 5.500 RUNOFF VOLUME (mm)= 31.985 TOTAL RAINFALL (mm)= 80.820 RUNOFF COEFFICIENT = 0.396 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.</pre>
CALIB NASHYD (0041) Area (ha) = 263.00 Curve Number (ID= 1 DT=15.0 min Ia (mm) = 8.90 # of Linear Res.(N) = 3.00 U.H. Tp(hrs) = 0.52	**************************************
Unit Hyd Qpeak (cms) = 19.468 PEAK FLOW (cms) = 8.356 (i) TIME TO PEAK (hrs) = 5.500 DUNORD UNDR (cms) = 26.760	
TOTAL RAINFALL (mm) = 73.100 RUNOFF COEFFICIENT = 0.366 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	TIME RAIN ITIME RAIN ITIME
**************************************	1.000.894.2515.057.503.5410.750.891.250.894.5040.717.753.5411.000.891.500.894.7540.718.003.5411.250.89

	1.75 2.00 2.25 2.50 2.75 3.00 3.25	0.89 0.89 0.89 5.31 5.31 5.31 5.31	5.00 5.25 5.50 5.75 6.00 6.25 6.50	40.71 40.71 11.51 11.51 11.51 11.51 11.51 6.20		8.25 8.50 8.75 9.00 9.25 9.50 9.75	3.54 1.77 1.77 1.77 1.77 1.77 0.89 0.89	11.50 11.75 12.00 12.25	0.89 0.89 0.89 0.89
CALIB NASHYD (00 ID= 1 DT=15.0 m Unit Hyd Qp PEAK FLOW TIME TO PEA RUNOFF VOLU TOTAL RAINF RUNOFF COEF (i) PEAK FL	 41) A in I U eak (cm K (hr ME (m ALL (m FICIENT OW DOES	rea () a () .H. Tp(h s)= 19. s)= 11. s)= 5. m)= 37. m)= 88. = 0. NOT INCL	ha) = 26 nm) = rs) = 468 742 (i) 500 428 540 423 JDE BAS	53.00 8.90 0.52 SEFLOW	Cur # c	cve Nur of Line ANY.	nber (C ear Res.(N)= 74.0 N)= 3.00	

VISUAL OTTHYMO OUTPUT: Snell's Hollow East Secondary Plan



READ STORM Ptotal=212.00 mm	READ STORM Filename: C:\Users\hmilukow\AppD ata\Local\Temp\ 853aa2dd-2815-444d-b092-b3bd072042c5\296e13 ctat=212.00 mm Comments: * Regional Storm					
TIME hrs 1.00 2.00 3.00	RAIN TIME RAIN TIME RAIN TIME RAIN mm/hr hrs mm/hr ' hrs mm/hr hrs mm/h 6.00 4.00 13.00 7.00 23.00 10.00 53.00 4.00 5.00 17.00 8.00 13.00 11.00 38.00 6.00 6.00 13.00 9.00 13.00 12.00 13.00	N r				

-----| CALIB |
| NASHYD (0041)| Area (ha)= 263.00 Curve Number (CN)= 88.0
|ID= 1 DT=15.0 min | Ia (mm)= 8.90 # of Linear Res.(N)= 3.00
------ U.H. Tp(hrs)= 0.52

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP.

		TRA	ANSFORMED	HYETOGR	APH	
TIME	RAIN	TIME	RAIN	' TIME	RAIN TIME	RAIN
hrs	mm/hr	hrs	mm/hr	' hrs	mm/hr hrs	mm/hr
0.250	6.00	3.250	13.00	6.250	23.00 9.25	53.00
0.500	6.00	3.500	13.00	6.500	23.00 9.50	53.00
0.750	6.00	3.750	13.00	6.750	23.00 9.75	53.00
1.000	6.00	4.000	13.00	7.000	23.00 10.00	53.00
1.250	4.00	4.250	17.00	7.250	13.00 10.25	38.00
1.500	4.00	4.500	17.00	7.500	13.00 10.50	38.00
1.750	4.00	4.750	17.00	7.750	13.00 10.75	38.00
2.000	4.00	5.000	17.00	8.000	13.00 11.00	38.00
2.250	6.00	5.250	13.00	8.250	13.00 11.25	13.00
2.500	6.00	5.500	13.00	8.500	13.00 11.50	13.00
2.750	6.00	5.750	13.00	8.750	13.00 11.75	13.00
3.000	6.00	6.000	13.00	9.000	13.00 12.00	13.00

Unit Hyd Qpeak (cms)= 19.468

 PEAK FLOW
 (cms) =
 32.356
 (i)

 TIME TO PEAK
 (hrs) =
 10.250

 RUNOFF VOLUME
 (mm) =
 172.918

 TOTAL RAINFALL
 (mm) =
 212.000

 RUNOFF COEFFICIENT
 0.816

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.



	******	1.75 0. 2.00 0
		2.25 0.
READ STORM	Filename: C:\Users\hmilukow\AppD	2.50 3.
	ata\Local\Temp\	2.75 3.
 Ptotal= 42.00 mm	723ccf33-eb30-4ca4-a097-59bcd19a8e77\9bfc2c76 Comments: 2yr/12hr	3.00 3. 3.25 3.
 ТТМЕ	RATN I TIME RATN I TIME RATN I TIME RATN	
hrs	mm/hr hrs mm/hr hrs mm/hr hrs mm/hr	
0.25	0.00 3.50 7.14 6.75 2.94 10.00 0.42	
0.50	0.42 3.75 7.14 7.00 2.94 10.25 0.42	CALIB
0.75	0.42 4.00 7.14 7.25 2.94 10.50 0.42	NASHYD (0447) Area
1.00	0.42 4.25 7.14 7.50 1.68 10.75 0.42	ID= 1 DT=15.0 min Ia
1.25	0.42 4.50 19.32 7.75 1.68 11.00 0.42	U.H.
1.50	0.42 4.75 19.32 8.00 1.68 11.25 0.42	
1.75	0.42 5.00 19.32 8.25 1.68 11.50 0.42	Unit Hyd Qpeak (cms)=
2.00		
2.25		PEAK FLOW (Cms)=
2.50		TIME TO PEAK (HTS) =
2.75		RUNOFF VOLUME (IIII) =
3.25	2.52 6.50 2.94 9.75 0.42	RUNOFF COEFFICIENT =
		() DENK FLOR DOED NOT
CALIB		*********************************
NASHYD (0447) ID= 1 DT=15.0 min	Area (ha)= 106.74 Curve Number (CN)= 79.0 Ia (mm)= 6.80 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= 0.58	** SIMULATION:Run 33 ***********************************
Unit Hyd Opeak	(cms) = -6.969	I READ STORM I F1
onite nya gpeak		
PEAK FLOW	(cms) = 1.410 (i)	i i
TIME TO PEAK	(hrs) = 5.500	Ptotal= 62.71 mm Cor
RUNOFF VOLUME	(mm) = 12.037	
TOTAL RAINFALL	(mm) = 42.000	TIME RA
RUNOFF COEFFICIE	NT = 0.287	hrs mm/
		0.25 0.
(i) PEAK FLOW DO	ES NOT INCLUDE BASEFLOW IF ANY.	0.50 0.
		0.75 0.
		1.00 0.
***************************************	*******	1.25 0
SIMULATION:Run 32	**	1.50 0
	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	1.75 0
		2.00 0
DEAD STORM	Filename. C.\Users\hmilukow\AnnD	2.25 0
INERE STORM	ata\Local\Temp\	2.50 5
I	723 cc f 33 -e b 30 - 4 ca 4 - a 097 - 59 b cd 19 a 8 e 77 b 231 e 31	2.75 5.
		3.00 3
Ptotal= 54.38 mm	Comments: 5yr/12hr	3.00 3. 3.25 3.
Ptotal= 54.38 mm	Comments: 5yr/12hr RAIN TIME RAIN TIME RAIN TIME RAIN	3.00 3 3.25 3.
Ptotal= 54.38 mm 	Comments: 5yr/12hr RAIN TIME RAIN ' TIME RAIN TIME RAIN mm/hr hrs mm/hr hrs mm/hr	3.00 3 3.25 3
Ptotal= 54.38 mm TIME hrs 0.25	Comments: 5yr/12hr RAIN TIME RAIN ' TIME RAIN TIME RAIN mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr 0.00 3.50 9.25 6.75 3.81 10.00 0.54	3.00 3 3.25 3
Ptotal= 54.38 mm 	Comments: 5yr/12hr RAIN TIME RAIN ' TIME RAIN TIME RAIN mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr 0.00 3.50 9.25 6.75 3.81 10.00 0.54 0.54 3.75 9.25 7.00 3.81 10.25 0.54	3.00 3 3.25 3

1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00 3.25	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	5 9.25 25.02 5 25.02 0 25.02 5 25.02 5 25.02 5 25.02 7.07 5 7.07 5 7.07 5 7.07 0 3.81	7.50 7.75 8.00 8.25 8.50 8.75 9.00 9.25 9.50 9.75	2.18 10.75 2.18 11.00 2.18 11.25 2.18 11.25 2.18 11.50 1.09 11.75 1.09 12.00 1.09 12.25 1.09 0.54 0.54	0.54 0.54 0.54 0.54 0.54 0.54 0.54
B IYD (0447) . DT=15.0 min Jnit Hyd Qpeak (Area (ha) = Ia (mm) = U.H. Tp(hrs) = cms) = 6.969	106.74 6.80 0.58	Curve Numb # of Linea	er (CN)= 79.0 r Res.(N)= 3.00)
YEAK FLOW (TIME TO PEAK () NUNOFF VOLUME YOTAL RAINFALL RUNOFF COEFFICIEN (i) PEAK FLOW DOE	cms) = 2.355 hrs) = 5.500 (mm) = 19.627 (mm) = 54.380 T = 0.361 S NOT INCLUDE F	(i) BASEFLOW I	F ANY.		
ULATION:Run 33	********** ** Filename: C: at: 72: Comments: 10	\Users\hmi a\Local\Te 3ccf33-eb3 yr/12hr	lukow\AppD mp\ 0-4ca4-a09	7-59bcd19a8e77\	,84fa4c73
TIME hrs 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 0.225 2.50 2.75 3.00 3.25	RAIN TIMM mm/hr hrs 0.00 3.5(0.63 3.75 0.63 4.00 0.63 4.25 0.63 4.25 0.63 5.00 0.63 5.25 0.63 5.25 0.63 5.25 0.63 5.75 3.76 6.00 3.76 6.25 3.76 6.50	E RAIN s mm/hr 0 10.66 0 10.66 0 28.84 0 28.84 0 28.84 0 28.84 0 28.84 0 28.84 0 28.84 0 28.84 0 28.84 0 8.15 0 8.15 0 8.15 0 8.15 0 8.15 0 8.15 0 4.39	<pre>' TIME ' hrs 6.75 7.20 7.25 7.50 7.75 8.00 8.25 8.50 8.50 8.75 9.00 9.25 9.50 9.75</pre>	RAIN TIME mm/hr hrs 4.39 10.00 4.39 10.25 4.39 10.50 2.51 10.75 2.51 11.00 2.51 11.25 2.51 11.25 1.25 12.00 1.25 12.05 1.25 12.00 1.25 12.25 1.25 0.63 0.63	RAIN mm/hr 0.63 0.63 0.63 0.63 0.63 0.63 0.63 0.63
TB NYD (0447)	Area (ha)=	106.74	Curve Numb	er (CN)= 79.0)

ID= 1 DT=15.0 min	Ia (mm)= 6.80 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= 0.58	*****************	
Unit Hyd Qpeak (d	cms) = 6.969	READ STORM Filename: C:\Users\hmilukow\AppD ata\Local\Temp\	
PEAK FLOW (cms) = 3.058 (i)	723ccf33-eb30-4ca4-a097-59bcd19a	.8e77\b05838de
TIME TO PEAK (I BUNGEE VOLUME	nrs) = 5.500 (mm) = 25.273	Ptotal= 80.82 mm Comments: 50yr/12hr	
TOTAL RAINFALL	(mm) = 62.710	TIME RAIN TIME RAIN ' TIME RAIN	TIME RAIN
RUNOFF COEFFICIEN	r = 0.403	hrs mm/hr hrs mm/hr ' hrs mm/hr	hrs mm/hr
(;) DEAK DION DOD		0.25 0.00 3.50 13.74 6.75 5.66 10	.00 0.81
(I) PEAK FLOW DOE.	5 NOI INCLUDE DASEFLOW IF ANI.	0.30 0.81 3.73 13.74 7.25 5.66 10	.50 0.81
		1.00 0.81 4.25 13.74 7.50 3.23 10	.75 0.81
****	******	1.25 0.81 4.50 37.17 7.75 3.23 11	.00 0.81
** SIMULATION:Run 34	**		.25 0.81
			.75 0.81
		2.25 0.81 5.50 10.50 8.75 1.62 12	.00 0.81
READ STORM	Filename: C:\Users\hmilukow\AppD	2.50 4.85 5.75 10.50 9.00 1.62 12	.25 0.81
	ata\Local\Temp\ 723ccf33-eb30-4ca4-a097-59bcd19a8e77\eaee5477		
Ptotal= 73.10 mm	Comments: 25yr/12hr	3.25 4.85 6.50 5.66 9.75 0.81	
TIME	RAIN TIME RAIN TIME RAIN TIME RAIN		
0.25			
0.50	0.73 3.75 12.43 7.00 5.12 10.25 0.73	CALIB	
0.75	0.73 4.00 12.43 7.25 5.12 10.50 0.73	NASHYD (0447) Area (ha) = 106.74 Curve Number (CN) =	79.0
1.00	0.73 4.25 12.43 7.50 2.92 10.75 0.73	ID= 1 DT=15.0 min Ia (mm) = 6.80 # of Linear Res.(N) =	3.00
1.25		U.H. Tp(hrs) = 0.58	
1.50	0.73 5.00 33.63 8.25 2.92 11.25 0.73	Unit Hvd Opeak (cms) = 6 969	
2.00	0.73 5.25 33.63 8.50 1.46 11.75 0.73		
2.25	0.73 5.50 9.50 8.75 1.46 12.00 0.73	PEAK FLOW $(cms) = 4.726$ (i)	
2.50	4.39 5.75 9.50 9.00 1.46 12.25 0.73	TIME TO PEAK (hrs) = 5.500	
2.75		RUNOFF VOLUME (mm) = 38.629	
3.00	4.39 6.50 5.12 9.75 0.73	RUNOFF COEFFICIENT = 0.478	
		(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	
CALIB		****	
NASHYD (0447)	Area (ha) = 106.74 Curve Number (CN) = 79.0	** SIMULATION:Run 36 **	
ID= 1 DT=15.0 min	Ia (mm)= 6.80 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= 0.58	*************	
Unit Hyd Qpeak (d	cms)= 6.969	READ STORM Filename: C:\Users\hmilukow\AppD	
		ata\Local\Temp\	
PEAK FLOW (0 TIME TO PEAK (1	cms) = 3.997 (i) brs) = 5.500	723ccf33-eb30-4ca4-a097-59bcd19a	.8e77\b4d34ed8
RUNOFF VOLUME	(mm) = 32.779		
TOTAL RAINFALL	(mm) = 73.100	TIME RAIN TIME RAIN ' TIME RAIN	TIME RAIN
RUNOFF COEFFICIEN	$\Gamma = 0.448$	hrs mm/hr hrs mm/hr hrs mm/hr	hrs mm/hr
(;) DEAK ELON DOD	C NOM TNOTINE DAGETON TE ANV		.00 0.89
(I) PEAK FLOW DOE:	D NOI INCLUDE DAGEFLUW IF ANI.		.25 0.89
		1.00 0.89 4.25 15.05 7.50 3.54 10	.75 0.89
* * * * * * * * * * * * * * * * * * * *	******	1.25 0.89 4.50 40.71 7.75 3.54 11	.00 0.89
** SIMULATION:Run 35	**	1.50 0.89 4.75 40.71 8.00 3.54 11	.25 0.89

1.75 2.00 2.25 2.50 2.75 3.00 3.25	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	0 40.71 5 40.71 11.51 5 11.51 6 11.51 6 20	8.25 8.50 8.75 9.00 9.25 9.50 9.75	3.54 11.50 1.77 11.75 1.77 12.00 1.77 12.25 1.77 0.89 0.89	0.89 0.89 0.89 0.89
CALIB NASHYD (0447) ID= 1 DT=15.0 min Unit Hyd Qpeak (PEAK FLOW (TIME TO PEAK (RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICIEN	Area (ha) = Ia (mm) = U.H. Tp(hrs) = cms) = 6.969 cms) = 5.478 hrs) = 5.500 (mm) = 44.670 (mm) = 88.540 T = 0.505	106.74 6.80 0.58 (i)	Curve Numbe # of Linear	er (CN)= 79.0 c Res.(N)= 3.00	
(I) FEAR FLOW DOE		DADELLOW I	.F ANI.		


READ STORM 	Filename: C:\Users\hmilukow\AppD ata\Local\Temp\ 166ca339-2260-4565-b289-9f97bf93bb13\296e1377				
Ptotal=212.00 mm	Comments: * Regional Storm				
TIME	RAIN TIME RAIN ' TIME RAIN TIME RAIN	1			
hrs	mm/hr hrs mm/hr hrs mm/hr hrs mm/hr	:			
1.00	6.00 4.00 13.00 7.00 23.00 10.00 53.00				
2.00	4.00 5.00 17.00 8.00 13.00 11.00 38.00				
3.00	6.00 6.00 13.00 9.00 13.00 12.00 13.00				
		· _			

------| CALIB | | NASHYD (0447)| Area (ha)= 106.74 Curve Number (CN)= 91.0 |ID= 1 DT=15.0 min | Ia (mm)= 6.80 # of Linear Res.(N)= 3.00 ----- U.H. Tp(hrs)= 0.58

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP.

		TRA	ANSFORMED HYETOGR	APH	
TIME	RAIN	TIME	RAIN ' TIME	RAIN TIME	RAIN
hrs	mm/hr	hrs	mm/hr ' hrs	mm/hr hrs	mm/hr
0.250	6.00	3.250	13.00 6.250	23.00 9.25	53.00
0.500	6.00	3.500	13.00 6.500	23.00 9.50	53.00
0.750	6.00	3.750	13.00 6.750	23.00 9.75	53.00
1.000	6.00	4.000	13.00 7.000	23.00 10.00	53.00
1.250	4.00	4.250	17.00 7.250	13.00 10.25	38.00
1.500	4.00	4.500	17.00 7.500	13.00 10.50	38.00
1.750	4.00	4.750	17.00 7.750	13.00 10.75	38.00
2.000	4.00	5.000	17.00 8.000	13.00 11.00	38.00
2.250	6.00	5.250	13.00 8.250	13.00 11.25	13.00
2.500	6.00	5.500	13.00 8.500	13.00 11.50	13.00
2.750	6.00	5.750	13.00 8.750	13.00 11.75	13.00
3.000	6.00	6.000	13.00 9.000	13.00 12.00	13.00

Unit Hyd Qpeak (cms)= 6.969

 PEAK FLOW
 (cms) =
 12.958
 (i)

 TIME TO PEAK
 (hrs) =
 10.250
 0

 RUNOFF VOLUME
 (mm) =
 182.435
 0

 TOTAL RAINFALL
 (mm) =
 212.000
 0

 RUNOFF COEFFICIENT
 0.861
 0
 0

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

Project: 2019-4851



	TRCA	TRCA	TRCA
Storm Event	Catchment	Catchment	Catchment ID
	ID 41	ID 24	447
	263.00 ha	140.14 ha	106.74 ha
2-Year	2.66 cms	1.55 cms	1.41 cms
5-Year	4.69 cms	2.69 cms	2.36 cms
10-Year	6.25 cms	3.55 cms	3.06 cms
25-Year	8.36 cms	4.71 cms	4.00 cms
50-Year	10.01 cms	5.62 cms	4.73 cms
100-Year	11.74 cms	6.57 cms	5.48 cms
Regional Event	32.36 cms	17.05 cms	12.96 cms

Existing TRCA Flows for catchments 41, 24 and 447 (12 hr AES)

Prorating the Flows to establish the existing flows from the Subject site using the Prorating Methodology (12 hr AES)

Storm Event	SCE Catchment ID 1	SCE Catchment ID 2	SCE Catchment ID 3
	46.20 ha	12.60 ha	2.90 ha
2-Year	0.72 cms	0.26 cms	0.09 cms
5-Year	1.27 cms	0.44 cms	0.16 cms
10-Year	1.70 cms	0.58 cms	0.20 cms
25-Year	2.27 cms	0.77 cms	0.27 cms
50-Year	2.72 cms	0.92 cms	0.32 cms
100-Year	3.19 cms	1.08 cms	0.37 cms
Regional Event	8.78 cms	2.80 cms	0.87 cms

7.0 Ontario Ministry of Transportation (MTO) Pro-rating Methodology

In some modelling situations, it may be applicable to pro-rate the flows from a large catchment to a smaller subcatchment with similar topography, watershed morphology and land cover. The accepted method for pro-rating flows is using a simplified version of the Modified Index Flood Method formula from the Ontario Ministry of Transportation section on nonhydrographic methods of flow rate calculation.

The Modified Index Flood Method referenced in the MTO Drainage Management Manual is the following formula:

$$Q_2 = Q_1 (A_2/A_1)^{0.75}$$

where:

- A₁ references to the known larger area;
- A2 references to the smaller area;
- Q₁ is the available flow available for the A₁ area; and
- Q₂ is the unknown variable.

If catchment areas have significantly different hydrologic characteristics, another method for flow calculation should be applied.

Source: Ontario Ministry of Transportation, MTO Drainage Management Manual, (1997).

Appendix A.3: Post - Development Calculations

Snell's Hollow VO Input Parameters



Area to Pond 1-Catchment 201	Area (ha)	С	TIMP	XIMP	Soil Type	CN	S	la
Low Density Area (Yellow)*	5.21	0.65	0.64	0.43	Oneida - D	87	37.95	5.7
Medium Density (Orange & Brown)*	0.88	0.75	0.79	0.79	Oneida - D	92	22.09	4.4
Road Area	4.29	0.65	0.64	0.65	Oneida - D	88	34.64	5.2
Park	1.31	0.25	0.07	0.07	Oneida - D	80	63.50	6.4
Heritage Home	0.10	0.55	0.50	0.50	Oneida - D	80	63.50	6.0
SWM Pond	1.60	0.55	0.50	0.50	Oneida - D	50	254.00	3.8
MTO Corridor	1.12	0.25	0.07	0.07	Oneida - D	80	63.50	6.4
total (weighted averages)	14.51	0.58	0.54	0.46		82.30		5.37

Area to Pond 202 and 204	Area (ha)	С	TIMP	XIMP	Soil Type	CN	S	la
Road Area and walkway	4.51	0.65	0.64	0.64	Oneida - D	88	34.64	5.2
Low Density Area (Yellow)*	4.71	0.65	0.64	0.43	Oneida - D	87	37.95	5.7
Medium Density (Orange & Brown)*	1.84	0.75	0.79	0.79	Oneida - D	92	22.09	4.4
High Density Residential (Red)	0.00	0.75	0.79	0.79	Oneida - D	92	22.09	4.4
SWM Pond	1.73	0.55	0.50	0.50	Oneida - D	50	254.00	3.8
MTO Corridor & open space	0.89	0.25	0.07	0.07	Oneida - D	80	63.50	6.4
Catchment 202 subtotal	13.68	0.62	0.61	0.53		82.87		5.15
Road Area (and road widening)	2.30	0.65	0.64	0.65	Oneida - D	88	34.64	5.2
Low Density Area (Yellow)*	0.37	0.65	0.64	0.43	Oneida - D	87	37.95	5.7
Medium Density (Orange & Brown)*	1.70	0.75	0.79	0.79	Oneida - D	92	22.09	4.4
High Density Residential (Red)*	1.27	0.75	0.79	0.79	Oneida - D	92	22.09	4.4
Park and servicing Block (not MTO setback)	0.39	0.25	0.07	0.07	Oneida - D	80	63.50	6.4
MTO Corridor	0.02	0.25	0.07	0.07	Oneida - D	80	63.50	6.4
Catchment 204 subtotal	6.05	0.67	0.67	0.66		89.36		4.92
Total to Pond 2(weighted averages)	19.73	0.64	0.63	0.57		85		5.1

Site Plan Area 1-Catchment 203	Area (ha)	С	TIMP	XIMP	Soil Type	CN	S	la
High Density Residential	1.25	0.75	0.79	0.79	Oneida - D	92	22.09	4.4
Commercial	1.47	0.90	1.00	1.00	Oneida - D	95	13.37	2.7
total (weighted averages)	2.72	0.83	0.90			94		3

Total Area

* Colors as per the draft plan

Snell's Hollow Pond 1 and LID Target Release Rates



Pre-Development Parameters	
Area 1 Less Natural Feature Area-to remain in existing Less Site Plan Area 1	46.17 ha -24.01 ha -2.72 ha
Total Area	19.44 ha



Target Rate Based on TRCA unit flow rates catchment #224

Storm Event	Unit Flow Rate (m ³ /s/ha)	Total Target Rate (m ³ /s)
Area (ha)		19.44
Runoff Coefficient C		-
AxC		-
2 Year	0.0075	0.146
5 Year	0.0133	0.259
10 Year	0.0187	0.364
25 Year	0.0270	0.525
50 Year	0.0352	0.684
100 Year	0.0421	0.819
Regional	0.1230	1.785

Unit flow rate based on the TRCA existing model

Snell's Hollow Pond 2 Release Rates



Pre-Development Paramete	rs
Area 2	12.65 ha

Post Developme	nt Area to Pond 2
Area to Pond 2	19.73 ha

Target Rate Based on TRCA unit flow rates catchment #224

Storm Event	Unit Flow Rate (m ³ /s/ha)	Total Target Rate (m ³ /s)
Area (ha)		12.645
Runoff Coefficient C		-
AxC		-
2 Year	0.0075	0.095
5 Year	0.0133	0.168
10 Year	0.0187	0.236
25 Year	0.0270	0.341
50 Year	0.0352	0.445
100 Year	0.0421	0.532
Regional	0.122	1.538

Snell's Hollow South Site Plan Target Release Rates



Pre-Development Parameters	
Site Plan South Area 1	2.72 ha
Total Area	2.72 ha



Target Rate Based on TRCA unit flow rates catchment #224

Storm Event	Unit Flow Rate (m ³ /s/ha)	Total Target Rate (m ³ /s)
Area (ha)		2.72
Runoff Coefficient C		-
AxC		-
2 Year	0.0075	0.020
5 Year	0.0133	0.036
10 Year	0.0187	0.051
25 Year	0.0270	0.073
50 Year	0.0352	0.096
100 Year	0.0421	0.115
Regional	0.1230	0.335

Unit flow rate based on the TRCA existing model

Snell's Hollow SWM Pond 1						HAEFFI	ERS
EROSION CONTROL	CALCU	LATIONS	-Pond 1				
Run	NHYD	DT [hr]	AREA [ha]	PKFW [m ³ /s]	TP [hr]	RV [mm]	DWF [m ³ /s]
19. Erosion (25mm)	656	0.25000	14.51000	0.39760	1.50000	14.80304	0.00000
Results of 4 hr 25 mm	Design S	Storm					
Input:	0						
Area =	14.5	1 ha					
R.V = = Draw Down Time	14.8 48	hrs					
Calculations:							
Storage =	2,14	7 m ³					
Average Outflow =	0.01	2 m ³ /s					
Peak Outflow =	0.019	9 m³/s					
SMEIL'S HOIIOW					SC co		FERS
EROSION CONTROL	CALCU	LATIONS	-Pond 2				
Run: 19. Erosion (25mm) 👻 Show	/ All Runs						

 Run
 NHYD
 FlowType
 DT [hr]
 AREA [ha]
 PKFW [m³/s]
 TP [hr]
 RV [mm]
 DWF [m³/s]
 TSSC [mg/l]
 TPPC [mg/l]
 TSSL [Kg]
 TPPL [g]

 19. Erosion (25mm)
 645
 Outflow
 0.083
 19.730
 0.026
 5.250
 16.776
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000

Results of 4 hr 25 mm Design Storm

Input:

Area = 19.73 ha R.V = 16.776 mm Draw Down Time = 48 hrs

Calculations:

Storage = 3,310 m³ Average Outflow = $0.019 \text{ m}^3/\text{s}$ Peak Outflow = $0.029 \text{ m}^3/\text{s}$

Snell's Hollow Site Plan South



EROSION CONTROL CALCULATIONS-Site Plan South

un: 19. Erosion (25mm) 👻 Show All Runs

Run	NHYD	FlowType	DT [hr]	AREA [ha]	PKFW [m³/s]	TP [hr]	RV [mm]	DWF [m³/s]	TSSC [mg/l]	TPPC [mg/l]	TSSL
19. Erosion (25mm)	12	Outflow	0.083	2.720	0.269	1.500	22.692	0.000	0.000	0.000	0
		5: S		66		2		3 X	()	1	
Results of 4 hr	25 mr	n Design) Storn	า							
Input:											
	Area	= 2.7	′2 ł	าล							
	R.V	= 22.6	692 r	nm							
Draw Down	Time	= 48	3 ł	ırs							
Calculations:											
St	orage	= 61	.7 r	n ³							
Average Ou	utflow	= 0.0	04 r	n³/s							
Peak Ou	utflow	= 0.0	05 r	n³/s							

Snell's Hollow

Theoretical Storages for Ponds- 2 to 100year events



5968

Area to Pond 1

Area Draining to Pond 1

Storm Event	Target Rate Prorated by	6 hour AES Release Rate	6 hour AES Required Volume	12 hour AES Release Rate	12 hour AES Required	3hr Chicago Release Rate	3hr Chicago Required Volume (m ³)
	Area(m [*] /s)	(m²/s)	(m [*])	(m ⁻ /S)	volume (m [*])	(m²/s)	
Erosion	0.019						
2 Year	0.146	0.117	2304	0.146	2350	0.017	1873
5 Year	0.259	0.248	2486	0.259	2500	0.112	2295
10 Year	0.364	0.362	2594	0.355	2587	0.198	2419
25 Year	0.525	0.522	2723	0.519	2723	0.452	2665
50 Year	0.684	0.677	2789	0.673	2789	0.609	2761
100 Year	0.819	0.815	2863	0.783	2845	0.776	2842
Regional	1.785		2863				
			Additional Region	nal Storage Required	3105	3900	

Additional Regional Storage Required Total Regional Volume Required

Snell's Hollow

Theoretical Storages for Ponds- 2 to 100year events



Area to Pond 2 New

Area Draining to Pond 2

Storm Event	Target Rate(m ³ /s)	6 hour AES Release Rate (m ³ /s)	6 hour AES Required Volume (m ³)	12 hour AES Release Rate (m ³ /s)	12 hour AES Required Volume (m³)	3hr Chicago Release Rate (m ³ /s)	3hr Chicago Required Volume (m ³)
2 Year	0.095	0.073	4174	0.095	4594	0.026	2970
5 Year	0.168	0.147	5390	0.168	5719	0.066	4040
10 Year	0.236	0.212	6156	0.236	6392	0.116	4918
25 Year	0.341	0.322	6972	0.341	7099	0.278	6676
50 Year	0.445	0.440	7466	0.445	7484	0.377	7240
100 Year	0.532	0.532	7925	0.528	7905	0.486	7694
Regional	1.538		14815				
			Additional Region	nal Storage Required	4222		

Additional Regional Storage Required

19037 Total Regional Volume Required

Snell's Hollow

Theoretical Storages for Ponds- 2 to 100year events



South Site Plan Area

On-site Control

Storm Event	Target Rate Prorated by Area(m ³ /s)	6 hour AES Release Rate (m ³ /s)	6 hour AES Required Volume (m³)	12 hour AES Release Rate (m ³ /s)	12 hour AES Required Volume (m ³)	3hr Chicago Release Rate (m ³ /s)	3hr Chicago Required Volume (m ³)
Erosion							
2 Year	0.020	0.017	780	0.020	819	0.005	593
5 Year	0.036	0.035	986	0.036	1002	0.016	767
10 Year	0.051	0.050	1116	0.050	1117	0.027	905
25 Year	0.073	0.073	1265	0.069	1242	0.062	1192
50 Year	0.096	0.096	1376	0.088	1338	0.081	1304
100 Year	0.115	0.114	1486	0.107	1440	0.102	1418
Regional	0.335		1968				
			Additional Region	nal Storage Required	582	3900	

Additional Regional Storage Required Total Regional Volume Required

2550



DATE: February 2021

	0.67 5.00 1.42 7.43 2.17 2.75 2.92 1.75
	0.75 6.81 1.50 6.20 2.25 2.58 3.00 1.68
V V I SSSSS U U A L (V 6.1.2003) V V I SS U U A A L	
V V I SS U U A A L V V I SS U U A A L VV I SSSSS UUUUU A A LLLLL	CALIB STANDHYD (0012) Area (ha)= 2.72 ID= 1 DT= 5.0 min Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00
000 TTTTT TTTTT H H Y Y M M 000 TM	
О О Т Т Н Н УУ ММ ММ О О	IMPERVIOUS PERVIOUS (1) Surface lrea (ba)= 2.45 0.27
о о т т н н у м м о о	Dep Storage $(mm) = 1.00 - 5.00$
ооо т т н н у м м ооо	Average Slope $(\$) = 1.00$ 2.00
Developed and Distributed by Smart City Water Inc	Length (m) = 134.66 40.00
All rights reserved.	Mannings n = 0.013 0.250
	Max.Eff.Inten.(mm/hr) = 95.47 27.76
****	over (min) 5.00 10.00
	Storage Coeff. (min) = 3.11 (ii) 6.10 (ii)
	Unit Hyd. Tpeak $(min) = 5.00$ 10.00
Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat	Unit Hyd. peak (Cms)- 0.27 0.15 *TOTALS*
Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e-	PEAK FLOW (cms) = 0.55 0.01 0.557 (iii)
a930-3446elae5bfa\850b0d5c-ddb9-42f6-aaal-ea189d349cde\scen	TIME TO PEAK (hrs)= 1.00 1.08 1.00
Summary filename: C:\Users\stanous\Applata\Local\Clvica\VHS\444DzD43-29CU-4I4e-	RUNOFF VOLUME (mm)= 24.36 10.98 23.02
	TOTAL RAINFALL (mm) = 25.36 25.36 25.36
	RUNOFF COEFFICIENT = 0.96 0.43 0.91
DATE: 02-09-2021 TIME: 01:20:05	***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
USER: COMMENTS:	 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 93.6 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
**********	RESERVOIR(0642) OVERFLOW IS OFF IN= 2> OUT= 1
<pre>** SIMULATION : 1. Chicago dnr 2yr ** **********************************</pre>	DT= 5.0 min OUTFLOW STORAGE OUTFLOW STORAGE
8766663e-6d3f-4db9-a962-c49127701f86\c7ad88c2 Ptotal= 25.36 mm Comments: Chicago 5 Min Time Step - 3hr - 2yr	AREA QPEAK TPEAK R.V.
 יעדגיי סאדא ו איז אין איז אין איז אין איז אין איז	INFLOW : ID= 2 (0012) 2.720 0.557 1.00 23.02
hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr	OUTFLOW: ID= 1 (0642) 2.720 0.005 3.08 21.86
0.08 1.86 0.83 10.84 1.58 5.33 2.33 2.43	PEAK FLOW REDUCTION $[Oout/Oin](\$) = 0.86$
0.17 2.03 0.92 27.01 1.67 4.68 2.42 2.30	TIME SHIFT OF PEAK FLOW (min)=125.00
	MAXIMUM STORAGE USED (ha.m.) = 0.0593
0.50 3.31 1.25 12.41 2.00 3.18 2.75 1.90	
0.58 3.97 1.33 9.30 2.08 2.95 2.83 1.82	L CALIB

IMPERVIOUS PERVIOUS (i) Surface Area (ha) = 8.34 5.34 Dep. Storage (mm) = 1.00 5.00 Average Slope (%) = 1.00 2.30 Length (m) = 301.99 40.00 Mannings n = 0.013 0.250 NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP. TRANSFORMED HYETOGRAPH TIME RAIN TIME hrs <mm hr="" td="" <=""> hrs<mm hr="" td="" <=""> hrs<mm hr="" td="" <=""> 0.250 2.04 1.000 44.44 0.250 2.04 1.000 44.44 0.500 2.89 1.250 2.16 2.000 3.47 2.75 1.99 0.750 5.26 1.500 7.64 2.250 2.76 3.00 1.75 Max.Eff.Inten.(mm/hr)= 44.44 10.45 0 0 1.75 Max.Eff.Inten.(mm/hr)= 6.00 45.00 1.00 1.75 Max.Eff.Inten.(mm/hr)= 0.07 0.01 *TOTALS* PEAK FLOW (</mm></mm></mm>	STANDHYD (0002) ID= 1 DT=15.0 min	Area Total In	(ha) = 1 np(%) = 6	L3.68 51.00	Dir.	Conn.(%)=	= 53.0	0	
NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP. TRANSFORMED HYETOGRAPH TIME RAIN TIME RAIN ' TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr 0.250 2.04 1.000 44.44 1.750 4.73 2.50 2.31 0.500 2.89 1.250 22.16 2.000 3.47 2.75 1.99 0.750 5.26 1.500 7.64 2.250 2.76 3.00 1.75 Max.Eff.Inten.(mm/hr) = 44.44 10.45 over (min) 15.00 45.00 Storage Coeff. (min) = 16.80 (ii) 97.80 (ii) Unit Hyd. Tpeak (min) = 15.00 105.00 Unit Hyd. peak (cms) = 0.07 0.01 *TOTALS* PEAK FLOW (cms) = 0.56 0.04 0.558 (iii) TIME TO PEAK (brs) = 1.00 2.75 1.00	Surface Area Dep. Storage Average Slope Length Mannings n	(ha) = (mm) = (%) = (m) = =	IMPERVIOU 8.34 1.00 1.00 301.99 0.013	JS I	PERVIOU 5.34 5.00 2.30 40.00 0.250	JS (i) 4))))			
TIME RAIN TIME RAIN ' TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr 0.250 2.04 1.000 44.44 1.750 4.73 2.50 2.31 0.500 2.89 1.250 22.16 2.000 3.47 2.75 1.99 0.750 5.26 1.500 7.64 2.250 2.76 3.00 1.75 Max.Eff.Inten.(mm/hr) = 44.44 10.45 over (min) 15.00 45.00 Storage Coeff. (min) = 16.80 (ii) 97.80 (ii) Unit Hyd. Tpeak (min) = 15.00 105.00 Unit Hyd. peak (cms) = 0.07 0.01 *TOTALS* PEAK FLOW (cms) = 0.56 0.04 0.558 (iii) TIME TO PEAK (hrs) = 1.00 2.75 1.00	NOTE: RAINFA	ALL WAS TH	RANSFORME	ED TO	15.0 M	4IN. TIME	STEP.		
Max.Eff.Inten.(mm/hr) = 44.44 10.45 over (min) 15.00 45.00 Storage Coeff. (min) = 16.80 (ii) 97.80 (ii) Unit Hyd. Tpeak (min) = 15.00 105.00 Unit Hyd. peak (cms) = 0.07 0.01 *TOTALS* PEAK FLOW (cms) = 0.56 0.04 0.558 (iii) TIME TO PEAK (brs) = 1.00 2.75 1.00	TIME hrs 0.250 0.500 0.750	RAIN mm/hr 2.04 2.89 5.26	TR# TIME hrs 1.000 1.250 1.500	ANSFORM RAII mm/h: 44.4 22.1 7.6	MED HYP N ' 7 r ' 4 1.7 6 2.0 4 2.2	ETOGRAPH - FIME RÅ hrs mm, 750 4. 000 3.4 250 2.	AIN 2 /hr 73 2 47 2 76 3	FIME hrs .50 .75 .00	RAIN mm/hr 2.31 1.99 1.75
TUTALS PEAK FLOW (cms)= 0.56 0.04 0.558 (iii) TIME TO PEAK (brs)= 1.00 2.75 1.00	Max.Eff.Inten.(mm over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak	n/hr) = (min) (min) = (min) = (cms) =	44.44 15.00 16.80 15.00 0.07	(ii)	10.45 45.00 97.80 105.00 0.01	5)) (ii)) 1			
RUNOFF VOLUME (mm) = 24.36 7.70 16.52 TOTAL RAINFALL (mm) = 25.36 25.36 25.36 RUNOFF COEFFICIENT = 0.96 0.30 0.65	PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICIEN	(cms) = (hrs) = (mm) = (mm) = JT =	0.56 1.00 24.36 25.36 0.96		0.04 2.75 7.70 25.36 0.30	4 5 0 6 0	0.558 1.00 16.52 25.36 0.65	(iii)	
 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 85.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. 	 (i) CN PROCEDUR CN* = 85 (ii) TIME STEP THAN THE ST (iii) PEAK FLOW I 	RE SELECTE 5.0 Ia (DT) SHOUI FORAGE COE DOES NOT 1	ED FOR PE = Dep. S LD BE SMA EFFICIENT INCLUDE E	ERVIOU: Storage ALLER (S. BASEFL(S LOSSI e (Abo DR EQU <i>I</i> DW IF <i>I</i>	ES: Dve) Al ANY.			

CALIB STANDHYD (0021)	Area	(ha) =	6.05				
ITD- 1 DT- 5 0 min 1	Total	Tmp(S) =	67 00	Dir ('onn (%)-	66 00	
1D= 1 D1= 3.0 mill	IULAI	Tub(~)-	07.00	DII. C		00.00	
		IMPERVI	OUS	PERVIOUS	S (i)		
Surface Area	(ha) =	4.0	5	2.00			
Dep. Storage	(mm) =	1.0	0	5.00			
Average Slope	(%) =	1.0	0	2.00			
Length	(m) =	200.8	3	40.00			
Mannings n	=	0.01	3	0.250			
Max.Eff.Inten.(n	nm/hr)=	95.4	7	15.47			
over	(min)	5.0	0	20.00			
Storage Coeff.	(min) =	3.9	5 (ii)	18.84	(ii)		
Unit Hyd. Tpeak	(min) =	5.0	0	20.00			
Unit Hyd. peak	(cms) =	0.2	4	0.06			
					*	TOTALS*	
PEAK FLOW	(cms) =	0.8	3	0.04		0.834	(iii)
TIME TO PEAK	(hrs) =	1.0	0	1.33		1.00	
RUNOFF VOLUME	(mm) =	24.3	6	7.77		18.71	

DATE: February 2021

TOTAL RAINFALL	(mm) =	25.36	25.36	25.36
BUNOFF COEFFICIE	NT =	0.96	0.31	0.74

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
- CN* = 88.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0658)				
1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0002):	13.68	0.558	1.00	16.52
+ ID2= 2 (0021):	6.05	0.834	1.00	18.71
ID = 3 (0658)	19 73	======================================	1 00	17 20

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0645	5)	OVERFL	OW IS C	FF			
IN= 2> OUT= 1	L						
DT= 5.0 min	i i	OUTFLO	W SI	ORAGE	1	OUTFLOW	STORAGE
·		(cms)	(1	.a.m.)	i	(cms)	(ha.m.)
		0.000	o c	.0000	i	0.2360	0.6393
		0.029	0 0	.3310	i	0.3410	0.7100
		0.095	0 0	.4595	i	0.4450	0.7485
		0.168	0 0	.5720	i	0.5320	0.7925
			AREA	OPEA	٩K	TPEAK	R.V.
			(ha)	(cms	5)	(hrs)	(mm)
INFLOW · ID= 2	(0658)	19 730	1	392	1 00	17 20
OUTFLOW: ID= 1	(0645)	19 730	 0	026	4 33	17.05
001110W. 1D- 1	(0040	/	10.100	0.	.020	1.55	11.00
	PEAK	FLOW	REDUC	TION [Ç	2out/	Qin](%)=	1.87

TIME SHIFT OF PEAK FLOW(min)=200.00MAXIMUM STORAGEUSED(ha.m.)= 0.2970

CALIB			
STANDHYD (0656)	Area	(ha) = 14.51	
ID= 1 DT=15.0 min	Total	Imp(%) = 54.00	Dir. Conn.(%) = 46.00
		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha) =	7.84	6.67
Dep. Storage	(mm) =	1.00	5.00
Average Slope	(%)=	1.00	2.30
Length	(m) =	311.02	40.00
Mannings n	=	0.013	0.250
NOTE: RAINI	FALL WAS	TRANSFORMED TO	15.0 MIN. TIME STEP.
		TRANSFO	RMED HYETOGRAPH

TIME RAIN | TIME RAIN | ' TIME RAIN | TIME RAIN

0.250

hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr 2.04 | 1.000 44.44 | 1.750 4.73 | 2.50 2.31

DATE: February 2021

***** DETAILED OUTPUT *****

2.89 | 1.250 22.16 | 2.000 3.47 | 2.75 1.99 0.500 0.750 5.26 | 1.500 7.64 | 2.250 2.76 | 3.00 1.75 Max.Eff.Inten.(mm/hr)= 44.44 9.33 Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat 15.00 45.00 Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4eover (min) Storage Coeff. (min) = 16.80 (ii) 97.80 (ii) a930-3446e1ae5bfa\ffd53e9e-e0f5-4a8a-894a-2ad4d02d2bb7\scen Unit Hyd. Tpeak (min) = 15.00 105.00 Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e-Unit Hyd. peak (cms) = 0.07 0.01 a930-3446e1ae5bfa\ffd53e9e-e0f5-4a8a-894a-2ad4d02d2bb7\scen *TOTALS*
 PEAK FLOW
 (cms) =
 0.51
 0.05

 TIME TO PEAK
 (hrs) =
 1.00
 2.75

 RUNOFF VOLUME
 (mm) =
 24.36
 7.14

 TOTAL RAINFALL
 (mm) =
 25.36
 25.36

 RUNOFF COEFFICIENT
 0.96
 0.28
 0.514 (iii) 1.00 15.06 25.36 DATE: 02-09-2021 TIME: 01:20:06 USER: (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: COMMENTS: CN* = 84.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. ******* ** SIMULATION : 10. AES 6hr 25yr ** | RESERVOIR(0657)| OVERFLOW IS OFF | IN= 2---> OUT= 1 | | DT= 5.0 min | OUTFLOW STORAGE | OUTFLOW STORAGE _____
 (cms)
 (ha.m.)
 (cms)
 (ha.m.)

 0.0000
 0.0000
 0.3640
 0.2594

 0.0190
 0.2147
 0.5250
 0.2723

 0.1460
 0.2350
 0.6840
 0.2789

 0.2590
 0.2500
 0.8190
 0.2863
 Filename: C:\Users\sfanous | ata\Local\Temp\ | READ STORM | Filename: C:\Users\sfanous\AppD 8766663e-6d3f-4db9-a962-c49127701f86\a8b5c5a3 | Ptotal= 65.59 mm | Comments: 25yr/6hr _____ TIME RAIN | TIME RAIN | ' TIME RAIN | TIME RAIN hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr AREA OPEAK TPEAK R.V. 0.25 0.00 | 2.00 22.30 | 3.75 9.18 | 5.50 1.31 (ha) (cms) (hrs) (mm) 15.06 0.50 1.31 | 2.25 22.30 | 4.00 5.25 | 5.75 1.31 INFLOW : ID= 2 (0656) 14.510 0.514 1.00 OUTFLOW: ID= 1 (0657) 14.510 0.017 5.33 14.86 0.75 1.31 | 2.50 60.35 | 4.25 5.25 | 6.00 1.31 1.00 1.31 | 2.75 60.35 | 4.50 2.62 | 6.25 1.31 PEAK FLOW REDUCTION [Oout/Oin](%) = 3.22 1.25 1.31 | 3.00 17.06 | 4.75 2.62 | TIME SHIFT OF PEAK FLOW (min)=260.00 1.50 7.87 | 3.25 17.06 | 5.00 1.31 | MAXIMUM STORAGE USED (ha.m.) = 0.18731.75 7.87 | 3.50 9.18 | 5.25 1.31 | _____ _____ _____ _____ | CALIB | V V I SSSSS U U A L (v 6.1.2003) | STANDHYD (0012) | Area (ha) = 2.72 V V I SS U U AA L |ID= 1 DT= 5.0 min | Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00 _____ IMPERVIOUS PERVIOUS (i) VV I SSSSS UUUUU A A LLLLL 0.27 Surface Area (ha) = 2.45 Lep. Storage (mm) = Average Slope (%) = Length 1.00 5 00 OOO TTTTT TTTTT H H Y Y M M OOO ΤМ 1.00 2.00 (m) = 134.66 О О Т Т Н Н ҮҮ ММ ММ О О Length 40.00 ООТТННҮММОО = 0.013 0.250 Mannings n ООО Т Т Н Н Ү М М ООО NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP. Developed and Distributed by Smart City Water Inc Copyright 2007 - 2020 Smart City Water Inc

All rights reserved.

---- TRANSFORMED HYETOGRAPH ----TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr 0.083 0.00 | 1.667 7.87 | 3.250 17.06 | 4.83 1.31 0.167 0.00 | 1.750 7.87 | 3.333 9.18 | 4.92 1.31 0.250 0.00 | 1.833 22.30 | 3.417 9.18 | 5.00 1.31 0.333 1.31 | 1.917 22.30 | 3.500 9.18 | 5.08 1.31 0.417 1.31 | 2.000 22.30 | 3.583 9.18 | 5.17 1.31 0.500 1.31 | 2.083 22.30 | 3.667 9.18 | 5.25 1.31 0.583 1.31 | 2.167 22.30 | 3.750 9.18 | 5.33 1.31 0.667 1.31 | 2.250 22.30 | 3.833 5.25 | 5.42 1.31 0.750 1.31 | 2.333 60.35 | 3.917 5.25 | 5.50 1.31 0.833 1.31 | 2.417 60.35 | 4.000 5.25 | 5.58 1.31 1.31 | 2.500 60.35 | 4.083 0.917 5.25 | 5.67 1.31 5.25 | 5.75 1.31 5.25 | 5.83 1.31 1.000 1.31 | 2.583 60.35 | 4.167 1.31 1.083 1.31 | 2.667 60.35 | 4.250 2.62 | 5.92 1.31 1.31 | 2.750 60.35 | 4.333 1.167 2.62 | 5.92 1.31 1.31 | 2.833 17.06 | 4.417 1.250 2.62 | 6.08 1.31 1.333 7.87 | 2.917 17.06 | 4.500 1.417 7.87 | 3.000 17.06 | 4.583 2.62 | 6.17 1.31 1.500 7.87 3.083 17.06 4.667 2.62 6.25 1.31 1.583 7.87 | 3.167 17.06 | 4.750 2.62 | Max.Eff.Inten.(mm/hr) = 60.35 54.03 over (min) 5.00 10.00 3.74 (ii) 7.32 (ii) Storage Coeff. (min) = Unit Hyd. Tpeak (min) = 5.00 10.00 0.13 Unit Hyd. peak (cms) = 0.25 *TOTALS*

 PEAK FLOW (cms) =
 0.41
 0.04
 0.449 (iii)

 TIME TO PEAK (hrs) =
 2.75
 2.75
 2.75

 RUNOFF VOLUME (mm) =
 64.59
 47.09
 62.84

 TOTAL RAINFALL (mm) =
 65.59
 65.59
 65.59

 RUNOFF COEFFICIENT =
 0.98
 0.72
 0.96

 2.75 62.84 65.59 0.96 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP! (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 93.6 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. | RESERVOIR(0642)| OVERFLOW IS OFF | IN= 2---> OUT= 1 | | DT= 5.0 min | OUTFLOW STORAGE | OUTFLOW STORAGE (ha.m.) _____ (cms) (ha.m.) | (cms) 0.0000 0.0000 | 0.0510 0.1120 0.1266 0.0050 0.0617 | 0.0730 0.0820 | 0.0960 0.0200 0 1376 0.0360 0.1003 | 0.1150 0.1490

AREA

(ha)

2.720

OUTFLOW: ID= 1 (0642) 2.720 0.073 3.50 61.68

INFLOW : ID= 2 (0012)

OPEAK

(cms)

PEAK FLOW REDUCTION [Qout/Qin](%) = 16.22

TIME SHIFT OF PEAK FLOW (min) = 45.00

0.449

TPEAK

(hrs)

R.V.

2.75 62.84

(mm)

CALIB | STANDHYD (0002) | Area (ha) = 13.68 |ID= 1 DT=15.0 min | Total Imp(%)= 61.00 Dir. Conn.(%)= 53.00 _____ IMPERVIOUS PERVIOUS (i)
 Surface Area
 (ha)=
 8.34
 5.34

 Dep. Storage
 (mm)=
 1.00
 5.00

 Average Slope
 (%) =
 1.00

 Length
 (m) =
 301.99

 Mannings n
 =
 0.013
 2 30 40.00 0.250 Max.Eff.Inten.(mm/hr) =
over (min)60.35
15.0053.14
30.00Storage Coeff. (min) =
Unit Hyd. Tpeak (min) =
Unit Hyd. peak (cms) =16.80
15.0097.80
105.00 *TOTALS*
 PEAK FLOW
 (cms) =
 1.08
 0.20

 TIME TO PEAK
 (hrs) =
 2.75
 4.25

 RUNOFF VOLUME
 (mm) =
 64.59
 38.27

 TOTAL RAINFALL
 (mm) =
 65.59
 65.59
 1.117 (iii) 2.75 52.22 65.59 RUNOFF COEFFICIENT = 0.98 0.58 0.80 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 85.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. _____ | STANDHYD (0021) | Area (ha) = 6.05 |ID= 1 DT= 5.0 min | Total Imp(%)= 67.00 Dir. Conn.(%)= 66.00 _____ IMPERVIOUS PERVIOUS (i) Surface Area (ha) = 4.05 2.00 Dep. Storage (mm) = 1.00 5.00
 Average Slope
 (%) =
 1.00
 2.00

 Length
 (m) =
 200.83
 40.00

 Mannings n
 =
 0.013
 0.250
 NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP. ---- TRANSFORMED HYETOGRAPH ----TIME RAIN | TIME RAIN | ' TIME RAIN | TIME RATN mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr hrs

0.00 | 1.667 7.87 | 3.250 17.06 | 4.83

0.00 | 1.750 7.87 | 3.333 9.18 | 4.92

0.00 | 1.833 22.30 | 3.417 9.18 | 5.00

1.31 | 1.917 22.30 | 3.500 9.18 | 5.08

1.31 | 2.000 22.30 | 3.583 9.18 | 5.17

1.31 | 2.083 22.30 | 3.667 9.18 | 5.25

1.31 | 2.167 22.30 | 3.750 9.18 | 5.33

0.667 1.31 | 2.250 22.30 | 3.833 5.25 | 5.42

1 31

1.31

1.31

1.31

1.31

1.31

1.31

1.31

STORAGE	USED	(ha.m.)=
DIOIUIOL	COLD	(1100 - 111 -)

MAXIMUM

CALIB

0.083

0.167

0.250

0.333

0.417

0.500

0.583

DATE: February 2021

0.1265

$\begin{array}{ccccc} 0.750 & 1.31 \\ 0.833 & 1.31 \\ 0.917 & 1.31 \\ 1.000 & 1.31 \\ 1.083 & 1.31 \\ 1.167 & 1.31 \\ 1.250 & 1.31 \\ 1.333 & 7.87 \\ 1.417 & 7.87 \\ 1.500 & 7.87 \\ 1.583 & 7.87 \end{array}$	2.333 60.35 2.417 60.35 2.500 60.35 2.583 60.35 2.667 60.35 2.750 60.35 2.833 17.06 3.000 17.06 3.083 17.06 3.167 17.06	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	25 5.50 1.31 25 5.58 1.31 25 5.67 1.31 25 5.75 1.31 25 5.75 1.31 25 5.92 1.31 62 6.00 1.31 62 6.08 1.31 62 6.08 1.31 62 6.17 1.31 62 6.25 1.31 62 6.25 1.31
Max.Eff.Inten.(mm/hr) = over (min) Storage Coeff. (min) = Unit Hyd. Tpeak (min) = Unit Hyd. peak (cms) = PEAK FLOW (cms) = TIME TO PEAK (hrs) = RUNOFF VOLUME (mm) = TOTAL RAINFALL (mm) = RUNOFF COEFFICIENT =	60.35 5.00 4.75 (ii) 5.00 0.22 0.67 2.75 64.59 65.59 0.98	47.89 15.00 14.23 (ii) 15.00 0.08 0.20 2.83 39.10 65.59 0.60	*TOTALS* 0.866 (iii) 2.75 55.92 65.59 0.85
***** WARNING: STORAGE COEFF. (i) CN PROCEDURE SELECTI CN* = 88.0 Ia (ii) TIME STEP (DT) SHOU THAN THE STORAGE COI (iii) PEAK FLOW DOES NOT :	IS SMALLER THAN ED FOR PERVIOUS = Dep. Storage LD BE SMALLER (EFFICIENT. INCLUDE BASEFIC	I TIME STEP! 5 LOSSES: 2 (Above) 0R EQUAL 0W IF ANY.	
ADD HYD (0658) 1 + 2 = 3 AI (1) ID1= 1 (0002): 13 + ID2= 2 (0021): 6 	REA QPEAK ha) (cms) .68 1.117 .05 0.866 .73 1.983	TPEAK R.V (hrs) (mm 2.75 52.22 2.75 55.92 2.75 53.35) =
NOTE: PEAK FLOWS DO NOT : RESERVOIR(0645) OVERF: IN= 2> OUT= 1 DT= 5.0 min OUTFL((cms) 0.001 0.022 0.092 0.161	INCLUDE BASEFLC LOW IS OFF (ha.m.) 00 0.0000 00 0.3310 50 0.4595 30 0.5720	WS IF ANY. OUTFLOW (cms) 0.2360 0.3410 0.4450 0.5320	STORAGE (ha.m.) 0.6393 0.7100 0.7485 0.7925
INFLOW : ID= 2 (0658)	AREA QPEA (ha) (cms 19.730 1.	K TPEAK 5) (hrs) 983 2.75	R.V. (mm) 53.35

PEAK FLOW REDUCTION [Qout/Qin](%)= 16.23

DATE: February 2021

STANDHYD (0656 ID= 1 DT=15.0 min) Area Total	(ha) = 14 Imp(%) = 54	.51 .00 Dir.	Conn.(%)= 4	6.00
		IMPERVIOUS	PERVIOU	JS (i)	
Surface Area	(ha) =	/.84	6.67		
Average Slope	(11111) =	1.00	2 30)	
Length	(m) =	311.02	40.00)	
Mannings n	=	0.013	0.250)	
Max.Eff.Inten	.(mm/hr)=	60.35	49.79	9	
OV	er (min)	15.00	30.00)	
Storage Coeff	. (min)=	16.80 (ii) 97.80) (ii)	
Unit Hyd. Tpe	ak (min)=	15.00	105.00)	
onic nyu. pea	K (CIIIS) -	0.07	0.01	- * TOT	ALS*
PEAK FLOW	(cms) =	0.99	0.23	1.	037 (iii)
TIME TO PEAK	(hrs) =	2.75	4.25	5 2	.75
RUNOFF VOLUME	(mm) =	64.59	36.68	8 49	.52
TOTAL RAINFAL	L (mm) =	65.59	65.59	65	.59
(i) CN PROC CN* = (ii) TIME ST	EDURE SELEC 84.0 EP (DT) SHO	CTED FOR PER [a = Dep. St DULD BE SMAL	VIOUS LOSSE orage (Abc LER OR EQU <i>P</i>	CS: ove) L	
(i) CN PROC: CN* = (ii) TIME ST: THAN TH: (iii) PEAK FL	EDURE SELE 84.0 : EP (DT) SH E STORAGE (OW DOES NO	CTED FOR PER TA = Dep. St DULD BE SMAL COEFFICIENT. F INCLUDE BA	VIOUS LOSSE orage (Abc LER OR EQUA SEFLOW IF A	CS: VVe) LL NNY.	
(i) CN PROC:	EDURE SELEC 84.0 : EP (DT) SHC E STORAGE (OW DOES NO?	CTED FOR PER Ia = Dep. St JULD BE SMAL COEFFICIENT. F INCLUDE BA RFLOW IS OFF	VIOUS LOSSE orage (Abc LER OR EQU <i>P</i> SEFLOW IF <i>P</i>	2S: vve) LL NY.	
(i) CN PROC: CN* = (ii) TIME ST: THAN TH: (iii) PEAK FL RESERVOIR(0657 IN= 2> OUT= 1	EDURE SELEC 84.0 : EP (DT) SHC E STORAGE (OW DOES NO 	CTED FOR PER Ia = Dep. St JULD BE SMAL COEFFICIENT. F INCLUDE BA RFLOW IS OFF	VIOUS LOSSE orage (Abc LER OR EQUA SEFLOW IF A	2S: vve) LL NY.	
(i) CN PROC: CN* = (ii) TIME ST: THAN TH: (iii) PEAK FL: RESERVOIR(0657 IN= 2> OUT= 1 DT= 5.0 min	EDURE SELEC 84.0 : EP (DT) SHO E STORAGE (OW DOES NO 	CTED FOR PER TA = Dep. St DULD BE SMAL COEFFICIENT. T INCLUDE BA COEFFICIENT RFLOW IS OFF FLOW STOR	VIOUS LOSSE orage (Abc LER OR EQUA SEFLOW IF A	NY. NY. STFLOW STO	RAGE
(i) CN PROC: CN* = (ii) TIME ST: THAN TH: (iii) PEAK FL: RESERVOIR(0657 IN= 2> OUT= 1 DT= 5.0 min	EDURE SELEC 84.0 : EP (DT) SHO E STORAGE (OW DOES NO 	CTED FOR PER Ta = Dep. St DULD BE SMAL COEFFICIENT. T INCLUDE BA COEFFICIENT RFLOW IS OFF FLOW STOR ns) (ha.; 0000 0 0	VIOUS LOSSE orage (Abc LER OR EQUA SEFLOW IF A AGE OU m.) 0	NY. NY. STFLOW STO (cms) (ha) 3640 0	RAGE .m.) 2594
(i) CN PROC: CN* = (ii) TIME ST: THAN TH: (iii) PEAK FL: RESERVOIR(0657 IN= 2> OUT= 1 DT= 5.0 min	EDURE SELEC 84.0 : EP (DT) SHO E STORAGE (OW DOES NO 	CTED FOR PER Ta = Dep. St DULD BE SMAL COEFFICIENT. P INCLUDE BA COEFFICIENT. RFLOW IS OFF FLOW STOR ns) (ha.: 0000 0.0	VIOUS LOSSE orage (Abc LER OR EQUP SEFLOW IF P AGE OU m.) (000 (147 (SS: vve) LL NY. TTFLOW STO (cms) (ha 0.3640 0 0.5250 0	RAGE .m.) .2594 .2723
(i) CN PROC: CN* = (ii) TIME ST: THAN TH: (iii) PEAK FL: RESERVOIR(0657 IN= 2> OUT= 1 DT= 5.0 min	EDURE SELEG 84.0 : EP (DT) SHO E STORAGE (OW DOES NO 	CTED FOR PER Ta = Dep. St DULD BE SMAL COEFFICIENT. P INCLUDE BA COEFFICIENT. RFLOW IS OFF FLOW STOR ns) (ha.: 0000 0.0 190 0.2 1460 0.2	VIOUS LOSSE orage (Abc LER OR EQUP SEFLOW IF P AGE OU m.) (000 (147 (350 (SS: vve) LL VTFLOW STO (cms) (ha 0.3640 0 0.5250 0 0.6840 0	RAGE .m.) .2594 .2723 .2789
(i) CN PROC: CN* = (ii) TIME ST: THAN TH: (iii) PEAK FL RESERVOIR(0657 IN= 2> OUT= 1 DT= 5.0 min	EDURE SELEC 84.0 : EP (DT) SHO E STORAGE (DW DOES NOT 	CTED FOR PER Ia = Dep. St DULD BE SMAL COEFFICIENT. T INCLUDE BA COEFFICIENT. RFLOW IS OFF FLOW STOR ns) (ha.: 0000 0.0 0190 0.2 1460 0.2 2590 0.2	VIOUS LOSSE orage (Abc LER OR EQUA SEFLOW IF A 	2S: .vve) LL NYY. 	RAGE .m.) .2594 .2723 .2789 .2863
(i) CN PROC: CN* = (ii) TIME ST: THAN TH: (iii) PEAK FL/ RESERVOIR(0657 IN= 2> OUT= 1 DT= 5.0 min	EDURE SELEC 84.0 : EP (DT) SHO E STORAGE (OW DOES NOT 	CTED FOR PER Ia = Dep. St DULD BE SMAL COEFFICIENT. F INCLUDE BA RFLOW IS OFF FLOW STOR ns) (ha.) 0000 0.0 0190 0.2 1460 0.2 2590 0.2 AREA	VIOUS LOSSE orage (Abc LER OR EQUA SEFLOW IF A 	US: DVP) LL MY. MTFLOW STO (cms) (ha 0.3640 0 0.5250 0 0.6840 0 0.8190 0 TPEAK	RAGE .m.) .2594 .2723 .2789 .2863 R.V.
(i) CN PROC: CN* = (ii) TIME ST: THAN TH: (iii) PEAK FL/ RESERVOIR(0657 IN= 2> OUT= 1 DT= 5.0 min	EDURE SELEC 84.0 : EP (DT) SHO E STORAGE (OW DOES NOT 	CTED FOR PER Ia = Dep. St DULD BE SMAL COEFFICIENT. F INCLUDE BA RFLOW IS OFF FLOW STOR ns) (ha.: 0000 0.0 0190 0.2 1460 0.2 2590 0.2 AREA (ha) 14 510	VIOUS LOSSE orage (Abc LER OR EQUA SEFLOW IF A AGE OU m.) (000 C 147 C 350 C 500 C QPEAK (cms) 1 027	US: DVP) LL MY. TTFLOW STO (cms) (ha 0.3640 0 0.5250 0 0.6840 0 0.8190 0 TPEAK (hrs) 2 75	RAGE .m.) .2594 .2723 .2789 .2863 R.V. (mm) 40.52
<pre>(i) CN PROC: CN* = (ii) TIME ST: THAN TH: (iii) PEAK FL/ (iii) PEAK FL/</pre>	EDURE SELEG 84.0 : EP (DT) SHO E STORAGE (OW DOES NO? 	CTED FOR PER Ea = Dep. St DULD BE SMAL COEFFICIENT. P INCLUDE BA RFLOW IS OFF FLOW STOR ns) (ha	VIOUS LOSSE orage (Abc LER OR EQUP SEFLOW IF P 	SS: vve) LL VTFLOW STO (cms) (ha .3640 0 0.5250 0 .6840 0 0.8190 0 TPEAK (hrs) 2.75 3.25	RAGE .m.) .2594 .2723 .2789 .2863 R.V. (mm) 49.52 49.32
<pre>(i) CN PROC:</pre>	EDURE SELE 84.0 : EP (DT) SHO E STORAGE (OW DOES NO 	CTED FOR PER Ia = Dep. St DULD BE SMAL COEFFICIENT. F INCLUDE BA	VIOUS LOSSE orage (Abc LER OR EQUA SEFLOW IF A 	DS: DVP) LL NYY. DTFLOW STO (cms) (ha 0.3640 0 0.5250 0 0.6840 0 0.8190 0 TPEAK (hrs) 2.75 3.25 	RAGE .m.) .2594 .2723 .2789 .2863 R.V. (mm) 49.52 49.32
<pre>(i) CN PROC:</pre>	EDURE SELEC 84.0 : EP (DT) SHO E STORAGE (OW DOES NO 	CTED FOR PER Ia = Dep. St DULD BE SMAL COEFFICIENT. F INCLUDE BA RFLOW IS OFF FLOW STOR ns) (ha.: 0190 0.2 1460 0.2 AREA (ha) 14.510 14.510 14.510 14.510 COM REDUCTION COM REDUCTION	VIOUS LOSSE orage (Abc LER OR EQUP SEFLOW IF P AGE OU m.) (000 O 147 O 350 O 500 O QPEAK (cms) 1.037 0.522 ON [Qout/Qi OW	SS: vve) LL VTFLOW STO (cms) (ha 0.3640 0 0.5250 0 0.6840 0 0.8190 0 TPEAK (hrs) 2.75 3.25 .n](%)= 50.37 (min) = 30.00	RAGE .m.) .2594 .2723 .2789 .2863 R.V. (mm) 49.52 49.32
<pre>(i) CN PROC:</pre>	EDURE SELEC 84.0 : EP (DT) SHO E STORAGE (OW DOES NO 	CTED FOR PER Ta = Dep. St DULD BE SMAL COEFFICIENT. F INCLUDE BA 	VIOUS LOSSE orage (Abc LER OR EQUP SEFLOW IF P AGE OU m.) (000 O 147 O 350 O 500 O QPEAK (cms) 1.037 0.522 ON [Qout/Qi OW ED (P	SS: vve) LL VTFLOW STO (cms) (ha 0.3640 0 0.5250 0 0.6840 0 0.8190 0 TPEAK (hrs) 2.75 3.25 	RAGE .m.) .2594 .2723 .2789 .2863 R.V. (mm) 49.52 49.32

VV

000

USER:

COMMENTS:

_____ _____ | CALIB | V V I SSSSS U U A L (v 6.1.2003) | STANDHYD (0012) | Area (ha) = 2.72 V V I SS U U AA L |ID= 1 DT= 5.0 min | Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00 V V I SS U U AAAAA L _____ V V I SS U U A A L I SSSSS UUUUU A A LLLLL S De OOO TTTTT TTTTT H H Y Y M M OOO ΤM A O O T T H H Y Y MM MM O O L О О Т Т Н Н Ү М М О О M Т Т Н Н Ү М М ООО Developed and Distributed by Smart City Water Inc Copyright 2007 - 2020 Smart City Water Inc All rights reserved. ***** DETAILED OUTPUT ***** Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4ea930-3446e1ae5bfa\189e6ca6-9823-4dd5-811c-ab3078eb04ea\scen Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4ea930-3446e1ae5bfa\189e6ca6-9823-4dd5-811c-ab3078eb04ea\scen DATE: 02-09-2021 TIME: 01:20:04 _____ _____ Μ

** SIMULATION : 11. AES 6hr 50yr ** ****

READ STORM	Filename: C:\Users\sfanous\AppD	
	ata\Local\Temp\	
	8766663e-6d3f-4db9-a962-c49127701f86\71df3a36	ŝ
Ptotal= 73.00 mm	Comments: 50yr/6hr	
TIME	RAIN TIME RAIN ' TIME RAIN TIME RAIN	
hrs	mm/hr hrs mm/hr hrs mm/hr hrs mm/hr	
0.25	0.00 2.00 24.82 3.75 10.22 5.50 1.46	
0.50	1.46 2.25 24.82 4.00 5.84 5.75 1.46	
0.75	1.46 2.50 67.16 4.25 5.84 6.00 1.46	
1.00	1.46 2.75 67.16 4.50 2.92 6.25 1.46	
1.25	1.46 3.00 18.98 4.75 2.92	
1.50	8.76 3.25 18.98 5.00 1.46	
1.75	8.76 3.50 10.22 5.25 1.46	

DATE: February 2021

1 DI- 5.0 MIII	IOCAI IN	up(%) = 9	0.00	DII. COMM.	. (%) = 90.00	
	,	MDEBUTOII	g DI	PVIOUS (1)		
Surface Area	(ha) -	2 45	5 11	0 27		
Don Storngo	(11a) = (mm) =	2.45		5.00		
Dep. Storage	(mm) =	1.00		5.00		
Average Slope	(%) =	1.00		2.00		
Length	(m) =	134.66		40.00		
Mannings n	=	0.013		0.250		
NOTE: RAIN	FALL WAS TH	RANSFORME	D TO	5.0 MIN. 7	FIME STEP.	
		TRA	NSFORM	ED HYETOGRA	APH	
TIM	E RAIN	TIME	RAIN	' TIME	RAIN TIME	RAIN
hr	s mm/hr	hrs	mm/hr	l' hrs	mm/hr hrs	mm/hr
0 08	3 0 00 1	1 667	8 76	3 250	18 98 1 4 83	1 46
0.16	7 0 00 1	1 750	8 76	1 3 333	10 22 4 92	1 46
0.25	0 0 00 1	1 833	24 82	1 3 417	10 22 5 00	1 46
0.23	3 1 46 1	1 917	24 82	1 3 500	10 22 5 08	1 46
0.00	7 1 46 1	2 000	21.02	1 3 593	10 22 5 17	1 46
0.41	0 1 46 1	2.000	24.02	3.505	10.22 5.17	1 46
0.50	2 1 46 1	2.005	24.02	1 3.007	10.22 5.23	1 46
0.00	7 1 46 1	2.107	24.02	3.730	IU.ZZ J.JJ	1 40
0.00	0 1.40	2.230	24.02	3.033	J.04 J.42	1 40
0.73	2 1.40	2.333	07.10	1 3.917	5.84 5.50	1.40
0.03	J 1.40	2.41/	07.10	4.000	J.04 J.J0	1.40
0.91	/ 1.40	2.500	07.10	4.083	5.84 5.67	1.40
1.00	0 1.40	2.583	07.10	4.10/	5.84 5.75	1.40
1.08	3 1.46	2.66/	6/.16	4.250	5.84 5.83	1.46
1.16	/ 1.46	2.750	6/.16	4.333	2.92 5.92	1.46
1.25	0 1.46	2.833	18.98	4.417	2.92 6.00	1.46
1.33	3 8.76	2.917	18.98	4.500	2.92 6.08	1.46
1.41	7 8.76	3.000	18.98	4.583	2.92 6.17	1.46
1.50	0 8.76	3.083	18.98	4.667	2.92 6.25	1.46
1.58	3 8.76	3.167	18.98	4.750	2.92	
Max.Eff.Inten.(mm/hr)=	67.16		61.21		
over	(min)	5.00		10.00		
Storage Coeff.	(min) =	3.58	(ii)	7.02 (ii)	J	
Unit Hyd. Tpeak	(min) =	5.00		10.00		
Unit Hyd. peak	(cms) =	0.26		0.14		
					TOTALS	
PEAK FLOW	(cms) =	0.46		0.04	0.501 (iii)	
TIME TO PEAK	(hrs) =	2.75		2.75	2.75	
RUNOFF VOLUME	(mm) =	72.00		54.17	70.22	
TOTAL BAINFALL	(mm) =	73 00		73 00	73 00	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

RUNOFF COEFFICIENT =

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

0.99

0.74

0.96

- CN* = 93.6 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
- THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(0642)	OVERFI	LOW IS OFF		
DT= 5.0 min	OUTFLC (cms) 0.000 0.005 0.020 0.036	STORA (ha.m 00 0.00 50 0.06 00 0.08 50 0.10	GE OUTFLOW .) (cms) 00 0.0510 17 0.0730 20 0.0966 03 0.1150	<pre>N STORAGE (ha.m.) 0 0.1120 0 0.1266 0 0.1376 0 0.1490</pre>
INFLOW : ID= 2 (OUTFLOW: ID= 1 (0012) 0642)	AREA (ha) 2.720 2.720	QPEAK TPEAH (cms) (hrs) 0.501 2. 0.096 3.	K R.V. (mm) 75 70.22 33 69.06
PI TI M2	CAK FLOW IME SHIFT (AXIMUM STO	REDUCTIO DF PEAK FLO DRAGE USE	N [Qout/Qin](%) W (min) D (ha.m.)	= 19.14 = 35.00 = 0.1376
CALIB STANDHYD (0002) ID= 1 DT=15.0 min	Area Total In	(ha) = 13. np(%) = 61.	68 00 Dir. Conn.	.(%)= 53.00
Surface Area Dep. Storage Average Slope Length Mannings n	(ha) = (mm) = (%) = (m) = =	IMPERVIOUS 8.34 1.00 1.00 301.99 0.013	PERVIOUS (i) 5.34 5.00 2.30 40.00 0.250	
Max.Eff.Inten.(r over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak	<pre>mm/hr) = (min) (min) = (min) = (cms) =</pre>	67.16 15.00 16.80 (i 15.00 0.07	61.56 30.00 i) 97.80 (ii) 105.00 0.01	+ TO T A 1 A 1
PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICIE	(cms) = (hrs) = (mm) = (mm) = ENT =	1.20 2.75 72.00 73.00 0.99	0.24 4.25 44.70 73.00 0.61	1.247 (iii) 2.75 59.17 73.00 0.81
<pre>(i) CN PROCEDU CN* = { (ii) TIME STEP THAN THE \$ (iii) PEAK FLOW</pre>	JRE SELECTE 35.0 Ia (DT) SHOUI STORAGE COE DOES NOT I	ED FOR PERV = Dep. Sto LD BE SMALL EFFICIENT. INCLUDE BAS	IOUS LOSSES: rage (Above) ER OR EQUAL EFLOW IF ANY.	
CALIB STANDHYD (0021) ID= 1 DT= 5.0 min	Area Total In	(ha)= 6. np(%)= 67.	05 00 Dir. Conn.	(%)= 66.00
Surface Area Dep. Storage Average Slope Lepgth	(ha) = (mm) = (%) = (m) =	IMPERVIOUS 4.05 1.00 1.00 200.83	PERVIOUS (i) 2.00 5.00 2.00 40.00	

DATE: February 2021

Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

		TRA	ANSFORMED HYETOGR	APH	
TIME	RAIN	TIME	RAIN ' TIME	RAIN TIME	RAIN
hrs	mm/hr	hrs	mm/hr ' hrs	mm/hr hrs	mm/hr
0.083	0.00	1.667	8.76 3.250	18.98 4.83	1.46
0.167	0.00	1.750	8.76 3.333	10.22 4.92	1.46
0.250	0.00	1.833	24.82 3.417	10.22 5.00	1.46
0.333	1.46	1.917	24.82 3.500	10.22 5.08	1.46
0.417	1.46	2.000	24.82 3.583	10.22 5.17	1.46
0.500	1.46	2.083	24.82 3.667	10.22 5.25	1.46
0.583	1.46	2.167	24.82 3.750	10.22 5.33	1.46
0.667	1.46	2.250	24.82 3.833	5.84 5.42	1.46
0.750	1.46	2.333	67.16 3.917	5.84 5.50	1.46
0.833	1.46	2.417	67.16 4.000	5.84 5.58	1.46
0.917	1.46	2.500	67.16 4.083	5.84 5.67	1.46
1.000	1.46	2.583	67.16 4.167	5.84 5.75	1.46
1.083	1.46	2.667	67.16 4.250	5.84 5.83	1.46
1.167	1.46	2.750	67.16 4.333	2.92 5.92	1.46
1.250	1.46	2.833	18.98 4.417	2.92 6.00	1.46
1.333	8.76	2.917	18.98 4.500	2.92 6.08	1.46
1.417	8.76	3.000	18.98 4.583	2.92 6.17	1.46
1.500	8.76	3.083	18.98 4.667	2.92 6.25	1.46
1.583	8.76	3.167	18.98 4.750	2.92	

Max.Eff.Inten.(n	nm/hr)=	67.16		55.21			
over	(min)	5.00		15.00			
Storage Coeff.	(min) =	4.55	(ii)	13.50	(ii)		
Unit Hyd. Tpeak	(min) =	5.00		15.00			
Unit Hyd. peak	(cms) =	0.23		0.08			
						TOTALS	
PEAK FLOW	(cms) =	0.74		0.24		0.979	(iii)
TIME TO PEAK	(hrs) =	2.75		2.83		2.75	
RUNOFF VOLUME	(mm) =	72.00		45.63		63.03	
TOTAL RAINFALL	(mm) =	73.00		73.00		73.00	
RUNOFF COEFFICIE	ENT =	0.99		0.63		0.86	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 88.0 Ia = Dep. Storage (Above)
 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
 (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0658)				
1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0002):	13.68	1.247	2.75	59.17
+ ID2= 2 (0021):	6.05	0.979	2.75	63.03
ID = 3 (0658):	19.73	2.226	2.75	60.35
NOTE: PEAK FLOWS DO I	NOT INCL	UDE BASEFI	OWS IF AN	.YY

RES	SERVOIR(0645)	I OVEF	FLOW IS C)FF				
DT=	= 5.0 min	OUTE (cm	'LOW SI IS) (h	CORAGE	I I	OUTFLOW (cms)	STORAGE (ha.m.)	
		0.0	000 0	0.0000	Ì	0.2360	0.6393	
		0.0	290 0	0.3310	1	0.3410	0.7100	
		0.0	680 C).4595	1	0.4450	0.7925	
			AREA	QPE	AK	TPEAK	R.V.	
ΤN	IFLOW · ID= 2	(0658)	(na) 19 730	(Cn	1S) 226	(nrs) 2 75	(mm) 60 35	
OU	JTFLOW: ID= 1	(0645)	19.730	(.440	4.33	60.20	
		PEAK FLC	W REDUC	FLOW	Qout/	Qin](%)=	19.75	
		MAXIMUM S	TORAGE	USED		(ha.m.) =	0.7466	
CAI	.IB							
STA	NDHYD (0656)	Area	(ha) =	14.51				
ID=	1 DT=15.0 min	Total	Imp(%)=	54.00	Dir	. Conn.(%) = 46.00	
			TMPERVIC		PERVI	OUS (i)		
	Surface Area	(ha) =	7.84	1	6.	67		
	Dep. Storage	(mm) =	1.00)	5.	00		
	Average Slope	(%) =	1.00)	2.	30		
	Length Mannings n	(m) = =	0 013	2	40.	50		
			0.010		0.2	00		
	Max.Eff.Inten.	(mm/hr) =	67.16	5	57.	89		
	ove Storage Cooff	er (min)	15.00)))))))))))))))))))))))))))))))))))))))	30.	00 80 (ii)		
	Unit Hvd. Tpea	ak (min)=	15.00) (11)	105.	00 (11)		
	Unit Hyd. peak	(cms) =	0.07	7	0.	01		
							TOTALS	
	PEAK FLOW	(cms) =	1.10)	0.	28	1.158 (111)	
	RUNOFF VOLUME	(111.3) = (mm) =	72.00)	42.	98	56.32	
	TOTAL RAINFALI	(mm) =	73.00)	73.	00	73.00	
	RUNOFF COEFFIC	CIENT =	0.99	9	0.	59	0.77	
	(i) CN PROCE	DURE SELEC	TED FOR E	PERVIOU	JS LOS	SES:		
	CN* =	84.0 I	a = Dep.	Stora	je (A	bove)		
	(ii) TIME STE	EP (DT) SHO	ULD BE SN	ALLER	OR EQ	UAL		
	(iii) PEAK FLO	DW DOES NOT	UEFFICIES TNCLUDE	BASEFI	OW TE	ANY.		
	,				==			
L RES	ERVOIR (0657)	 L OVER	FLOW IS C	न न (
IN=	= 2> OUT= 1			/				
DT=	= 5.0 min	OUTE	LOW SI	ORAGE	I	OUTFLOW	STORAGE	
		(cm	us) (h	na.m.)		(cms)	(ha.m.)	
		0.0	190 0).2147	1	0.5250	0.2723	

0.6840

0.8190

0.2350

0.2500

0.1460

1

1

0.2789

DATE: February 2021

INFLOW : ID= 2 (0656) OUTFLOW: ID= 1 (0657)	AREA QPEAK (ha) (cms) 14.510 1.158 14.510 0.677	TPEAK (hrs) 2.75 3.17	R.V. (mm) 56.32 56.12
PEAK FLOW TIME SHIFT (MAXIMUM ST(REDUCTION [Qout/Q OF PEAK FLOW ORAGE USED (in](%)= 58.46 (min)= 25.00 ha.m.)= 0.27	5) 789
V V I SSSSS U V V I SS U V V I SS U V V I SS U VV I SSSSS UU	U A L U AA L U AAAAA L U A A L UUUU A A LLLLL	(v 6.1	1.2003)
000 TTTTT TTTTT H 0 0 T T H 0 0 T T H 000 T T H 000 T T H Developed and Distributed by Sr Copyright 2007 - 2020 Smart Cir All rights reserved.	H Y Y M M H Y Y MM MM O H Y M M O H Y M M mart City Water Inc ty Water Inc	MT 000 0 000	
**** DE	TAILED OUT	PUT ****	
Input filename: C:\Program Output filename: C:\Users\s: a930-3446elae5bfa\791534ba-067 Summary filename: C:\Users\s: a930-3446elae5bfa\791534ba-067	Files (x86)\Visual fanous\AppData\Local 1-452e-9de6-e5d066fb fanous\AppData\Local 1-452e-9de6-e5d066fb	OTTHYMO 6.1\\ \Civica\VH5\4 b528\scen \Civica\VH5\4 b528\scen	702\voin.dat 1a4b2b43-29c0-4f4e- 1a4b2b43-29c0-4f4e-
DATE: 02-09-2021	TIME: 0	1:20:05	
USER:			
COMMENTS:			
**************************************	**************************************		
READ STORM Filenar Ptotal= 80.31 mm Comment	me: C:\Users\sfanous ata\Local\Temp\ 8766663e-6d3f-4d ts: 100yr/6hr	\AppD b9-a962-c4912	27701£86\58£83706

Shell S Hollow Seeon	<i>iaary</i> 1 ia	n m cu					
TIME hrs 0.25 0.50 0.75 1.00 1.25 1.50 1.75	RAIN mm/hr 0.00 1.61 1.61 1.61 1.61 9.64 9.64	TIME hrs 2.00 2.25 2.50 2.75 3.00 3.25 3.50	RAIN mm/hr 27.30 27.30 73.88 73.88 20.88 20.88 11.24	' TIME ' hrs 3.75 4.00 4.25 4.50 4.50 4.75 5.00 5.25	RAIN mm/hr 11.24 6.42 6.42 3.21 1.61 1.61	TIME hrs 5.50 5.75 6.00 6.25	RAIN mm/hr 1.61 1.61 1.61 1.61
CALIB STANDHYD (0012) ID= 1 DT= 5.0 min	Area Total Imp	(ha) = p(%) = 9	2.72 00.00	Dir. Conn	. (%)= 9	0.00	
Surface Area Dep. Storage Average Slope Length Mannings n	(ha) = (mm) = (%) = (m) = =	2.45 1.00 1.00 134.66 0.013	,5 FI	0.27 5.00 2.00 40.00 0.250			
NOTE: RAINFA	LL WAS TRA	ANSFORME	D TO	5.0 MIN. 7	FIME STE	Ρ.	
TIME hrs 0.083 0.167 0.250 0.333 0.417 0.500 0.583 0.667 0.750 0.833 0.917 1.000 1.083 1.167 1.250 1.333 1.417 1.500	RAIN mm/hr 0.00 0.00 1.61 1	TIME hrs 1.750 1.833 1.917 2.000 2.083 2.167 2.250 2.417 2.500 2.583 2.417 2.500 2.583 2.637 2.750 2.833 2.917 3.000 3.083 3.167	ANSFORMA RAIN mm/hr 9.64 27.30 27.30 27.30 27.30 27.30 27.30 27.30 27.38 73.88 73.88 73.88 73.88 73.88 73.88 20.88 20.88 20.88 20.88 20.88	ED HYETOGRA ' TIME ' hrs 3.250 3.333 3.417 3.500 3.583 3.667 3.750 3.833 3.917 4.000 4.083 4.167 4.250 4.333 4.417 4.500 4.583 4.667 4.750	APH RAIN mm/hr 20.88 11.24 11.24 11.24 11.24 11.24 11.24 11.24 6.42 6.42 6.42 6.42 6.42 3.21 3.21 3.21 3.21	TIME hrs 4.83 4.92 5.00 5.08 5.25 5.33 5.42 5.50 5.58 5.50 5.58 5.67 5.75 5.83 5.92 6.00 6.08 6.17 6.25	RAIN mm/hr 1.61 1.61 1.61 1.61 1.61 1.61 1.61 1.6
Max.Eff.Inten.(mm over (Storage Coeff. (Unit Hyd. Tpeak (Unit Hyd. peak (<pre>min) = min) = min) = min) = ccms) =</pre>	73.88 5.00 3.45 5.00 0.26	(ii)	68.25 10.00 6.76 (ii) 10.00 0.14	1		
PEAK FLOW (TIME TO PEAK (RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICIEN	cms) = (hrs) = (mm) = (mm) = IT =	0.50 2.75 79.31 80.31 0.99		0.05 2.75 61.20 80.31 0.76	*TOT. 0. 2 77 80 0	ALS* 552 (iii) .75 .50 .31 .96	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

CN* = 93.6 Ia = Dep. Storage (Above)

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(0642) IN= 2> OUT= 1	OVERFLOW :	IS OFF			
DT= 5.0 min	OUTFLOW	STORAGE	OU	JTFLOW	STORAGE
	(cms)	(ha.m.)		(cms)	(ha.m.)
	0.0000	0.0000	(0.0510	0.1120
	0.0050	0.0617	(0.0730	0.1266
	0.0200	0.0820	(0.0960	0.1376
	0.0360	0.1003	(.1150	0.1490
INFLOW : ID= 2 (0 OUTFLOW: ID= 1 (0	ARI (ha 0012) 2. 0642) 2.	EA QPEAN a) (cms) 720 0.5 720 0.5	K 552 114	TPEAK (hrs) 2.75 3.33	R.V. (mm) 77.50 76.34

PEAK FLOW REDUCTION [Qout/Qin] (%) = 20.68 (min) = 35.00 TIME SHIFT OF PEAK FLOW MAXIMUM STORAGE USED (ha.m.) = 0.1486

-								
I	CALIB	I.						
I	STANDHYD (0002)	Area	(ha) =	13.68			
	ID= 1 DT=15.0	min	Total	Imp(%)=	61.00	Dir.	Conn.(%)=	53.00

		IMPERVIOU	JS	PERVIOUS	(i)		
Surface Area	(ha) =	8.34		5.34			
Dep. Storage	(mm) =	1.00		5.00			
Average Slope	(%) =	1.00		2.30			
Length	(m) =	301.99		40.00			
Mannings n	=	0.013		0.250			
Max.Eff.Inten.(m	nm/hr)=	73.88		69.93			
over	(min)	15.00		30.00			
Storage Coeff.	(min) =	16.80	(ii)	97.80	(ii)		
Unit Hyd. Tpeak	(min) =	15.00		105.00			
Unit Hyd. peak	(cms) =	0.07		0.01			
						TOTALS	r
PEAK FLOW	(cms) =	1.32		0.27		1.375	(iii)
TIME TO PEAK	(hrs) =	2.75		4.25		2.75	
RUNOFF VOLUME	(mm) =	79.31		51.17		66.08	
TOTAL RAINFALL	(mm) =	80.31		80.31		80.31	
RUNOFF COEFFICIE	ENT =	0.99		0.64		0.82	

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

CN* = 85.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

					l
CALIB	Aroa (h	- 6.05			
JID= 1 DT= 5 0 min	Total Tmp()	(1) = 0.00	Dir Conn	(%) - 66.00	_
1D= 1 D1= 5.0 min	iotai imp(.)- 07.00	DII. COMM.	(%) = 00.00	
	тмр	RVIOUS P	ERVIOUS (i)		
Surface Area	(ha) =	4 05	2 00		
Dep Storage	(mm) =	1 00	5.00		
Average Slope	(%) =	1 00	2 00		
Length	(m) = 2	0.83	40.00		=
Mannings n	=	0.013	0.250		-
5					1
NOTE: RAINF	ALL WAS TRAN	SFORMED TO	5.0 MIN. T	IME STEP.	
					-
		TRANSFORM	ED HYETOGRA	APH	
TIME	RAIN	FIME RAIN	' TIME	RAIN TIME	RAIN
hrs	mm/hr	hrs mm/hr	' hrs	mm/hr hrs	mm/hr
0.083	0.00 1	.667 9.64	3.250	20.88 4.83	1.61
0.167	0.00 1	.750 9.64	3.333	11.24 4.92	1.61
0.250	0.00 1	.833 27.30	3.417	11 24 5.00	1.61
0.333	1.01 1	.91/ 27.30	1 3.500	11 24 5.08	1.01
0.417	1.01 2	.000 27.30	3.383	11.24 5.17	1.61
0.500	1 61 2	167 27.30	1 3 750	11 24 5 33	1 61
0.585	1 61 2	250 27 30	3.750	6 42 5 42	1 61
0.750	1 61 2	333 73.88	1 3 917	6 42 5 50	1 61
0.833	1.61 2	.417 73.88	4.000	6.42 5.58	1.61
0.917	1.61 2	.500 73.88	4.083	6.42 5.67	1.61
1.000	1.61 2	.583 73.88	4.167	6.42 5.75	1.61 -
1.083	1.61 2	.667 73.88	4.250	6.42 5.83	1.61 -
1.167	1.61 2	.750 73.88	4.333	3.21 5.92	1.61
1.250	1.61 2	.833 20.88	4.417	3.21 6.00	1.61
1.333	9.64 2	.917 20.88	4.500	3.21 6.08	1.61
1.417	9.64 3	.000 20.88	4.583	3.21 6.17	1.61 -
1.500	9.64 3	.083 20.88	4.667	3.21 6.25	1.61
1.583	9.64 3	.167 20.88	4.750	3.21	
May Eff Inton (m	m /hm) =	72 00	62 47		
Max.EII.Incen. (m	(min)	5 00	15 00		
Storage Coeff	(min) =	4 38 (ii)	12 90 (ii)		
Unit Hvd. Tpeak	(min) =	5.00	15.00		
Unit Hvd. peak	(cms) =	0.23	0.08		
2 1 - 2				*TOTALS*	
PEAK FLOW	(cms) =	0.82	0.28	1.092 (iii)
TIME TO PEAK	(hrs) =	2.75	2.83	2.75	
RUNOFF VOLUME	(mm) =	79.31	52.20	70.09	
TOTAL RAINFALL	(mm) =	30.31	80.31	80.31	
RUNOFF COEFFICIE	NT =	0.99	0.65	0.87	
***** WARNING: STORAG	E COEFF. IS :	SMALLER THÀN	TIME STEP!		
(i) CN DDOCEDU	DE GELECTER		LOSSES		
(I) CN PROCEDU	RE SELECTED . 8 0	Den Storago	(Above)		
(ii) TIME STEP	(DT) SHOULD I	BE SMALLER O	R EQUAL		
THAN THE S	TORAGE COEFF	ICIENT.			
(iii) PEAK FLOW	DOES NOT INC	LUDE BASEFLO	W IF ANY.		

DATE: February 2021

ADD HYD (0658) 1 + 2 = 3 ID1= 1 (000 + ID2= 2 (002 ================= ID = 3 (065	A ()2): 13 (1): 6 ====================================	REA QPH ha) (cr .68 1.3° .05 1.09 	EAK TPE ns) (hi 75 2.7 92 2.7	EAK R.V. cs) (mm) 75 66.08 75 70.09 =======	
NOTE PEAK FLOW		INCLUDE B	ASEFLOWS 1	F ANY	
RESERVOIR(0645) IN= 2> OUT= 1 DT= 5.0 min	OVERF OUTFL (cms 0.00 0.02 0.09 0.16	LOW IS OFF OW STOP) (ha 00 0.0 90 0.0 50 0.4 80 0.5	F RAGE .m.) 0000 3310 4595 5720	OUTFLOW (cms) 0.2360 0.3410 0.4450 0.5320	STORAGE (ha.m.) 0.6393 0.7100 0.7485 0.7925
INFLOW : ID= 2 (OUTFLOW: ID= 1 (0658) 0645)	AREA (ha) 19.730 19.730	QPEAK (cms) 2.467 0.532	TPEAK (hrs) 2.75 4.25	R.V. (mm) 67.31 67.16
PE TI MA	CAK FLOW ME SHIFT XXIMUM ST	REDUCT OF PEAK FI ORAGE US	ION [Qout/ LOW SED	<pre>/Qin](%) = 21 (min) = 90 (ha.m.) = 0</pre>	.56 .00 .7925
CALIB STANDHYD (0656) ID= 1 DT=15.0 min	Area Total I	(ha) = 14 mp(%) = 54	4.51 4.00 Dir	c. Conn.(%)=	46.00
Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten.(m over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICIE	<pre>(ha) = (mm) = (%) = (m) = (min) (min) = (min) = (cms) = (cms) = (hrs) = (mm) = (mm) = NT =</pre>	IMPERVIOUS 7.84 1.00 1.00 311.02 0.013 73.88 15.00 16.80 15.00 0.07 1.22 2.75 79.31 80.31 0.99	S PERVI 6 5 2 40 0.2 65 30 (ii) 97 105 0 0 4 4 9 80 80 0	LOUS (i) .67 .00 .30 .00 .250 .97 .00 .80 (ii) .01 .32 .25 .32 .31 .61	TOTALS* 1.279 (iii) 2.75 63.11 80.31 0.79
(i) CN PROCEDU CN* = 8 (ii) TIME STEP THAN THE S	URE SELECT 34.0 Ia (DT) SHOU STORAGE CO	ED FOR PEH = Dep. St LD BE SMAI EFFICIENT	RVIOUS LOS torage (<i>1</i> LLER OR EÇ	SSES: Above) QUAL	

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DATE: February 2021

RESI IN=	ERVOI 2	IR (-> OU	0657) JT= 1	OV	ERFI	LOW	IS OFF					
DT=	5.0) mir	1	OU	TFL	WC	STORA	.GE	OU	TFLOW	STORAGE	
				. (cms)	(ha.m	.)	(cms)	(ha.m.)	
				0	.00	00	0.00	00	0	.3640	0.2594	
				0	.01	90	0.21	47	0	.5250	0.2723	
				0	.14	60	0.23	50	0	.6840	0.2789	
				0	.25	90	0.25	00	0	.8190	0.2863	
						AR	EA	QPEAK		TPEAK	R.V.	
						(h	a)	(cms)		(hrs)	(mm)	
IN	FLOW	: 11	D= 2 (0656)		14.	510	1.27	9	2.75	63.11	
OU	FFLOV	V: II)= 1 (0657)		14.	510	0.81	5	3.00	62.91	
			Т М	'IME SHI NAXIMUM	STO	OF P ORAG	EAK FLC E USE	W D	(h	(min) = a.m.) =	15.00 0.2863	
			T M	'IME SHI HAXIMUM 	FT (ST(OF P ORAG 	EAK FLC E USE 	W D 	(h 	(min)= a.m.)= 	15.00 0.2863	
			T M 	IME SHI	FT (ST(OF P ORAG 	EAK FLC E USE 	W D 	(h 	(min)= a.m.)= ======	15.00 0.2863	
	 V V	 V V	T M I T	IME SHI	FT (ST(===:	OF P ORAG ==== U	EAK FLC E USE E====== A	W D ====== L	(h 	(min)= a.m.)= =======	15.00 0.2863 v 6.1.2003)	
	V V V	V V V	T M 	IME SHI AXIMUM SEESS SS SS SS SS	FT (ST(==== U U U	DF P DRAG ==== U U U	EAK FLC E USE ======= A A A A	W :D :====== L L L I.	(h 	(min)= a.m.)= =======	15.00 0.2863 v 6.1.2003)	
	V V V V	v v v v	T M I I I T	IME SHI AXIMUM SEESSS SS SS SS SS SS	FT (ST(===: U U U U U	DF P DRAG ==== U U U U U	EAK FLC E USE ======= A A A AAAAA a a	W 5D ======= L L L L L L	(h 	(min)= a.m.)= =======	15.00 0.2863 v 6.1.2003)	
	V V V V V		T M 	IME SHI IAXIMUM SSSSS SS SS SS SS SS SSSSS	FT (ST(==== U U U U U U U U	OF P ORAG ==== U U U U U UUU	EAK FLC E USE A A A A A A A A A A A A A A A A	W ED ====== L L L L LLLLI	(h 	(min)= a.m.)= =======	15.00 0.2863 v 6.1.2003)	
	v v v v v v	V V V V V V	T M 	IME SHI IAXIMUM SSSSS SS SS SSSSS SSSSS TTTTTT	FT (ST(==== U U U U U U U U U U U U U	OF P ORAG U U U U U U U U U U U U U U U U U	EAK FLC E USE A A A AAAAA A A A A A A A A Y Y	W D L L L L L L L L L L L L L L L L L L	(h 	(min)= a.m.)= ((000 I	15.00 0.2863 v 6.1.2003) M	
	V V V V V V	v v v v v v v	T M I I I I I TTTTT T	IME SHI IAXIMUM SSSSS SS SS SS SSSSS TTTTTT T	FT (ST(==== U U U U U U U U U H H	OF P ORAG U U U U U U U U U U U U U U U U U	EAK FLC E USE A A A AAAAA A A A A A A Y Y Y Y	W D L L L L L L L L L L L L L L L L L L	(h 	(min) = a.m.) = (000 I	15.00 0.2863 ₩ 6.1.2003)	
	V V V V V V V V V	V V V V V V V V V V V V V V V V V V V	T M 	IME SHI IAXIMUM SSSSS SS SS SS SSSSS TTTTT T T T	FT (STC ===: U U U U U U U U U U U U U U U U U	OF P ORAG ==== U U U U U U U U U U U U U U U U U	EAK FLC E USE A A A AAAAA A A A A A A Y Y Y Y Y Y	W D L L L L L L L L L L L L L L L L L L	(h 	(min) = a.m.) = ====== (0 0 0	15.00 0.2863 ▼ 6.1.2003) M	
		V V V V V V V V V V V V V V V V V V V	T M J I I I TTTTTT T T T	IME SHI IAXIMUM SSSSS SS SS SSSSS TTTTTT T T T T T	FT (ST(U U U U U U U U H H H	OF P ORAG U U U U U U U U U U U U U U U U U U U	EAK FLC E USE A A A AAAAA A A A A A A Y Y Y Y Y Y	W D L L L L L L L L L L L L L L L L L M M M M M M M M M M M M M M M M M	(h ===== 1 0 1 0 1 0	(min) = a.m.) = (0 0 0 0 0	15.00 0.2863 v 6.1.2003) M	
	V V V V V V 00 0 0 0 00000000000000000	v v v v v v v v v v v v v v v v v v v	T M J I TTTTTT T T Distri	IME SHI IAXIMUM SSSSS SS SS SSSSS TTTTTT T T T T	FT (ST(U U U U U U U U U U U U U U U U U U U	OF P ORAG ==== U U U U U U U U U U U U U U U U U	EAK FLC E USE A A A AAAAA A A A A A A Y Y Y Y Y Y Y City W	W D L L L LLLLI M M M M M M M M M M M M M Sater I	(h ===== 1 0 1 0 1 0 1 0 1 0	(min) = a.m.) = ====== (0 0 0 0 0 0	15.00 0.2863 v 6.1.2003) M	
Devel Copyr	V V V V V V V V V V V V V V V V V V V	V V V V V V V V V V V V V V V V V V V	T M M I I I T T T T T T T T T T T T T T	IME SHI IAXIMUM SSSSS SS SS SSSSS TTTTT T T T buted b 0 Smart	FT (ST(U U U U U U U U U U U U U U U U U U U	DF P DRAG U U U U U U U U U U U U U U U U U	EAK FLC E USE A A A AAAAA A A A A Y Y Y Y Y Y Y City W ater In	W D L L L L L L L L L L L L L L L L L L	(h ===== 1 0 1 0 1 0 1 0 1 0	(min) = a.m.) = (0 0 0 0 0 0 0	15.00 0.2863 v 6.1.2003) M	

***** DETAILED OUTPUT *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4ea930-3446e1ae5bfa\f2f2422e-5afa-42ad-b7a1-6ec56d4ad7f8\scen

Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4ea930-3446e1ae5bfa\f2f2422e-5afa-42ad-b7a1-6ec56d4ad7f8\scen

DATE: 02-09-2021	TIME:	01:20:06
USER:		
COMMENTS:		

** SIMULATION : 13. AES 12hr 2yr **

Ptotal= 42.00 mm	Filenar Comment	me: C:\Users\s ata\Local\ 8766663e-6 ts: 2yr/12hr	fanous\AppD Temp\ d3f-4db9-a90	62-c49127701f86\:	155f0ad
T 0 0 1 1 1 1 1 2 2 2 2 2 2 3 3 3	IME RAIN hrs mm/hr .25 0.00 .50 0.42 .75 0.42 .00 0.42 .50 0.42 .50 0.42 .50 0.42 .50 0.42 .50 0.42 .50 0.42 .50 0.42 .50 2.52 .50 2.52 .50 2.52 .25 2.52 .25 2.52	TIME RAI hrs mm/h 3.50 7.1 3.75 7.1 4.00 7.1 4.25 7.1 4.50 19.3 5.00 19.3 5.25 19.3 5.50 5.4 5.75 5.4 6.00 5.4 6.50 2.9	N ' TIME r ' hrs 4 6.75 4 7.00 4 7.25 4 7.50 2 7.75 2 8.00 2 8.25 2 8.50 6 8.75 6 9.00 6 9.25 6 9.50 4 9.75	RAIN TIME mm/hr hrs 2.94 10.00 2.94 10.25 2.94 10.50 1.68 10.75 1.68 11.00 1.68 11.25 1.68 11.50 0.84 11.50 0.84 12.00 0.84 12.25 0.84 0.42 0.42	RAIN mm/hr 0.42 0.42 0.42 0.42 0.42 0.42 0.42 0.42
CALIB STANDHYD (0012 ID= 1 DT= 5.0 min) Area Total Ir	(ha) = 2.72 mp(%) = 90.00	Dir. Conn	.(%)= 90.00	
Surface Area Dep. Storage Average Slope Length Mannings n	(ha) = (mm) = (%) = (m) = =	IMPERVIOUS 2.45 1.00 1.00 134.66 0.013	PERVIOUS (i) 0.27 5.00 2.00 40.00 0.250		
Surface Area Dep. Storage Average Slope Length Mannings n NOTE: RA	(ha) = (mm) = (%) = (m) = = INFALL WAS TH	IMPERVIOUS 2.45 1.00 1.00 134.66 0.013 RANSFORMED TO	PERVIOUS (i) 0.27 5.00 2.00 40.00 0.250 5.0 MIN. 1	TIME STEP.	

1.083

1.167

0.42 | 4.167

0.42 | 4.250

7.14 | 7.250

7.14 | 7.333

2.94 | 10.33

1.68 | 10.42

0.42

0.42

INFLOW : ID= 2 (0012)

OUTFLOW: ID= 1 (0642)

1.250 1.333 1.417 1.500 1.583 1.667 1.750 1.833 1.917	0 0.42 3 0.42 7 0.42 8 0.42 9 0.42 9 0.42 9 0.42 9 0.42 9 0.42 9 0.42 9 0.42 9 0.42 9 0.42 9 0.42	4.333 4.417 4.500 4.583 4.667 4.750 4.833 4.917 5.000	19.32 19.32 19.32 19.32 19.32 19.32 19.32 19.32 19.32 19.32	7.417 7.500 7.583 7.667 7.750 7.833 7.917 8.000 8.083	1.68 1.68 1.68 1.68 1.68 1.68 1.68 1.68 1.68 1.68	10.50 10.58 10.67 10.75 10.83 10.92 11.00 11.08 11.17	0.42 0.42 0.42 0.42 0.42 0.42 0.42 0.42
2.000 2.083 2.167 2.256 2.333 2.417 2.500 2.583 2.667 2.755 2.833 2.917 3.000 3.083	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	5.083 5.167 5.250 5.333 5.417 5.500 5.583 5.667 5.750 5.833 5.917 6.000 6.083 6.167	$19.32 \\ 19.32 \\ 19.32 \\ 5.46$	8.167 8.250 8.333 8.417 8.500 8.583 8.667 8.750 8.833 8.917 9.000 9.083 9.167 9.250	$\begin{array}{c cccc} 1.68 & \\ 1.68 & \\ 0.84 & \\$	11.25 11.33 11.42 11.50 11.58 11.67 11.75 11.83 11.92 12.00 12.08 12.17 12.25	0.42 0.42 0.42 0.42 0.42 0.42 0.42 0.42
Max.Eff.Inten.(m over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICIE (i) CN PROCEDU CN* = S (ii) TIME STEP	<pre>um/hr) = (min) (min) = (min) = (cms) = (cms) = (hrs) = (mm) = (mm) = ENT = URE SELECTEIN 33.6 IA = (DT) SHOULD </pre>	19.32 5.00 5.89 5.00 0.19 0.13 5.25 41.00 42.00 0.98	(ii) ERVIOUS torage LLLER OR	15.62 25.00 20.73 (ii) 25.00 0.05 0.01 5.33 25.18 42.00 0.60 LOSSES: (Above) EQUAL	*TOT 0. 539 42 0	PALS* 141 (iii) .25 .41 .00 .94	
THAN THE S (iii) PEAK FLOW	OVERFLC OUTFLOW (cms)	FICIENT ICLUDE E IN IS OF I STO (ha	 PRAGE)	OUTFLOW (cms) 0 0510	STC (ha	PRAGE m.) 1120	
	0.0050 0.0200 0.0360	0. 0. 0. 0. 0.	0617 0820 1003 QPEAK	0.0730 0.0960 0.1150	0 0 0	.1266 .1376 .1490 R.V.	

(ha)

2.720

2.720

TIME SHIFT OF PEAK FLOW

(cms)

PEAK FLOW REDUCTION [Qout/Qin] (%) = 14.14

0.141

0.020

(hrs)

5.25

7.25

(min)=120.00

(mm)

39.41

38.26

DATE: February 2021

	MAXIMUM	STORAGE	USED	(ha.m.)= 0.0819	
CALIB STANDHYD (0002 ID= 1 DT=15.0 min		(ha) = . Imp(%) =	13.68 61.00	Dir. Conn	.(%)= 53.00	
Surface Area Dep. Storage Average Slope Length Mannings n	(ha) = (mm) = (%) = (m) = =	IMPERVI 8.3 1.0 1.0 301.9 0.01	COUS 4 10 10 99 .3	PERVIOUS (i 5.34 5.00 2.30 40.00 0.250)	
Max.Eff.Inten ov Storage Coeff Unit Hyd. Tpe Unit Hyd. pea	.(mm/hr) = er (min) . (min) = ak (min) = k (cms) =	19.3 15.0 16.8 15.0 0.0	32 10 10 (ii) 10 17	14.45 45.00 97.80 (ii 105.00 0.01) *¤∩¤àis*	
PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFAL RUNOFF COEFFI	(cms) = (hrs) = (mm) = L (mm) = CIENT =	0.3 5.2 41.0 42.0 0.9	88 5 00 00 88	0.08 6.75 19.09 42.00 0.45	0.410 (iii) 5.25 30.70 42.00 0.73)
(i) CN PROC CN* = (ii) TIME ST THAN TH (iii) PEAK FL CALIB STANDHYD (0021	EDURE SELE 85.0 EP (DT) SH E STORAGE OW DOES NO 	CTED FOR Ia = Dep. HOULD BE S COEFFICIE DT INCLUDE (ha) =	PERVIOU Storag MALLER NT. BASEFI	JS LOSSES: je (Above) OR EQUAL LOW IF ANY.		
ID= 1 DT= 5.0 min	Total	Imp(%)=	67.00	Dir. Conn	.(%)= 66.00	
Surface Area Dep. Storage Average Slope Length Mannings n	(ha) = (mm) = (%) = (m) = =	IMPERVI 4.0 1.0 200.8 0.01	OUS 5 0 0 3 .3	PERVIOUS (i 2.00 5.00 2.00 40.00 0.250)	
NOTE: RA	INFALL WAS	5 TRANSFOR	MED TO	5.0 MIN.	TIME STEP.	
T 0. 0. 0. 0. 0.	IME RAJ hrs mm/h 083 0.0 167 0.0 250 0.0 333 0.4 417 0.4	T N TIME nr hrs 00 3.167 00 3.250 00 3.333 12 3.417 12 3.500	2 RANSFOI RA mm/1 2 2 7 7 7 7 7	RMED HYETOGR. IN ' TIME Ir ' hrs 52 6.250 52 6.333 14 6.417 14 6.500 14 6.583	APH RAIN TIME mm/hr hrs 5.46 9.33 2.94 9.42 2.94 9.50 2.94 9.58 2.94 9.67	RAIN mm/hr 0.42 0.42 0.42 0.42 0.42
0. 0.	500 0.4 583 0.4	12 3.583 12 3.667	7.	L4 6.667 L4 6.750	2.94 9.75 2.94 9.83	0.42 0.42

0.667

0.42 | 3.750

7.14 | 6.833

2.94 |

9.92

0.42

ID = 3 (0658): 19.73 0.675

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

0.750 0.42	3.833	7.14	6.917	2.94	10.00	0.42
0.833 0.42	3.917	7.14	7.000	2.94	10.08	0.42
0.917 0.42	4.000	7.14	7.083	2.94	10.17	0.42
1.000 0.42	4.083	7.14	7.167	2.94	10.25	0.42
1.083 0.42	4.167	7.14	7.250	2.94	10.33	0.42
1.167 0.42	4.250	7.14	7.333	1.68	10.42	0.42
1.250 0.42	4.333	19.32	7.417	1.68	10.50	0.42
1.333 0.42	4.417	19.32	7.500	1.68	10.58	0.42
1.417 0.42	4.500	19.32	7.583	1.68	10.67	0.42
1.500 0.42	4.583	19.32	7.667	1.68	10.75	0.42
1.583 0.42	4.667	19.32	7.750	1.68	10.83	0.42
1.667 0.42	4.750	19.32	7.833	1.68	10.92	0.42
1.750 0.42	4.833	19.32	7.917	1.68	11.00	0.42
1.833 0.42	4.917	19.32	8.000	1.68	11.08	0.42
1.917 0.42	5.000	19.32	8.083	1.68	11.17	0.42
2.000 0.42	5.083	19.32	8.167	1.68	11.25	0.42
2.083 0.42	5.167	19.32	8.250	1.68	11.33	0.42
2.167 0.42	5.250	19.32	8.333	0.84	11.42	0.42
2.250 0.42	5.333	5.46	8.417	0.84	11.50	0.42
2.333 2.52	5.417	5.46	8.500	0.84	11.58	0.42
2.417 2.52	5.500	5.46	8.583	0.84	11.67	0.42
2.500 2.52	5.583	5.46	8.667	0.84	11.75	0.42
2.583 2.52	5.667	5.46	8.750	0.84	11.83	0.42
2.667 2.52	5.750	5.46	8.833	0.84	11.92	0.42
2.750 2.52	5.833	5.46	8.917	0.84	12.00	0.42
2.833 2.52	5.917	5.46	9.000	0.84	12.08	0.42
2.917 2.52	6.000	5.46	9.083	0.84	12.17	0.42
2.02 2.52	6.083	5.40	9.107	0.84	1 12.25	0.42
Max.Eff.Inten.(mm/hr)= over (min) Storage Coeff. (min)= Unit Hyd. Tpeak (min)= Unit Hyd. peak (cms)=	19.32 5.00 7.49 5.00 0.17	(ii)	12.54 25.00 23.69 (ii) 25.00 0.05)		
	0 01		0.05	*TO:	FALS*	
PEAK FLOW (cms) =	0.21		0.05	0	.266 (111)	
TIME TO PEAK (nrs) =	5.25		5.4Z	2	2.25	
TOTAL BAINFALL (mm) =	41.00		19.30	3. A '	2 00	
BUNOFF COEFFICIENT =	0.98		0.46		2.00	
	0.00		0.10			
 (i) CN PROCEDURE SELECTE CN* = 88.0 Ia (ii) TIME STEP (DT) SHOUL THAN THE STORAGE COD (iii) PEAK FLOW DOES NOT 1 	ED FOR PE = Dep. S LD BE SMA EFFICIENT INCLUDE B	RVIOUS torage LLER OR ASEFLOW	LOSSES: (Above) E EQUAL I IF ANY.			
ADD HYD (0658)						
1 + 2 = 3 AF	REA QP	EAK	TPEAK	R.V.		
(h	na) (c	ms)	(hrs)	(mm)		
ID1= 1 (0002): 13.	.68 0.4	10	5.25 30	0.70		
+ ID2= 2 (0021): 6.	.05 0.2	66	5.25 33	3.69		
				====		

5.25 31.62

DATE: February 2021

RESERVOIR(0645)	OVERFLOW	IS OFF		
IN= 2> OUT= 1				
DT= 5.0 min	OUTFLOW	STORAGE	OUTFLOW	STORAGE
	(cms)	(ha.m.)	(cms)	(ha.m.)
	0.0000	0.0000	0.2360	0.6393
	0.0290	0.3310	0.3410	0.7100
	0.0950	0.4595	0.4450	0.7485
	0.1080	0.5720	0.5320	0.7925
	AF	REA QPEAK	TPEAK	R.V.
	(h	a) (cms)	(hrs)	(mm)
INFLOW : ID= 2 (0658) 19.	730 0.6	575 5.25	31.62
OUTFLOW: ID= 1 (0)645) 19.	730 0.0	95 8.50	31.46
PE	AK FLOW F	EDUCTION [OC	out/Oinl(%)= 1	4.05
IIT	AE SHIFT OF F	PEAK FLOW	(min)=19	5.00
MAX	KIMUM STORAG	E USED	(ha.m.) =	0.4594
CALIB				
STANDHYD (0656)	Area (ha	1) = 14.51		
ID= 1 DT=15.0 min	Total Imp(%	() = 54.00	Dir. Conn.(%)	= 46.00
	TMPF	RVTOUS PF	RVTOUS (i)	
Surface Area	(ha) =	7.84	6.67	
Dep. Storage	(mm) =	1.00	5.00	
Average Slope	(%) =	1.00	2.30	
Length	(m) = 31	1.02	40.00	
Mannings n	= C	.013	0.250	
Max.Eff.Inten.(m	n/hr)= 1	9.32	12.58	
over	(min) 1	5.00	45.00	
Storage Coeff.	(min) = 1	.6.80 (ii)	97.80 (ii)	
Unit Hyd. Tpeak	(min) = 1	5.00 1	.05.00	
Unit Hyd. peak	(cms) =	0.07	0.01	
				TOTALS
PEAK FLOW	(cms) =	0.35	0.09	0.383 (111)
TIME TO PEAK	(IIIIS) = //	J.25	0./0	3.∠3 28.60
TOTAL RAINFALL	(mm) = 4	2 00	42 00	42 00
RUNOFF COEFFICIE	VT =	0.98	0.43	0.68
(-) ON PROCEDU			1000000	
(I) CN PROCEDU	AE SELECTED F	OR PERVIOUS	LUSSES:	
(ii) TIME STEP	(DT) SHOULD F	SE SMALLER OR	EOUAL	
THAN THE S	FORAGE COEFFI	CIENT.	· z	
(iii) PEAK FLOW I	DOES NOT INCL	UDE BASEFLOW	I IF ANY.	
RESERVOIR(0657)	OVERFLOW	IS OFF		
IN= 2> OUT= 1				
DT= 5.0 min	OUTFLOW	STORAGE	OUTFLOW	STORAGE
	(cms)	(ha.m.)	(cms)	(ha.m.)
	0.0000	0.0000	0.3640	0.2594
	0.0190	0.2147	0.5250	0.2723
	0.1460	0.2350	0.6840	0.2/89

0.2590 0.2500 0.8190 0.2863	
AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW: ID= 2 0.656) 14.510 0.383 5.25 28.60 OUTFLOW: ID= 1 0.657) 14.510 0.146 7.00 28.40	
PEAK FLOW REDUCTION [Qout/Qin](%)= 38.10 TIME SHIFT OF PEAK FLOW (min)=105.00 MAXIMUM STORAGE USED (ha.m.)= 0.2350	
V V I SSSS U U A L (v 6.1.2003) V V I SS U U A A L V V I SS U U AAAAA L V V I SS U U AAAAA L	
VV I SSSS UUUUU A A LLLLL OOO TTTTT TTTTT H H Y Y M M OOO TM O O T T H H Y Y MM MM O O O O T T H H Y Y MM MM O O	CALIB STANDHY ID= 1 DT
000 T T H H Y M M 000 Developed and Distributed by Smart City Water Inc Copyright 2007 - 2020 Smart City Water Inc All rights reserved.	Surf Dep. Aver Leng
***** DETAILED OUTPUT *****	Mann
<pre>Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446elae5bfa\bff3f53e-29fd-43c8-b1a0-99b54fd426c3\scen Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446elae5bfa\bff3f53e-29fd-43c8-b1a0-99b54fd426c3\scen</pre>	
DATE: 02-09-2021 TIME: 01:20:05	
USER:	
COMMENTS:	

READ STORM Filename: C:\Users\sfanous\AppD ata\Local\Temp\ ata\Local\Temp\ 8766663e-6d3f-4db9-a962-c49127701f86\31488919 Ptotal= 54.38 mm Comments: 5yr/12hr	

DATE: February 2021

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	' '	TIME hrs	RAIN mm/hr	- 1	TIME hrs	RAIN mm/hr	
0.25	0.00	3.50	9.25	1	6.75	3.81	10	0.00	0.54	
0.50	0.54	3.75	9.25	Ì.	7.00	3.81	10	0.25	0.54	
0.75	0.54	4.00	9.25	i	7.25	3.81	110	0.50	0.54	
1.00	0.54	4.25	9.25	i	7.50	2.18	110).75	0.54	
1.25	0.54	4.50	25.02	i	7.75	2.18	i 11	L.00	0.54	
1.50	0.54	4.75	25.02	i	8.00	2.18	i 11	L.25	0.54	
1.75	0.54	5.00	25.02	Ì.	8.25	2.18	11	L.50	0.54	
2.00	0.54	5.25	25.02	i	8.50	1.09	i 11	L.75	0.54	
2.25	0.54	5.50	7.07	i	8.75	1.09	1 12	2.00	0.54	
2.50	3.26	5.75	7.07	i	9.00	1.09	1 12	2.25	0.54	
2.75	3.26	6.00	7.07	Ì.	9.25	1.09	Í.			
3.00	3.26	6.25	7.07	Ì.	9.50	0.54	Í.			
3.25	3.26	6.50	3.81	Ì.	9.75	0.54	Í.			
1										
ZD (0012)	Area (1	na) =	2.72							
[= 5.0 min ∣	Total Imp	(%)= 9	0.00	Dir	. Conn.	(%)=	90.0	00		

		IMPERVIOUS	PERVIOUS	(i)
Surface Area	(ha) =	2.45	0.27	
Dep. Storage	(mm) =	1.00	5.00	
Average Slope	(%) =	1.00	2.00	
Length	(m) =	134.66	40.00	
Mannings n	=	0.013	0.250	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

		_	TRAN	ISFORMED	HVETOCRA	며		
m	TME D	A T NI I	TIME	DATM	ITTME	DATM		DATM
1	IME R.	/bx	hra	mm/hx	i hra	mm /h m	IIME	mm /hm
0	002 0	00 1	2 1 6 7	2 26 1	6 250		0 22	0 54
0.	167 0	.00	2 250	2.20	6 222	2 01 1	9.33	0.54
0.	167 0	.00	3.250	3.20	0.333	3.81 2.01	9.42	0.54
0.	250 0	.00	3.333	9.25	0.417	3.81	9.50	0.54
0.	333 0	.54	3.41/	9.25	6.500	3.81	9.58	0.54
0.	417 0	.54	3.500	9.25	6.583	3.81	9.67	0.54
0.	500 0	.54	3.583	9.25	6.667	3.81	9.75	0.54
0.	583 0	.54	3.667	9.25	6.750	3.81	9.83	0.54
0.	667 0	.54	3.750	9.25	6.833	3.81	9.92	0.54
0.	750 0	.54	3.833	9.25	6.917	3.81	10.00	0.54
0.	833 0	.54	3.917	9.25	7.000	3.81	10.08	0.54
Ο.	917 0	.54	4.000	9.25	7.083	3.81	10.17	0.54
1.	000 0	.54	4.083	9.25	7.167	3.81	10.25	0.54
1.	083 0	.54	4.167	9.25	7.250	3.81	10.33	0.54
1.	167 0	.54	4.250	9.25	7.333	2.18	10.42	0.54
1.	250 0	.54	4.333	25.02	7.417	2.18	10.50	0.54
1.	333 0	.54	4.417	25.02	7.500	2.18	10.58	0.54
1.	417 0	.54	4.500	25.02	7.583	2.18	10.67	0.54
1.	500 0	.54	4.583	25.02	7.667	2.18	10.75	0.54
1.	583 0	.54	4.667	25.02 j	7.750	2.18	10.83	0.54
1.	667 0	.54	4.750	25.02 j	7.833	2.18	10.92	0.54
1.	750 0	.54 1	4.833	25.02 1	7.917	2.18 1	11.00	0.54
1.	833 0	.54	4.917	25.02	8.000	2.18	11.08	0.54
1.	917 0	.54	5.000	25.02	8.083	2.18	11.17	0.54
2.	000 0	.54	5.083	25.02	8.167	2.18	11.25	0.54

2.083 0.54 2.167 0.54 2.250 0.54 2.333 3.26 2.500 3.26 2.583 3.26 2.583 3.26 2.667 3.26 2.667 3.26 2.833 3.26 2.833 3.26 2.917 3.26 3.000 3.26 3.083 3.26	5.167 25.02 5.250 25.02 5.333 7.07 5.417 7.07 5.500 7.07 5.583 7.07 5.750 7.07 5.750 7.07 5.750 7.07 5.833 7.07 5.917 7.07 6.000 7.07 6.083 7.07 6.167 7.07	8.250 2. 8.333 1. 8.417 1. 8.503 1. 8.583 1. 8.667 1. 8.833 1. 8.833 1. 8.917 1. 9.000 1. 9.083 1. 9.167 1. 9.250 1.	18 11.33 0.54 09 11.42 0.54 09 11.50 0.54 09 11.57 0.54 09 11.67 0.54 09 11.75 0.54 09 11.67 0.54 09 11.75 0.54 09 11.75 0.54 09 11.92 0.54 09 12.00 0.54 09 12.00 0.54 09 12.08 0.54 09 12.17 0.54 09 12.25 0.54 09 12.25 0.54
<pre>Max.Eff.Inten.(mm/hr)=</pre>	25.02 5.00 5.32 (ii) 5.00 0.21	21.71 20.00 18.32 (ii) 20.00 0.06	*TOTALS*
PEAK FLOW (cms) = TIME TO PEAK (hrs) = RUNOFF VOLUME (mm) = TOTAL RAINFALL (mm) = RUNOFF COEFFICIENT =	0.17 5.25 53.38 54.38 0.98	0.01 5.25 36.53 54.38 0.67	0.185 (iii) 5.25 51.69 54.38 0.95
 (i) CN PROCEDURE SELECTE CN* = 93.6 Ia (ii) TIME STEP (DT) SHOUL THAN THE STORAGE COE (iii) PEAK FLOW DOES NOT I 	ED FOR PERVIOUS = Dep. Storage LD BE SMALLER O EFFICIENT. INCLUDE BASEFLO	LOSSES: (Above) R EQUAL W IF ANY.	
RESERVOIR(0642) OVERFI	LOW IS OFF		
IN= 2> OUT= 1 DT= 5.0 min OUTFLC (cms) 0.000 0.005 0.020 0.036	STORAGE (ha.m.) 00 0.0000 50 0.0617 00 0.0820 50 0.1003	OUTFLOW (cms) 0.0510 0.0730 0.0960 0.1150	STORAGE (ha.m.) 0.1120 0.1266 0.1376 0.1490
INFLOW : ID= 2 (0012) OUTFLOW: ID= 1 (0642)	AREA QPEA (ha) (cms 2.720 0. 2.720 0.	K TPEAK) (hrs) 185 5.25 036 6.42	R.V. (mm) 51.69 50.54
PEAK FLOW TIME SHIFT C MAXIMUM STC	REDUCTION [Q DF PEAK FLOW DRAGE USED	<pre>out/Qin](%)= 1 (min)= 7 (ha.m.)=</pre>	.9.42 70.00 0.1002
CALIB STANDHYD (0002) Area ID= 1 DT=15.0 min Total Im	(ha) = 13.68 np(%) = 61.00	Dir. Conn.(%)	= 53.00
I Surface Area (ha)=	IMPERVIOUS P 8.34	ERVIOUS (i) 5.34	

DATE: February 2021

Dep. Storage Average Slope Length Mannings n	(mm) = (%) = (m) = =	1.00 1.00 301.99 0.013		5.00 2.30 40.00 0.250		
Max.Eff.Inten.(m over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak	<pre>m/hr) = (min) (min) = (min) = (cms) =</pre>	25.02 15.00 16.80 15.00 0.07	(ii) (ii) (ii)	21.25 30.00 97.80 (ii) 05.00 0.01	+200231.0+	
PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICIE	(cms) = (hrs) = (mm) = (mm) = NT =	0.49 5.25 53.38 54.38 0.98		0.12 6.75 28.86 54.38 0.53	0.541 (iii) 5.25 41.85 54.38 0.77	
 (i) CN PROCEDU CN* = 8 (ii) TIME STEP THAN THE S (iii) PEAK FLOW 	RE SELECTI 5.0 Ia (DT) SHOU TORAGE COI DOES NOT	ED FOR PE = Dep. S LD BE SMA EFFICIENT INCLUDE E	ERVIOUS 1 Storage ALLER OR 2. BASEFLOW	LOSSES: (Above) EQUAL IF ANY.		
CALIB STANDHYD (0021) ID= 1 DT= 5.0 min	Area Total In	(ha) = np(%) = 6	6.05 57.00 I	Dir. Conn.	.(%)= 66.00	
Surface Area Dep. Storage Average Slope Length Mannings n	(ha) = (mm) = (%) = (m) = =	IMPERVIOU 4.05 1.00 1.00 200.83 0.013	JS PEI	RVIOUS (i) 2.00 5.00 2.00 40.00 0.250		
NOTE: RAINF	ALL WAS TI	RANSFORME	D TO S	5.0 MIN. 1	FIME STEP.	
TIME hrs 0.083 0.167 0.250 0.333 0.417 0.500	RAIN mm/hr 0.00 0.00 0.54 0.54 0.54	TRA TIME hrs 3.167 3.250 3.333 3.417 3.500 3.583	ANSFORME RAIN mm/hr 3.26 3.26 9.25 9.25 9.25 9.25 9.25	D HYETOGRA ' TIME ' hrs 6.250 6.333 6.417 6.500 6.583 6.667	APH RAIN TIME mm/hr hrs 7.07 9.33 3.81 9.42 3.81 9.50 3.81 9.58 3.81 9.67 3.81 9.75	RAIN mm/hr 0.54 0.54 0.54 0.54 0.54 0.54
0.583 0.667 0.750 0.833 0.917 1.000 1.083 1.167 1.250 1.333	0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54	3.667 3.750 3.833 3.917 4.000 4.083 4.167 4.250 4.333 4.417 4.500	9.25 9.25 9.25 9.25 9.25 9.25 9.25 9.25	6.750 6.833 6.917 7.000 7.083 7.167 7.250 7.333 7.417 7.500 7.583	3.81 9.83 3.81 9.92 3.81 10.00 3.81 10.08 3.81 10.17 3.81 10.25 3.81 10.33 2.18 10.42 2.18 10.58 2.18 10.58 2.18 10.67	0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54
1.500	0.54	4.583	25.02	7.667	2.18 10.75	0.54

| DT=

(cms)

0.0000

0.0290

0.0950

0.1680

(ha.m.)

0.0000

0.3310

0.4595

0.5720

(cms)

0.2360

0.3410

0.4450

0.5320

- 1

(ha.m.)

0.6393 0.7100

0.7485

0.7925

1.583 1.667 1.750 1.833 1.917 2.000 2.083 2.167 2.250	0.54 4.667 0.54 4.750 0.54 4.833 0.54 4.917 0.54 5.000 0.54 5.083 0.54 5.167 0.54 5.250 0.54 5.250	25.02 25.02 25.02 25.02 25.02 25.02 25.02 25.02 25.02 7.07	7.750 7.833 7.917 8.000 8.083 8.167 8.250 8.333 8.417	2.18 2.18 2.18 2.18 2.18 2.18 2.18 2.18 1.09 1.09 1.09	10.83 10.92 11.00 11.08 11.17 11.25 11.33 11.42 11.50	0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54
2.530 2.417 2.500 2.583 2.667 2.750 2.833 2.917 3.000	3.26 5.500 3.26 5.500 3.26 5.583 3.26 5.667 3.26 5.833 3.26 5.833 3.26 5.833 3.26 5.817 3.26 6.000 3.26 6.083	7.07 7.07 7.07 7.07 7.07 7.07 7.07 7.07	8.583 8.583 8.667 8.750 8.833 8.917 9.000 9.083 9.167	1.09 1.09 1.09 1.09 1.09 1.09 1.09 1.09 1.09	11.67 11.75 11.83 11.92 12.00 12.08 12.17 12.25	0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54
3.083 Max Eff Inten (m	$3.26 \mid 6.167$	7.07	9.250	1.09		
over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak	(min) 5.0 (min)= 6.7 (min)= 5.0 (cms)= 0.1	0 6 (ii) 0 8	25.00 20.56 (ii) 25.00 0.05			
PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICIE	(cms) = 0.2 (hrs) = 5.2 (mm) = 53.3 (mm) = 54.3 NNT = 0.9	8 5 8 8 8	0.08 5.33 29.50 54.38 0.54	*TOT 0. 5 45 54 0	ALS* 360 (iii) .25 .26 .38 .83	
 (i) CN PROCEDU CN* = 8 (ii) TIME STEP THAN THE S (iii) PEAK FLOW 	RE SELECTED FOR 8.0 Ia = Dep. (DT) SHOULD BE S TORAGE COEFFICIE DOES NOT INCLUDE	PERVIOUS Storage MALLER OR NT. BASEFLOW	LOSSES: (Above) EQUAL IF ANY.			
ADD HYD (0658) 1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)		
ID1= 1 (000 + ID2= 2 (002 =========	12): 13.68 0 1): 6.05 0	.541 .360	5.25 41 5.25 45 ======	.85		
ID = 3 (065 Note: peak flow	8): 19.73 0 NS DO NOT INCLUDE	.901 BASEFLOW	5.25 42 S IF ANY.	2.90		
RESERVOIR(0645) IN= 2> OUT= 1	OVERFLOW IS	off				
DT= 5.0 min	OUTFLOW S	TORACE		0.TTC	PACE	

DATE: February 2021

INFLOW : ID= 2	(0658)	AREA (ha) 19.730	QPEAK (cms) 0.901	TPEAK (hrs) 5.25 8.08	R.V. (mm) 42.90
COIFLOW. ID- I	(0045)	19.750	0.100	0.00	42.75
	PEAK FLOW	W REDUCT	ION [Qout/Q	in](%)= 18	.65
	TIME SHIFT	OF PEAK F	LOW	(min)=170	.00
	MAXIMUM 5	FORAGE U	SED (na.m.)= 0	.5/19
CALIB		$(h_{2}) = 1$	4 51		
STANDHID (0050) Area I Total'	(na) = 1 (mn(%) = 5	4.JL 4.00 Dir	Conn (%)=	46.00
		Imp(0) 0	1.00 D11.	. ()	10.00
		IMPERVIOU	S PERVIC	US (i)	
Surface Area	(ha) =	7.84	6.6	7	
Dep. Storage	(mm) =	1.00	5.0	0	
Average Slope	e (%)=	1.00	2.3	0	
Length	(m) =	311.02	40.0	0	
Mannings n	=	0.013	0.25	0	
Max.Eff.Inter	(mm/hr)=	25.02	19.8	5	
01	ver (min)	15.00	30.0	0	
Storage Coeff	(min) =	16.80	(ii) 97.8	0 (ii)	
Unit Hyd. Tpe	eak (min)=	15.00	105.0	0	
Unit Hyd. pea	uk (cms)=	0.07	0.0	1	
				*	TOTALS*
PEAK FLOW	(cms) =	0.46	0.1	4	0.508 (111)
TIME TO PEAK	(11rs) =	53 39	0./ 27 5	0	39.40
TOTAL RAINFAL	.T. (mm) =	54 38	54 3	8	54 38
RUNOFF COEFFI	CIENT =	0.98	0.5	1	0.72
(i) CN PROC	EDURE SELEC	FED FOR PE	RVIOUS LOSS	ES:	
CN* =	= 84.0 Ia	a = Dep. S	torage (Ab	ove)	
(II) TIME SI THAN TH	TEP (DT) SHUU	JLD BE SMA Nefetcient	LLER OR EQU	AL	
(iii) PEAK FI	OW DOES NOT	INCLUDE B	ASEFLOW IF	ANY.	
			_		
RESERVOIR (0657) OVERI	FLOW IS OF	F		
IN= 2> UUT= 1			DACE	UTELOW	CTODACE
1 DI = 0.0 mill	(cm	s) (ha	m)	(cms)	(ham)
	0.0	000 0.	0000 1	0.3640	0.2594
	0 0	190 0	2147 1	0 5250	0 2723

	0.2590	0.2500	0.8190	0.2863
INFLOW : ID= 2 OUTFLOW: ID= 1	A ((0656) 14 (0657) 14	REA QPEAI ha) (cms) .510 0.1 .510 0.2	K TPEAK) (hrs) 508 5.25 259 6.33	R.V. (mm) 39.40 39.21
	PEAK FLOW TIME SHIFT OF MAXIMUM STORA	REDUCTION [Q0 PEAK FLOW GE USED	<pre>out/Qin](%) = (min) = (ha.m.) =</pre>	50.96 65.00 0.2500

0.2350 | 0.6840

0.2789

0.1460

DATE: February 2021

	2.00	0.63	5.25	28.84	8.50	1.25	11.75	0.63
	2.23	3 76	1 5 75	8.15	1 9 00	1 25 1	12.00	0.63
	2.30	3.76	6.00	8.15	9.25	1.25	12.20	0.00
	3.00	3.76	6.25	8.15	9.50	0.63		
V V I SSSSS U U A L (v 6.1.2003)	3.25	3.76	6.50	4.39	9.75	0.63		
V V I SS U U A A L								
VV I SSSSS UUUUU A A LLLLL								
	CALIB							
OOO TTTTT TTTTT H H Y Y M M OOO TM	STANDHYD (0012)	Area	(ha) =	2.72				
О О Т Т Н Н ҮҮ ММ ММ О О	ID= 1 DT= 5.0 min	Total Ir	np(%)= 9	90.00	Dir. Conn	.(%)= 9	0.00	
О О Т Т Н Н Ү М М О О								
ооо т т н н ү м м ооо			IMPERVIOU	JS PE	RVIOUS (i)		
Developed and Distributed by Smart City Water Inc	Surface Area	(ha) =	2.45		0.27			
Copyright 2007 - 2020 Smart City Water Inc	Dep. Storage	(mm) =	1.00		5.00			
All lights feserved.	Average Slope	(~) = (m) =	134 66		2.00			
	Mannings n	(111) =	0 013		40.00 0 250			
**** DETATLED OUTPUT *****	Hamings n	_	0.015		0.230			
	NOTE: RAINE	ALL WAS TH	RANSFORM	ED TO	5.0 MIN.	TIME STE	P.	
Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat								
Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e-			TRA	ANSFORME	D HYETOGR	APH		
a930-3446elae5bfa\453377f5-9ed8-4652-a685-cf063d8575f7\scen	TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e-	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
a930-3446elae5bla\4533//15-9ed8-4652-a685-c1063d85/51/\scen	0.083	0.00	3.16/	3.76	6.250	8.15	9.33	0.63
	0.10/	0.00	1 3.230	10 66	0.333	4.39	9.42	0.03
DATE: 02-09-2021 TTME: 01-20-05	0.230	0.00	3.333	10.00	1 6 500	4.39	9.50	0.03
DATE: 02 09 2021	0.333	0.03	3 500	10.00	1 6 583	4 39 1	9.67	0.63
USER:	0.500	0.63	3.583	10.66	6.667	4.39	9.75	0.63
	0.583	0.63	3.667	10.66	6.750	4.39	9.83	0.63
	0.667	0.63	3.750	10.66	6.833	4.39	9.92	0.63
	0.750	0.63	3.833	10.66	6.917	4.39	10.00	0.63
COMMENTS:	0.833	0.63	3.917	10.66	7.000	4.39	10.08	0.63
	0.917	0.63	4.000	10.66	7.083	4.39	10.17	0.63
	1.000	0.63	4.083	10.66	7.167	4.39	10.25	0.63
	1.083	0.63	4.167	10.66	7.250	4.39	10.33	0.63
	1.167	0.63	4.250	10.66	7.333	2.51	10.42	0.63
***	1.250	0.63	4.333	28.84	1 7.41/	2.51	10.50	0.63
^^ SIMULATION : IS. AES IZER INVE	1.333	0.63	4.41/	28.84	1 7.500	2.51	10.58	0.03
	1.41/	0.03	1 4.500	20.04	1 7 667	2.51	10.07	0.03
	1 583	0.03	4.505	28.84	1 7 750	2.51	10.75	0.03
	1 667	0.03	4 750	28.84	1 7 833	2.51	10.00	0.63
READ STORM Filename: C:\Users\sfanous\AppD	1.750	0.63	4.833	28.84	7.917	2.51	11.00	0.63
ata\Local\Temp\	1.833	0.63	4.917	28.84	8.000	2.51	11.08	0.63
8766663e-6d3f-4db9-a962-c49127701f86\2f58dc3d	1.917	0.63	5.000	28.84	8.083	2.51	11.17	0.63
Ptotal= 62.71 mm Comments: 10yr/12hr	2.000	0.63	5.083	28.84	8.167	2.51	11.25	0.63
	2.083	0.63	5.167	28.84	8.250	2.51	11.33	0.63
TIME RAIN TIME RAIN TIME RAIN TIME RAIN	2.167	0.63	5.250	28.84	8.333	1.25	11.42	0.63
hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr	2.250	0.63	5.333	8.15	8.417	1.25	11.50	0.63
0.25 0.00 3.50 10.66 6.75 4.39 10.00 0.63	2.333	3.76	5.417	8.15	8.500	1.25	11.58	0.63
0.50 0.63 3.75 10.66 7.00 4.39 10.25 0.63	2.417	3.76	5.500	8.15	8.583	1.25	11.67	0.63
0.75 0.63 4.00 10.66 7.25 4.39 10.50 0.63	2.500	3.76	5.583	8.15	8.667	1.25	11.75	0.63
	2.583	3.76	5.667	8.15	8.750	1.25	11.83	0.63
	2.667	3.76	1 5./50	8.15	8.833	1.25	11.92	0.63
	2.750	3.10	3.033 5.017	0.15	1 0.91/	1 25 1	12.00	0.63
1.75 0.05 5.00 20.84 8.25 2.51 11.50 0.63	2.833	3.10	1 7.211	0.13	1 9.000	1.20	12.00	0.03

Unit Hyd. peak (cms) =

		2.917 3.000 3.083	3.76 3.76 3.76	6.000 6.083 6.167	8.15 8.15 8.15	9.08 9.16 9.25	33 57 50	1.25 1.25 1.25	12.17 12.25 	0.63 0.63
	Max.Eff.Int Storage Coe Unit Hyd. T Unit Hyd. p	en.(mm/hr over (min ff. (min peak (min eak (cms	$(x_{1}) = (x_{1})$ $(x_{2}) = (x_{2})$ $(x_{2}) = (x_{2})$ $(x_{2}) = (x_{2})$	28.84 5.00 5.02 5.00 0.21	(ii)	25.90 10.00 9.84 10.00 0.11	(ii)			
	PEAK FLOW TIME TO PEA RUNOFF VOLU TOTAL RAINF RUNOFF COEF	(cms K (hrs ME (mm ALL (mm FICIENT	$(x_{1}) = (x_{1}) = (x_{$	0.20 5.25 61.71 62.71 0.98		0.02 5.25 44.36 62.71 0.71		* TC C 5	0.215 (iii) 5.25 59.97 52.71 0.96	
	(i) CN PR CN* (ii) TIME THAN (iii) PEAK	OCEDURE S = 93.6 STEP (DT) THE STORA FLOW DOES	ELECTED Ia = SHOULD GE COEF NOT IN	FOR PE Dep. S BE SMA FICIENT CLUDE B	RVIOUS torage LLER OF ASEFLOW	LOSSES (Abox EQUAI I IF AN	3: /e) /Y.			
RE IN D7	ESERVOIR(06 N= 2> OUT= F= 5.0 min	42) 1 	OVERFLO OUTFLOW (cms)	W IS OF STO (ha	F RAGE .m.)	1 OU1	FLOW	SI (h	'ORAGE aa.m.)	
			0.0000 0.0050 0.0200 0.0360	0. 0. 0.	0000 0617 0820 1003	0. 0. 0.	0510 0730 0960 1150		0.1120 0.1266 0.1376 0.1490	
]	INFLOW : ID= DUTFLOW: ID=	2 (0012 1 (0642	:) :)	AREA (ha) 2.720 2.720	QPEAF (cms) 0.2 0.0	1 1 215 050	PEAK (hrs) 5.2 6.3	25 33	R.V. (mm) 59.97 58.82	
		PEAK TIME S MAXIMU	FLOW HIFT OF M STOR	REDUCT PEAK F AGE U	ION [Qc LOW SED	out/Qir (ha	n](%)= (min)= a.m.)=	= 23.4 = 65.0 = 0.1	4 0 .117	
C# S1 ID=	ALIB FANDHYD (00 = 1 DT=15.0 m	 02) Ar in Tc	ea (tal Imp	ha)= 1 (%)= 6	3.68 1.00	Dir. (Conn.(_%) =	53.00	
	Surface Are Dep. Storag Average Slo Length Mannings n	a (ha e (mm pe (% (m	IM () = ()	PERVIOU 8.34 1.00 1.00 301.99 0.013	S PE	5.34 5.00 2.30 40.00 0.250	3 (i)			
	Max.Eff.Int Storage Coe Unit Hyd. T	en.(mm/hr over (min ff. (min peak (min	() = () = () =	28.84 15.00 16.80 15.00	(ii) 1	25.95 30.00 97.80 05.00	(ii)			

0.07

0.01

DATE: February 2021

				TOTALS			
PEAK FLOW	(cms) =	0.57	0.15	0.630	(iii)		
TIME TO PEAK	(hrs) =	5.25	6.75	5.25			
RUNOFF VOLUME	(mm) =	61.71	35.81	49.53			
TOTAL RAINFALL	(mm) =	62.71	62.71	62.71			
RUNOFF COEFFICI	ENT =	0.98	0.57	0.79			

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

CN* = 85.0 Ia = Dep. Storage (Above)

- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
 - THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| CALIB | | STANDHYD (0021)| Area (ha)= 6.05

ID= 1	DT= 5.0 min	Total Imp(%)=	67.00	Dir. Conn.(%)=	66.00

		IMPERVIOUS	PERVIOUS	(i)
Surface Area	(ha) =	4.05	2.00	
Dep. Storage	(mm) =	1.00	5.00	
Average Slope	(%) =	1.00	2.00	
Length	(m) =	200.83	40.00	
Mannings n	=	0.013	0.250	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

		TRA	ANSFORME	D HYETOGRA	APH	
TIME	RAIN	TIME	RAIN	' TIME	RAIN TIME	RAIN
hrs	mm/hr	hrs	mm/hr	' hrs	mm/hr hrs	mm/hr
0.083	0.00	3.167	3.76	6.250	8.15 9.33	0.63
0.167	0.00	3.250	3.76	6.333	4.39 9.42	0.63
0.250	0.00	3.333	10.66	6.417	4.39 9.50	0.63
0.333	0.63	3.417	10.66	6.500	4.39 9.58	0.63
0.417	0.63	3.500	10.66	6.583	4.39 9.67	0.63
0.500	0.63	3.583	10.66	6.667	4.39 9.75	0.63
0.583	0.63	3.667	10.66	6.750	4.39 9.83	0.63
0.667	0.63	3.750	10.66	6.833	4.39 9.92	0.63
0.750	0.63	3.833	10.66	6.917	4.39 10.00	0.63
0.833	0.63	3.917	10.66	7.000	4.39 10.08	0.63
0.917	0.63	4.000	10.66	7.083	4.39 10.17	0.63
1.000	0.63	4.083	10.66	7.167	4.39 10.25	0.63
1.083	0.63	4.167	10.66	7.250	4.39 10.33	0.63
1.167	0.63	4.250	10.66	7.333	2.51 10.42	0.63
1.250	0.63	4.333	28.84	7.417	2.51 10.50	0.63
1.333	0.63	4.417	28.84	7.500	2.51 10.58	0.63
1.417	0.63	4.500	28.84	7.583	2.51 10.67	0.63
1.500	0.63	4.583	28.84	7.667	2.51 10.75	0.63
1.583	0.63	4.667	28.84	7.750	2.51 10.83	0.63
1.667	0.63	4.750	28.84	7.833	2.51 10.92	0.63
1.750	0.63	4.833	28.84	7.917	2.51 11.00	0.63
1.833	0.63	4.917	28.84	8.000	2.51 11.08	0.63
1.917	0.63	5.000	28.84	8.083	2.51 11.17	0.63
2.000	0.63	5.083	28.84	8.167	2.51 11.25	0.63
2.083	0.63	5.167	28.84	8.250	2.51 11.33	0.63
2.167	0.63	5.250	28.84	8.333	1.25 11.42	0.63
2.250	0.63	5.333	8.15	8.417	1.25 11.50	0.63
2.333	3.76	5.417	8.15	8.500	1.25 11.58	0.63

2.417 3.76 2.500 3.76 2.583 3.76 2.667 3.76 2.750 3.76 2.833 3.76 2.917 3.76 3.000 3.76 3.083 3.76	5.500 8.15 5.583 8.15 5.667 8.15 5.750 8.15 5.833 8.15 5.917 8.15 6.000 8.15 6.083 8.15 6.167 8.15	8.583 1. 8.667 1. 8.750 1. 8.833 1. 9.000 1. 9.083 1. 9.167 1. 9.250 1.	25 11.67 0.63 25 11.75 0.63 25 11.83 0.63 25 12.00 0.63 25 12.00 0.63 25 12.08 0.63 25 12.17 0.63 25 12.17 0.63 25 12.25 0.63 25 12.25 0.63
Max.Eff.Inten.(mm/hr) =	28.84 5.00 6.38 (ii) 5.00 0.18 0.32 5.25 61.71 62.71 0.98	22.78 20.00 19.14 (ii) 20.00 0.06 0.11 5.33 36.59 62.71 0.58	*TOTALS* 0.427 (iii) 5.25 53.17 62.71 0.85
<pre>(i) CN PROCEDURE SELECTEI CN* = 88.0 Ia = (ii) TIME STEP (DT) SHOULI THAN THE STORAGE COEH (iii) PEAK FLOW DOES NOT IN </pre>	D FOR PERVIOUS = Dep. Storage D BE SMALLER O FFICIENT. NCLUDE BASEFIC 	LOSSES: (Above) R EQUAL W IF ANY. TPEAK R.V (hrs) (mm	
ID1= 1 (0002): 13.6 + ID2= 2 (0021): 6.0 ID = 3 (0658): 19.7 NOTE: PEAK FLOWS DO NOT IN	68 0.630 05 0.427 73 1.057 NCLUDE BASEFLC	5.25 49.53 5.25 53.17 5.25 50.65 WS IF ANY.	
RESERVOIR(0645) OVERFLC IN= 2> OUT= 1 DT= 5.0 min OUTFLOW (cms) 0.0000 0.0290 0.0950 0.1680	DW IS OFF (ha.m.) 0 0.0000 0 0.3310 0 0.4595 0 0.5720	OUTFLOW (cms) 0.2360 0.3410 0.4450 0.5320	STORAGE (ha.m.) 0.6393 0.7100 0.7485 0.7925
INFLOW : ID= 2 (0658) 1 OUTFLOW: ID= 1 (0645) 1 PEAK FLOW TIME SHIFT OF MAXIMUM STOF	AREA QPEA (ha) (cms) 19.730 1. 19.730 0. REDUCTION [Q F PEAK RAGE USED	K TPEAK) (hrs) 057 5.25 236 7.58 out/Qin](%) = 2 (min)=14 (ha.m.)=	R.V. (mm) 50.65 50.48 2.30 0.00 0.6392

DATE: February 2021

CALIB							
STANDHYD (0656)	Area	(ha) =	14.51				
ID= 1 DT=15.0 min	Total	Imp(%)=	54.00	Dir. (Conn.(%)=	46.00	
		IMPERVI	OUS	PERVIOUS	5 (i)		
Surface Area	(ha) =	7.8	4	6.67			
Dep. Storage	(mm) =	1.0	0	5.00			
Average Slope	(%) =	1.0	0	2.30			
Length	(m) =	311.0	2	40.00			
Mannings n	=	0.01	3	0.250			
Max.Eff.Inten.(mm/hr)=	28.8	4	24.35			
over	(min)	15.0	0	30.00			
Storage Coeff.	(min) =	16.8	0 (ii)	97.80	(ii)		
Unit Hyd. Tpeak	(min) =	15.0	0	105.00			
Unit Hyd. peak	(cms) =	0.0	7	0.01			
					1	'OTALS	
PEAK FLOW	(cms) =	0.5	3	0.17		0.593 (iii)	
TIME TO PEAK	(hrs) =	5.2	5	6.75		5.25	
RUNOFF VOLUME	(mm) =	61.7	1	34.28		46.89	
TOTAL RAINFALL	(mm) =	62.7	1	62.71		62.71	
RUNOFF COEFFICI	ENT =	0.9	8	0.55		0.75	
(i) CN PROCED	URE SELEC	CTED FOR	PERVIOU	JS LOSSES	5:		
CN* =	84.0	Ia = Dep.	Storag	je (Abov	ve)		
(ii) TIME STEP	(DT) SHO	DULD BE SI	MALLER	OR EQUAL	L		
THAN THE	STORAGE (COEFFICIE	NT.				
(iii) PEAK FLOW	DOES NO	r include	BASEFI	LOW IF AN	NY.		
RESERVOIR(0657)	OVEI	KELOW IS (OF.E.				

RESERVOI	R(0	657	I OV	ERF:	LOW	IS (OFF					
IN= 2	> OUT	= 1	1									
DT= 5.0	min		OU	JTFL(WC	S	FORA	GE		OUTFLOW	STORAGE	
			((cms)	(]	ha.m	.)		(cms)	(ha.m.)	
			C	0.00	00	(0.00	00		0.3640	0.2594	
			C	0.01	90	(0.21	47		0.5250	0.2723	
			C	.14	60	(0.23	50		0.6840	0.2789	
			C	.25	90		0.25	00		0.8190	0.2863	
					AR	EA		QPEAK		TPEAK	R.V.	
					(ha	a)		(cms)		(hrs)	(mm)	
INFLOW	: ID=	2	(0656)		14.	510		0.59	3	5.25	46.89	
OUTFLOW	: ID=	1	(0657)		14.	510		0.35	5	5.67	46.70	
			PEAK E TIME SHI MAXIMUM	FLOW FT (ST)	RI DF PI DRAGI	EDU(EAK E	CTIO FLO USE	N [Qou W D	t/	Qin](%)= 5 (min)= 2 (ha.m.)=	9.90 5.00 0.2587	
		===:				===:		=====	==			
		===:										
V	V	I	SSSSS	U	U	i	A	L		(v	6.1.2003)	
V	V	I	SS	U	U	A	A	L				
V	V	I	SS	U	U	AA	AAA	L				
V	V	I	SS	U	U	A	A	L				
V	v	I	SSSSS	UU	JUU	A	A	LLLLL				

_

DATE: February 2021

000 TTTTT TTTTT H H Y Y M M 000 TM 0 0 T T H H Y Y MM MM 0 0	CALIB STANDHYD (0012) ID= 1 DT= 5.0 min	Area Total In	(ha)= np(%)=	2.72 90.00	Dir. Conn.	(%)= 9	0.00	
о о т т н н у м м о о								
		(1)	IMPERVIO	US PI	ERVIOUS (1)			
Developed and Distributed by Smart City Water Inc	Surface Area	(na) =	2.45		0.27			
Copyright 2007 - 2020 Smart City water inc	Dep. Storage	= (1111)	1.00		2.00			
All rights reserved.	Average Slope	(~) = (~) =	124 66		2.00			
	Manninga n	(111) =	134.00		40.00			
*****	Mainings II	-	0.013		0.230			
DEIRIED COIFOI	NOTE · RAINFA	LL WAS TH	ANGFORM	ED TO	5 0 MTN T	TME STE	P	
	NOTE: NATIVER	DD WAS II	VANO1 0101	LD 10	5.0 MIN. 1	IND OIL		
Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat								
Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e-			TR.	ANSFORM	ED HYETOGRA	РН		
a930-3446e1ae5bfa\f2d0c5ba-35e8-42ef-b592-689325161f65\scen	TIME	RAIN	TIME	RAIN	' TIME	RAIN	TIME	RAIN
Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e-	hrs	mm/hr	hrs	mm/hr	' hrs	mm/hr	hrs	mm/hr
a930-3446e1ae5bfa\f2d0c5ba-35e8-42ef-b592-689325161f65\scen	0.083	0.00	3.167	4.39	6.250	9.50	9.33	0.73
	0.167	0.00	3.250	4.39	6.333	5.12	9.42	0.73
	0.250	0.00	3.333	12.43	6.417	5.12	9.50	0.73
DATE: 02-09-2021 TIME: 01:20:06	0.333	0.73	3.417	12.43	6.500	5.12	9.58	0.73
	0.417	0.73	3.500	12.43	6.583	5.12	9.67	0.73
USER:	0.500	0.73	3.583	12.43	6.667	5.12	9.75	0.73
	0.583	0.73	3.667	12.43	6.750	5.12	9.83	0.73
	0.667	0.73	3.750	12.43	6.833	5.12	9.92	0.73
	0.750	0.73	3.833	12.43	6.917	5.12	10.00	0.73
COMMENTS:	0.833	0.73	3.917	12.43	7.000	5.12	10.08	0.73
	0.917	0.73	4.000	12.43	7.083	5.12	10.17	0.73
	1.000	0.73	4.083	12.43	7.167	5.12	10.25	0.73
	1.083	0.73	4.167	12.43	7.250	5.12	10.33	0.73
	1.167	0.73	4.250	12.43	7.333	2.92	10.42	0.73
***************************************	1.250	0.73	4.333	33.63	7.417	2.92	10.50	0.73
** SIMULATION : 16. AES 12hr 25yr **	1.333	0.73	4.417	33.63	7.500	2.92	10.58	0.73
***************************************	1.417	0.73	4.500	33.63	7.583	2.92	10.67	0.73
	1.500	0.73	4.583	33.63	7.667	2.92	10.75	0.73
	1.583	0.73	4.667	33.63	7.750	2.92	10.83	0.73
	1.667	0.73	4.750	33.63	7.833	2.92	10.92	0.73
READ STORM Filename: C:\Users\sfanous\AppD	1.750	0.73	4.833	33.63	7.917	2.92	11.00	0.73
ata\Local\Temp\	1.833	0.73	4.917	33.63	8.000	2.92	11.08	0.73
8766663e-6d3f-4db9-a962-c49127701f86\4b1e5c14	1.917	0.73	5.000	33.63	8.083	2.92	11.17	0.73
Ptotal= 73.10 mm Comments: 25yr/12hr	2.000	0.73	5.083	33.63	8.167	2.92	11.25	0.73
	2.083	0.73	5.167	33.63	8.250	2.92	11.33	0.73
TIME RAIN TIME RAIN TIME RAIN TIME RAIN	2.167	0.73	5.250	33.63	8.333	1.46	11.42	0.73
hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr	2.250	0.73	5.333	9.50	8.417	1.46	11.50	0.73
0.25 0.00 3.50 12.43 6.75 5.12 10.00 0.73	2.333	4.39	5.417	9.50	8.500	1.46	11.58	0.73
0.50 0.73 3.75 12.43 7.00 5.12 10.25 0.73	2.417	4.39	5.500	9.50	8.583	1.46	11.67	0.73
0.75 0.73 4.00 12.43 7.25 5.12 10.50 0.73	2.500	4.39	5.583	9.50	8.667	1.46	11.75	0.73
	2.583	4.39	5.66/	9.50	8.750	1.46	11.83	0.73
1.25 0.73 4.50 33.63 7.75 2.92 11.00 0.73	2.667	4.39	5./50	9.50	8.833	1.46	11.92	0.73
1.50 0.73 4.75 33.63 8.00 2.92 11.25 0.73	2.750	4.39	5.833	9.50	8.917	1.46	12.00	0.73
	2.833	4.39	5.917	9.50	9.000	1.40	12.08	0.73
2.00 0.73 3.23 33.03 8.30 1.40 11.73 0.73	2.91/	4.39	6 092	9.50	1 9.003	1 40	12.1/	0.73
	3.000	1 30	6 167	9.00	1 9 250	1 16 1	12.20	0.13
2 75 4 39 6 00 9 50 9 25 1 46 12 23 0.73	5.065	4.59	0.10/	9.00	1 9.230	T.40		
3 00 4 39 6 25 9 50 9 23 1 40	May Eff Inten (mm	(hr) =	33 63		30 94			
3 25 4 39 6 50 5 12 9 75 0 73	over /	min)	5 00		10 00			
5.25 1.55 5.56 5.22 5.75 5.75	Storage Coeff (min)=	4 72	(ii)	9 25 (ii)			
	Unit Hyd Theat (min) =	5 00	(± ±)	10 00			
	Unit Hvd peak (cms) =	0 22		0.12			
	outo nia. boar (v.22			* т∩т	'ALS*	
						101		

PEAK FLOW	(cms) =	0.23	0.02	0.252 (iii)
TIME TO PEAK	(hrs) =	5.25	5.25	5.25
RUNOFF VOLUME	(mm) =	72.10	54.26	70.31
TOTAL RAINFALL	(mm) =	73.10	73.10	73.10
RUNOFF COEFFICI	ENT =	0.99	0.74	0.96

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
- CN* = 93.6 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
- THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

	-				
RESERVOIR(0642)	OVER	FLOW IS OFF			
IN= 2> OUT= 1					
DT= 5.0 min	OUTE	LOW STORA	GE I OUT	FLOW ST	ORAGE
	- (cm	s) (ha.m	1.) (c	ms) (h	a.m.)
	0 0	000 0.00		0510	0 1120
	0.0	050 0.06	517 I 0	0730	0 1266
	0.0	200 0.08	20 1 0	0960	0 1376
	0.0	360 0.00		1150	0 1490
	0.0	0.10	105 0.	1130	0.1490
			ODEAR .	UDE A K	D V
		(ha)	(cma)	(bxc)	(mm)
TNELOW - TD- 2 (00101	(IId) 0.700	(CIIIS)	(IIIIS) E 0E	(11111)
INFLOW : ID= 2 (0012)	2.720	0.252	5.25	70.31
OUTFLOW: ID= I (0642)	2.720	0.069	6.25	69.16
			NI FORME (OF	1(0) - 07 F	0
1	PEAK FLO	W REDUCTIO	N [QOUL/QII	1] (3) = 27.5	8
-	TIME SHIFT	OF PEAK FLC	W .	(min) = 60.0	0
P	MAXIMUM S	TORAGE USE	lD (ha	a.m.) = 0.1	242
	-				
CALLD					
STANDHYD (0002)	Area	(ha)= 13.	68		
STANDHYD (0002) ID= 1 DT=15.0 min	Area Total	(ha)= 13. Imp(%)= 61.	68 00 Dir. (Conn.(%)=	53.00
STANDHYD (0002) ID= 1 DT=15.0 min	Area Total	(ha) = 13. Imp(%) = 61.	68 00 Dir. (Conn.(%)=	53.00
STANDHYD (0002) ID= 1 DT=15.0 min	Area Total	(ha) = 13. Imp(%) = 61. IMPERVIOUS	68 00 Dir. 0 PERVIOUS	Conn.(%)=	53.00
STANDHYD (0002) ID= 1 DT=15.0 min 	Area Total (ha)=	(ha) = 13. Imp(%) = 61. IMPERVIOUS 8.34	68 00 Dir. 0 PERVIOUS 5.34	Conn.(%)= 5 (i)	53.00
STANDHYD (0002) ID= 1 DT=15.0 min Surface Area Dep. Storage	Area Total (ha) = (mm) =	(ha) = 13. Imp(%) = 61. IMPERVIOUS 8.34 1.00	68 00 Dir. 0 PERVIOUS 5.34 5.00	Conn.(%)= S (i)	53.00
STANDHYD (0002) ID= 1 DT=15.0 min 	Area Total (ha) = (mm) = (%) =	(ha) = 13. Imp(%) = 61. IMPERVIOUS 8.34 1.00 1.00	68 00 Dir. 0 PERVIOUS 5.34 5.00 2.30	Conn.(%)= 5 (i)	53.00
STANDHYD (0002) ID= 1 DT=15.0 min 	Area Total (ha) = (mm) = (%) = (m) =	(ha) = 13. Imp(%) = 61. IMPERVIOUS 8.34 1.00 1.00 301.99	68 00 Dir. 0 PERVIOUS 5.34 5.00 2.30 40.00	Conn.(%)= S (i)	53.00
STANDHYD (0002) ID= 1 DT=15.0 min 	Area Total (ha) = (mm) = (%) = (m) = =	(ha) = 13. Imp(%) = 61. IMPERVIOUS 8.34 1.00 301.99 0.013	68 00 Dir. 0 PERVIOUS 5.34 5.00 2.30 40.00 0.250	Conn.(%)=	53.00
STANDHYD (0002) ID= 1 DT=15.0 min 	Area Total (ha) = (mm) = (%) = (m) = =	(ha) = 13. Imp(%) = 61. IMPERVIOUS 8.34 1.00 1.00 301.99 0.013	68 00 Dir. 0 5.34 5.00 2.30 40.00 0.250	Conn.(%)=	53.00
Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten.	Area Total (ha) = (mm) = (%) = (m) = (mm/hr) =	(ha) = 13. Imp(%) = 61. IMPERVIOUS 8.34 1.00 1.00 301.99 0.013 33.63	68 00 Dir. 0 PERVIOUS 5.34 5.00 2.30 40.00 0.250 31.91	Conn.(%)=	53.00
STANDHYD (0002) ID= 1 DT=15.0 min 	Area Total (ha) = (mm) = (%) = (m) = = (mm/hr) = r (min)	<pre>(ha) = 13. Imp(%) = 61. IMPERVIOUS</pre>	68 00 Dir. 0 PERVIOUS 5.34 5.00 2.30 40.00 0.250 31.91 30.00	Conn.(%)=	53.00
STANDHYD (0002) ID= 1 DT=15.0 min 	Area Total (ha) = (mm) = (%) = (m = = (mm/hr) = c (min) (min) =	<pre>(ha) = 13. Imp(%) = 61. IMPERVIOUS</pre>	68 00 Dir. (PERVIOUS 5.34 5.00 2.30 40.00 0.250 31.91 30.00 97.80	Conn.(%)=	53.00
Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten. oven Storage Coeff. Unit Hyd. Tpeal	Area Total (ha) = (mm) = (%) = (m) = (mm/hr) = c (min) = c (min) =	(ha) = 13. Imp(%) = 61. IMPERVIOUS 8.34 1.00 1.00 301.99 0.013 33.63 15.00 16.80 (i 15.00	68 00 Dir. 0 PERVIOUS 5.34 5.00 2.30 40.00 0.250 31.91 30.00 .i) 97.80 105.00	Conn.(%)= S (i) (ii)	53.00
STANDHYD (0002) ID= 1 DT=15.0 min 	<pre>Area Total (ha) = (mm) = (%) = (m) = = (mm/hr) = c (min) = c (min) = (cms) =</pre>	<pre>(ha) = 13. Imp(%) = 61. IMPERVIOUS</pre>	68 00 Dir. 0 PERVIOUS 5.34 5.00 2.30 40.00 0.250 31.91 30.00 97.80 105.00 0.01	Conn.(%)= S (i) (ii)	53.00
Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten. Storage Coeff. Unit Hyd. Tpeak	Area Total (ha) = (mm) = (%) = (m) = = (mm/hr) = c (min) (min) = c (min) = (cms) =	<pre>(ha) = 13. Imp(%) = 61. IMPERVIOUS</pre>	68 00 Dir. 0 PERVIOUS 5.34 5.00 2.30 40.00 0.250 31.91 30.00 105.00 0.01	Conn.(%)= S (i) (ii) *TO	53.00 TALS*
STANDHYD (0002) ID= 1 DT=15.0 min 	Area Total (ha) = (mm) = (%) = (m) = = (mm/hr) = c (min) (min) = c (min) = (cms) =	<pre>(ha) = 13. Imp(%) = 61. IMPERVIOUS</pre>	68 00 Dir. (PERVIOUS 5.34 5.00 2.30 40.00 0.250 31.91 30.00 .1) 97.80 105.00 0.01 0.19	Conn.(%)= S (i) (ii) *TO 0	53.00 TALS* .743 (iii)
Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten. oven Storage Coeff. Unit Hyd. Tpeak PEAK FLOW TIME TO PEAK	<pre>Area Total (ha) = (mm) = (%) = (m) = c (min) = c (min) = c (min) = c (cms) = (cms) = (hrs) =</pre>	(ha) = 13. Imp(%) = 61. IMPERVIOUS 8.34 1.00 1.00 301.99 0.013 33.63 15.00 16.80 (i 15.00 0.07 5.25	68 00 Dir. C PERVIOUS 5.34 5.00 2.30 40.00 0.250 31.91 30.00 0.97.80 105.00 0.01 0.19 6.75	Conn.(%)= S (i) (ii) *TO 0	53.00 TALS* .743 (iii) 5.25
STANDHYD (0002) STANDHYD (0002) ID= 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten. over Storage Coeff. Unit Hyd. Tpeal Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME	<pre>Area Total (ha) = (mm) = (%) = (m) = = (mm/hr) = c (min) = c (min) = (cms) = (hrs) = (hrs) = (mm) =</pre>	<pre>(ha) = 13. Imp (%) = 61. IMPERVIOUS</pre>	68 00 Dir. C PERVIOUS 5.34 5.00 2.30 40.00 0.250 31.91 30.00 97.80 105.00 0.01 0.19 6.75 44.79	Conn.(%)= 5 (i) (ii) *TO 0 5	53.00 TALS* .743 (iii) 5.25 9.26
STANDHYD (0002) STANDHYD (0002) ID= 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten. over Storage Coeff. Unit Hyd. Tpeal Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL	Area Total (ha) = (mm) = (%) = (m) = = (mm/hr) = c (min) (min) = c (min) = (cms) = (hrs) = (hrs) = (mm) =	<pre>(ha) = 13. Imp(%) = 61. IMPERVIOUS</pre>	68 00 Dir. 0 PERVIOUS 5.34 5.00 2.30 40.00 0.250 31.91 30.00 105.00 0.01 0.19 6.75 44.79 73.10	Conn.(%)= S (i) (ii) *TO 0 5 7	TALS* .743 (iii) 5.25 9.26 3.10
STANDHYD (0002) STANDHYD (0002) ID= 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten. Over Storage Coeff. Unit Hyd. Tpeal Unit Hyd. Tpeal Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL BUNOFF COFFFIC	Area Total (ha) = (mm) = (%) = (m) = = (mn/hr) = (min) (min) = (cms) = (hrs) = (hrs) = (mm) = (mm) = (mm) =	<pre>(ha) = 13. Imp(%) = 61. IMPERVIOUS</pre>	68 00 Dir. (PERVIOUS 5.34 5.00 2.30 40.00 0.250 31.91 30.00 0.250 105.00 0.01 0.19 6.75 44.79 73.10 0.61	Conn.(%)= S (i) (ii) *TO 0 5 7	TALS* .743 (iii) 5.25 9.26 3.10 0.81
Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten. oven Storage Coeff. Unit Hyd. Tpeal Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFIC:	<pre>Area Total (ha) = (mm) = (%) = (m) = c (min) = c (min) = c (min) = (cms) = (cms) = (hrs) = (mm) = (mm) = UENT =</pre>	(ha) = 13. Imp (%) = 61. IMPERVIOUS 8.34 1.00 1.00 301.99 0.013 33.63 15.00 16.80 (i 5.00 0.07 0.67 5.25 72.10 73.10 0.99	68 00 Dir. C PERVIOUS 5.34 5.00 2.30 40.00 0.250 31.91 30.00 105.00 0.01 0.19 6.75 44.79 73.10 0.61	Conn.(%)= S (i) (ii) *TO 0 5 7	TALS* .743 (iii) 5.25 9.26 3.10 0.81

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

DATE: February 2021

CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

I	CALIB			1						
	STANDHYD	(0021)	1	Area	(ha) =	6.05			
]	ID= 1 DT=	5.	.0 min	1	Total	Imp(%)=	67.00	Dir.	Conn.(%)=	66.00

		IMPERVIOUS	PERVIOUS	(i)
Surface Area	(ha) =	4.05	2.00	
Dep. Storage	(mm) =	1.00	5.00	
Average Slope	(%) =	1.00	2.00	
Length	(m) =	200.83	40.00	
Mannings n	=	0.013	0.250	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

		TR	ANSFORME	D HYETOGRA	APH	-	
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	' hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	4.39	6.250	9.50	9.33	0.73
0.167	0.00	3.250	4.39	6.333	5.12	9.42	0.73
0.250	0.00	3.333	12.43	6.417	5.12	9.50	0.73
0.333	0.73	3.417	12.43	6.500	5.12	9.58	0.73
0.417	0.73	3.500	12.43	6.583	5.12	9.67	0.73
0.500	0.73	3.583	12.43	6.667	5.12	9.75	0.73
0.583	0.73	3.667	12.43	6.750	5.12	9.83	0.73
0.667	0.73	3.750	12.43	6.833	5.12	9.92	0.73
0.750	0.73	3.833	12.43	6.917	5.12	10.00	0.73
0.833	0.73	3.917	12.43	7.000	5.12	10.08	0.73
0.917	0.73	4.000	12.43	7.083	5.12	10.17	0.73
1.000	0.73	4.083	12.43	7.167	5.12	10.25	0.73
1.083	0.73	4.167	12.43	7.250	5.12	10.33	0.73
1.167	0.73	4.250	12.43	7.333	2.92	10.42	0.73
1.250	0.73	4.333	33.63	7.417	2.92	10.50	0.73
1.333	0.73	4.417	33.63	7.500	2.92	10.58	0.73
1.417	0.73	4.500	33.63	7.583	2.92	10.67	0.73
1.500	0.73	4.583	33.63	7.667	2.92	10.75	0.73
1.583	0.73	4.667	33.63	7.750	2.92	10.83	0.73
1.667	0.73	4.750	33.63	7.833	2.92	10.92	0.73
1.750	0.73	4.833	33.63	7.917	2.92	11.00	0.73
1.833	0.73	4.917	33.63	8.000	2.92	11.08	0.73
1.917	0.73	5.000	33.63	8.083	2.92	11.17	0.73
2.000	0.73	5.083	33.63	8.167	2.92	11.25	0.73
2.083	0.73	5.167	33.63	8.250	2.92	11.33	0.73
2.167	0.73	5.250	33.63	8.333	1.46	11.42	0.73
2.250	0.73	5.333	9.50	8.417	1.46	11.50	0.73
2.333	4.39	5.417	9.50	8.500	1.46	11.58	0.73
2.417	4.39	5.500	9.50	8.583	1.46	11.67	0.73
2.500	4.39	5.583	9.50	8.667	1.46	11.75	0.73
2.583	4.39	5.667	9.50	8.750	1.46	11.83	0.73
2.667	4.39	5.750	9.50	8.833	1.46	11.92	0.73
2.750	4.39	5.833	9.50	8.91/	1.46	12.00	0.73
2.833	4.39	1 5.917	9.50	9.000	1.46	12.08	0.73
2.917	4.39	1 6.000	9.50	9.083	1.46	12.1/	0.73
3.000	4.39	1 6.083	9.50	1 9.16/	1.46	12.25	0./3
3.083	4.39	1 6.167	9.50	1 9.250	1.46		

Max.Eff.Inten.(m	nm/hr)=	33.63	27.93		
over	(min)	5.00	20.00		
Storage Coeff.	(min) =	6.00	(ii) 17.76	(ii)	
Unit Hyd. Tpeak	(min) =	5.00	20.00		
Unit Hyd. peak	(cms) =	0.19	0.06		
				TOTALS	
PEAK FLOW	(cms) =	0.37	0.14	0.509	(iii)
TIME TO PEAK	(hrs) =	5.25	5.25	5.25	
RUNOFF VOLUME	(mm) =	72.10	45.72	63.13	
TOTAL RAINFALL	(mm) =	73.10	73.10	73.10	
RUNOFF COEFFICIE	ENT =	0.99	0.63	0.86	

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 88.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
- THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

L	ADD	ΗY	ΖD	(C	65	8)				
L	1	+	2	=	3	3	I	AREA	QPEAK	TPEAK	R.V.
								(ha)	(cms)	(hrs)	(mm)
			ID	1=	1	(0002):	13.68	0.743	5.25	59.26
		+	ID	2=	2	(0021):	6.05	0.509	5.25	63.13
			==:	===	===	==					
			ID	=	3	(0658):	19.73	1.252	5.25	60.45

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0645)	OVERFLOW I	S OFF		
TN= 2> OUT= 1				
DT = 5.0 min	OUTFLOW	STORAGE I	OUTFLOW	STORAGE
	(cmg)	(ham)	(cms)	(bam)
	(CIII3)	(110.111.)	(CIII3)	(114.111.)
	0.0000	0.0000	0.2360	0.6393
	0.0290	0.3310	0.3410	0.7100
	0.0950	0.4595	0.4450	0.7485
	0.1680	0.5720	0.5320	0.7925
	ARE	A OPEAK	TPEAK	R.V.
	(ha) (cms)	(hrs)	(mm)
INFLOW : ID= 2 (0658) 19.7	30 1.252	5.25	60.45
OUTFLOW: ID= 1 (0645) 19.7	30 0.341	7.33	60.28
PI	EAK FLOW RE	DUCTION [Oout	(0in1(%) = 27)	7 20

(min)=125.00 TIME SHIFT OF PEAK FLOW (ha.m.) = 0.7099 MAXIMUM STORAGE USED

CALIB STANDHYD (0656) ID= 1 DT=15.0 min	Area Total	(ha)= Imp(%)=	14.51 54.00	Dir.	Conn.(%)=	46.00
		IMPERVI	DUS	PERVIOU	JS (i)	
Surface Area	(ha) =	7.84	4	6.6	7	
Dep. Storage	(mm) =	1.00	C	5.00	C	

2.30 Average Slope (%)= 1.00 Length (m) = 311.02 Mannings n = 0.013 40.00 0.250 Max.Eff.Inten.(mm/hr) = 33.63 30.10 over (min) 15.00 30.00 Storage Coeff. (min) = 16.80 (ii) 97.80 (ii) Unit Hyd. Tpeak (min) = 15.00 105.00 Unit Hyd. peak (cms) = 0.07 0.01 *TOTALS* PEAK FLOW (cms) = 0.61 0.22 TIME TO PEAK (hrs) = 5.25 6.75 RUNOFF VOLUME (mm) = 72.10 43.06 TOTAL RAINFALL (mm) = 73.10 73.10 RUNOFF COEFFICIENT 0.99 0.59 0.702 (iii) 5.25 56.42 73.10

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

CN* = 84.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(0657) IN= 2> OUT= 1	- OVERE 	'LOW I	S OFF				
DT= 5.0 min	OUTFI	JOW	STORA	GE	OUTFLOW	STORAGE	
	- (cms	5)	(ha.m	.)	(cms)	(ha.m.)	
	0.00	000	0.00	00	0.3640	0.2594	
	0.01	.90	0.21	47	0.5250	0.2723	
	0.14	160	0.23	50	0.6840	0.2789	
	0.25	590	0.25	00	0.8190	0.2863	
		ARE (ha	lA L)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	
INFLOW : ID= 2 (0656)	14.5	10	0.702	5.25	56.42	
OUTFLOW: ID= 1 (0657)	14.5	510	0.519	5.42	56.22	
	PEAK FLOU TIME SHIFT MAXIMUM ST	OF PE OF PE ORAGE	AK FLO	N [QOUL W D =======	(min) = (ha.m.) =	10.00 0.2723	
V V I	SSSSS U	U	A	L	(v 6.1.2003)	
I V V	SS U	U	ΑA	L			
I V V	SS U	U	AAAAA	L			
I V V	SS U	U	A A	L			
I VV	SSSSS UU	JUUU	A A	LLLLL			
000 TTTTT	ТТТТТ Н	Н	у у	м м	000 T	М	
0 0 Т	т н	Н	ΥY	MM MM	0 0		
0 0 Т	т н	Н	Y	M M	0 0		
000 T	т н	Н	Y	M M	000		
Developed and Distr Copyright 2007 - 20 All rights reserved	ibuted by S 20 Smart Ci •	Smart ty Wa	City W ter In	ater In c	С		

0.77

DATE: February 2021

	Mannings n = 0.013 0.250
***** DETAILED OUTPUT *****	Mainings n = 0.015 0.250
	NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.
Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat	
Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e-	TRANSFORMED HYETOGRAPH
a930-3446e1ae5bfa\88947e14-a655-438e-8b03-2f4b16a6137e\scen	TIME RAIN TIME RAIN TIME RAIN TIME RAIN
Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e-	hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr
a930-3446e1ae5bfa\88947e14-a655-438e-8b03-2f4b16a6137e\scen	0.083 0.00 3.167 4.85 6.250 10.50 9.33 0.81
	0 167 0 00 1 3 250 4 85 1 6 333 5 66 1 9 42 0 81
	0 250 0 00 1 3 333 13 74 1 6 417 5 66 1 9 50 0 81
DATE: 02-09-2021 TIME: 01-20-05	
IIGED.	
COMMENTE -	
	1.000 0.81 4.083 13.74 7.167 5.66 10.25 0.81
	1.083 0.81 4.167 13.74 7.250 5.66 10.33 0.81
	1.167 0.81 4.250 13.74 7.333 3.23 10.42 0.81
****	1.250 0.81 4.333 37.17 7.417 3.23 10.50 0.81
** SIMULATION : 17. AES 12hr 50yr **	1.333 0.81 4.417 37.17 7.500 3.23 10.58 0.81
***********	1.417 0.81 4.500 37.17 7.583 3.23 10.67 0.81
	1.500 0.81 4.583 37.17 7.667 3.23 10.75 0.81
	1.583 0.81 4.667 37.17 7.750 3.23 10.83 0.81
	1.667 0.81 4.750 37.17 7.833 3.23 10.92 0.81
READ STORM Filename: C:\Users\sfanous\AppD	1.750 0.81 4.833 37.17 7.917 3.23 11.00 0.81
ata\Local\Temp\	1.833 0.81 4.917 37.17 8.000 3.23 11.08 0.81
8766663e-6d3f-4db9-a962-c49127701f86\b7dba7b0	1.917 0.81 5.000 37.17 8.083 3.23 11.17 0.81
Ptotal= 80.82 mm Comments: 50vr/12hr	2.000 0.81 5.083 37.17 8.167 3.23 11.25 0.81
	2.083 0.81 5.167 37.17 8.250 3.23 11.33 0.81
TIME BAIN I TIME BAIN I TIME BAIN I TIME BAIN	
brs mm/br brs mm/br brs mm/br brs mm/br	
	2.917 4.85 6.000 10.50 9.085 1.62 12.17 0.81
2.25 0.81 5.50 10.50 8.75 1.62 12.00 0.81	3.000 4.85 6.083 10.50 9.167 1.62 12.25 0.81
2.50 4.85 5.75 10.50 9.00 1.62 12.25 0.81	3.083 4.85 6.167 10.50 9.250 1.62
2.75 4.85 6.00 10.50 9.25 1.62	
3.00 4.85 6.25 10.50 9.50 0.81	Max.Eff.Inten.(mm/hr)= 37.17 34.64
3.25 4.85 6.50 5.66 9.75 0.81	over (min) 5.00 10.00
	Storage Coeff. (min)= 4.54 (ii) 8.89 (ii)
	Unit Hyd. Tpeak (min) = 5.00 10.00
	Unit Hyd. peak (cms)= 0.23 0.12
	TOTALS
CALIB	PEAK FLOW (cms)= 0.25 0.03 0.279 (iii)
STANDHYD (0012) Area (ha) = 2.72	TIME TO PEAK (hrs) = 5.25 5.25 5.25
ID= 1 DT= 5.0 min Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00	RUNOFF VOLUME (mm) = 79.82 61.69 78.01
	TOTAL RAINFALL (mm) = 80.82 80.82 80.82
IMPERVIOUS PERVIOUS (i)	RUNOFF COEFFICIENT = 0.99 0.76 0.97
Surface Area $(ha) = 2.45 0.27$	
Dep. Storage (mm) = 1.00 5.00	***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
Average Slope (%) = 1.00 2.00	
Length $(m) = 134.66 40.00$	(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

24
| STANDHYD (0021)| Area

(iii) PEAK FLOW	(DT) SHOU STORAGE CO DOES NOT	JLD BE SMAL DEFFICIENT. INCLUDE BA	LER OR EQ	Y ANY.		
	OVERI	FLOW IS OFF				
N= 2> OUT= 1	OVER	100 15 011				
)T= 5.0 min	OUTFI	LOW STOR	AGE	OUTFLOW	STORAGE	
	(cms	s) (ha.	m.)	(cms)	(ha.m.)	
	0.00	0.0	000	0.0510	0.1120	
	0.00	0.0	617	0.0730	0.1266	
	0.02	200 0.0	820	0.0960	0.1376	
	0.03	0.1	003	0.1150	0.1490	
		AREA	QPEAK	TPEAK	R.V.	
		(ha)	(cms)	(hrs)	(mm)	
INFLOW : ID= 2 (0012)	2.720	0.279	5.25	78.01	
OUTFLOW: ID= 1 (0642)	2.720	0.088	5.50	76.85	
F T M	EAK FLOW IME SHIFT AXIMUM SI	N REDUCTI OF PEAK FL FORAGE US	ON [Qout/ OW ED	Qin](%)= (min)= (ha.m.)=	31.56 15.00 0.1338	
ALIB TANDHYD (0002) = 1 DT=15 0 min	Area	(ha) = 13	.68	Conn (8) = 53.00	
CALIB STANDHYD (0002) D= 1 DT=15.0 min	Area Total 1	(ha) = 13 Imp(%) = 61	.68 .00 Dir	. Conn.(%)= 53.00	
CALIB STANDHYD (0002) >= 1 DT=15.0 min	Area Total 1	(ha) = 13 Imp(%) = 61 IMPERVIOUS	.68 .00 Dir PERVI	. Conn.(%)= 53.00	
CALIB STANDHYD (0002) >= 1 DT=15.0 min Surface Area	Area Total I (ha)=	(ha) = 13 Imp(%) = 61 IMPERVIOUS 8.34	.68 .00 Dir PERVI 5.	c. Conn.(% COUS (i) 34)= 53.00	
CALIB TANDHYD (0002) 1 DT=15.0 min Surface Area Dep. Storage	Area Total 1 (ha) = (mm) =	(ha) = 13 Imp(%) = 61 IMPERVIOUS 8.34 1.00	.68 .00 Dir PERVI 5. 5.	CONN.(% COUS (i) 34 00 30)= 53.00	
CALIB TANDHYD (0002) 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length	Area Total 1 (ha) = (mm) = (%) = (m) =	(ha) = 13 Imp(%) = 61 IMPERVIOUS 8.34 1.00 1.00 301 99	.68 .00 Dir PERVI 5. 5. 2.	COUS (i) 34 00 30 00)= 53.00	
CALIB TANDHYD (0002) 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length Mannings n	Area Total 1 (ha) = (mm) = (%) = (m) = =	(ha) = 13 Imp(%) = 61 IMPERVIOUS 8.34 1.00 1.00 301.99 0.013	.68 .00 Dir PERVI 5. 5. 2. 40. 0.2	COUS (i) 34 00 30 00 50)= 53.00	
CALIB TANDHYD (0002) 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length Mannings n	Area Total 1 (ha) = (mm) = (%) = (m) = =	(ha) = 13 Imp(%) = 61 IMPERVIOUS 8.34 1.00 1.00 301.99 0.013	.68 .00 Dir PERVI 5. 5. 2. 40. 0.2	c. Conn.(% OUS (i) 34 00 30 00 50)= 53.00	
CALIB TANDHYD (0002) 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten.(Area Total 1 (ha) = (mm) = (%) = (m) = = mm/hr) =	(ha) = 13 Imp(%) = 61 IMPERVIOUS 8.34 1.00 1.00 301.99 0.013 37.17 15 00	.68 .00 Dir 5. 5. 2. 40. 0.2 36.	Conn.(% OUS (i) 34 00 30 00 50 35 00)= 53.00	
CALIB TANDHYD (0002) 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten.(over Storage Coeff	Area Total 1 (ha) = (mm) = (%) = (m) = = mm/hr) = (min) (min) =	(ha) = 13 Imp(%) = 61 IMPERVIOUS 8.34 1.00 1.00 301.99 0.013 37.17 15.00 16.80 (.68 .00 Dir PERVI 5. 5. 2. 40. 0.2 36. 30. 31. 97	Conn.(% OUS (i) 34 00 30 00 50 35 00 80 (ii))= 53.00	
ALIB TANDHYD (0002) 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten.(over Storage Coeff. Unit Hyd. Tpeak	Area Total 1 (ha) = (mm) = (%) = (m) = (min) (min) = (min) =	(ha) = 13 Imp(%) = 61 IMPERVIOUS 8.34 1.00 1.00 301.99 0.013 37.17 15.00 16.80 (15.00	.68 .00 Dir PERVI 5. 5. 2. 40. 0.2 36. 30. ii) 97. 105.	Conn.(% OUS (i) 34 00 30 00 50 35 00 80 (ii) 00)= 53.00	
CALIB TANDHYD (0002) D= 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten.(over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak	Area Total 1 (ha) = (mm) = (%) = (m) = (min) = (min) = (min) = (cms) =	(ha) = 13 Imp(%) = 61 IMPERVIOUS 8.34 1.00 1.00 301.99 0.013 37.17 15.00 16.80 (15.00 0.07	.68 .00 Dir PERVI 5. 5. 2. 40. 0.2 36. 30. ii) 97. 105. 0.	Conn.(% OUS (i) 34 00 30 00 50 35 00 80 (ii) 00 01)= 53.00	
ALIB STANDHYD (0002) = 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten.(over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak	Area Total 1 (ha) = (mm) = (%) = (m) = = mm/hr) = (min) = (cms) =	(ha) = 13 Imp(%) = 61 IMPERVIOUS 8.34 1.00 1.00 301.99 0.013 37.17 15.00 16.80 (15.00 0.07	.68 .00 Dir PERVI 5. 5. 2. 40. 0.2 36. 30. ii) 97. 105. 0.	Conn.(% OUS (i) 34 00 30 00 50 35 00 80 (ii) 00 01)= 53.00 *TOTALS*	
ALIB STANDHYD (0002) = 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten.(over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak PEAK FLOW	Area Total 1 (ha) = (mm) = (%) = (m) = = mm/hr) = (min) = (cms) = (cms) =	(ha) = 13 Imp(%) = 61 IMPERVIOUS 8.34 1.00 1.00 301.99 0.013 37.17 15.00 16.80 (15.00 0.07 0.74	.68 .00 Dir PERVI 5. 2. 40. 0.2 36. 30. 31. 97. 105. 0.	Conn.(% COUS (i) 34 00 30 00 50 35 00 80 (ii) 00 01 22)= 53.00 *TOTALS* 0.828 (iii)	
CALIB STANDHYD (0002) D= 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten.(over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak PEAK FLOW TIME TO PEAK	Area Total 1 (ha) = (mm) = (%) = (m) = = mm/hr) = · (min) (min) = : (min) = (cms) = (hrs) =	(ha) = 13 Imp(%) = 61 IMPERVIOUS 8.34 1.00 1.00 301.99 0.013 37.17 15.00 16.80 (15.00 0.07 0.74 5.25	.68 .00 Dir PERVI 5. 5. 2. 40. 0.2 36. 30. 105. 0. 0. 0. 6.	Conn.(% OUS (i) 34 00 30 00 50 35 00 80 (ii) 00 01 22 50)= 53.00 *TOTALS* 0.828 (iii) 5.25	
CALIB TANDHYD (0002) = 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten.(over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME	Area Total 1 (ha) = (mm) = (%) = (m) = = (mn) + (min) = (cms) = (cms) = (hrs) = (mm) =	(ha) = 13 Imp(%) = 61 IMPERVIOUS 8.34 1.00 1.00 301.99 0.013 37.17 15.00 16.80 (15.00 0.07 0.74 5.25 79.82	.68 .00 Dir PERVI 5. 5. 2. 40. 0.2 36. 30. 105. 0. 0. 0. 51.	Conn.(% OUS (i) 34 00 30 00 50 35 00 80 (ii) 00 01 22 50 63	*TOTALS* 0.828 (iii) 5.25 66.56	
CALIB TANDHYD (0002) D= 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten.(Over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL	Area Total 1 (ha) = (mm) = (%) = (m) = (min) (min) = :(min) = :(min) = (cms) = (hrs) = (mm) = (mm) = :(mm) =	(ha) = 13 Imp(%) = 61 IMPERVICUS 8.34 1.00 1.00 301.99 0.013 37.17 15.00 16.80 (15.00 0.07 0.74 5.25 79.82 80.82 80.82	.68 .00 Dir PERVI 5. 5. 2. 40. 0.2 36. 30. 105. 0. 0. 6. 51. 80.	Conn.(% OUS (i) 34 00 30 00 50 35 00 80 (ii) 00 01 22 50 63 82	*TOTALS* 0.828 (iii) 5.25 66.56 80.82	
CALIB TANDHYD (0002) = 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten.(over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICI	Area Total 1 (ha) = (mm) = (%) = (m) = (min) (min) = (cms) = (cms) = (hrs) = (mm) = (mm) = ENT =	(ha) = 13 Imp(%) = 61 IMPERVIOUS 8.34 1.00 1.00 301.99 0.013 37.17 15.00 16.80 (15.00 0.07 0.74 5.25 79.82 80.82 0.99	.68 .00 Dir PERVI 5. 5. 2. 40. 0.2 36. 30. 105. 0. 0. 6. 51. 80. 0.	Conn.(% OUS (i) 34 00 30 00 50 35 00 80 (ii) 00 01 22 50 63 82 64	*TOTALS* 0.828 (iii) 5.25 66.56 80.82 0.82	
ALIB STANDHYD (0002) >= 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten.(over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICI	Area Total 1 (ha) = (mm) = (%) = (m) = = mm/hr) = (min) = (cms) = (cms) = (hrs) = (mm) = (mm) = ENT = URE SELECT	(ha) = 13 Imp(%) = 61 IMPERVIOUS 8.34 1.00 1.00 301.99 0.013 37.17 15.00 16.80 (15.00 0.07 0.74 5.25 79.82 80.82 0.99	.68 .00 Dir PERVI 5. 5. 2. 40. 0.2 36. 30. 105. 105. 0. 6. 51. 80. 0. VIOUS LOS	Conn.(% OUS (i) 34 00 30 00 50 35 00 80 (ii) 00 01 22 50 63 82 64 SES:)= 53.00 *TOTALS* 0.828 (iii) 5.25 66.56 80.82 0.82	
ALIB STANDHYD (0002) = 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten.(over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. Tpeak Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICI (i) CN PROCEE CN* =	Area Total 1 (ha) = (mm) = (%) = (m) = = mm/hr) = (min) = (cms) = (hrs) = (mm) = (mm) = ENT = URE SELECT 85.0 Ia	<pre>(ha) = 13 Imp(%) = 61 IMPERVIOUS</pre>	.68 .00 Dir PERVI 5. 2. 40. 0.2 36. 30. 105. 0. 105. 0. 6. 51. 80. 0. VIOUS LOS orage (A	Conn.(% OUS (i) 34 00 30 00 50 35 00 80 (ii) 00 01 22 50 63 82 64 SES: bove))= 53.00 *TOTALS* 0.828 (iii) 5.25 66.56 80.82 0.82	
ALIB TANDHYD (0002) D= 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten.(over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. Tpeak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICI (i) CN PROCEED CN* = (ii) TIME STEF	Area Total 1 (ha) = (mm) = (%) = (m) = (m) = (min) = (cms) = (cms) = (hrs) = (nmn) = (rmm) = ENT = URE SELECT 85.0 I at (DT) SHOU	<pre>(ha) = 13 Imp(%) = 61 IMPERVIOUS</pre>	.68 .00 Dir PERVI 5. 5. 2. 40. 0.2 36. 30. 105. 0. 105. 0. 0. 51. 80. 0. VIOUS LOS orage (A LER OR EQ	Conn.(% OUS (i) 34 00 30 00 50 35 00 80 (ii) 00 01 22 50 63 82 64 32 55 64	*TOTALS* 0.828 (iii) 5.25 66.56 80.82 0.82	
ALIB TANDHYD (0002) D= 1 DT=15.0 min Surface Area Dep. Storage Average Slope Length Mannings n Max.Eff.Inten.(over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. Tpeak Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICI (i) CN PROCEEL CN* = (ii) TIME STEF THAN THE	Area Total 1 (ha) = (mm) = (%) = (m) = (m) = (min) = (cms) = (cms) = (cms) = (cms) = (mm) = (DT)	<pre>(ha) = 13 Imp(%) = 61 IMPERVIOUS</pre>	.68 .00 Dir PERVI 5. 5. 2. 40. 0.2 36. 30. 0. 105. 0. 105. 0. 0. 51. 80. 0. VIOUS LOS orage (A LER OR EQ	Conn.(% OUS (i) 34 00 30 00 50 35 00 80 (ii) 00 01 22 50 63 82 64 3SES: bove) UAL	*TOTALS* 0.828 (iii) 5.25 66.56 80.82 0.82	

(ha) = 6.05

DATE: February 2021

|ID= 1 DT= 5.0 min | Total Imp(%)= 67.00 Dir. Conn.(%)= 66.00

	IMPERVIOUS	PERVIOUS	(i)
(ha) =	4.05	2.00	
(mm) =	1.00	5.00	
(%) =	1.00	2.00	
(m) =	200.83	40.00	
=	0.013	0.250	
	(ha) = (mm) = (%) = (m) = =	IMPERVIOUS (ha) = 4.05 (mm) = 1.00 (%) = 1.00 (m) = 200.83 = 0.013	$\begin{array}{ccc} IMPERVIOUS & PERVIOUS \\ (ha) = & 4.05 & 2.00 \\ (mm) = & 1.00 & 5.00 \\ (\%) = & 1.00 & 2.00 \\ (m) = & 200.83 & 40.00 \\ = & 0.013 & 0.250 \end{array}$

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

		TRA	ANSFORM	ED HYETOGRA	PH	
TIME	RAIN	TIME	RAIN	' TIME	RAIN TIME	RAIN
hrs	mm/hr	hrs	mm/hr	' hrs	mm/hr hrs	mm/hr
0.083	0.00	3.167	4.85	6.250	10.50 9.33	0.81
0.167	0.00	3.250	4.85	6.333	5.66 9.42	0.81
0.250	0.00	3.333	13.74	6.417	5.66 9.50	0.81
0.333	0.81	3.417	13.74	6.500	5.66 9.58	0.81
0.417	0.81	3.500	13.74	6.583	5.66 9.67	0.81
0.500	0.81	3.583	13.74	6.667	5.66 9.75	0.81
0.583	0.81	3.667	13.74	6.750	5.66 9.83	0.81
0.667	0.81	3.750	13.74	6.833	5.66 9.92	0.81
0.750	0.81	3.833	13.74	6.917	5.66 10.00	0.81
0.833	0.81	3.917	13.74	7.000	5.66 10.08	0.81
0.917	0.81	4.000	13.74	7.083	5.66 10.17	0.81
1.000	0.81	4.083	13.74	7.167	5.66 10.25	0.81
1.083	0.81	4.167	13.74	7.250	5.66 10.33	0.81
1.167	0.81	4.250	13.74	7.333	3.23 10.42	0.81
1.250	0.81	4.333	37.17	7.417	3.23 10.50	0.81
1.333	0.81	4.417	37.17	7.500	3.23 10.58	0.81
1.417	0.81	4.500	37.17	7.583	3.23 10.67	0.81
1.500	0.81	4.583	37.17	7.667	3.23 10.75	0.81
1.583	0.81	4.667	37.17	7.750	3.23 10.83	0.81
1.667	0.81	4.750	37.17	7.833	3.23 10.92	0.81
1.750	0.81	4.833	37.17	1 7.917	3.23 11.00	0.81
1.833	0.81	4.917	37.17	8.000	3.23 11.08	0.81
1.917	0.81	5.000	37.17	8.083	3.23 11.17	0.81
2.000	0.81	5.083	37.17	8.167	3.23 11.25	0.81
2.083	0.81	5.16/	3/.1/	8.250	3.23 11.33	0.81
2.16/	0.81	5.250	3/.1/	8.333	1.62 11.42	0.81
2.250	0.81	5.333	10.50	8.417	1.62 11.50	0.81
2.333	4.85	5.41/	10.50	8.500	1.62 11.58	0.81
2.41/	4.85	5.500	10.50	8.583	1.62 11.6/	0.81
2.500	4.85	5.583	10.50	8.66/	1.62 11.75	0.81
2.583	4.85	5.66/	10.50	8.750	1.62 11.83	0.81
2.66/	4.85	5./50	10.50	8.833	1.62 11.92	0.81
2./50	4.85	5.833	10.50	8.917	1.62 12.00	0.81
2.833	4.85	5.917	10.50	9.000	1.62 12.08	0.81
2.91/	4.85	6.000	10.50	9.083	1.62 12.17	0.81
3.000	4.85	6.083	10.50	9.167	1.62 12.25	0.81
3.083	4.85	0.10/	10.50	9.250	1.02	
Max.Eff.Inten.(m	m/hr)=	37.17		31.76		
over	(min)	5.00		20.00		
Storage Coeff.	(min) =	5.77	(ii)	16.93 (ii)		
Unit Hyd. Tpeak	(min) =	5.00		20.00		
Unit Hyd. peak	(cms) =	0.20		0.06		
					TOTALS	
PEAK FLOW	(cms) =	0.41		0.16	0.570 (iii)	
TIME TO PEAK	(hrs) =	5.25		5.25	5.25	

RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICIE	(mm) = (mm) = NT =	79.82 80.82 0.99	52.66 80.82 0.65	70.58 80.82 0.87
(i) CN PROCEDU CN* = 8 (ii) TIME STEP THAN THE S (iii) PEAK FLOW	RE SELECTED (B.O Ia = (DT) SHOULD TORAGE COEF DOES NOT IN) FOR PERVIOUS Dep. Storage BE SMALLER C FICIENT. CLUDE BASEFLC	LOSSES: (Above) R EQUAL W IF ANY.	
ADD HYD (0658) 1 + 2 = 3 ID1= 1 (000 + ID2= 2 (002	ARE (ha 2): 13.6 (1): 6.0	A QPEAK (cms) 0.828 5.0.570 	TPEAK R. (hrs) (r 5.25 66.5 5.25 70.5	V. mm) 56 58 ===
NOTE: PEAK FLOW	IS DO NOT IN	ICLUDE BASEFLC	WS IF ANY.	
RESERVOIR(0645) IN= 2> OUT= 1 DT= 5.0 min 	OVERFLC OUTFLOW (cms) 0.0000 0.0290 0.0950 0.1680 0658) 1 0645) 1 CAK FLOW ME SHIFT OF XIMUM STOR	W IS OFF (ha.m.) 0.0000 0.3310 0.4595 0.5720 AREA QPEA (ha) (cms 9.730 1. 9.730 0. REDUCTION [Q PEAK FLOW AGE USED	<pre> OUTFLOW (cms) 0.2360 0.3410 0.4450 0.5320 K TPEAK) (hrs) 397 5.25 445 6.75 cout/Qin](%)= (min)= (ha.m.)=</pre>	STORAGE (ha.m.) 0.6393 0.7100 0.7485 0.7925 R.V. (mm) 5 67.80 5 67.63 31.81 90.00 0.7484
CALIB STANDHYD (0656) ID= 1 DT=15.0 min	Area (Total Imp	(%) = 14.51 (%) = 54.00	Dir. Conn.(§	b) = 46.00
Surface Area Dep. Storage Average Slope Length Mannings n	IM (ha) = (mm) = (%) = (m) = =	IPERVIOUS F 7.84 1.00 1.00 311.02 0.013	ERVIOUS (i) 6.67 5.00 2.30 40.00 0.250	
Max.Eff.Inten.(m over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak	<pre>m/hr) = (min) (min) = (min) = (cms) =</pre>	37.17 15.00 16.80 (ii) 15.00 0.07	34.40 30.00 97.80 (ii) 105.00 0.01	

DATE: February 2021

				TOTALS
PEAK FLOW	(cms) =	0.68	0.25	0.783 (iii)
TIME TO PEAK	(hrs) =	5.25	6.75	5.25
RUNOFF VOLUME	(mm) =	79.82	49.77	63.59
TOTAL RAINFALL	(mm) =	80.82	80.82	80.82
RUNOFF COEFFICIE	ENT =	0.99	0.62	0.79

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

CN* = 84.0 Ia = Dep. Storage (Above)

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

IN= 2	IR (-> OU	0657) JT= 1	OV	ERF	LOW	IS OFF					
DT= 5.0) mir	n	OU	TFL(WO	STORA	GE		OUTFLOW	STORAGE	
			(cms)	(ha.m	ı.)	i	(cms)	(ha.m.)	
			0	.00	00	0.00	000	i	0.3640	0.259	4
			0	.01	90	0.21	47	i	0.5250	0.272	3
			0	.14	60	0.23	150	i	0.6840	0.278	9
			0	25	90	0.25	00	i	0 8190	0 286	3
			0			0.20		'	0.0100	0.200	0
					AR	EA	OPEAR		TPEAK	B.V.	
					(h	a)	(cms)	-	(hrs)	(mm)	
INFLOW	• тт) = 2 (0656)		14	510	0 7	83	5	25 63	59
OUTFLO	• тт м• тт) = 1 (0657)		14	510	0.6	573	5	33 63	39
001120		(000,,			010	0.0	,,,,,	0.		
		P	EAK F	T.OW	R	EDUCTIO	N [Oc	t	/Oin1(%)	= 85 92	
		T	TME SHT	FT (OFP	EAK FLC	W LQC	, a c	(min)	= 5 00	
		M	AXTMIM	STO	ORAG	E USE	חיי. מי		(ham)	= 0.2789	
				01	01010				(110.111.)	0.2705	
				===:							
		=====	===								
V		I	=== SSSSS	U	U	A	L			(v 6.1.200	3)
V V	 V V	I I	=== SSSSS SS	U U	U U	A A A	L L			(v 6.1.200	3)
V V V	v v v	I I I	=== SSSSS SS SS	U U U	U U U	A A A AAAAA	L L L			(v 6.1.200	3)
V V V V	V V V V	I I I I	=== SSSSSS SS SS SS	U U U U	U U U U	A A A AAAAA A A	L L L L			(⊽ 6.1.200	3)
V V V V		I I I I I I	=== SSSSSS SS SS SSSSS	บ บ บ บบบ	ט ט ט טטטט	А АА АААААА А А А А	L L L LLLI	L		(v 6.1.200	3)
V V V V		I I I I I	=== SSSSS SS SS SS SSSSS	บ บ บ บบบ	ט ט ט טטטט	А ААААА А А А А А А	L L L LLLI	L		(v 6.1.200	3)
V V V V		I I I I I TTTTT	=== SSSSS SS SS SSSSS TTTTT	U U U UUU H	U U U UUUU H	A AAAAA A A A A A A Y Y	L L L LLLI M	L	000	(v 6.1.200 TM	3)
	v v v v vv vv	I I I I TTTTT T	=== SSSSS SS SS SS SSSSS TTTTT T	U U U U U U H H	U U U UUU H H	A AAAAA A A A A A A Y Y Y Y	L L L LLLI M MM N	L M	000	(v 6.1.200 TM	3)
V V V V 00 0		I I I I TTTTTT T	=== SSSSS SS SS SSSSS TTTTTT T T	U U U U H H H	U U U UUUU H H	A AAAAA A A A A Y Y Y Y Y	L L LLLI M MM N M	L M M		(v 6.1.200 TM	3)
		I I I I TTTTTT T T	=== SSSSS SS SS SSSSS TTTTTT T T T T	U U U U H H H H	U U U U U U U U U U U U U U U U U U U	A AAAAA A A A A Y Y Y Y Y Y	L L LLLI M MM N M M	L M M M M	000 0 0 0 0	(v 6.1.200 TM	3)
	V V V V VV OO O O O O O O	I I I I TTTTTT T T T Distri	=== SSSSSS SS SS SSSSS TTTTT T T T T buted b	U U U U H H H H H	U U U U U U U U U U U U U U U U U U U	A AAAAA A A A A Y Y Y Y Y Y City P	L L LLLI M MM N M M M M	JL M M M M M Tn		(v 6.1.200 TM	3)
V V V V O O O Developed Copyright	V V V V V V V V V V V V V V V V V V V	I I I I TTTTTT T T Distri	=== SSSSSS SS SS SSSSS TTTTT T T T T buted b 0 Smart	U U U U H H H H H H C I	U U U U U U U U U U U U U U U U U U U	A AAAAA A A A A Y Y Y Y City V ater T	L L L LLLI M M M M M M M M Jater	L M M M In	000 0 0 0 0 000 c	(v 6.1.200 TM	3)
V V V V V V V V V V V V V V V V V V V	V V V V V V V V V V V V V V V V V V V	I I I I TTTTTT T T Distri V - 202	=== SSSSS SS SS SSSSS TTTTTT T T T buted b 0 Smart	U U U U H H H H C I	U U U U U H H H mart	A AAAAA A A A A Y Y Y Y Y Y City V ater Ir	L L L LLLI M M M M M M Jater	L M M M In	000 0 0 0 0 000 c	(v 6.1.200 TM	3)
V V V V O O Developed Copyright All rights	V V V V V V V V V V V V V V V V V V V	I I I I T T T T Distri 7 – 202 served.	=== SSSSS SS SS SSSSS TTTTT T T T T buted b 0 Smart	U U U U H H H H C I	U U U U H H H H H H T Y W	A AAAAA A A A A A A Y Y Y Y Y Y City W ater In	L L L LLLI M M M M N M Jater Ic	.L M M M In	000 0 0 0 0 000 c	(v 6.1.200 TM	3)

***** DETAILED OUTPUT****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat
Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4ea930-3446elae5bfa\49eef634-74ce-475f-a8c9-71fc17a18461\scen
Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4ea930-3446elae5bfa\49eef634-74ce-475f-a8c9-71fc17a18461\scen

DATE: 02-09-2021

USER:

COMMENTS:

_____ _____

** SIMULATION : 18. AES 12hr 100yr * *

R.	EAD	STORM	l	Filenam	e:	C:\Us ata\L	ers\sfa ocal\Te	noi emp\	ıs\AppD		
						87666	63e-6d3	3f-4	1db9-a96	2-c49127701f80	5\eeb5780e
Ptot	al=	88.54	mm	Comment	s:	100yr	/12hr				
			TIME	RATN I	т	TME	RAIN		TTME	RAIN I TIME	RATN
			hrs	mm/hr	-	hrs	mm/hr	i.	hrs	mm/hr hrs	s mm/hr
			0.25	0.00	3	.50	15.05	i	6.75	6.20 10.00	0.89
			0.50	0.89	3	.75	15.05		7.00	6.20 10.25	0.89
			0.75	0.89	4	.00	15.05		7.25	6.20 10.50	0.89
			1.00	0.89	4	.25	15.05		7.50	3.54 10.75	0.89
			1.25	0.89	4	.50	40.71		7.75	3.54 11.00	0.89
			1.50	0.89	4	.75	40.71		8.00	3.54 11.25	0.89
			1.75	0.89	5	.00	40.71		8.25	3.54 11.50	0.89
			2.00	0.89	5	.25	40.71		8.50	1.77 11.75	0.89
			2.25	0.89	5	.50	11.51		8.75	1.77 12.00	0.89
			2.50	5.31	5	.75	11.51	1	9.00	1.77 12.25	0.89
			2.75	5.31	6	.00	11.51		9.25	1.77	
			3.00	5.31	6	.25	11.51		9.50	0.89	
			3.25	5.31	6	.50	6.20		9.75	0.89	

TIME: 01:20:05

_____ | CALIB | | STANDHYD (0012) | Area (ha) = 2.72 |ID= 1 DT= 5.0 min | Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00 _____ IMPERVIOUS PERVIOUS (i) Surface Area (ha) = 2.45 0.27 1.00 5.00 Dep. Storage (mm) = Average Slope (%) = 1.00 2.00 Length (m) = 134.66 40.00 Mannings n = 0.013 0.250 NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

		TRA	ANSFORME	SD	HYETOGR.	APH			
TIME	RAIN	TIME	RAIN	11	TIME	RAIN	TIME	RAIN	
hrs i	mm/hr	hrs	mm/hr	11	hrs	mm/hr	hrs	mm/hr	
0.083	0.00	3.167	5.31		6.250	11.51	9.33	0.89	

				<i>coruary</i> 2021	
0.167	0.00 3.250	5.31	6.333	6.20 9.42	0.89
0.250	0.00 3.333	15.05	6.417	6.20 9.50	0.89
0.333	0.89 3.417	15.05	6.500	6.20 9.58	0.89
0.417	0.89 3.500	15.05	6.583	6.20 9.67	0.89
0.500	0.89 3.583	15.05	6.667	6.20 9.75	0.89
0.583	0.89 3.667	15.05	6.750	6.20 9.83	0.89
0.667	0.89 3.750	15.05	6.833	6.20 9.92	0.89
0.750	0.89 3.833	15.05	6.917	6.20 10.00	0.89
0.833	0.89 3.917	15.05	7.000	6.20 10.08	0.89
0.917	0.89 4.000	15.05	7.083	6.20 10.17	0.89
1.000	0.89 4.083	15.05	7.167	6.20 10.25	0.89
1.083	0.89 4.167	15.05	7.250	6.20 10.33	0.89
1.167	0.89 4.250	15.05	7.333	3.54 10.42	0.89
1.250	0.89 4.333	40.71	7.417	3.54 10.50	0.89
1.333	0.89 4.417	40.71	7.500	3.54 10.58	0.89
1.417	0.89 4.500	40.71	7.583	3.54 10.67	0.89
1.500	0.89 4.583	40.71	7.667	3.54 10.75	0.89
1.583	0.89 4.667	40.71	7.750	3.54 10.83	0.89
1.667	0.89 4.750	40.71	7.833	3.54 10.92	0.89
1.750	0.89 4.833	40.71	7.917	3.54 11.00	0.89
1.833	0.89 4.917	40.71	8.000	3.54 11.08	0.89
1.917	0.89 5.000	40.71	8.083	3.54 11.17	0.89
2.000	0.89 5.083	40.71	8.167	3.54 11.25	0.89
2.083	0.89 5.167	40.71	8.250	3.54 11.33	0.89
2.167	0.89 5.250	40.71	8.333	1.77 11.42	0.89
2.250	0.89 5.333	11.51	8.417	1.77 11.50	0.89
2.333	5.31 5.417	11.51	8.500	1.77 11.58	0.89
2.417	5.31 5.500	11.51	8.583	1.77 11.67	0.89
2.500	5.31 5.583	11.51	8.667	1.77 11.75	0.89

2.583 5.31 | 5.667 11.51 | 8.750 1.77 | 11.83

2.667 5.31 | 5.750 11.51 | 8.833 1.77 | 11.92

5.31 | 5.833 11.51 | 8.917

5.31 | 5.917 11.51 | 9.000

5.31 | 6.000 11.51 | 9.083 5.31 | 6.083 11.51 | 9.167

3.083 5.31 | 6.167 11.51 | 9.250

DATE: Echryan, 2021

0.89

0.89

0.89

0.89

0.89

0.89

1.77 | 12.00

1.77 | 12.08

1.77 | 12.17

1.77 | 12.25

1.77 |

Max.Eff.Inten.(m	nm/hr)=	40.71	38.32		
over	(min)	5.00	10.00		
Storage Coeff.	(min) =	4.38	(ii) 8.57	(ii)	
Unit Hyd. Tpeak	(min) =	5.00	10.00		
Unit Hyd. peak	(cms) =	0.23	0.12		
				TOTALS	:
PEAK FLOW	(cms) =	0.28	0.03	0.305	(iii)
TIME TO PEAK	(hrs) =	5.17	5.25	5.25	
RUNOFF VOLUME	(mm) =	87.54	69.16	85.70	
TOTAL RAINFALL	(mm) =	88.54	88.54	88.54	
RUNOFF COEFFICIE	ENT =	0.99	0.78	0.97	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

- CN* = 93.6 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

_____ | RESERVOIR(0642)|

OVERFLOW IS OFF | IN= 2---> OUT= 1 |

2.750

2.833

2.917

3.000

Length

Mannings n

(m) =

200.83

0.013

40.00

0.250

DT= 5.0 min	OUTFLOT (cms) 0.0000 0.0050 0.0200 0.0360	<pre>N STORAGE (ha.m.) 0 0.0000 0 0.0617 0 0.0820 0 0.1003</pre>	OUTFLOW (cms) 0.0510 0.0730 0.0960 0.1150	STORAGE (ha.m.) 0.1120 0.1266 0.1376 0.1490
INFLOW : ID= 2 OUTFLOW: ID= 1	(0012) (0642)	AREA QP (ha) (c 2.720 2.720	EAK TPEAK ms) (hrs) 0.305 5.25 0.107 5.50	R.V. (mm) 85.70 84.55
	PEAK FLOW TIME SHIFT OI MAXIMUM STOP	REDUCTION F PEAK FLOW RAGE USED	[Qout/Qin](%) = (min) = (ha.m.) =	34.87 15.00 0.1440
CALIB STANDHYD (0002) ID= 1 DT=15.0 min	 Area Total Imp 	(ha) = 13.68 p(%) = 61.00	Dir. Conn.(%)= 53.00
Surface Area Dep. Storage Average Slope Length Mannings n	IM (ha) = (mm) = (%) = (m) = =	4PERVIOUS 8.34 1.00 1.00 301.99 0.013	PERVIOUS (i) 5.34 5.00 2.30 40.00 0.250	
Max.Eff.Inten ove Storage Coeff Unit Hyd. Tpe Unit Hyd. peal	<pre>(mm/hr) = er (min) (min) = ak (min) = c (cms) =</pre>	40.71 15.00 16.80 (ii) 15.00 0.07	40.80 30.00 97.80 (ii) 105.00 0.01	* TOTALS*
PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALI RUNOFF COEFFIC	(cms) = (hrs) = (mm) = (mm) = CIENT =	0.81 5.25 87.54 88.54 0.99	0.25 6.50 58.57 88.54 0.66	0.913 (iii) 5.25 73.92 88.54 0.83
(i) CN PROCH CN* = (ii) TIME STH THAN THH (iii) PEAK FLC	EDURE SELECTE 85.0 Ia = EP (DT) SHOULI E STORAGE COE DW DOES NOT IN	D FOR PERVIO = Dep. Stora D BE SMALLER FFICIENT. NCLUDE BASEF	US LOSSES: ge (Above) OR EQUAL LOW IF ANY.	
CALIB STANDHYD (0021) ID= 1 DT= 5.0 min	 Area Total Imp	(ha) = 6.05 p(%) = 67.00	Dir. Conn.(%)= 66.00
Surface Area Dep. Storage Average Slope	(ha) = (mm) = (%) =	4PERVIOUS 4.05 1.00 1.00	PERVIOUS (i) 2.00 5.00 2.00	

---- TRANSFORMED HYETOGRAPH ----TIME RAIN | TIME RAIN |' TIME RAIN | TIME RATN mm/hr | hrs mm/hr |' hrs mm/hr | hrs mm/hr hrs 0.083 0.00 | 3.167 5.31 | 6.250 11.51 | 9.33 0.89 0.167 0.00 | 3.250 5.31 | 6.333 6.20 | 9.42 0.89 15.05 | 6.417 0.250 0.00 | 3.333 6.20 | 9.50 0.89 15.05 | 6.500 0.89 | 3.417 6.20 | 9.58 0.333 0.89 0.417 0.89 | 3.500 15.05 | 6.583 6.20 | 9.67 0.89 15.05 | 6.667 0.500 0.89 | 3.583 6.20 | 9.75 0.89 0.583 0.89 | 3.667 15.05 | 6.750 6.20 | 9.83 0.89 0.89 | 3.750 15.05 | 6.833 9.92 0.667 6.20 I 0.89 0.750 0.89 | 3.833 15.05 | 6.917 6.20 | 10.00 0.89 0.833 0.89 | 3.917 15.05 | 7.000 6.20 | 10.08 0.89 15.05 | 7.083 0.917 0.89 | 4.000 6.20 | 10.17 0.89 1.000 0.89 4.083 15.05 | 7.167 6.20 | 10.25 0.89 15.05 | 7.250 1.083 0.89 | 4.167 6.20 | 10.33 0.89 15.05 | 7.333 1.167 0.89 | 4.250 3.54 | 10.42 0.89 1.250 0.89 | 4.333 40.71 | 7.417 3.54 | 10.50 0.89 1.333 0.89 | 4.417 40.71 | 7.500 3.54 | 10.58 0.89 40.71 | 7.583 1.417 0.89 | 4.500 3.54 | 10.67 0.89 40.71 | 7.667 1.500 0.89 | 4.583 3.54 | 10.75 0.89 0.89 | 4.667 40.71 | 7.750 3.54 | 10.83 1.583 0.89 1.667 0.89 | 4.750 40.71 | 7.833 3.54 | 10.92 0.89 0.89 | 4.833 40.71 | 7.917 3.54 | 11.00 1.750 0.89 0.89 | 4.917 40.71 | 8.000 3.54 | 11.08 1.833 0.89 0.89 | 5.000 40.71 | 8.083 1.917 3.54 | 11.17 0.89 2.000 0.89 | 5.083 40.71 | 8.167 3.54 | 11.25 0.89 2.083 0.89 | 5.167 40.71 | 8.250 3.54 | 11.33 0.89 2.167 0.89 | 5.250 40.71 | 8.333 1.77 | 11.42 0.89 2.250 0.89 | 5.333 11.51 | 8.417 1.77 | 11.50 0.89 2.333 5.31 | 5.417 11.51 | 8.500 1.77 | 11.58 0.89 5.31 | 5.500 2.417 11.51 | 8.583 1.77 | 11.67 0.89 2.500 5.31 | 5.583 11.51 | 8.667 1.77 | 11.75 0.89 2.583 5.31 | 5.667 11.51 | 8.750 1.77 | 11.83 0.89 2.667 5.31 | 5.750 11.51 | 8.833 1.77 | 11.92 0.89 2.750 5.31 | 5.833 11.51 | 8.917 1.77 | 12.00 0.89 2.833 5.31 | 5.917 11.51 | 9.000 1.77 | 12.08 0.89 2.917 5.31 | 6.000 11.51 | 9.083 1.77 | 12.17 0.89 5.31 | 6.083 11.51 | 9.167 1.77 | 12.25 3.000 0.89 3.083 5.31 | 6.167 11.51 | 9.250 1.77 | Max.Eff.Inten.(mm/hr) = 40.71 35.59 over (min) 5.00 20.00 Storage Coeff. (min) = 5.56 (ii) 16.23 (ii) Unit Hyd. Tpeak (min) = 5.00 20.00 Unit Hyd. peak (cms) = 0.20 0.06 *TOTALS* PEAK FLOW (cms) = 0.45 0.18 0.630 (iii) TIME TO PEAK 5.25 5.25 (hrs) =5.25 RUNOFF VOLUME (mm) = 87.54 59.70 78.07 TOTAL RAINFALL (mm) = 88.54 88.54 88.54 RUNOFF COEFFICIENT = 0.99 0.67 0.88 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 88.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

THAN THE STORAGE COEFFICIENT.

DATE: February 2021

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	<pre>CN* = 84.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.</pre>				
ADD HYD (0658) 1 + 2 = 3 AREA QPEAK TPEAK R.V.	RESERVOIR(0657) OVERFLOW IS OFF IN= 2> OUT= 1				
+ ID2= 2 (0021): 6.05 0.630 5.25 78.07	DT= 5.0 min OUTFLOW STORAGE OUTFLOW STORAGE				
ID = 3 (0658): 19.73 1.543 5.25 75.20 NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	(Cms) (na.m.) (Cms) (na.m.) 0.0000 0.0000 0.3640 0.2594 0.0190 0.2147 0.5250 0.2723 0.1460 0.2350 0.6840 0.2789 0.2590 0.2500 0.8190 0.2863				
RESERVOIR(0645) OVERFLOW IS OFF IN= 2> OUT= 1 OUTFLOW STORAGE OUTFLOW STORAGE DT= 5.0 min OUTFLOW STORAGE OUTFLOW (ha.m.) (cms) (ha.m.) (cms) (ha.m.) 0.0000 0.0000 0.2360 0.6393 0.0290 0.3310 0.3410 0.7100 0.0950 0.4595 0.4450 0.7485 0.1680 0.5720 0.5320 0.7925	AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW: ID= 2 (0656) 14.510 0.866 5.25 70.83 OUTFLOW: ID= 1 (0657) 14.510 0.783 5.33 70.63 PEAK FLOW REDUCTION [Qout/Qin] (%) = 90.51 TIME SHIFT OF PEAK FLOW (min) = 5.00 MAXIMUM STORAGE USED (ha.m.) = 0.2845				
AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW: ID= 2 (0658) 19.730 1.543 5.25 75.20 OUTFLOW: ID= 1 (0645) 19.730 0.528 6.58 75.02 PEAK FLOW REDUCTION [Qout/Qin](%)= 34.22 TIME SHIFT OF PEAK FLOW (min)= 80.00 MAXIMUM STORAGE USED (ha.m.)= 0.7905	V V I SSSS U U A L (v 6.1.2003) V V I SS U U AA L V V I SS U U AAAA V V I SS U U AAAAA L V V I SS U U AAAAA L VV I SS U U A A L VV I SSSSS UUUUU A A LLLLL				
CALIB STANDHYD (0656) Area (ha) = 14.51 ID= 1 DT=15.0 min Total Imp(%) = 54.00 Dir. Conn.(%) = 46.00 IMPERVIOUS PERVIOUS (i) Surface Area (ha) = 7.84 6.67 Dep. Storage (mm) = 1.00 5.00 Average Slope (%) = 1.00 2.30 Length (m) = 311.02 40.00 Mannings n = 0.013 0.250	OOO TTTTT TTTTT H H Y Y M M OOO TM O O T T H H Y Y MM MM O O O O T T H H Y M M O O OOO T T H H Y M M OOO Developed and Distributed by Smart City Water Inc Copyright 2007 - 2020 Smart City Water Inc All rights reserved.				
Max.Eff.Inten.(mm/hr) = 40.71 38.72 over (min) 15.00 30.00 Storage Coeff. (min) = 16.80 (ii) 97.80 (ii) Unit Hyd. Tpeak (min) = 15.00 105.00 Unit Hyd. peak (cms) = 0.07 0.01 *TOTALS* PEAK FLOW (cms) = 0.74 0.29 0.866 (iii) TIME TO PEAK (hrs) = 5.25 6.50 5.25 BUNOFF VOLUME (mm) = 87.54 56.60 70.83	Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\V02\voin.dat Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446elae5bfa\243ef2e3-c612-48ff-abfb-bc605eaa5626\scen Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446elae5bfa\243ef2e3-c612-48ff-abfb-bc605eaa5626\scen DATE: 02-09-2021 TIME: 01:20:05				
TOTAL RAINFALL (mm) = 88.54 88.54 88.54 RUNOFF COEFFICIENT = 0.99 0.64 0.80	USER:				
(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:	COMMENTS:				

DATE: February 2021

29

DATE: February 2021

Unit Hyd. peak (cms) = 0.23 0.12
TOTALS
PEAK FLOW (cms)= 0.26 0.01 0.269 (iii)
TIME TO PEAK (hrs)= 1.50 1.58 1.50
RUNOFF VOLUME (mm) = 24.02 10.72 22.69
TOTAL RAINFALL (mm) = 25.02 25.02 25.02
RUNOFF COEFFICIENT = 0.96 0.43 0.91
***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 93.6 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
RESERVOIR(0642) OVERFLOW IS OFF
DT= 5.0 min OUTFLOW STORAGE OUTFLOW STORAGE
(Cms) (na.m.) (Cms) (na.m.)
0.0300 0.1003 0.1130 0.1490
AREA OPEAK TPEAK R V
(ha) (cms) (hrs) (mm)
INFLOW : ID= 2 (0012) 2.720 0.269 1.50 22.69
OUTFLOW: ID= 1 (0642) 2.720 0.005 4.08 21.54
PEAK FLOW REDUCTION [Oout/Oin](%) = 1.74
TIME SHIFT OF PEAK FLOW (min)=155.00
MAXIMUM STORAGE USED (ha.m.)= 0.0577

| STANDHYD (0002) | Area (ha) = 13.68

	'	TRANSFORMED	D HYETOGRAE	РН		
TIME	RAIN TIM	E RAIN	' TIME	RAIN	TIME	RAIN
hrs	mm/hr hr	s mm/hr	' hrs	mm/hr	hrs	mm/hr
0.083	2.17 1.08	3 6.20	2.083	5.62	3.08	2.95
0.167	2.17 1.16	7 6.20	2.167	5.62	3.17	2.95
0.250	2.38 1.25	0 12.18	2.250	4.80	3.25	2.76
0.333	2.38 1.33	3 12.18	2.333	4.80	3.33	2.76
0.417	2.66 1.41	7 41.67	2.417	4.21	3.42	2.62
0.500	2.66 1.50	0 41.67	2.500	4.21	3.50	2.62
0.583	3.03 1.58	3 15.28	2.583	3.78	3.58	2.47
0.667	3.03 1.66	7 15.28	2.667	3.78	3.67	2.47
0.750	3.58 1.75	0 9.22	2.750	3.45	3.75	2.35
0.833	3.58 1.83	3 9.22	2.833	3.45	3.83	2.35
0.917	4.47 1.91	7 6.88	2.917	3.18	3.92	2.23
1.000	4.47 2.00	0 6.88	3.000	3.18	4.00	2.23
May Eff Inton (mm/	hr) - 41	67 1	14 02			
Max.Ell.incen.(mm/	nr)= 41.	0/ 1	14.92			
over (m	iin) 5.	1 00	10.00			
Storage Coeff. (m	iin) = 4.	33 (11)	8.49 (11)			
Unit Hyd. Tpeak (m	in)= 5.	00 1	10.00			

		IMPERVIOUS	PERVIOUS	(i)
Surface Area	(ba) =	8 34	5 34	

|ID= 1 DT=15.0 min | Total Imp(%)= 61.00 Dir. Conn.(%)= 53.00

	. ,		
Dep. Storage	(mm) =	1.00	5.00
Average Slope	(%) =	1.00	2.30
Length	(m) =	301.99	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP.

		TRA	NSFORMED HYETOGRA	APH		
TIME	RAIN	TIME	RAIN ' TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr ' hrs	mm/hr	hrs	mm/hr
0.250	2.24	1.250	8.19 2.250	5.35	3.25	2.89
0.500	2.57	1.500	31.84 2.500	4.41	3.50	2.67
0.750	3.21	1.750	13.26 2.750	3.67	3.75	2.43
1.000	4.17	2.000	7.66 3.000	3.27	4.00	2.27
Max.Eff.Inten.(mm/	hr)=	31.84	7.23			

over	(min)	15.00	45.00		
Storage Coeff.	(min) =	16.80	(ii) 97.80	(ii)	
Unit Hyd. Tpeak	(min) =	15.00	105.00		
Unit Hyd. peak	(cms) =	0.07	0.01		
				TOTALS	
PEAK FLOW	(cms) =	0.43	0.03	0.432	(iii)
TIME TO PEAK	(hrs) =	1.50	3.75	1.50	
RUNOFF VOLUME	(mm) =	24.02	7.50	16.26	
TOTAL RAINFALL	(mm) =	25.02	25.02	25.02	
RUNOFF COEFFICIE	ENT =	0.96	0.30	0.65	

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 85.0 Ia = Dep. Storage (Above)
 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
 THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0021) ID= 1 DT= 5.0 min	Area Total	(ha)= Imp(%)=	6.05 67.00	Dir. Co	onn.(%)=	66.00
		IMPERVIO	JUS	PERVIOUS	(1)	
Surface Area	(ha) =	4.05	5	2.00		
Dep. Storage	(mm) =	1.00)	5.00		
Average Slope	(%) =	1.00)	2.00		
Length	(m) =	200.83	3	40.00		
Mannings n	=	0.013	3	0.250		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN mm/hr |' hrs hrs mm/hr | hrs mm/hr | hrs mm/hr 0.083 2.17 | 1.083 6.20 | 2.083 5.62 | 3.08 2.95 0.167 2.17 | 1.167 6.20 | 2.167 5.62 | 3.17 2.95 0.250 2.38 | 1.250 12.18 | 2.250 4.80 | 3.25 2.76 2.38 | 1.333 12.18 | 2.333 0.333 4.80 | 3.33 2.76 0.417 2.66 | 1.417 41.67 | 2.417 4.21 | 3.42 2.62 0.500 2.66 | 1.500 41.67 | 2.500 4.21 | 3.50 2.62 0.583 3.03 | 1.583 15.28 | 2.583 3.78 | 3.58 2.47 3.03 | 1.667 15.28 | 2.667 3.78 | 3.67 0.667 2.47 0.750 3.58 | 1.750 9.22 | 2.750 3.45 | 3.75 2.35 0.833 3.58 | 1.833 9.22 | 2.833 3.45 | 3.83 2.35 0.917 4.47 | 1.917 6.88 | 2.917 3.18 | 3.92 2.23 4.47 | 2.000 6.88 | 3.000 1.000 3.18 | 4.00 2.23 Max.Eff.Inten.(mm/hr) = 41.67 7.91 over (min) 5.00 25.00 Storage Coeff. (min) = 5.51 (ii) 24.98 (ii) Unit Hyd. Tpeak (min) = 5.00 25.00 Unit Hyd. peak (cms) = 0.20 0.05 *TOTALS* 0.02 0.411 (iii) PEAK FLOW (cms) = 0.41 TIME TO PEAK 1.50 2.00 1.50 (hrs) =RUNOFF VOLUME (mm) = 24.02 7.56 18.42 TOTAL RAINFALL (mm) = 25.02 25.02 25.02 RUNOFF COEFFICIENT = 0.96 0.30 0.74

DATE: February 2021

 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 88.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
ADD HYD (0658) 1 + 2 = 3 AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) ID1= 1 (0002): 13.68 0.432 1.50 16.26 + ID2= 2 (0021): 6.05 0.411 1.50 18.42
NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
RESERVOIR (0645) OVERFLOW IS OFF IN= 2> OUT= 1 OUTFLOW STORAGE OUTFLOW STORAGE DT= 5.0 min OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) 0.0000 0.0000 0.2360 0.6393 0.0290 0.3310 0.3410 0.7100 0.0950 0.4595 0.4450 0.7485 0.1680 0.5720 0.5320 0.7925 AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW : ID= 2 (0658) 19.730 0.843 1.50 16.92 OUTFLOW: ID= 1 (0645) 19.730 0.025 5.25 16.77 PEAK FLOW REDUCTION [Qout/Qin] (%) = 3.02
TIME SHIFT OF PEAK FLOW (min)=225.00
MAXIMUM STURAGE USED (na.m.) = 0.2901
<pre></pre>
IMPERVIOUS PERVIOUS (i) Surface Area (ha) = 7.84 6.67 Dep. Storage (mm) = 1.00 5.00 Average Slope (%) = 1.00 2.30 Length (m) = 311.02 40.00 Mannings n = 0.013 0.250 NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP.
TRANSFORMED HYETOGRAPH TIME RAIN TIME RAIN ' TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr 0.250 2.24 1.250 8.19 2.250 5.35 3.25 2.89

0.500

2.57 | 1.500

31.84 | 2.500

4.41 | 3.50

2.67

0.750 3.21 1.750 13.26 2.750 1.000 4.17 2.000 7.66 3.000	3.67 3.75 2.43 3.27 4.00 2.27
Max.Eff.Inten.(mm/hr)= 31.84 6.42 over (min) 15.00 45.00 Storage Coeff. (min)= 16.80 (ii) 97.80 (ii) Unit Hyd. Tpeak (min)= 15.00 105.00 Unit Hyd. peak (cms)= 0.07 0.01)
PEAK FLOW (cms) = 0.40 0.04 TIME TO PEAK (hrs) = 1.50 3.75 RUNOFF VOLUME (mm) = 24.02 6.96 TOTAL RAINFALL (mm) = 25.02 25.02 RUNOFF COEFFICIENT 0.96 0.28	0.398 (iii) 1.50 14.80 25.02 0.59
 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 84.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. 	
RESERVOIR(0657) OVERFLOW IS OFF IN= 2> OUT= 1 DT= 5.0 min OUTFLOW STORAGE OUTFLO (cms) (ha.m.) (cms) 0.0000 0.0000 0.364 0.0190 0.2147 0.525	W STORAGE (ha.m.) 0 0.2594 0 0.2723
0.1460 0.2350 0.684 0.2590 0.2500 0.819 AREA QPEAK TPEA (ha) (cms) (hrs INFLOW: ID= 2 (0656) 14.510 0.398 1 OUTFLOW: ID= 1 (0657) 14.510 0.016 6	0 0.2789 0 0.2863 K R.V.) (mm) .50 14.80 .17 14.60
PEAK FLOW REDUCTION [Qout/Qin](% TIME SHIFT OF PEAK FLOW (min MAXIMUM STORAGE USED (ha.m.) = 4.07) = 280.00) = 0.1828
V V I SSSSS U U A L V V I SS U U A A L V V I SS U U AAAAA L V V I SS U U A A L VV I SSSSS UUUUU A A LLLLL	(v 6.1.2003)
OOO TTTTT TTTTT H H Y M M OOO O O T T H H Y MM MM O O O O T T H H Y M M O O O O T T H H Y M M OOO OOO T T H H Y M M OOO Developed and Distributed by Smart City Water Inc Copyright 2007 - 2020 Smart City Water Inc H Copyright State Copyright State	ТМ
All rights reserved.	

DATE: February 2021

***** DETAILED OUTPUT *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat
Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4ea930-3446e1ae5bfa\e67c8224-0e01-4e52-90ee-f2fdb2a04b71\scen

Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4ea930-3446e1ae5bfa\e67c8224-0e01-4e52-90ee-f2fdb2a04b71\scen

DATE: 02-09-2021

TIME: 01:20:06

USER:

COMMENTS:

|--|

READ STORM Ptotal= 34.09 mm	Filename: C:\t ata` 8760 Comments: Chio	Jsers\sfanous\AppD Local\Temp\ 6663e-6d3f-4db9-a99 cago 5 Min Time Ste	62-c49127701f86\8 ep - 3hr - 5yr	33c52d41
TIME hrs 0.08 0.17 0.25 0.33 0.42 0.50 0.58 0.67 0.75	RAIN TIME mm/hr hrs 2.50 0.83 2.73 0.92 3.01 1.00 3.36 1.08 3.82 1.17 4.45 1.25 5.34 1.33 6.72 1.42 9.15 1.50	RAIN ' TIME mm/hr ' hrs 14.57 1.58 36.31 1.67 128.34 1.75 47.68 1.83 24.98 1.92 16.69 2.00 12.50 2.08 9.99 2.17 8.34 2.25	RAIN TIME mm/hr hrs 7.16 2.33 6.29 2.42 5.61 2.50 5.07 2.58 4.64 2.67 4.27 2.75 3.96 2.83 3.70 2.92 3.47 3.00	RAIN mm/hr 3.27 3.09 2.94 2.79 2.67 2.55 2.45 2.35 2.26
L CALTB				

I CUTTD						
STANDHYD (0012)	Area	(ha) =	2.72			
ID= 1 DT= 5.0 min	Total	Imp(%)=	90.00	Dir. C	onn.(%)=	90.00
		IMPERVI	OUS	PERVIOUS	(i)	
Surface Area	(ha) =	2.4	5	0.27		
Dep. Storage	(mm) =	1.0	0	5.00		
Average Slope	(%) =	1.0	0	2.00		
Length	(m) =	134.6	6	40.00		
Mannings n	=	0.01	3	0.250		
Max.Eff.Inten.(m	m/hr)=	128.3	4	49.82		
over	(min)	5.0	0	10.00		
Storage Coeff.	(min)=	2.7	6 (ii)	5.42	(ii)	

0.500

Max.Eff.Inten.(mm/hr)=

Unit Hyd. Tpeak	(min) =	5.00	10.00	
Unit Hyd. peak	(cms) =	0.28	0.16	
				TOTALS
PEAK FLOW	(cms) =	0.77	0.03	0.779 (iii)
TIME TO PEAK	(hrs) =	1.00	1.08	1.00
RUNOFF VOLUME	(mm) =	33.09	18.21	31.60
TOTAL RAINFALL	(mm) =	34.09	34.09	34.09
RUNOFF COEFFICIE	ENT =	0.97	0.53	0.93

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i)	CN P	ROCED	JRE SE	ELECTED	FOR	PERVIOU	JS 1	LOSSES:
	CN*	=	93.6	Ia =	Dep	. Storag	je	(Above)
(ii)	TIME	STEP	(DT)	SHOULD	ΒE	SMALLER	OR	EQUAL

- THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(0642) IN= 2> OUT= 1	OVERFLO	W IS OFF				
DT= 5.0 min	OUTFLOW	STOR	AGE	OUTFLOW	STORAGE	
	(cms)	(ha.r	n.)	(cms)	(ha.m.)	
	0.0000	0.00	000	0.0510	0.1120	
	0.0050	0.0	517	0.0730	0.1266	
	0.0200	0.08	320	0.0960	0.1376	
	0.0360	0.10	003	0.1150	0.1490	
		AREA	QPEAK	TPEAK	R.V.	
	0010)	(ha)	(cms)	(hrs)	(mm)	
INFLOW : ID= 2 (0012)	2.720	0.//9	1.00	31.60	
OUTFLOW: ID= I (0642)	2.720	0.016	3.00	30.44	
P	TAK FLOW	REDUCTIO	N [Oout	(∩in1(%)=	2 06	
т. Т	IME SHIFT OF	PEAK FLO	W LOOUC	(min)=12	2.00	
M	AVIMIN STOP	ACF US	חק	(ham)=	0 0767	
111	-X1000 0101	AGE 001	10	(114.111.) -	0.0707	
CALIB						
STANDHYD (0002)	Area (ha)= 13	.68			
ID= 1 DT=15.0 min	Total Imp	(%)= 61	.00 Di	r. Conn.(%)	= 53.00	
	(h)	IPERVIOUS	PERV	1005 (1)		
Surface Area	(11a) = (mm) =	8.34	5	.34		
Dep. Storage	(11111) -	1.00	2	.00		
Average Slope	(~) -	301 00	40	.30		
Mappings p	(111) =	0 013	40	250		
Mainings II	-	0.015	0.	2.50		
NOTE: RAIN	FALL WAS TRA	NSFORMED	то 15.	0 MIN. TIME	STEP.	
	-	TRANS	SFORMED !	HYETOGRAPH		
TIM	E RAIN	TIME	RAIN '	TIME H	RAIN TIME	RAIN
hr	s mm/hr	hrs r	nm/hr '	hrs mr	n/hr hrs	mm/hr
0.25) 2.74	1.000 !	59.74	1.750 6.	36 2.50	3.10

0.750 7.07 | 1.500 10.27 | 2.250

59.74

3.88 | 1.250 29.78 | 2.000 4.66 | 2.75

19.48

over	(min)	15.00		30.00			
Storage Coeff.	(min) =	16.80	(ii)	97.80	(ii)		
Unit Hyd. Tpeak	(min) =	15.00		105.00			
Unit Hyd. peak	(cms) =	0.07		0.01			
						TOTALS	
PEAK FLOW	(cms) =	0.75		0.07		0.754	(iii)
TIME TO PEAK	(hrs)=	1.00		2.75		1.00	
RUNOFF VOLUME	(mm) =	33.09		13.35		23.81	
TOTAL RAINFALL	(mm) =	34.09		34.09		34.09	
RUNOFF COEFFICIE	ENT =	0.97		0.39		0.70	

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

CN* = 85.0 Ia = Dep. Storage (Above)

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

_____ -----| CALIB

STANDHYD (0021)	Area	(ha) =	6.05				
ID= 1 DT= 5.0 min	Total	Imp(%)=	67.00	Dir. C	conn.(%)=	66.00)
		-					
		IMPERVI	DUS	PERVIOUS	(i)		
Surface Area	(ha) =	4.05	5	2.00			
Dep. Storage	(mm) =	1.00)	5.00			
Average Slope	(%) =	1.00)	2.00			
Length	(m) =	200.83	3	40.00			
Mannings n	=	0.013	3	0.250			
Max.Eff.Inten.(r	nm/hr)=	128.34	1	35.62			
over	(min)	5.00)	10.00			
Storage Coeff.	(min) =	3.53	l (ii)	8.35	(ii)		
Unit Hyd. Tpeak	(min) =	5.00)	10.00			
Unit Hyd. peak	(cms) =	0.20	5	0.12			
					* T	OTALS*	r
PEAK FLOW	(cms) =	1.10	5	0.12		1.214	(iii)
TIME TO PEAK	(hrs) =	1.00)	1.08		1.00	
RUNOFF VOLUME	(mm) =	33.09	9	13.60		26.46	
TOTAL RAINFALL	(mm) =	34.09	9	34.09		34.09	
RUNOFF COEFFICI	ENT =	0.9	7	0.40		0.78	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 88.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0658)				
1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0002):	13.68	0.754	1.00	23.81
+ ID2= 2 (0021):	6.05	1.214		26.46
ID = 3 (0658):	19.73	1.968	1.00	24.62

2.67

2.36

3.71 | 3.00

DATE: February 2021

RESERVOIR(0645)	OVERFLOW IS C	FF			
IN= 2> OUT= 1					RESERVO
DT= 5.0 min	OUTFLOW ST	ORAGE OUTFLOW	STORAGE		IN= 2
	(cms) (n	a.m.) (Cms)	(na.m.)		DT= 5.
	0.0290 0	3310 0.2300	0.0393		
	0.0950 0	.4595 0.4450	0.7485		
	0.1680 0	.5720 0.5320	0.7925		
	AREA	QPEAK TPEAK	R.V.		
INFLOW : ID- 2 (00	(ha)	(cms) (hrs)	(mm)		
IIIFLOW: $ID=2$ (06	572) 19.730 575) 19.730	1.968 1.	67 24.62		INFLOW
001110W: 1D- 1 (00	19.130	0.000 5.	21.1/		OUTFLC
PEAK	K FLOW REDUC	TION [Qout/Qin](%):	= 3.38		
TIME	E SHIFT OF PEAK	FLOW (min):	=160.00		
MAXI	IMUM STORAGE	USED (ha.m.)	= 0.4040		
CALIB					
STANDHYD (0656)	Area (ha)=	14.51			
D= 1 DT=15.0 min	Total Imp(%)=	54.00 Dir. Conn.	(%)= 46.00		
	IMPERIO				V
Surface Area	(ba) = 7.84	US PERVIOUS (1)			V
Dep Storage ((mm) = 1.00	5.00			V
Average Slope	(%) = 1.00	2.30			
Length	(m) = 311.02	40.00			
Mannings n	= 0.013	0.250			0
					0
NOTE: RAINFAL	LL WAS TRANSFORM	ED TO 15.0 MIN. T	IME STEP.		0
					Developed
	TR	ANSFORMED HYETOGRA	PH		Copyright
TIME	RAIN TIME	RAIN TIME	RAIN TIME	RAIN	All right
hrs	mm/hr hrs	mm/hr ' hrs	mm/hr hrs	mm/hr	-
0.250	2.74 1.000	59.74 1.750	6.36 2.50	3.10	
0.500	3.88 1.250	29.78 2.000	4.66 2.75	2.67	
0.750	7.07 1.500	10.27 2.250	3.71 3.00	2.36	
Max Eff Inten (mm/	(hr) = 59.74	17 86			Tnput
over (m	nin) 15.00	45.00			Output
Storage Coeff. (m	nin) = 16.80	(ii) 97.80 (ii)			a930-3446
Unit Hyd. Tpeak (m	nin)= 15.00	105.00			Summary
Unit Hyd. peak (c	cms) = 0.07	0.01			a930-3446
			TOTALS		
PEAK FLOW (C	cms) = 0.69	0.08	U.695 (iii)		
TIME TO PEAK (h	(mm) = 1.00	2./5	1.UU 21 09		DATE: 02-
TOTAL RAINFALL	(mm) = 34.09	34 09	34 09		USER .
RUNOFF COEFFICIENT	c = 0.97	0.37	0.64		

THAN THE STORAGE COEFFICIENT. PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

IN= 2> OUT= 1 DT= 5.0 min	OUTFLOW (cms) 0.0000 0.0190 0.1460	STORA (ha.m 0.00 0.21	AGE 1.) 000	OUTFLOW (cms)	STORAGE (ha.m.)	
	0.2390	0.23 0.25	47 350 300	0.3640 0.5250 0.6840 0.8190	0.2594 0.2723 0.2789 0.2863	
INFLOW : ID= 2 (065 OUTFLOW: ID= 1 (065	AF (1 (1 (1 (1) (1) (1) (1) (1) (1) (1) (1	REA na) 510 510	QPEAK (cms) 0.695 0.112	TPEAK (hrs) 1.00 3.1	R.V. (mm) 0 21.98 7 21.78	
PEAK TIME MAXIM	FLOW F SHIFT OF F IUM STORAG	REDUCTIO PEAK FLO GE USE	DN [Qout DW DD	/Qin](%)= (min)=1 (ha.m.)=	16.06 130.00 0.2295	
VVI SSS VVI SS VVI SS VVI SS VVI SSS	SS U U U U U U S U U SS UUUUU	A A A AAAAA A A A A	L L L L LLLLL		(v 6.1.2003)	
OOO TTTTT TTT O O T T O O T T OOO T T Developed and Distribute Copyright 2007 - 2020 Sm All rights reserved.	TT H H H H H H H H H H d by Smart mart City W	Y Y YY Y CityW Jater In	M M MM MM M M M M Jater In M	000 5 0 0 000 c	ΓM	
****	DETA	ILED	U O U	T P U T *'	***	
Input filename: C:\F Output filename: C:\U a930-3446e1ae5bfa\2e3c3d Summary filename: C:\U a930-3446e1ae5bfa\2e3c3c	Program Fil Sers\sfanc Lc5-4c64-49 Sers\sfanc Lc5-4c64-49	.es (x86 pus\AppD 9f4-9e53 pus\AppD 9f4-9e53	5)\Visua Data\Loc B-6ff42c Data\Loc B-6ff42c	l OTTHYMO al\Civica\ f556f4\sce al\Civica\ f556f4\sce	6.1\VO2\voin VH5\4a4b2b43 en VH5\4a4b2b43 en	.dat -29c0-4f4e- -29c0-4f4e-
DATE: 02-09-2021			TIME:	01:20:05		
JSER:						

DATE: February 2021

	RESERVOIR(0642) OVERFLOW IS OFF
****	DT= 5.0 min OUTFLOW STORAGE OUTFLOW STORAGE
** SIMULATION : 3. Chicago 3hr 10yr **	(cms) (ha.m.) (cms) (ha.m.)
***************************************	0.0000 0.0000 0.0510 0.1120
	0.0360 0.1003 0.1150 0.1490
READ STORM Filename: C:\Users\sfanous\AppD	
ata\Local\Temp\	AREA OPEAK TPEAK R.V.
8766663e-6d3f-4db9-a962-c49127701f86\77778385	(ha) (cms) (hrs) (mm)
Ptotal= 41.98 mm Comments: Chicago 5 Min Time Step - 3hr - 10yr	INFLOW : ID= 2 (0012) 2.720 1.011 1.00 39.40
	OUTFLOW: ID= 1 (0642) 2.720 0.027 2.50 38.25
TIME RAIN TIME RAIN ' TIME RAIN TIME RAIN	
hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr	PEAK FLOW REDUCTION [Qout/Qin](%) = 2.72
0.08 3.08 0.83 17.95 1.58 8.82 2.33 4.03	TIME SHIFT OF PEAK FLOW (min) = 90.00
0.17 3.36 0.92 44.72 1.67 7.75 2.42 3.81	MAXIMUM STORAGE USED (na.m.)= 0.0905
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	
0.50 5.48 1.25 20.55 2.00 5.26 2.75 3.14	L CALTE I
0.58 6.57 1.33 15.39 2.08 4.88 2.83 3.02	STANDHYD (0002) Area (ha) = 13.68
0.67 8.27 1.42 12.31 2.17 4.55 2.92 2.90	ID= 1 DT=15.0 min Total Imp(%)= 61.00 Dir. Conn.(%)= 53.00
0.75 11.27 1.50 10.27 2.25 4.27 3.00 2.79	
	IMPERVIOUS PERVIOUS (i)
	Surface Area (ha)= 8.34 5.34
	Dep. Storage (mm) = 1.00 5.00
	Average Slope (%) = 1.00 2.30
CALIB	Length $(m) = 301.99 40.00$
STANDHYD (0012) Area (na) = 2.72	Mannings n = 0.013 0.250
1D = 1 D = 5.0 min 10 for at 1 mp(s) = 90.00 Dir. Conn.(s) = 90.00 min 10 mp(s) = 90.00	NOTE - DAINEDALI WAS TRANSFORMED TO 15.0 MIN TIME STED
IMPERVIOUS PERVIOUS (i)	NOTE. MAINTALL WAS TRANSFORMED TO 15.0 MIN. TIME STET.
Surface Area $(ba) = 245 - 0.27$	
Dep. Storage $(mm) = 1.00$ 5.00	TRANSFORMED HYETOGRAPH
Average Slope $(\%) = 1.00$ 2.00	TIME RAIN TIME RAIN TIME RAIN TIME RAIN
Length (m) = 134.66 40.00	hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr
Mannings n = 0.013 0.250	0.250 3.38 1.000 73.58 1.750 7.83 2.50 3.82
	0.500 4.78 1.250 36.68 2.000 5.74 2.75 3.29
Max.Eff.Inten.(mm/hr)= 158.07 70.80	0.750 8.71 1.500 12.66 2.250 4.57 3.00 2.90
over (min) 5.00 5.00	
Storage Coeff. $(min) = 2.54$ (11) 4.98 (11)	Max.Eff.Inten.(mm/hr)= /3.58 29.52
Unit Hya. Tpeak $(min) = 5.00$ 5.00	over (min) 15.00 30.00
Unit nya. peak (Cms)= U.29 U.22	Storage coeff. $(min) = 16.80$ (11) 97.80 (11)
- TUTALS- PEAK FLOW (cmc) = 0.96 0.05 1.011 (iii)	Unit Hyd. Tpeak $(mn) = 15.00$ 105.00
$\frac{1}{2} \sum_{i=1}^{n} \frac{1}{2} \sum_{i=1}^{n} \frac{1}$	*TOTAIS*
RUNOFF VOLUME (mm) = 40.98 25 17 39 40	PEAK FLOW (cms) = 0.93 0.11 0.932 (iii)
TOTAL RAINFALL $(mm) = 41.98$ 41.98 41.98	TIME TO PEAK (hrs) = 1.00 2.75 1.00
RUNOFF COEFFICIENT = 0.98 0.60 0.94	RUNOFF VOLUME (mm) = 40.98 19.08 30.68
	TOTAL RAINFALL (mm) = 41.98 41.98 41.98
***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!	RUNOFF COEFFICIENT = 0.98 0.45 0.73
(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:	
CN* = 93.6 Ia = Dep. Storage (Above)	(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL	$CN^* = 85.0$ Ia = Dep. Storage (Above)
THAN THE STORAGE COEFFICIENT.	(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	THAN THE STORAGE COEFFICIENT.
	(111) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0021) Are ID= 1 DT= 5.0 min Tot	ea (ha)= 6.05 tal Imp(%)= 67.00	Dir. Conn.(%)=	= 66.00
Surface Area (ha) Dep. Storage (mm) Average Slope (%) Length (m) Mannings n	IMPERVIOUS P = 4.05 = 1.00 = 1.00 = 200.83 = 0.013	ERVIOUS (i) 2.00 5.00 2.00 40.00 0.250	
Max.Eff.Inten.(mm/hr) over (min) Storage Coeff. (min) Unit Hyd. Tpeak (min) Unit Hyd. peak (cms))= 158.07 5.00 = 3.23 (ii) = 5.00 0 = 0.27	52.97 10.00 7.69 (ii) 10.00 0.13	*70721.5*
PEAK FLOW (cms) TIME TO PEAK (hrs) RUNOFF VOLUME (mm) TOTAL RAINFALL (mm) RUNOFF COEFFICIENT	$\begin{array}{l} 0 = & 1.47 \\ 0 = & 1.00 \\ 0 = & 40.98 \\ 0 = & 41.98 \\ = & 0.98 \end{array}$	0.19 1.08 19.49 41.98 0.46	1.560 (iii) 1.00 33.67 41.98 0.80
<pre>***** WARNING: STORAGE COM (i) CN PROCEDURE SI CN* = 88.0 (ii) TIME STEP (DT) THAN THE STORAG (iii) PEAK FLOW DOES</pre>	EFF. IS SMALLER THAN ELECTED FOR PERVIOUS Ia = Dep. Storage SHOULD BE SMALLER O SE COEFFICIENT. NOT INCLUDE BASEFLO	TIME STEP! LOSSES: (Above) R EQUAL W IF ANY.	
ADD HYD (0658) 1 + 2 = 3 ID1= 1 (0002): + ID2= 2 (0021):	AREA QPEAK (ha) (cms) 13.68 0.932 6.05 1.560	TPEAK R.V. (hrs) (mm) 1.00 30.68 1.00 33.67	
ID = 3 (0658):	19.73 2.492	1.00 31.60	=
NOTE: PEAK FLOWS DO	NOT INCLUDE BASEFLO	WS IF ANY.	
RESERVOIR (0645) () IN= 2> OUT= 1	OVERFLOW IS OFF		
DT= 5.0 min (DUTFLOW STORAGE (cms) (ha.m.) 0.0000 0.0000 0.0290 0.3310 0.0950 0.4595 0.1680 0.5720	OUTFLOW (cms) 0.2360 0.3410 0.4450 0.5320	STORAGE (ha.m.) 0.6393 0.7100 0.7485 0.7925
INFLOW : ID= 2 (0658) OUTFLOW: ID= 1 (0645)	AREA QPEA (ha) (cms) 19.730 2.) 19.730 0.	K TPEAK) (hrs) 492 1.00 116 3.33	R.V. (mm) 31.60 31.45

DATE: February 2021

I	FIME SHIFT OF PE MAXIMUM STORAGE	CAK FLOW USED	(min)=1 (ha.m.)=	40.00 0.4918	
CALIB STANDHYD (0656) ID= 1 DT=15.0 min	- Area (ha) Total Imp(%) -	= 14.51 = 54.00 D	ir. Conn.(%)= 46.00	
Surface Area Dep. Storage Average Slope Length Mannings n NOTE: BAIL	IMPER (ha) = 7 (mm) = 1 (%) = 1 (m) = 311 = 0.	RVIOUS PER 2.84 .00 .00 .00 .02 4 013 0 CORMED TO 15	VIOUS (i) 6.67 5.00 2.30 0.00 .250	F STEP.	
NOTE. IAI		· TRANSFORMED	HYETOGRAPH		
TII h: 0.2: 0.5: 0.7:	ME RAIN TI rs mm/hr h 50 3.38 1.0 00 4.78 1.2 50 8.71 1.5	Image: Metal Normal State RAIN mrs mm/hr 000 73.58 250 36.68 000 12.66	' TIME ' hrs m 1.750 7 2.000 5 2.250 4	RAIN TIME m/hr hrs .83 2.50 .74 2.75 .57 3.00	RAIN mm/hr 3.82 3.29 2.90
Max.Eff.Inten. ove: Storage Coeff. Unit Hyd. Tpea Unit Hyd. peak	(mm/hr) = 73 r (min) 15 (min) = 16 k (min) = 15 (cms) = 0	3.58 2 5.00 3 5.80 (ii) 9 5.00 10 0.07	6.55 0.00 7.80 (ii) 5.00 0.01		
PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFIC	(cms) = 0 (hrs) = 1 (mm) = 40 (mm) = 41 IENT = 0	0.85 00 0.98 1 98 4 0.98	0.12 2.75 8.03 1.98 0.43	*TOTALS* 0.859 (iii) 1.00 28.58 41.98 0.68	
(i) CN PROCED CN* = (ii) TIME STEX THAN THE (iii) PEAK FLOW	DURE SELECTED FC 84.0 Ia = De P (DT) SHOULD BE STORAGE COEFFIC W DOES NOT INCLU	PR PERVIOUS L Pp. Storage SMALLER OR DIENT. DE BASEFLOW	OSSES: (Above) EQUAL IF ANY.		
IN= 2> OUT= 1 DT= 5.0 min	OUTFLOW (cms) 0.0000 0.0190 0.1460 0.2590	STORAGE (ha.m.) 0.0000 0.2147 0.2350 0.2500	OUTFLOW (cms) 0.3640 0.5250 0.6840 0.8190	STORAGE (ha.m.) 0.2594 0.2723 0.2789 0.2863	
INFLOW : ID= 2 (OUTFLOW: ID= 1 (ARE (ha 0656) 14.5 0657) 14.5	CA QPEAK (cms) (cms) (10 0.85 (10 0.19	TPEAK (hrs) 9 1.00 8 2.75	R.V. (mm) 28.58 28.39	

9.18 | 2.67 PEAK FLOW REDUCTION [Oout/Oin] (%) = 23.00 0.42 7.68 | 1.17 43.26 | 1.92 5 50 0.50 8.83 | 1.25 29.84 | 2.00 8.51 | 2.75 TIME SHIFT OF PEAK FLOW (min)=105.00 5 28 MAXIMUM STORAGE USED (ha.m.) = 0.24190.58 10.46 | 1.33 22.88 | 2.08 7.94 | 2.83 5.07 0.67 12.93 | 1.42 18.63 | 2.17 7.45 | 2.92 4.89 0.75 17.18 | 1.50 15.77 | 2.25 7.02 | 3.00 4.72 _____ V V I SSSSS U U A L (v 6.1.2003) _____ V V I SS U U AA L | CALIB | V V I SS U U AAAAA L | STANDHYD (0012) | Area (ha) = 2.72 VVI SSUUAAL |ID= 1 DT= 5.0 min | Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00 VV I SSSSS UUUUU A A LLLLL _____ IMPERVIOUS PERVIOUS (i) 0.27 OOO TTTTT TTTTT H H Y Y M M OOO TM Surface Area (ha) = 2.45 Dep. Storage (mm) = 1.00 5.00 Average Slope (%) = 1.00 2.00 Length (m) = 134.66 40.00 Mannings n = 0.013 0.250 Developed and Distributed by Smart City Water Inc Copyright 2007 - 2020 Smart City Water Inc All rights reserved. Max.Eff.Inten.(mm/hr) = 198.74 106.65 over (min) 5.00 5.00 Storage Coeff. (min) = 2.32 (ii) 4.55 (ii) ***** DETAILED OUTPUT ***** Unit Hyd. Tpeak (min) = 5.00 5.00 Unit Hyd. peak (cms)= 0.30 0.23 *TOTALS* PEAK FLOW (cms) = 1.24 0.08 TIME TO PEAK (hrs) = 1.00 1.00 RUNOFF VOLUME (mm) = 58.41 41.24 TOTAL RAINFALL (mm) = 59.41 59.41 Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat 1.318 (iii) Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e-1.00 56.69 a930-3446e1ae5bfa\bec09bba-3d18-4f11-8ab1-5e97d24653ae\scen 59.41 Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4ea930-3446e1ae5bfa\bec09bba-3d18-4f11-8ab1-5e97d24653ae\scen RUNOFF COEFFICIENT = 0.98 0.69 0.95 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP! DATE: 02-09-2021 TIME: 01:20:05 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 93.6 Ia = Dep. Storage (Above) USER: (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. COMMENTS _____ | RESERVOIR(0642)| OVERFLOW IS OFF | IN= 2---> OUT= 1 | _____ ********** DT= 5.0 min | OUTFLOW STORAGE | OUTFLOW STORAGE ** SIMULATION : 4. Chicago 3hr 25yr ** _____ (cms) (ha.m.) | (cms) (ha.m.) 0.1120 0.0000 0.0000 | 0.0510 0.0050 0.0617 | 0.0730 0.1266 0.0200 0.0820 | 0.0960 0.1376 0.0360 0.1003 | 0.1150 0.1490 READ STORM Filename: C:\Users\sfanous\AppD | ata\Local\Temp\ AREA OPEAK TPEAK RV 8766663e-6d3f-4db9-a962-c49127701f86\79190208 (ha) (cms) (hrs) (mm) 56.69 INFLOW : ID= 2 (0012) | Ptotal= 59.41 mm | Comments: Chicago 5 Min Time Step - 3hr - 25yr 2.720 1.318 1.00 2.720 0.062 2.08 55.54 _____ OUTFLOW: ID= 1 (0642) TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr PEAK FLOW REDUCTION [Oout/Oin] (%) = 4.69 5.17 | 0.83 26.33 | 1.58 13.72 | 2.33 6.64 0.08 TIME SHIFT OF PEAK FLOW (min) = 65.00 5.61 | 0.92 60.92 | 1.67 12.17 | 2.42 6.31 0.17 MAXIMUM STORAGE USED (ha.m.) = 0.11920.25 6.15 | 1.00 198.74 | 1.75 10.96 | 2.50 6.01 0 33 6.82 | 1.08 78.66 | 1.83 9.98 | 2.58 5.74

DATE: February 2021

CA1 ST2 ID=	LIB ANDHYD (0002) 1 DT=15.0 min	Area Total :	(ha) = Imp(%) =	13.68 61.00	Dir. Conr	n.(%)= 5	3.00	
	Surface Area Dep. Storage Average Slope Length Mannings n	(ha) = (mm) = (%) = (m) = =	IMPERVIC 8.34 1.00 1.00 301.99 0.013	DUS 1)) 3	PERVIOUS (3 5.34 5.00 2.30 40.00 0.250	i)		
	NOTE: RAINF	ALL WAS	TRANSFORM	1ED TO	15.0 MIN.	TIME STE	P.	
	TIME hrs 0.250 0.500 0.750	RAIN mm/hr 5.64 7.78 13.52	TH TIME hrs 1.000 1.250 1.500	RANSFOF RAI mm/h 95.3 50.5 19.0	MED HYETOGH N ' TIME r ' hrs 3 1.750 9 2.000 9 2.250	RAPH RAIN mm/hr 12.28 9.22 7.47	TIME hrs 2.50 2.75 3.00	RAIN mm/hr 6.32 5.50 4.89
	Max.Eff.Inten.(m over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak	<pre>m/hr) = (min) (min) = (min) = (cms) =</pre>	95.33 15.00 16.80 15.00 0.07	3)) (ii))	52.08 30.00 97.80 (i 105.00 0.01	i)	AT C +	
	PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICIE	(cms) = (hrs) = (mm) = (mm) = CNT =	1.22 1.00 58.42 59.42 0.98	2) - }	0.18 2.75 33.03 59.41 0.56	101 1. 1 46 59 0	228 (iii) .00 .48 .41 .78	
	 (i) CN PROCEDU CN* = 8 (ii) TIME STEP THAN THE S (iii) PEAK FLOW 	URE SELEC 35.0 I (DT) SHOU STORAGE CO DOES NOT	TED FOR H a = Dep. JLD BE SN DEFFICIEN INCLUDE	PERVIOU Storag MALLER MT. BASEFI	S LOSSES: e (Above) OR EQUAL OW IF ANY.			
CA1 STA ID=	LIB ANDHYD (0021) 1 DT= 5.0 min	Area Total :	(ha) = Imp(%) =	6.05 67.00	Dir. Conr	n.(%)= 6	6.00	
	Surface Area Dep. Storage Average Slope Length Mannings n	(ha) = (mm) = (%) = (m) = =	IMPERVIC 4.05 1.00 200.83 0.013	DUS 5 1 1 3 3	PERVIOUS (3 2.00 5.00 2.00 40.00 0.250	i)		
	Max.Eff.Inten.(m over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak	<pre>mm/hr) = (min) (min) = (min) = (cms) =</pre>	198.74 5.00 2.95 5.00 0.28	1) 5 (ii) 3	85.59 10.00 7.01 (i 10.00 0.14	Ĺ) ★Ლ⌒Ლ	AT.S*	
	PEAK FLOW	(cms) =	1 97		0 34	2	086 (iii)	

DATE: February 2021

TIME TO PEAK	(hrs) =	1.00	1.08	1.00
RUNOFF VOLUME	(mm) =	58.41	33.76	50.03
TOTAL RAINFALL	(mm) =	59.41	59.41	59.41
RUNOFF COEFFICI	ENT =	0.98	0.57	0.84

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 88.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
 - THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

I	ADD	H	ĽD	(0	065	8)				
l	1	+	2	=	3	3		AREA	QPEAK	TPEAK	R.V.
								(ha)	(cms)	(hrs)	(mm)
			ID1	=	1	(0002):	13.68	1.228	1.00	46.48
		+	ID2	2=	2	(0021):	6.05	2.086	1.00	50.03
			===			===					
			ID	=	3	(0658):	19.73	3.314	1.00	47.56

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0645) IN= 2> OUT= 1	OVERFLOW	IS OFF			
DT= 5.0 min	OUTFLOW (cms) 0.0000 0.0290 0.0950 0.1680	STORAGE (ha.m.) 0.0000 0.3310 0.4595		OUTFLOW (cms) 0.2360 0.3410 0.4450	STORAGE (ha.m.) 0.6393 0.7100 0.7485
INFLOW : ID= 2 (OUTFLOW: ID= 1 (Al (1 0658) 19 0645) 19	REA QPE ha) (cm .730 3 .730 0	AK is) .314 .278	TPEAK (hrs) 1.00 3.08	R.V. (mm) 47.56 47.42

PEAKFLOWREDUCTION [Qout/Qin](%) =8.38TIMESHIFT OF PEAK FLOW(min)=125.00MAXIMUMSTORAGEUSED(ha.m.) =0.6676

CALIB					
STANDHYD (0656)	Area	(ha) =	14.51		
ID= 1 DT=15.0 min	Total	Imp(%)=	54.00	Dir. Conn.(%)=	46.00
		IMPERVI	OUS	PERVIOUS (i)	
Surface Area	(ha) =	7.8	4	6.67	
Dep. Storage	(mm) =	1.0	0	5.00	
Average Slope	(%) =	1.0	0	2.30	
Length	(m) =	311.0	2	40.00	
Mannings n	=	0.01	3	0.250	
NOTE: BAINE	ALL WAS	TRANSFOR	MED TO	15.0 MIN. TIME	STEP.

			TR <i>P</i>	ANSFOR	MED	HYEI	OGRA	APH			
TIME	RAIN		TIME	RAI	N '	ΤI	ME	RAIN	I	TIME	RAIN
hrs	mm/hr		hrs	mm/h	r '	h	nrs	mm/hr		hrs	mm/hr
0.250	5.64		1.000	95.3	3	1.75	50	12.28	1	2.50	6.32
0.500	7.78		1.250	50.5	9	2.00	0	9.22		2.75	5.50
0.750	13.52	Ι	1.500	19.0	9	2.25	50	7.47	I	3.00	4.89
Max.Eff.Inten.(m	m/hr)=		95.33		47	.47					
over	(min)		15.00		30	00.0					
Storage Coeff.	(min) =		16.80	(ii)	97	.80	(ii)				
Unit Hyd. Tpeak	(min)=		15.00		105	5.00					
Unit Hyd. peak	(cms) =		0.07		C	0.01					
								* TC	TAI	JS*	
PEAK FLOW	(cms) =		1.12		C	.21		1	.13	83 (iii)	
TIME TO PEAK	(hrs) =		1.00		2	2.75			1.0	0	
RUNOFF VOLUME	(mm) =		58.41		31	.56		4	3.9	91	
TOTAL RAINFALL	(mm) =		59.41		59	9.41		5	9.4	1	
RUNOFF COEFFICIE	INT =		0.98		C	.53			0.7	4	

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 84.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
- THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(0657	OVERFL	OW IS OF	FF			
IN= 2> OUT= 1	1					
DT= 5.0 min	OUTFLO	W STO	ORAGE	OUTFLOW	I STORAGE	
	(cms)	(ha	a.m.)	(cms)	(ha.m.)	
	0.000	0 0.	.0000	0.3640	0.2594	
	0.019	0 0.	.2147	0.5250	0.2723	
	0.146	0 0.	.2350	0.6840	0.2789	
	0.259	0 0.	.2500	0.8190	0.2863	
		AREA	OPEAK	TPEAF	K R.V.	
		(ha)	(cms)	(hrs)	(mm)	
INFLOW : ID= 2	(0656)	14.510	1.13	33 1.	.00 43.91	
OUTFLOW: ID= 1	(0657)	14.510	0.4	52 1.	.83 43.71	
	PEAK FLOW	REDUCI	FION [Qoi	ut/Qin](%)	= 39.90	
	TIME SHIFT O	F PEAK B	FLOW	(min)	= 50.00	
	MAXIMUM STO	RAGE U	JSED	(ha.m.)	= 0.2665	
V V I	SSSSS U	U A	L		(v 6.1.2003)	
V V I	SS U	U A A	A L			
V V I	SS U	U AAAA	AA L			
V V I	SS U	U A	A L			
I VV	SSSSS UUU	UU A	A LLLL			
000 TTTT	г ттттт н	н ү	у м и	1 000	ТМ	
0 0 T	т н	H Y Y	Y MM M	1 0 0		
0 0 T	тн	н ү	M 1	1 0 0		

ООО Т Т Н Н Ү М М ООО

Developed and Distributed by Smart City Water Inc

DATE: February 2021

Copyright 2007 - 2020 Smart City Water Inc All rights reserved.

***** DETAILED OUTPUT *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat
Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4ea930-3446e1ae5bfa\aa397637-0a47-4238-89ce-bdcb7e18b59a\scen

Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4ea930-3446e1ae5bfa\aa397637-0a47-4238-89ce-bdcb7e18b59a\scen

DATE: 02-09-2021

TIME: 01:20:05

COMMENTS:

USER:

** SIMULATION : 5. Chicago 3hr 50yr **

(m) =

=

134.66

0.013

40.00

0.250

READ STORM 	Filename:	C:\Users\sfa ata\Local\Te 8766663e-6d3	mous\AppD mp\ f-4db9-a90	52-c49127701f86\9	ecc3658
Ptotal= 66.55 mm	Comments:	Chicago 5 Mi	n Time Ste	ep - 3hr - 50yr	
TIME hrs 0.08 0.17 0.25 0.33 0.42 0.50 0.58 0.67 0.75	RAIN mm/hr 5.80 6.30 7.66 8.63 9.92 11.75 14.53 19.32	TIME RAIN hrs mm/hr 0.83 29.62 0.92 68.42 1.00 220.93 1.08 88.27 1.17 48.66 1.25 33.57 1.33 25.73 1.42 20.95 1.50 17.73	' TIME ' hrs 1.58 1.67 1.75 1.83 1.92 2.00 2.08 2.17 2.25	RAIN TIME mm/hr hrs 15.42 2.33 13.67 2.42 12.31 2.50 11.21 2.58 10.31 2.67 9.56 2.75 8.91 2.83 8.36 2.92 7.88 3.00	RAIN mm/hr 7.46 7.08 6.74 6.44 6.17 5.92 5.69 5.49 5.29
CALIB STANDHYD (0012) ID= 1 DT= 5.0 min	Area (h Total Imp(a)= 2.72 %)= 90.00 PERVIOUS PE	Dir. Conn	.(%)= 90.00	
Surface Area	(ha) =	2 45	0 27	T Contraction of the second	
Dep Storage	(mm) =	1 00	5 00		
Average Slope	(%) =	1.00	2.00		

Length

Mannings n

<pre>FEAK FLOW (cms)= 1.39 0.09 1.424 (iii) TIME TO PEAK (hrs)= 1.00 1.00 1.00 NUNOFF VOLUME (hrs)= 65.55 48.01 65.80 TOTAL RAINFALL (mm)= 66.55 66.55 66.55 RUNOFF COEFFICIENT = 0.99 0.72 0.96 ***** WARNING: STORAGE COEFF. IS SMALLER THAN THE STEP! (i) CN FROCEDURE SELECTED FOR PERVIOUS LOSSES:</pre>	Max.Eff.Inten.(over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak	<pre>mm/hr) = 220 (min) = 22 (min) = 2 (min) = 5 (cms) = 0 </pre>	0.93 5.00 2.22 (ii) 5.00 0.30	123.80 5.00 4.36 (ii) 5.00 0.23	*TOTALS*
<pre>TIME TO PEAK (hrs)= 1.00 1.00 1.00 RUNOFF VOLUME (mm)= 65.55 48.01 63.80 TOTAL RAINFALL (mm)= 66.55 66.55 66.55 RUNNOFF COEFFICIENT = 0.98 0.72 0.96 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP! (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:</pre>	PEAK FLOW	(cms) =	L.39	0.09	1.484 (iii)
<pre>NNOFF VOLUME (mm)= 65.55 48.01 63.80 TOTAL RAINFALL (mm)= 66.55 66.55 66.55 NUNOFF COEFFICIENT = 0.98 0.72 0.96 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP! (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:</pre>	TIME TO PEAK	(hrs) = 1	L.00	1.00	1.00
TOTAL RAINFALL (mm) = 66.55 66.55 66.55 RUNOFF COEFFICIENT = 0.98 0.72 0.96 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP! (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 93.6 I a = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. 	RUNOFF VOLUME	(mm) = 65	5.55	48.01	63.80
RUNOFF COEFFICIENT = 0.98 0.72 0.96 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP! (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CM* = 93.6 Ia = Dep. Storage (Above) (ii) THE STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUBE BASEFLOW IF ANY. 	TOTAL RAINFALL	(mm) = 60	5.55	66.55	66.55
<pre>**** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP! (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 93.6 Ia = Dep. Storage (Above) (i) THME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. ***** WARNING: STORAGE OVERFLOW IS OFF ! IN= 2> OUT= 1 ! DT= 5.0 min OUTFLOW STORAGE OUTFLOW STORAGE ! DT= 5.0 min OUTFLOW STORAGE OUTFLOW STORAGE ! DT= 5.0 min OUTFLOW STORAGE OUTFLOW STORAGE</pre>	RUNOFF COEFFICI	ENT = (0.98	0.72	0.96
<pre>(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN * = 93.6 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.</pre>	***** WARNING: STORA	GE COEFF. IS SN	MALLER THAN	TIME STEP!	
<pre>CN* = 93.6 Ia = Dep. Storage (Above) (ii) THE STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. TRESERVOIR(0642) OVERFLOW IS OFF N= 2> OUT= 1 DT= 5.0 min OUTFLOW STORAGE OUTFLOW STORAGE DT= 5.0 min OUTFLOW STORAGE OUTFLOW STORAGE DT= 5.0 min OUTFLOW STORAGE OUTFLOW STORAGE DT= 5.0 min OUTFLOW OUTFLOW IS OFF IN= 2> OUT= 1 O000 0.0000 0.0510 0.1120 0.0000 0.0020 0.0510 0.1120 0.0050 0.0617 0.0730 0.1266 0.0200 0.0820 0.0960 0.1376 0.0360 0.1003 0.1150 0.1490 AREA OPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW : ID= 2 (0012) 2.720 1.484 1.000 63.80 OUTFLOW: ID= 1 (0642) 2.720 0.081 1.92 62.64 PEAK FLOW REDUCTION [Qout/Qin](%]= 5.45 TIME SHIFT OF PEAK FLOW (min)= 55.00 MAXIMUM STORAGE USED (ha.m.)= 0.1304</pre>	(i) CN PROCED	URE SELECTED FO	OR PERVIOUS	LOSSES:	
<pre>(11) THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. (iii) DT= 5.0 min OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) 0.0000 0.0000 0.0510 0 0.1120 0.0050 0.0617 0.0730 0.1266 0.0200 0.0820 0.0960 0.1376 0.0360 0.1003 0.1150 0.11490 AREA QPEAK TFEAK R.V. (ha) (cms) (hrs) (mm) INFLOW : ID= 2 (0012) 2.720 1.484 1.00 63.80 OUTFLOW: ID= 1 (0642) 2.720 1.484 1.00 1.92 62.64 PEAK FLOW REDUCTION [Qout/Qin](%)= 5.45 TIME SHIFT OF PEAK FLOW (min)= 55.00 MAXIMUM STORAGE USED (ha.m.)= 0.1304</pre>	CN* = (ii) TIME STED	(DT) SHOULD BE	ep. Storage	(Above)	
<pre>(iii) PEAR FLOW DOES NOT INCLUDE BASEFLOW IF ANY. TRESERVOIR(0642) OVERFLOW IS OFF IN= 2> OUT= DT= 5.0 min OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) 0.0000 0.0000 0.0510 0.1120 0.0050 0.0617 0.0730 0.1266 0.0200 0.0820 0.0960 0.1376 0.0360 0.1003 0.1150 0.1490 AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW : ID= 2 (0012) 2.720 1.484 1.00 63.80 OUTFLOW: ID= 1 (0642) 2.720 0.081 1.92 62.64 PEAK FLOW REDUCTION [Qout/Qin](%)= 5.45 TIME SHIFT OF PEAK FLOW (min)= 55.00 MAXIMUM STORAGE USED (ha.m.)= 0.1304 TOTALIB STANDHYD (0002) Area (ha)= 13.68 IDD= 1 DT=15.0 min Total Imp(%)= 61.00 Dir. Conn.(%)= 53.00 TMPERVIOUS PERVIOUS (i) Surface Area (ha)= 8.34 5.34 Dep. Storage (m)= 1.00 2.30 Length (m)= 301.99 40.00 Mannings n = 0.013 0.250 NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP. TRANSFORMED HYETOGRAPH TIME RAIN TIME RAIN ' TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr ' hrs mm/hr '</pre>	THAN THE	STORAGE COEFFIC	CIENT.	I DOUND	
<pre> reservoirs(0642) OVERFLOW IS OFF IN= 2> OUT= 1 DT= 5.0 min OUTFLOW STORAGE OUTFLOW STORAGE</pre>	(iii) PEAK FLOW	DOES NOT INCLU	JDE BASEFLO	W IF ANY.	
<pre></pre>					
RESERVOIR (0642) OVERFLOW IS OFF IN= 2> OUT= 1 DT= 5.0 min OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) 0.0000 0.0000 0.0510 0.1120 0.0050 0.0617 0.0730 0.1266 0.0200 0.0820 0.0960 0.1376 0.0360 0.1003 0.1150 0.1490 AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW : ID= 2 (0012) 2.720 1.484 1.00 63.80 OUTFLOW: ID= 1 (0642) 2.720 0.081 1.92 62.64 PEAK FLOW REDUCTION [Qout/Qin](%)= 5.45 TIME SHIFT OF PEAK FLOW (min)= 55.00 MAXIMUM STORAGE USED (ha.m.)= 0.1304 					
<pre> IN= 2> OUT= 1 DT= 5.0 min OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) 0.0000 0.0000 0.0510 0.1120 0.0050 0.0617 0.0730 0.1266 0.0200 0.0820 0.0960 0.1376 0.0360 0.1003 0.1150 0.1490 AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW : ID= 2 (0012) 2.720 1.484 1.00 63.80 OUTFLOW: ID= 1 (0642) 2.720 0.081 1.92 62.64 PEAK FLOW REDUCTION [Qout/Qin] (%) = 5.45 TIME SHIFT OF PEAK FLOW (min) = 55.00 MAXIMUM STORAGE USED (ha.m.) = 0.1304 </pre>	RESERVOIR(0642)	OVERFLOW 1	IS OFF		
<pre></pre>	IN= 2> OUT= 1	OUTEL OW	CTODACE		STORACE
<pre>CALLE CALLE C</pre>	D1= 5.0 min	(Cms)	(ha m)	(Cms)	(ha m)
0.0050 0.0617 0.0730 0.1266 0.0200 0.0820 0.0960 0.1376 0.0360 0.1003 0.1150 0.1490 AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW : ID= 2 (0012) 2.720 1.484 1.00 63.80 OUTFLOW: ID= 1 (0642) 2.720 1.484 1.00 63.80 OUTFLOW: ID= 1 (0642) 2.720 0.081 1.92 62.64 PEAK FLOW REDUCTION [Qout/Qin] (%) = 5.45 TIME SHIFT OF PEAK FLOW (min) = 55.00 MAXIMUM STORAGE USED (ha.m.) = 0.1304 IMPERVIOUS PERVIOUS (i) Surface Area (ha) = 13.68 IMPERVIOUS PERVIOUS (i) Surface Area (ha) = 8.34 5.34 DEP. Storage (mm) = 1.00 2.30 Length (m) = 301.99 40.00 Autom of 5.00 Autom of 5.00 NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP. TRANSFORMED HYETOGRAPH TIME RAIN TIME RAIN ' TIME RAIN TIME RAIN Mare frow for 15.0 MIN. TIME STEP.		0.0000	0.0000	0.0510	0.1120
0.0200 0.0820 0.0960 0.1376 0.0360 0.1003 0.1150 0.1490 AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW : ID= 2 (0012) 2.720 1.484 1.00 63.80 OUTFLOW: ID= 1 (0642) 2.720 0.081 1.92 62.64 PEAK FLOW REDUCTION [Qout/Qin](%)= 5.45 TIME SHIFT OF PEAK FLOW (min)= 55.00 MAXIMUM STORAGE USED (ha.m.)= 0.1304 IMPERVIOUS (i) MAXIMUM STORAGE USED (ha.m.)= 0.1304 IMPERVIOUS PERVIOUS (i) Surface Area (ha)= 13.68 IMPERVIOUS PERVIOUS (i) Surface Area (ha)= 8.34 5.34 DEPUSION (i) Surface Area (ha)= 8.34 5.30 IMPERVIOUS PERVIOUS (i) Surface Area (ha)= 8.34 5.34 DEPUSION 2.30 Length (m)= 301.99 40.00 Auron 2.30 Length (m)= 301.99 40.00 MAXIM TIME RAIN TIME RAIN TIME RAIN TIME RAIN TIME RAIN ' TIME RAIN TIME RAIN COLSPANE: Colspan="2" COLSPANE: Colspan=		0.0050	0.0617	0.0730	0.1266
0.0360 0.1003 0.1150 0.1490 AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW : ID= 2 (0012) 2.720 1.484 1.00 63.80 OUTFLOW: ID= 1 (0642) 2.720 0.081 1.92 62.64 PEAK FLOW REDUCTION [Qout/Qin] (%) = 5.45 TIME SHIFT OF PEAK FLOW (min) = 55.00 MAXIMUM STORAGE USED (ha.m.) = 0.1304 		0.0200	0.0820	0.0960	0.1376
AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW: ID=2 (0012) 2.720 1.484 1.00 63.80 OUTFLOW: ID=1 (0642) 2.720 0.081 1.92 62.64 PEAK FLOW REDUCTION [Qout/Qin](%) = 5.45 5.45 1100 1.92 62.64 PEAK FLOW REDUCTION [Qout/Qin](%) = 5.45 100 1.92 62.64 VIMED OUTFLOW: STANDHYD (0002) Area (ha) = 13.68 1.00 1.01 1.01 ID=1 DT=15.0 min Total Imp(%) = 61.00 Dir. Conn.(%) = 53.00 ID=1 DT=15.0 min Total Imp(%) = 61.00 Dir. Conn.(%) = 53.00 ID=1 DT=15.0 min TMPERVIOUS PERVIOUS (i) Surface Area (ha) = 3.01.99 40.00 Average Slope (%) = 1.00 2.30 1.000 0.250 NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME RAIN hrs		0.0360	0.1003	0.1150	0.1490
AREA OPEAR TPEAR R.V. (ha) (cms) (hrs) (mm) INFLOW: ID= 2 (0012) 2.720 1.484 1.00 63.80 OUTFLOW: ID= 1 (0642) 2.720 0.081 1.92 62.64 PEAK FLOW REDUCTION [Qout/Qin] (%) = 5.45 5.00 MAXIMUM STORAGE USED (ha.m.) = 0.1304		3.01			D. 11
<pre>INFLOW : ID= 2 (0012) 2.720 1.484 1.00 63.80 OUTFLOW: ID= 1 (0642) 2.720 0.081 1.92 62.64 PEAK FLOW REDUCTION [Qout/Qin](%)= 5.45 TIME SHIFT OF PEAK FLOW (min)= 55.00 MAXIMUM STORAGE USED (ha.m.)= 0.1304 </pre>		ARE	SA QPEA	K TPEAK	R.V. (mm)
OUTFLOW: ID = 1 (0642) 2.720 0.081 1.92 62.64 PEAK FLOW REDUCTION [Qout/Qin] (%) = 5.45 TIME SHIFT OF PEAK FLOW (min) = 55.00 MAXIMUM STORAGE USED (ha.m.) = 0.1304	INFLOW · ID= 2 (0012) 2 7	1) (CIIIS 720 1	484 1 00	63 80
PEAK FLOW REDUCTION [Qout/Qin](%) = 5.45 TIME SHIFT OF PEAK FLOW (min) = 55.00 MAXIMUM STORAGE USED (ha.m.) = 0.1304	OUTFLOW: ID= 1 (0642) 2.7	720 0.	081 1.92	62.64
PEAK FLOW REDUCTION [Qout/Qin](%) = 5.45 TIME SHIFT OF PEAK FLOW (min) = 55.00 MAXIMUM STORAGE USED (ha.m.) = 0.1304			DUGETON IO		5 45
INM DIFF OF LEAR LIGW (mm) = 05.00 (ha.m.) = 0.1304 MAXIMUM STORAGE USED (ha.m.) = 0.1304	P	EAK FLOW RE	SDUCTION [Q	out/Qin](%)=	5.45
<pre> CALIB STANDHYD (0002) Area (ha)= 13.68 ID= 1 DT=15.0 min Total Imp(%)= 61.00 Dir. Conn.(%)= 53.00 IMPERVIOUS PERVIOUS (i) Surface Area (ha)= 8.34 5.34 Dep. Storage (mm)= 1.00 5.00 Average Slope (%)= 1.00 2.30 Length (m)= 301.99 40.00 Mannings n = 0.013 0.250 NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP. TRANSFORMED HYETOGRAPH TIME RAIN TIME RAIN ' TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr 0.250 6.33 1.000 106.32 1.750 13.80 2.50 7.09</pre>	± M	AXIMUM STORAGE	E USED	(ha.m.) =	0.1304
<pre> CALIB STANDHYD (0002) Area (ha) = 13.68 ID= 1 DT=15.0 min Total Imp(%) = 61.00 Dir. Conn.(%) = 53.00 IMPERVIOUS PERVIOUS (i) Surface Area (ha) = 8.34 5.34 Dep. Storage (mm) = 1.00 5.00 Average Slope (%) = 1.00 2.30 Length (m) = 301.99 40.00 Mannings n = 0.013 0.250 NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP. TRANSFORMED HYETOGRAPH TIME RAIN TIME RAIN ' TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr 0.250 6.33 1.000 106.32 1.750 13.80 2.50 7.09</pre>			0022	(11011117)	0.1001
<pre> CALIB STANDHYD (0002) Area (ha) = 13.68 ID= 1 DT=15.0 min Total Imp(%) = 61.00 Dir. Conn.(%) = 53.00 </pre>					
<pre>STANDHYD (0002) Area (ha)= 13.68 ID= 1 DT=15.0 min Total Imp(%)= 61.00 Dir. Conn.(%)= 53.00 </pre>	CALIB				
<pre> ID= 1 DT=15.0 min Total Imp(%)= 61.00 Dir. Conn.(%)= 53.00 IMPERVIOUS PERVIOUS (i) Surface Area (ha)= 8.34 5.34 Dep. Storage (mm)= 1.00 5.00 Average Slope (%)= 1.00 2.30 Length (m)= 301.99 40.00 Mannings n = 0.013 0.250 NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP. TRANSFORMED HYETOGRAPH TIME RAIN TIME RAIN ' TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr 0.250 6.33 1.000 106.32 1.750 13.80 2.50 7.09</pre>	STANDHYD (0002)	Area (ha)	= 13.68		
IMPERVIOUS PERVIOUS (i) Surface Area (ha) = 8.34 5.34 Dep. Storage (mm) = 1.00 5.00 Average Slope (%) = 1.00 2.30 Length (m) = 301.99 40.00 Mannings n = 0.013 0.250 NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP. TIME RAIN TIME RAIN ' TIME RAIN TIME RAIN hrs mm/hr hrs hrs 0.250 6.33 1.000 106.32 1.750 13.80 2.50	ID= 1 DT=15.0 min	Total Imp(%)	= 61.00	Dir. Conn.(%)= 53.00
Implementation Implementation Surface Area (ha) = 8.34 5.34 Dep. Storage (mm) = 1.00 5.00 Average Slope (%) = 1.00 2.30 Length (m) = 301.99 40.00 Mannings n = 0.013 0.250 NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP. TRANSFORMED HYETOGRAPH TIME RAIN TIME RAIN TIME hrs mm/hr hrs mm/hr hrs mm/hr 0.250 6.33 1.000 106.32 1.750 13.80 2.50 7.09		TMDET	DUTOILS D	EDVITOUS (1)	
Dep. Storage (mm) = 1.00 5.00 Average Slope (%) = 1.00 2.30 Length (m) = 301.99 40.00 Mannings n = 0.013 0.250 NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP. TRANSFORMED HYETOGRAPH TIME RAIN TIME RAIN TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr 0.250 6.33 1.000 106.32 1.750 13.80 2.50 7.09	Surface Area	(ha) = 8	3.34	5.34	
Average Slope (%) = 1.00 2.30 Length (m) = 301.99 40.00 Mannings n = 0.013 0.250 NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP. TRANSFORMED HYETOGRAPH TIME RAIN TIME RAIN ' TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr 0.250 6.33 1.000 106.32 1.750 13.80 2.50 7.09	Dep. Storage	(mm) =	L.00	5.00	
Length (m) = 301.99 40.00 Mannings n = 0.013 0.250 NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP. TRANSFORMED HYETOGRAPH TIME RAIN TIME RAIN ' TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr 0.250 6.33 1.000 106.32 1.750 13.80 2.50 7.09	Average Slope	(%) = 1	L.00	2.30	
Mannings n = 0.013 0.250 NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP. TRANSFORMED HYETOGRAPH TIME RAIN TIME RAIN ' TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr hrs mm/hr 0.250 6.33 1.000 106.32 1.750 13.80 2.50 7.09	Length	(m) = 301	L.99	40.00	
NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP. TRANSFORMED HYETOGRAPH TIME RAIN TIME RAIN TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr 0.250 6.33 1.000 106.32 1.750 13.80 2.50 7.09	Mannings n	= 0.	.013	0.250	
TRANSFORMED HYETOGRAPH TIME RAIN TIME RAIN TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr 0.250 6.33 1.000 106.32 1.750 13.80 2.50 7.09	NOTE: RAIN	FALL WAS TRANSI	FORMED TO	15.0 MIN. TIM	E STEP.
TRANSFORMED HYETOGRAPH TIME RAIN TIME RAIN TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr 0.250 6.33 1.000 106.32 1.750 13.80 2.50 7.09					
TIME RAIN TIME RAIN TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr 0.250 6.33 1.000 106.32 1.750 13.80 2.50 7.09			- TRANSFORM	ED HYETOGRAPH	
0.250 6.33 1.000 106.32 1.750 13.80 2.50 7.09	TIM	E RAIN TI	LME RAIN	I. TIME 1	KAIN TIME RAIN
	0.25	0 6.33 1.0	100 106.32	1 1.750 13	.80 2.50 7.09

DATE: February 2021

	0.500	8.74 1.2 5.20 1.5	50 56.83 00 21.45	3 2.000	10.36 8.39	2.75	6.18 5.49
Max.Eff.In Storage Co Unit Hyd. Unit Hyd. PEAK FLOW TIME TO PE RUNOFF VOL TOTAL RAIN RUNOFF COE (i) CN P CN* (ii) TIME THAN (iii) PEAK	U.750 1 ten.(mm/hr over (min Tpeak (min peak (cms (cms AK (hrs UME (mm FFILCIENT ROCEDURE S = 85.0 STEP (DT) THE STORA FLOW DOES	5.20 1.5)= 106)= 15)= 0)= 1)= 1)= 1)= 65)= 65)= 65 = 0 ELECTED FO Ia = De SHOULD BE GE COEFFIC NOT INCLU	00 21.4 [°] .32 .00 .80 (ii) .00 .07 .36 .00 .55 .55 .55 .98 R PERVIOUS p. Storage SMALLER (IENT. DE BASEFIC	<pre>/ 2.250 63.18 30.00 97.80 (ii) 105.00 0.01 0.22 2.75 39.10 66.55 0.59 S LOSSES: > (Above) DR EQUAL DW IF ANY.</pre>	*TOTAI 1.3 1. 53.2 66.5 0.6	3.00 2.5* 72 (iii) 00 11 55 30	5.49
CALIB STANDHYD (0 ID= 1 DT= 5.0	 021) Ar min To	ea (ha) tal Imp(%)	= 6.05 = 67.00	Dir. Conn	.(%)= 66.	.00	
Surface Ar Dep. Stora Average Sl Length Mannings n	ea (ha ge (mm ope (% (m	IMPER)= 4)= 1)= 1)= 200 = 0.	VIOUS H .05 .00 .00 .83 013	PERVIOUS (i 2.00 5.00 2.00 40.00 0.250)		
Max.Eff.In Storage Co Unit Hyd. Unit Hyd.	ten.(mm/hr over (min eff. (min Tpeak (min peak (cms) = 220) 5) = 2) = 5) = 0	.93 .00 .83 (ii) .00 .28	101.72 10.00 6.72 (ii) 10.00 0.14)		
PEAK FLOW TIME TO PE RUNOFF VOL TOTAL RAIN RUNOFF COE	(cms AK (hrs UME (mm FALL (mm FFICIENT) = 2) = 1) = 65) = 66 = 0	.15 .00 .55 .55 .98	0.42 1.08 39.94 66.55 0.60	*TOTAI 2.36 1.0 56.8 66.5 0.8	LS* 59 (iii) 00 34 55 35	
***** WARNING: (i) CN P CN* (ii) TIME THAN (iii) PEAK	STORAGE CO ROCEDURE S = 88.0 STEP (DT) THE STORA FLOW DOES	EFF. IS SM ELECTED FO Ia = De SHOULD BE GE COEFFIC NOT INCLU	ALLER THAN R PERVIOUS p. Storage SMALLER (IENT. DE BASEFL(N TIME STEP S LOSSES: e (Above) DR EQUAL DW IF ANY.	!		
ADD HYD (0 1 + 2 = 3	 658) 	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)		

	ID1=	1	(0002):	13.68	1.372	1.00	53.11
+	1D2=	2	(0021):	6.05	2.369	1.00	56.84
	ID =	3	(0658):	19.73	3.741	1.00	54.26

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0645	5) OVE	RFLOW IS	OFF			
IN= 2> OUT= 1	LI					
DT= 5.0 min	OUT	FLOW S	STORAGE	1 OT	JTFLOW	STORAGE
	(c	ms)	(ha.m.)	1	(cms)	(ha.m.)
	0.	0000	0.0000	(0.2360	0.6393
	0.	0290	0.3310	(0.3410	0.7100
	0.	0950	0.4595	(0.4450	0.7485
	0.	1680	0.5720	(0.5320	0.7925
		AREA	QPEA	K	TPEAK	R.V.
		(ha)	(cms)	(hrs)	(mm)
INFLOW : ID= 2	(0658)	19.730	э з.	741	1.00	54.26
OUTFLOW: ID= 1	(0645)	19.730	0.	377	3.08	54.11
	PEAK FL	OW REDU	JCTION [O	out/0:	inl(%)= 1(.09

TIME SHIFT OF PEAK FLOW (min)=125.00 MAXIMUM STORAGE USED (ha.m.)= 0.7240

CALIB STANDHYD (0656) ID= 1 DT=15.0 min	Area Total	(ha) = 14.51 Imp(%) = 54.00	Dir. Conn.(%)=	46.00
		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha) =	7.84	6.67	
Dep. Storage	(mm) =	1.00	5.00	
Average Slope	(%) =	1.00	2.30	
Length	(m) =	311.02	40.00	
Mannings n	=	0.013	0.250	

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP.

		TRA	ANSFORMED HYET	OGRAPH	
TIME	RAIN	TIME	RAIN ' TI	ME RAIN 7	TIME RAIN
hrs	mm/hr	hrs	mm/hr ' h	rs mm/hr	hrs mm/hr
0.250	6.33	1.000	106.32 1.75	0 13.80 2.	.50 7.09
0.500	8.74	1.250	56.83 2.00	0 10.36 2.	.75 6.18
0.750	15.20	1.500	21.47 2.25	0 8.39 3.	.00 5.49
Max.Eff.Inten.(m	m/hr)=	106.32	57.84		
over	(min)	15.00	30.00		
Storage Coeff.	(min) =	16.80	(ii) 97.80	(ii)	
Unit Hyd. Tpeak	(min) =	15.00	105.00		
Unit Hyd. peak	(cms) =	0.07	0.01		
				*TOTALS'	ł
PEAK FLOW	(cms) =	1.25	0.25	1.266	(iii)
TIME TO PEAK	(hrs) =	1.00	2.75	1.00	
RUNOFF VOLUME	(mm) =	65.55	37.49	50.39	
FOTAL RAINFALL	(mm) =	66.55	66.55	66.55	
RUNOFF COEFFICIE	NT =	0.98	0.56	0.76	

DATE: February 2021

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

- CN* = 84.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
- THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
- -----| RESERVOIR(0657)| OVERFLOW IS OFF | IN= 2---> OUT= 1 | | DT= 5.0 min | OUTFLOW STORAGE | OUTFLOW STORAGE -----(cms) (ha.m.) | (cms) (ha.m.) 0.0000 0.0000 0.3640 0.2594 0.0190 0.2147 | 0.5250 0.2723 0.2350 0.6840 0.1460 0.2789 0.2590 0.2500 | 0.8190 0.2863 AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW : ID= 2 (0656) 14.510 1.266 1.00 50.39 OUTFLOW: ID= 1 (0657) 14.510 0.609 1.67 50.20

PEAKFLOWREDUCTION[Qout/Qin] (%) = 48.13TIME SHIFT OF PEAK FLOW(min) = 40.00MAXIMUMSTORAGEUSED(ha.m.) = 0.2761

V	V	I	SSSSS	U	U	2	A	L				(v 6.1.2003)
V	V	I	SS	U	U	A	A	L				
V	V	I	SS	U	U	AAA	AAA	L				
V	V	I	SS	U	U	A	A	L				
V	V	I	SSSSS	UUU	JUU	A	A	LLI	LLL			
00	0	TTTTT	TTTTT	Н	Н	Y	Y	М	М	00	00	ТМ
0	0	Т	Т	Н	Η	Y	Y	MM	MM	0	0	
0	0	Т	Т	Η	Η	1	Ľ	М	М	0	0	
00	0	Т	Т	Н	Η	1	Y	М	М	00	00	

Developed and Distributed by Smart City Water Inc Copyright 2007 - 2020 Smart City Water Inc

All rights reserved.

***** DETAILED OUTPUT *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat
Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4ea930-3446elae5bfa\4aa15be0-83b8-4b24-85a4-db5642493933\scen

Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4ea930-3446e1ae5bfa\4aa15be0-83b8-4b24-85a4-db5642493933\scen

DATE: 02-09-2021

USER:

TIME: 01:20:05

VISUAL OTTHYMO OUTPUT:

Snell's Hollow Secondary Plan Area

COMMENTS: _____

DATE: February 2021

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

	RESERVOIR (0642) OVERFLOW IS OFF
** CIMILATION . 6 Chicago 20x 100	DT= 5.0 min OUTFLOW STORAGE OUTFLOW STORAGE
^^ SIMULATION : 6. Chicago Shi LUUyr ^^	(CmS) (na.m.) (CmS) (na.m.)
READ STORM Filename: C:\Users\sfanous\AppD	
ata\Local\Temp\	AREA OPEAK TPEAK R.V.
8766663e-6d3f-4db9-a962-c49127701f86\7eb7ce48	(ha) (cms) (hrs) (mm)
Ptotal= 74.17 mm Comments: Chicago 5 Min Time Step - 3hr - 100yr	INFLOW : ID= 2 (0012) 2.720 1.647 1.00 71.38
	OUTFLOW: ID= 1 (0642) 2.720 0.103 1.75 70.22
TIME RAIN TIME RAIN TIME RAIN TIME RAIN	
hrs mm/hr hrs mm/hr ' hrs mm/hr hrs mm/hr	PEAK FLOW REDUCTION [Qout/Qin](%)= 6.25
0.08 6.49 0.83 33.28 1.58 17.30 2.33 8.35	TIME SHIFT OF PEAK FLOW (min) = 45.00
$0.17 7.05 \mid 0.92 76.62 \mid 1.67 15.34 \mid 2.42 7.92$	MAXIMUM STORAGE USED (ha.m.) = 0.1418
0.25 7.72 1.00 242.53 1.75 13.80 2.50 7.55	
0.42 9.66 $ 1.17$ 54.64 $ 1.92$ $ 11.55$ $ 2.67$ 6.90	
	CALLB
	JEANDRED(0,002) Alea(a) = 1.00
	IMPERVIOUS PERVIOUS (i)
	Surface Area $(ha) = 8.34$ 5.34
	Dep. Storage (mm) = 1.00 5.00
	Average Slope (%)= 1.00 2.30
CALIB	Length (m) = 301.99 40.00
STANDHYD (0012) Area (ha) = 2.72	Mannings n = 0.013 0.250
ID= 1 DT= 5.0 min Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00	
	NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP.
IMPERVIOUS PERVIOUS (i)	
Surface Area $(na) = 2.45$ 0.27	
Dep. storage $(mn) = 1.00$ 5.00	TIME DAIN - TRANSFORMED HYETOGRAPH
Average slope $(\pi) = 1.00 2.00$	TIME RAIN TIME RAIN TIME RAIN TIME RAIN
Manpings p = 0.013 0.250	
Max Eff Inten (mm/hr) = 242.53 141.27	
over (min) 5.00 5.00	
Storage Coeff. (min) = 2.14 (ii) 4.20 (ii)	Max.Eff.Inten.(mm/hr) = 117.48 75.05
Unit Hyd. Tpeak (min) = 5.00 5.00	over (min) 15.00 30.00
Unit Hyd. peak $(cms) = 0.31$ 0.24	Storage Coeff. (min) = 16.80 (ii) 97.80 (ii)
TOTALS	Unit Hyd. Tpeak (min) = 15.00 105.00
PEAK FLOW (cms)= 1.54 0.11 1.647 (iii)	Unit Hyd. peak (cms) = 0.07 0.01
TIME TO PEAK (hrs) = 1.00 1.00 1.00	*TOTALS*
RUNOFF VOLUME (mm) = 73.17 55.29 71.38	PEAK FLOW (cms)= 1.50 0.25 1.519 (iii)
TOTAL RAINFALL (mm) = 74.17 74.17 74.17	TIME TO PEAK (hrs)= 1.00 2.75 1.00
RUNOFF COEFFICIENT = 0.99 0.75 0.96	RUNOFF VOLUME (mm)= 73.17 45.73 60.27
	TOTAL RAINFALL (mm) = 74.17 74.17 74.17
***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!	RUNOFF COEFFICIENT = 0.99 0.62 0.81
(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:	
CN* = 93.6 Ia = Dep. Storage (Above)	(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL	CN* = 85.0 Ia = Dep. Storage (Above)
THAN THE STORAGE COEFFICIENT.	(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB						
STANDHYD (0021) ID= 1 DT= 5.0 min	Area Total 1	(ha) = (%) = 6	6.05 7.00 Dir.	Conn.(%)=	66.00	
		IMPERVIOU	S PERVIO	US (i)		
Surface Area	(ha) =	4.05	2.0	0		
Dep. Storage	(mm) =	1.00	5.0	0		
Average Slope	(%)=	1.00	2.0	0		
Length	(m) =	200.83	40.0	0		
Mannings n	=	0.013	0.25	0		
Max.Eff.Inten.(mm/hr)=	242.53	118.5	8		
over	(min)	5.00	10.0	0		
Storage Coeff.	(min) =	2.72	(ii) 6.4	8 (ii)		
Unit Hyd. Tpeak	: (min) =	5.00	10.0	0		
Unit Hyd. peak	(cms) =	0.29	0.1	4		
				*	TOTALS*	
PEAK FLOW	(cms) =	2.38	0.5	0	2.654 (iii)	
TIME TO PEAK	(hrs) =	1.00	1.0	8	1.00	
RUNOFF VOLUME	(mm) =	73.17	46.6	8	64.16	
TOTAL RAINFALL	(mm) =	74.17	74.1	7	74.17	
RUNOFF COEFFICI	ENT =	0.99	0.6	3	0.87	
 (i) CN PROCEL CN* = (ii) TIME STEP THAN THE (iii) DEAK FLOK 	OURE SELECT 88.0 Ia (DT) SHOU STORAGE CO	TED FOR PE a = Dep. S JLD BE SMA DEFFICIENT	RVIOUS LOSS torage (Ab LLER OR EQU	ES: ove) AL		
 (i) CN PROCEI CN* = (ii) TIME STEF THAN THE (iii) PEAK FLOW 	DURE SELECT 88.0 Ia (DT) SHOU STORAGE CO DOES NOT	TED FOR PE a = Dep. S JLD BE SMA DEFFICIENT INCLUDE B.	RVIOUS LOSS torage (Ab LLER OR EQU ASEFLOW IF	ES: ove) AL ANY.		
(i) CN PROCED CN* = (ii) TIME STEF THAN THE (iii) PEAK FLOW ADD HYD (0658) 1 + 2 = 3 ID1= 1 (00 + ID2= 2 (00)	URE SELECT 88.0 Ia (DT) SHOU STORAGE CC DOES NOT 	TED FOR PEL a = Dep. S JLD BE SMA DEFFICIENT INCLUDE B. AREA QPI (ha) (c) 3.68 1.5 5.05 2.6	RVIOUS LOSS: torage (Ab LLER OR EQU. ASEFLOW IF . EAK TPEA ms) (hrs 19 1.00 54 1.00	ES: ove) AL ANY. (mm) 60.27 64.16		
(i) CN PROCED CN* = (ii) TIME STEF THAN THE (iii) PEAK FLOW ADD HYD (0658) 1 + 2 = 3 ID1= 1 (00 + ID2= 2 (00 ID = 3 (06	URE SELECT 88.0 I a (DT) SHOU STORAGE CC DOES NOT 	TED FOR PE; a = Dep. S a = Dep. S JLD BE SMA: JEFFICTENT INCLUDE B. AREA QP: (ci) (ha) (ci) 3.68 1.5 5.05 2.66 1.5 9.73 4.1 (.13)	RVIOUS LOSS torage (Ab LLER OR EQU. ASEFLOW IF . EAK TPEA ms) (hrs 19 1.00 54 1.00	ES: ove) AL ANY. K R.V. (mm) 60.27 64.16 61.46		
(i) CN PROCED CN* = (ii) TIME STEF THAN THE (iii) PEAK FLOW ADD HYD (0658) 1 + 2 = 3 ID1= 1 (00 + ID2= 2 (00 ========= ID = 3 (06	URE SELECT 88.0 I a (DT) SHOU STORAGE CC DOES NOT 	TED FOR PE: A = Dep. S: JLD BE SMA: DEFFICIENT INCLUDE B. AREA QP: (ha) (ci 3.68 1.5 5.05 2.66 ===================================	RVIOUS LOSS torage (Ab LLER OR EQU. ASEFLOW IF . EAK TPEA ms) (hrs 19 1.00 54 1.00	ES: ove) AL ANY. K R.V. (mm) 60.27 64.16 61.46		
<pre>(i) CN PROCEI CN* = (ii) TIME STEF THAN THE (iii) PEAK FLOW ADD HYD (0658) 1 + 2 = 3 ID1= 1 (00 + ID2= 2 (00 ========= ID = 3 (06 NOTE: PEAK FLC</pre>	URE SELECT 88.0 Ia (DT) SHOU STORAGE CC DOES NOT 	TED FOR PE: a = Dep. S JLD BE SMA: DEFFICIENT INCLUDE B. AREA QP: (ha) (c: 3.68 1.5 5.05 2.6 	RVIOUS LOSS: torage (Ab LLER OR EQU. ASEFLOW IF . EAK TPEA ms) (hrs 19 1.00 54 1.00 73 1.00 ASEFLOWS IF	ES: ove) AL ANY. (mm) 60.27 64.16 61.46 ANY.		
<pre>(i) CN PROCEL CN* = (ii) TIME STEF THAN THE (iii) PEAK FLOW ADD HYD (0658) 1 + 2 = 3 ID1= 1 (000 + ID2= 2 (000 ========== ID = 3 (06 NOTE: PEAK FLC NOTE: PEAK FLC RESERVOIR(0645) IN= 2> OUT= 1 </pre>	URE SELECT 88.0 I a (DT) SHOU STORAGE CC DOES NOT 	TED FOR PE: A = Dep. S JLD BE SMA: DEFFICIENT INCLUDE B. AREA QP: (ha) (c: 3.68 1.5 5.05 2.6 3.73 4.1 INCLUDE B. FLOW IS OF	RVIOUS LOSS: torage (Ab LLER OR EQU. ASEFLOW IF . EAK TPEA ms) (hrs 19 1.00 54 1.00 54 1.00 ASEFLOWS IF F	ES: ove) AL ANY. (mm) 60.27 64.16 61.46 ANY.		
<pre>(i) CN PROCEL CN* = (ii) TIME STEF THAN THE (iii) PEAK FLOW ADD HYD (0658) 1 + 2 = 3 ID1= 1 (000 + ID2= 2 (000 =================================</pre>	URE SELECT 88.0 Ia (DT) SHOU STORAGE CC DOES NOT 	TED FOR PE A = Dep. S JLD BE SMA DEFFICIENT INCLUDE B. AREA QP (ha) (cr 3.68 1.5 5.05 2.6 3.73 4.1 INCLUDE B. FLOW IS OF COW STO	RVIOUS LOSS torage (Ab LLER OR EQU. ASEFLOW IF . EAK TPEA ms) (hrs 19 1.00 54 1.00 54 1.00 54 1.00 ASEFLOWS IF F RAGE O	ES: ove) AL ANY. (mm) 60.27 64.16 61.46 ANY. UTFLOW	STORAGE	
<pre>(i) CN PROCED CN* = (ii) TIME STEF THAN THE (iii) PEAK FLOW ADD HYD (0658) 1 + 2 = 3 ID1= 1 (00 + ID2= 2 (00 + ID2= 2 (00 D = 3 (06 NOTE: PEAK FLC RESERVOIR (0645) IN= 2> OUT= 1 DT= 5.0 min </pre>	URE SELECT 88.0 Ia (DT) SHOU STORAGE CC DOES NOT 	AREA QPI (ha) (ci 3.68 1.5 5.05 2.6 0.73 4.1 INCLUDE B. 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.	RVIOUS LOSS torage (Ab LLER OR EQU. ASEFLOW IF . EAK TPEA ms) (hrs 19 1.00 54 1.00 54 1.00 54 1.00 ASEFLOWS IF F RAGE O .m.)	ES: ove) AL ANY. 	STORAGE (ha.m.)	
<pre>(i) CN PROCED CN* = (ii) TIME STEF THAN THE (iii) PEAK FLOW ADD HYD (0658) 1 + 2 = 3 ID1= 1 (00 + ID2= 2 (00 HID2= 2 (00 EXAMPLE 1 ID = 3 (06 NOTE: PEAK FLC RESERVOIR(0645) IN= 2> OUT= 1 DT= 5.0 min </pre>	URE SELECT 88.0 I a (DT) SHOU STORAGE CC DOES NOT 	TED FOR PE: A = Dep. S JLD BE SMA: DEFFICIENT INCLUDE B. AREA QP: (ha) (cr 3.68 1.5 5.05 2.66 0.73 4.1 INCLUDE B. 	RVIOUS LOSS: torage (Ab) LLER OR EQU. ASEFLOW IF EAK TPEA ms) (hrs 19 1.00 54 1.00 ASEFLOWS IF 73 1.00 ASEFLOWS IF F RAGE 0 0000	ES: ove) AL ANY. (mm) 60.27 64.16 61.46 ANY. (ms) 0.2360	STORAGE (ha.m.) 0.6393	
<pre>(i) CN PROCEL CN* = (ii) TIME STEF THAN THE (iii) PEAK FLOW ADD HYD (0658) 1 + 2 = 3 ID1= 1 (000 + ID2= 2 (00 ============ ID = 3 (06 NOTE: PEAK FLC RESERVOIR(0645) IN= 2> OUT= 1 DT= 5.0 min </pre>	URE SELECT 88.0 Ia (DT) SHOU STORAGE CC DOES NOT 	TED FOR PE: A = Dep. S JLD BE SMA: DEFFICIENT INCLUDE B. AREA QP: AREA QP: AREA (c: AREA	RVIOUS LOSS: torage (Ab LLER OR EQU. ASEFLOW IF ASEFLOW IF EAK TPEA ms) (hrs 19 1.00 54 1.00 F RAGE O' .m.) 0000 3310	ES: ove) AL ANY. (mm) 60.27 64.16 61.46 ANY. UTFLOW (cms) 0.2360 0.3410	STORAGE (ha.m.) 0.6393 0.7100	
<pre>(i) CN PROCEI CN* = (ii) TIME STEF THAN THE (iii) PEAK FLOW ADD HYD (0658) 1 + 2 = 3 ID1= 1 (00 + ID2= 2 (00 ========= ID = 3 (06 NOTE: PEAK FLC RESERVOIR(0645) IN= 2> OUT= 1 DT= 5.0 min </pre>	URE SELECT 88.0 Ia (DT) SHOU STORAGE CC DOES NOT 	TED FOR PE: A = Dep. S A = Dep. S JLD BE SMA: DEFFICIENT INCLUDE B. INCLUDE A. (cr) AREA QP: (cr) (ha) (cr) (cr) 3.68 1.5 5.05 2.6 0.73 4.1 INCLUDE B. FLOW IS OF <td>RVIOUS LOSS: torage (Ab LLER OR EQU. ASEFLOW IF EAK TPEA ms) (hrs 19 1.00 54 1.00 F F RAGE O' </td> <td>ES: ove) AL ANY. (mm) 60.27 64.16 61.46 ANY. UTFLOW (cms) 0.2360 0.3410 0.4450</td> <td>STORAGE (ha.m.) 0.6393 0.7100 0.7485</td> <td></td>	RVIOUS LOSS: torage (Ab LLER OR EQU. ASEFLOW IF EAK TPEA ms) (hrs 19 1.00 54 1.00 F F RAGE O'	ES: ove) AL ANY. (mm) 60.27 64.16 61.46 ANY. UTFLOW (cms) 0.2360 0.3410 0.4450	STORAGE (ha.m.) 0.6393 0.7100 0.7485	
<pre>(i) CN PROCEI CN* = (ii) TIME STEF THAN THE (iii) PEAK FLOW ADD HYD (0658) 1 + 2 = 3 ID1= 1 (000 + ID2= 2 (000 + ID2= 2 (000 EXAMPLE OF CONTERST ID = 3 (064 NOTE: PEAK FLC RESERVOIR (0645) IN= 2> OUT= 1 DT= 5.0 min </pre>	URE SELECT 88.0 Ia (DT) SHOU STORAGE CC DOES NOT 	TED FOR PE: a = Dep. S JLD BE SMA: DEFFICIENT INCLUDE B. AREA QP: (ha) (ci 3.68 1.5 5.05 2.66 9.73 4.1' INCLUDE B. PICOW IS OF COW STO: (b) (ha) (color) (color) <td>RVIOUS LOSS: torage (Ab) LLER OR EQU. . ASEFLOW IF . EAK TPEA ms) (hrs 19 1.00 54 1.00 ASEFLOWS IF F RAGE O' .m.) 0000 3310 4595 </td> <td>ES: ove) AL ANY. (mm) 60.27 64.16 61.46 ANY. UTFLOW (cms) 0.2360 0.3410 0.4450 0.5320</td> <td>STORAGE (ha.m.) 0.6393 0.7100 0.7485 0.7925</td> <td></td>	RVIOUS LOSS: torage (Ab) LLER OR EQU. . ASEFLOW IF . EAK TPEA ms) (hrs 19 1.00 54 1.00 ASEFLOWS IF F RAGE O' .m.) 0000 3310 4595	ES: ove) AL ANY. (mm) 60.27 64.16 61.46 ANY. UTFLOW (cms) 0.2360 0.3410 0.4450 0.5320	STORAGE (ha.m.) 0.6393 0.7100 0.7485 0.7925	
<pre>(i) CN PROCEI CN* = (ii) TIME STEF THAN THE (iii) PEAK FLOW ADD HYD (0658) 1 + 2 = 3 ID1= 1 (00 + ID2= 2 (00 HID2= 2 (00 EXAMPLE 1 ID = 3 (06 NOTE: PEAK FLC RESERVOIR(0645) IN= 2> OUT= 1 DT= 5.0 min </pre>	URE SELECT 88.0 I a (DT) SHOU STORAGE CC DOES NOT 	TED FOR PE: a = Dep. S JLD BE SMA: DEFFICIENT INCLUDE B. AREA QP: (ha) (ci) 3.68 1.5 5.05 2.66 0.73 4.1' INCLUDE B. PION IS OF: SOW STO: s) (ha 0.00 0. 290 0. 580 0.	RVIOUS LOSS: torage (Ab) LLER OR EQU. ASEFLOW IF EAK TPEA ms) (hrs 19 1.00 54 1.00 ASEFLOWS IF 73 1.00 ASEFLOWS IF F RAGE O 0000 3310 4595 5720	ES: ove) AL ANY. (mm) 60.27 64.16 61.46 ANY. (cms) 0.2360 0.3410 0.4450 0.5320	STORAGE (ha.m.) 0.6393 0.7100 0.7485 0.7925	

(ha)

(cms)

(hrs)

(mm)

DATE: February 2021

INFLOW : ID= 2 (OUTFLOW: ID= 1 (0658) 2 0645) 2	L9.730 L9.730	4.173 0.486	1.00 3.00	61.46 61.31	
PE Ti MZ	CAK FLOW ME SHIFT ON XIMUM STOP	REDUCTIO F PEAK FLO RAGE USI	DN [Qout/Qi DW ED (P	.n](%)= 11. (min)=120. ha.m.)= 0.	65 00 7694	
CALIB		()	F 1			
ID= 1 DT=15.0 min	Area Total Imp	(na) = 14 p(%) = 54	.00 Dir.	Conn.(%)=	46.00	
	II	APERVIOUS	PERVIOU	JS (i)		
Surface Area Dep Storage	(ha) = (mm) =	1 00	6.67 5.00)		
Average Slope	(%) =	1.00	2.30)		
Length	(m) =	311.02	40.00)		
Mannings n	=	0.013	0.250)		
NOTE: RAINE	ALL WAS TRA	ANSFORMED	TO 15.0 M	MIN. TIME S	TEP.	
		TRANS	SFORMED HYE	TOGRAPH		
TIME	E RAIN	TIME	RAIN ' 1	IME RAI	N TIME	RAIN
hrs 0 250	s mm/hr) 7 09	hrs r	nm/hr ' 748 17	hrs mm/h 750 15 48	r hrs	mm/hr 7 94
0.500	9.78	1.250	53.69 2.0	00 11.61	2.75	6.91
0.750	17.05	1.500 2	24.11 2.2	250 9.39	3.00	6.14
Max.Eff.Inten.(m	nm/hr)=	117.48	68.99)		
over	(min)	15.00	30.00) (::)		
Unit Hyd. Tpeak	(min) =	15.00	105.00) (11)		
Unit Hyd. peak	(cms) =	0.07	0.01			
PEAK FLOW	(cms) =	1 38	0.30	*T	OTALS* 1 402 (iii)	
TIME TO PEAK	(hrs) =	1.00	2.75	5	1.00	
RUNOFF VOLUME	(mm) =	73.17	43.98	3	57.40	
TOTAL RAINFALL RUNOFF COEFFICIE	(mm) =	/4.1/	/4.1/)	/4.1/	
(i) CN PROCEDU	JRE SELECTEI) FOR PERV	/IOUS LOSSE	ls:		
$CN^* = 8$	34.0 Ia =	= Dep. Sto	orage (Abo	ove)		
(11) TIME STEP THAN THE S	(DT) SHOULD STORAGE COED	FICIENT.	JER OR EQUA	11		
(iii) PEAK FLOW	DOES NOT IN	ICLUDE BAS	SEFLOW IF P	NY.		
RESERVOIR(0657)	OVERFL	DW IS OFF				
IN= 2> OUT= 1						
DT= 5.0 min	OUTFLO	V STORA	AGE OU	UTFLOW S	TORAGE	
	0.0000	0.0	000 0	.3640	0.2594	
	0.0190	0.2	L47 C	.5250	0.2723	
	0.1460		350 C).6840).8190	0.2789	
	0.2000	, 0.2.			0.2000	
		AREA	QPEAK	TPEAK	R.V.	

DATE: February 2021

(ha) (cms) (hrs) (mm) INFLOW: ID= 2 (0656) 14.510 1.402 1.00 57.40 OUTFLOW: ID= 1 (0657) 14.510 0.776 1.58 57.20 PEAK FLOW REDUCTION [Qout/Qin] (%)= 55.33 TIME SHIFT OF PEAK FLOW (min)= 35.00 MAXIMUM STORAGE USED (ha.m.)= 0.2842	0.25 0.50 0.75 1.00 1.25 1.50 1.75	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2.00 2.25 2.50 2.75 3.00 3.25 3.50	12.24 3 12.24 4 33.12 4 33.12 4 9.36 4 9.36 5 5.04 5	.75 5.04 .00 2.88 .25 2.88 .50 1.44 .75 1.44 .00 0.72 .25 0.72	5.50 5.75 6.00 6.25 	0.72 0.72 0.72 0.72
V V I SSSSS U U A L (v 6.1.2003) V V I SS U U A A L V V I SS U U AAAAA L	CALIB STANDHYD (0012) ID= 1 DT= 5.0 min	Area Total I	(ha) = mp(%) = 9	2.72 90.00 Dir.	Conn.(%)=	90.00	
V V I SS U U A A L VV I SSSSS UUUUU A A LLLLL	Surface Area Dep. Storage	(ha) = (mm) =	IMPERVIOU 2.45 1.00	JS PERVIO 0.2 5.0	US (i) 7 0		
OOO TTTTT TTTTT H H Y Y M M OOO TM O O T T H H Y Y MM MM O O O O T T H H Y M M O O O O T T H H Y M M O O	Average Slope Length Mannings n	(왕) = (m) = =	1.00 134.66 0.013	2.0 40.0 0.25	0 0 0		
Developed and Distributed by Smart City Water Inc Copyright 2007 - 2020 Smart City Water Inc All rights reserved.	NOTE: RAINE	TALL WAS T	RANSFORME	D TO 5.0 1	MIN. TIME SI	ΈΡ.	
			TRA	ANSFORMED HY	ETOGRAPH	-	
	TIME	E RAIN	TIME	RAIN	TIME RAIN	TIME	RAIN
***** DETAILED OUTPUT *****	hrs	s mm/hr	hrs	mm/hr '	hrs mm/hr	hrs	mm/hr
	0.083		1 1 750	4.32 3.	230 9.36	4.83	0.72
Input filename. C.\Program Files (x86)\Visual OTTHYMO 6 1\VO2\voin dat	0.107	0.00	1 1 833	12 24 3	417 5 04	1 5 00	0.72
Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e-	0.333	0.72	1 1.917	12.24 3.	500 5.04	1 5.08	0.72
a930-3446e1ae5bfa\f14a78eb-5ada-4479-821d-47d1091e03fe\scen	0.417	0.72	2.000	12.24 3.	583 5.04	5.17	0.72
Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e-	0.500	0.72	2.083	12.24 3.	667 5.04	5.25	0.72
a930-3446e1ae5bfa\f14a78eb-5ada-4479-821d-47d1091e03fe\scen	0.583	3 0.72	2.167	12.24 3.	750 5.04	5.33	0.72
	0.667	0.72	2.250	12.24 3.	833 2.88	5.42	0.72
	0.750	0.72	2.333	33.12 3.	917 2.88	5.50	0.72
DATE: 02-09-2021 TIME: 01:20:06	0.833	3 0.72	2.417	33.12 4.	2.88	5.58	0.72
	0.917	0.72	2.500	33.12 4.	2.88	5.67	0.72
USER:	1.000	0.72	2.583	33.12 4.	16/ 2.88	5./5	0.72
	1.003	0.72	2.007	33 12 4.	230 2.00	1 5 92	0.72
	1 250	0.72	1 2 833	9 36 1 4	417 1 44	1 6 00	0.72
COMMENTS:	1.333	4.32	2.917	9.36 4.	500 1.44	6.08	0.72
	1.417	4.32	3.000	9.36 4.	583 1.44	6.17	0.72
	1.500	4.32	3.083	9.36 4.	667 1.44	6.25	0.72
	1.583	4.32	3.167	9.36 4.	750 1.44	1	
		(1	22.10	~ · · ·	<u>^</u>		
	Max.Eff.Inten.(n	m/hr) =	33.12	24.9	9		
^^ SIMULATION : /. AES ONT ZYR **	over Storage Coeff	(min) (min) -	5.00	(11) 10.0	U 1 (ii)		
	Unit Hyd Theak	(min) =	4.75	(11) 9.3	1 (11) 1		
	Unit Hyd. peak	(cms) =	0.22	0.1	2		
	till ingen pour	, . ,		0.1	*TC	TALS*	
READ STORM Filename: C:\Users\sfanous\AppD	PEAK FLOW	(cms) =	0.22	0.0	2 0	.241 (iii)
ata\Local\Temp\	TIME TO PEAK	(hrs) =	2.75	2.7	5	2.75	
8766663e-6d3f-4db9-a962-c49127701f86\77df6b23	RUNOFF VOLUME	(mm) =	35.00	19.8	7 3	3.49	
Ptotal= 36.00 mm Comments: 2yr/6hr	TOTAL RAINFALL	(mm) =	36.00	36.0	0 3	6.00	
	RUNOFF COEFFICIE	ENT =	0.97	0.5	5	0.93	
TIME RAIN TIME RAIN TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr	***** WARNING: STORAG	GE COEFF.	IS SMALLE	CR THAN TIME	STEP!		

 (i) CN PROCEDURE CN★ = 93. (ii) TIME STEP (D' THAN THE STON (iii) PEAK FLOW DON 	SELECTED FOR PER 5 IA = Dep. St 7) SHOULD BE SMAL RAGE COEFFICIENT. 3S NOT INCLUDE BA	VIOUS LOSSES: orage (Above) LER OR EQUAL SEFLOW IF ANY.	
RESERVOIR(0642) IN= 2> OUT= 1 DT= 5.0 min	OVERFLOW IS OFF OUTFLOW STOR (cms) (ha. 0.0000 0.0 0.0050 0.0 0.0200 0.0 0.0360 0.1 AREA	AGE OUTFLOW m.) (cms) 000 0.0510 617 0.0730 820 0.0960 003 0.1150 OPEAK TPEAK	STORAGE (ha.m.) 0.1120 0.1266 0.1376 0.1490 R.V.
INFLOW : ID= 2 (00: OUTFLOW: ID= 1 (064 PEAK TIME MAXIN	(ha) (2) 2.720 (2) 2.720 FLOW REDUCTI SHIFT OF PEAK FL MUM STORAGE US	(cms) (hrs) 0.241 2.7 0.017 4.3 ON [Qout/Qin](%)= OW (min)= ED (ha.m.)=	(mm) 5 33.49 3 32.33 7.04 95.00 0.0780
CALIB STANDHYD (0002) 2 ID= 1 DT=15.0 min 5	Area (ha)= 13 Cotal Imp(%)= 61	.68 .00 Dir. Conn.(⁴	ზ)= 53.00
Surface Area (1 Dep. Storage (r Average Slope Length Mannings n	IMPERVIOUS ma) = 8.34 mm) = 1.00 (%) = 1.00 (m) = 301.99 = 0.013	PERVIOUS (i) 5.34 5.00 2.30 40.00 0.250	
Max.Eff.Inten.(mm/h over (m: Storage Coeff. (m: Unit Hyd. Tpeak (m: Unit Hyd. peak (cr	nr) = 33.12 n) 15.00 n) = 16.80 (n) = 15.00 ns) = 0.07	21.19 30.00 ii) 97.80 (ii) 105.00 0.01	
PEAK FLOW (cr TIME TO PEAK (h; RUNOFF VOLUME (r TOTAL RAINFALL (r RUNOFF COEFFICIENT	$\begin{array}{llllllllllllllllllllllllllllllllllll$	0.08 4.25 14.69 36.00 0.41	*TOTALS* 0.604 (iii) 2.75 25.45 36.00 0.71
 (i) CN PROCEDURE CN* = 85.0 (ii) TIME STEP (D THAN THE STOP (iii) PEAK FLOW DOP 	SELECTED FOR PER) Ia = Dep. St) SHOULD BE SMAL RAGE COEFFICIENT. S NOT INCLUDE BA	VIOUS LOSSES: orage (Above) LER OR EQUAL SEFLOW IF ANY.	

DATE: February 2021

Surface Area Dep. Storage Average Slope Length Mannings n	(ha) = (mm) = (%) = (m) = =	IMPERVIOU 4.05 1.00 1.00 200.83 0.013	S PE	ERVIOUS (i) 2.00 5.00 2.00 40.00 0.250			
NOTE: RAINF?	ALL WAS T	RANSFORME	D TO	5.0 MIN. T	IME STEP.		
TIME hrs 0.083 0.167 0.250 0.333 0.417 0.500 0.583 0.667 0.750 0.833 0.917 1.000 1.083 1.167 1.250 0.333 1.417 1.500	RAIN mm/hr 0.00 0.72 0.72 0.72 0.72 0.72 0.72 0.72	TRA TIME hrs 1.667 1.750 1.833 1.917 2.000 2.083 2.167 2.250 2.333 2.417 2.500 2.583 2.667 2.750 2.750 2.833 2.917 3.000 3.083	NSFORME RAIN mm/hr 4.32 4.32 12.24 12.24 12.24 12.24 12.24 12.24 12.24 12.24 33.12 33.12 33.12 33.12 33.12 33.12 33.12 9.36 9.36 9.36	D HYETOGRA ' TIME ' hrs 3.250 3.333 3.417 3.500 3.583 3.667 3.750 3.833 3.917 4.000 4.083 4.167 4.250 4.333 4.417 4.500 4.583 4.67	PH RAIN mm/hr 9.36 5.04 5.04 5.04 5.04 5.04 2.88 2.88 2.88 2.88 2.88 2.88 2.88 1.44 1.44 1.44 1.44 1.44	TIME hrs 4.83 4.92 5.00 5.08 5.17 5.25 5.53 5.42 5.50 5.58 5.75 5.83 5.92 6.00 6.08 6.17 6.25	RAII mm/h. 0.72 0.72 0.72 0.72 0.72 0.72 0.72 0.7
Max.Eff.Inten.(mu over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICIEN (i) CN PROCEDUN CN* = 81 (ii) TIME STEP THAN THE S' (iii) PEAK FLOW N	n/hr) = (min) = (min) = (cms) = (hrs) = (hrs) = (hrs) = (mm) = (mm) = NT = RE SELECT: 8.0 Ia (DT) SHOU: TORAGE CO: DOES NOT	33.12 5.00 6.04 5.00 0.19 0.37 2.75 35.00 36.00 0.97 ED FOR PE = Dep. S LD BE SMA EFFICIENT INCLUDE B	(ii) RVIOUS torage LLER OF ASEFLOW	18.71 20.00 19.84 (ii) 20.00 0.06 0.07 2.92 14.98 36.00 0.42 LOSSES: (Above) & EQUAL	*TOTAL 0.42 2.7 28.1 36.0 0.7	S* 0 (iii) 5 9 0 8	

QPEAK

TPEAK

R.V.

45

ID1= 1 (00 + ID2= 2 (00	(ha) 02): 13.68 21): 6.05	(cms) 0.604 0.420	(hrs) 2.75 2.75	(mm) 25.45 28.19	
ID = 3 (06	58): 19.73	1.024	2.75	26.29	
NOTE: PEAK FLO	WS DO NOT INC	LUDE BASEFL	OWS IF AN	Y.	
RESERVOIR(0645) IN= 2> OUT= 1 DT= 5.0 min	OVERFLOW OUTFLOW (cms) 0.0000	I IS OFF STORAGE (ha.m.) 0.0000	OUTF: (cm. 0.2	LOW s) 360	STORAGE (ha.m.) 0.6393
	0.0290 0.0950 0.1680	0.3310 0.4595 0.5720	0.3 0.4 0.5	410 450 320	0.7100 0.7485 0.7925
INFLOW : ID= 2 (OUTFLOW: ID= 1 (A (0658) 19 0645) 19	REA QPE (ha) (cm. 730 1 730 0	AK TP s) (h .024 .073	EAK rs) 2.75 5.92	R.V. (mm) 26.29 26.14
P: T M	EAK FLOW IME SHIFT OF AXIMUM STORA	REDUCTION [4 PEAK FLOW AGE USED	Qout/Qin] (m. (ha.)	(%)= 7 in)=190 m.)= 0	.16 .00 .4174
CALIB STANDHYD (0656) ID= 1 DT=15.0 min	Area (h Total Imp(na)= 14.51 %)= 54.00	Dir. Co:	nn.(%)=	46.00
Surface Area Dep. Storage Average Slope Length Mannings n	IMF (ha) = (mm) = (%) = (m) = 3 =	PERVIOUS 7.84 1.00 1.00 911.02 0.013	PERVIOUS 6.67 5.00 2.30 40.00 0.250	(i)	
Max.Eff.Inten.(over Storage Coeff. Unit Hyd. Tpeak	<pre>mm/hr) = (min) (min) = (min) = (min) =</pre>	33.12 15.00 16.80 (ii) 15.00	19.40 30.00 97.80 (. 105.00	ii)	
DNIT HYA. PEAK PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICI	(cms) = (hrs) = (hrs) = (mm) = (mm) = ENT =	0.54 2.75 35.00 36.00 0.97	0.01 0.09 4.25 13.81 36.00 0.38	*'	TOTALS* 0.558 (iii) 2.75 23.55 36.00 0.65
 (i) CN PROCEDI CN* = (ii) TIME STEP THAN THE : (iii) PEAK FLOW 	URE SELECTED 84.0 Ia = (DT) SHOULD STORAGE COEFF DOES NOT INC	FOR PERVIOU Dep. Storag BE SMALLER TICIENT. LUDE BASEFLO	S LOSSES: e (Above DR EQUAL DW IF ANY)	

DATE: February 2021

<pre>1 IN 22> OUT = 1 DT = 5.0 min OUTFLOW STORAGE OUTFLOW STORAGE</pre>
AREA QPEAK TPEAK R.V. (ha) (nm) INFLOW: ID = 2 (0656) 14.510 0.558 2.75 23.55 OUTFLOW: ID = 1 (0657) 14.510 0.117 4.67 23.36 FEAK FLOW REDUCTION [Qout/Qin] (%) = 20.93 TIME SHIFT OF PEAK FLOW (min) = 115.00 MAXIMUM STORAGE USED (ha.m.) = 0.2304
<pre>PEAK FLOW REDUCTION [Quut/Qin] (%) = 20.93 TIME SHIFT OF PEAK FLOW (min)=115.00 (ha.m.)= 0.2304 </pre>
<pre>V V I SSSS U U A L (v 6.1.2003) V V I SS U U AAAAA L V V I SS U U AAAAA L VV I SSSS UUUUU A A LLLLL OOO TTTTT TTTTT H H Y Y M M OOO TM O O T T H H H YY M M O O OOO T T H H H Y M M O O OOO T T T H H H Y M M OOO Developed and Distributed by Smart City Water Inc Copyright 2007 - 2020 Smart City Water Inc All rights reserved. ***** DETAILED OUTPUT***** Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\V02\voin.dat Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446elae5bfa\dee187a0-cfd3-4695-94f4-c29e544625fd\scen Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446elae5bfa\dee187a0-cfd3-4695-94f4-c29e544625fd\scen Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446elae5bfa\dee187a0-cfd3-4695-94f4-c29e544625fd\scen Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446elae5bfa\dee187a0-cfd3-4695-94f4-c29e544625fd\scen Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446elae5bfa\dee187a0-cfd3-4695-94f4-c29e544625fd\scen DATE: 02-09-2021 TIME: 01:20:06</pre>
<pre>V V I SSSSS U U A A L (v 6.1.2003) V V I SS U U AAAAA L V V I SS U U AAAAA L VV I SSSSS UUUUUU A A LLLLL OOO TTTTT TTTTT H H Y Y M M OOO TM O O T T T H H Y Y MM MM O O O O T T T H H Y M M O O OOO T T T H H Y M M OOO Developed and Distributed by Smart City Water Inc Copyright 2007 - 2020 Smart City Water Inc All rights reserved. ***** D E T A I L E D O U T P U T ***** Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\V02\voin.dat Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446elae5bfa\deel87a0-cfd3-4695-94f4-c29e544625fd\scen Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446elae5bfa\deel87a0-cfd3-4695-94f4-c29e544625fd\scen Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446elae5bfa\deel87a0-cfd3-4695-94f4-c29e544625fd\scen Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446elae5bfa\deel87a0-cfd3-4695-94f4-c29e544625fd\scen DATE: 02-09-2021 TIME: 01:20:06</pre>
<pre>000 TTTTT TTTTT H H Y Y M M 000 TM 0 0 T T T H H YY MMMM 0 0 000 T T H H Y M M 000 Developed and Distributed by Smart City Water Inc Copyright 2007 - 2020 Smart City Water Inc All rights reserved. ***** DETAILED 0UTPUT***** Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\V02\voin.dat Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446elae5bfa\deel87a0-cfd3-4695-94f4-c29e544625fd\scen Summary filename: C:\Users\sfanous\AppDat4Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446elae5bfa\deel87a0-cfd3-4695-94f4-c29e544625fd\scen Summary filename: C:\Users\sfanous\AppDat4Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446elae5bfa\deel87a0-cfd3-4695-94f4-c29e544625fd\scen Summary filename: C:\Users\sfanous\AppDat4Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446elae5bfa\deel87a0-cfd3-4695-94f4-c29e544625fd\scen DATE: 02-09-2021 TIME: 01:20:06</pre>
<pre>***** DETAILED OUTPUT**** Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446elae5bfa\dee187a0-cfd3-4695-94f4-c29e544625fd\scen Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446elae5bfa\dee187a0-cfd3-4695-94f4-c29e544625fd\scen DATE: 02-09-2021 TIME: 01:20:06 JSER:</pre>
Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446e1ae5bfa\dee187a0-cfd3-4695-94f4-c29e544625fd\scen Summary filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e- a930-3446e1ae5bfa\dee187a0-cfd3-4695-94f4-c29e544625fd\scen DATE: 02-09-2021 TIME: 01:20:06 JSER:
DATE: 02-09-2021 TIME: 01:20:06
JSER:
COMMENTS:

** SIMULATION : 8. AES 6hr 5yr **

READ STORM Ptotal= 47.81 mm	Filename: Comments:	C:\Users\sfa ata\Local\Te 8766663e-6d 5yr/6hr	anous\AppD emp\ 3f-4db9-a962-c495	127701f86\e1d4db76
TIME hrs 0.25 0.50 0.75 1.00 1.25 1.50 1.75	RAIN T mm/hr 0.00 2 0.96 2 0.96 2 0.96 2 0.96 3 5.74 3 5.74 3	IME RAIN hrs mm/hr .00 16.25 .25 16.25 .50 43.98 .00 12.43 .25 12.43 .50 6.69	' TIME RAIN ' hrs mm/hu 3.75 6.69 4.00 3.82 4.25 3.82 4.50 1.91 4.75 1.91 5.00 0.96 5.25 0.96	N TIME RAIN c hrs mm/hr 5.50 0.96 5.75 0.96 6.00 0.96 6.25 0.96
CALIB STANDHYD (0012) ID= 1 DT= 5.0 min	Area (ha Total Imp(%)= 2.72)= 90.00	Dir. Conn.(%)=	90.00
Surface Area Dep. Storage Average Slope Length Mannings n	IMPE (ha) = (mm) = (%) = (m) = 13 = 0	RVIOUS P1 2.45 1.00 1.00 4.66 .013	ERVIOUS (1) 0.27 5.00 2.00 40.00 0.250	
NOTE: RAINFA	LL WAS TRANS	FORMED TO	5.0 MIN. TIME ST	TEP.
		- TRANSFORM	ED HYETOGRAPH	
TIME	RAIN T	IME RAIN	' TIME RAIN	N TIME RAIN
0 083		667 5 74	3 250 12 43	
0.003	0.00 1	750 5.74	1 3 333 6 69	4 92 0 96
0.250	0.00 1.	833 16.25	3.417 6.69	5.00 0.96
0.333	0.96 1.	917 16.25	3.500 6.69	5.08 0.96
0.417	0.96 2.	000 16.25	3.583 6.69	5.17 0.96
0.500	0.96 2.	083 16.25	3.667 6.69	5.25 0.96
0.583	0.96 2.	167 16.25	3.750 6.69	5.33 0.96
0.667	0.96 2.	250 16.25	3.833 3.82	5.42 0.96
0.750	0.96 2.	333 43.98	3.917 3.82	5.50 0.96
0.833	0.96 2.	417 43.98	4.000 3.82	5.58 0.96
0.917	0.96 2.	500 43.98	4.083 3.82	5.67 0.96
1.000	0.96 2.	583 43.98	4.167 3.82	5.75 0.96
1.083	0.96 2.	667 43.98	4.250 3.82	5.83 0.96
1.167	0.96 2.	750 43.98	4.333 1.91	5.92 0.96
1.250	0.96 2.	833 12.43	4.417 1.91	6.00 0.96
1.333	5./4 2.	91/ 12.43	4.500 1.91	1 6.08 0.96
1.41/	5.74 3.	000 12.43	4.383 1.91	1 0.17 U.96
1.583	5.74 3.	167 12.43	4.750 1.91	0.20 0.90
Max.Eff.Inten.(mm	/hr)= 4	3.98	36.63	
over (min)	5.00	10.00	
Ctorrage Cooff /	minle	1 24 (111)	0 21 (11)	

DATE: February 2021

Unit Hyd. Tpeak	(min) =	5.00	10.00		
Unit Hyd. peak	(cms) =	0.24	0.13		
				TOTALS	
PEAK FLOW	(cms) =	0.30	0.03	0.324 (:	iii)
TIME TO PEAK	(hrs) =	2.75	2.75	2.75	
RUNOFF VOLUME	(mm) =	46.81	30.45	45.17	
TOTAL RAINFALL	(mm) =	47.81	47.81	47.81	
RUNOFF COEFFICIE	ENT =	0.98	0.64	0.94	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
- CN* = 93.6 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----| RESERVOIR(0642)| OVERFLOW IS OFF | IN= 2---> OUT= 1 | | DT= 5.0 min | OUTFLOW STORAGE | OUTFLOW STORAGE _____ (cms) (ha.m.) | (cms) (ha.m.) 0.0000 0.0000 | 0.0510 0.1120 0.0050 0.0617 | 0.0730 0.1266 0.0200 0.0820 | 0.0960 0.1376 0.0360 0.1003 | 0.1150 0.1490 AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) 2.75 INFLOW : ID= 2 (0012) 2.720 0.324 45.17 OUTFLOW: ID= 1 (0642) 2.720 0.035 3.83 44.02

PEAK FLOW REDUCTION [Qout/Qin](%) = 10.64 TIME SHIFT OF PEAK FLOW (min) = 65.00 MAXIMUM STORAGE USED (ha.m.) = 0.0986

CALIB					
STANDHYD (0002)	Area	(ha) =	13.68		
ID= 1 DT=15.0 min	Total	Imp(%)=	61.00	Dir. Conn.(%)=	53.00

		IMPERVIOU	JS	PERVIOUS	(i)		
Surface Area	(ha) =	8.34		5.34			
Dep. Storage	(mm) =	1.00		5.00			
Average Slope	(%) =	1.00		2.30			
Length	(m) =	301.99		40.00			
Mannings n	=	0.013		0.250			
Max.Eff.Inten.(m	m/hr)=	43.98		33.45			
over	(min)	15.00		30.00			
Storage Coeff.	(min) =	16.80	(ii)	97.80	(ii)		
Unit Hyd. Tpeak	(min) =	15.00		105.00			
Unit Hyd. peak	(cms) =	0.07		0.01			
						TOTALS	
PEAK FLOW	(cms) =	0.79		0.12		0.807	(iii)
TIME TO PEAK	(hrs) =	2.75		4.25		2.75	
RUNOFF VOLUME	(mm) =	46.81		23.58		35.89	
TOTAL RAINFALL	(mm) =	47.81		47.81		47.81	
RUNOFF COEFFICIE	NT =	0.98		0.49		0.75	

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	REA QPEAK TPEAK R.V. ha) (cms) (hrs) (mm) .68 0.807 2.75 35.89 .05 0.587 2.75 39.09 	
CALIB ADD HYD (0658) CALIB 1 + 2 = 3 A CALIB 1 + 2 = 3 A CD 1 DT= 5.0 min Total Imp(%) = 67.00 Dir. Conn.(%) = 66.00 IDI= 1 (0002): 13 ID = 1 DT= 5.0 min Total Imp(%) = 67.00 Dir. Conn.(%) = 66.00 + ID2= 2 (0021): 6 IMPERVIOUS PERVIOUS (i) ID = 3 (0658): 19 Surface Area (ha) = 4.05 2.00 ID = 3 (0658): 19 Dep. Storage (mm) = 1.00 5.00 NOTE: PEAK FLOWS DO NOT Average Slope (%) = 1.00 2.00	REA QPEAK TPEAK R.V. ha) (cms) (hrs) (mm) .68 0.807 2.75 35.89 .05 0.587 2.75 39.09 	
CALLB	A) (Cms) (Hns) (Hns) .68 0.807 2.75 35.89 .05 0.587 2.75 39.09 	
IMPERVIOUS PERVIOUS (i) ID = 3 (0658): 19 Surface Area (ha) = 4.05 2.00 Dep. Storage (mm) = 1.00 5.00 Average Slope (%) = 1.00 2.00 Length (m) = 200.83 40.00 Manpings n = 0.013 0.250	.73 1.394 2.75 36.87 INCLUDE BASEFLOWS IF ANY.	
Surface Area (na)= 4.05 2.00 Dep. Storage (mm)= 1.00 5.00 NOTE: PEAK FLOWS DO NOT Average Slope (%)= 1.00 2.00	INCLUDE BASEFLOWS IF ANY.	
Length (m) = 200.83 40.00	LOW IS OFF	
IN= 2> OUT= 1		
NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP. DT= 5.0 min OUTFL (cms	OW STORAGE OUTFLOW STORAGE) (ha.m.) (cms) (ha.m.)	
0.00 0.00 TIME RAIN TIME RAIN 0.00 TIME RAIN TIME RAIN 0.00 TIME RAIN TIME RAIN 0.00 IME RAIN TIME RAIN 0.00 hrs mm/hr 0.09 0.166 0.167 0.00 1 1.625 1 3.500 6.69 5.08 0.96 INFLOW : ID= 2 0.0658) 0.01FLOW: ID= 1 0.0645) 0.0533 <td colspa="</td"><td>00 0.0000 0.2300 0.3310 0.3410 0.7100 50 0.4595 0.4450 0.7485 80 0.5720 0.5320 0.7925 AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) 19.730 1.394 2.75 36.87 19.730 0.147 5.17 36.72 REDUCTION [Qout/Qin] (%) = 10.51 OF PEAK FLOW (min)=145.00 ORAGE USED (ha.m.) = 0.5390</td></td>	<td>00 0.0000 0.2300 0.3310 0.3410 0.7100 50 0.4595 0.4450 0.7485 80 0.5720 0.5320 0.7925 AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) 19.730 1.394 2.75 36.87 19.730 0.147 5.17 36.72 REDUCTION [Qout/Qin] (%) = 10.51 OF PEAK FLOW (min)=145.00 ORAGE USED (ha.m.) = 0.5390</td>	00 0.0000 0.2300 0.3310 0.3410 0.7100 50 0.4595 0.4450 0.7485 80 0.5720 0.5320 0.7925 AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) 19.730 1.394 2.75 36.87 19.730 0.147 5.17 36.72 REDUCTION [Qout/Qin] (%) = 10.51 OF PEAK FLOW (min)=145.00 ORAGE USED (ha.m.) = 0.5390
1.000 0.96 2.583 43.98 4.167 3.82 5.75 0.96 1.083 0.96 2.667 43.98 4.250 3.82 5.83 0.96 CALIB 1.167 0.96 2.750 43.98 4.333 1.91 5.92 0.96 STANDHYD (0656) Area 1.250 0.96 2.833 12.43 4.417 1.91 6.00 0.96 ID=1 DT=15.0 min Total I 1.333 5.74 2.917 12.43 4.500 1.91 6.08 0.96	(ha) = 14.51 mp(%) = 54.00 Dir. Conn.(%) = 46.00	
1.417 5.74 3.000 12.43 4.583 1.91 6.17 0.96 1.500 5.74 3.083 12.43 4.667 1.91 6.25 0.96 Surface Area (ha)= 1.583 5.74 3.167 12.43 4.750 1.91 6.25 0.96 Surface Area (ha)= Dep. Storage (mm)= Average Slope (%)= 0.96 0.96 0.96	IMPERVIOUS PERVIOUS (i) 7.84 6.67 1.00 5.00 1.00 2.30	
Max.Eff.Inten.(mm/hr) = 43.98 29.52 Length (m) = over (min) 5.00 20.00 Mannings n =	311.02 40.00 0.013 0.250	
Storage Coeff. (min) = 5.39 (ii) 16.89 (ii) Unit Hyd. Tpeak (min) = 5.00 20.00 Unit Hyd. peak (cms) = 0.21 0.06 *TOTALS* Storage Coeff. (min) =	43.98 30.98 15.00 30.00 16.80 (ji) 97.80 (ji)	
PEAK FLOW (cms) = 0.49 0.11 0.587 (iii) Unit Hyd. Tpeak (min) = TIME TO PEAK (hrs) = 2.75 2.92 2.75 Unit Hyd. peak (cms) = BUNOFF VOLUME (mm) = 46.81 24.10 39.09 0.9	15.00 105.00 0.07 0.01	
TOTAL RAINFALL (mm) = 47.81 47.81 47.81 PEAK FLOW (cms) = RUNOFF COEFFICIENT = 0.98 0.50 0.82 TIME TO PEAK (hrs) = RUNOFF VOLUME (mm) = TOTAL RAINFALL (mm) =	0.72 0.14 0.748 (iii) 2.75 4.25 2.75 46.81 22.38 33.61	

DATE: February 2021

DATE: February 2021

 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 84.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL 	COMMENTS:				
THAN THE STORAGE COEFFICIENT.					
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.					
	****	***************************************			
	** SIMULATION : 9. A	AES 6nr lUyr **			
		~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~			
KESEKVOIR(0657) OVERILOW IS OFF					
IN- 2					
(cms) (ba m) (cms) (ba m)	L READ STORM	Filename: C:\Users\sfanous\AnnD			
		atallocallTemp			
		$87666663e - 6d3f - 4db9 - a962 - c49127701f86\ce5cfdff$			
0.1460 0.2350 0.6840 0.2789	Ptotal= 55.69 mm	Comments: 10vr/6hr			
0.2590 0.2500 0.8190 0.2863					
	TTME	RAIN I TIME RAIN I TIME RAIN I TIME RAIN			
AREA OPEAK TPEAK R.V.	hrs	mm/hr hrs mm/hr hrs mm/hr hrs mm/hr			
(ha) (cms) (hrs) (mm)	0.25	0.00 2.00 18.94 3.75 7.80 5.50 1.11			
INFLOW : ID= 2 (0656) 14.510 0.748 2.75 33.61	0.50	1.11 2.25 18.94 4.00 4.46 5.75 1.11			
OUTFLOW: ID= 1 (0657) 14.510 0.248 3.92 33.41	0.75	1.11 2.50 51.24 4.25 4.46 6.00 1.11			
	1.00	1.11 2.75 51.24 4.50 2.23 6.25 1.11			
PEAK FLOW REDUCTION [Qout/Qin] (%) = 33.23	1.25	1.11 3.00 14.48 4.75 2.23			
TIME SHIFT OF PEAK FLOW (min) = 70.00	1.50	6.68 3.25 14.48 5.00 1.11			
MAXIMUM STORAGE USED (ha.m.) = 0.2486	1.75 6.68 3.50 7.80 5.25 1.11				
V V I SS U U AAAAA L V V I SS U U A A L VV I SSSS UUUUU A A LLLLL OOO TTTTT TTTTT H H Y Y M M OOO TM O O T T H H Y Y MM MM O O O O T T H H Y M M M O O OOO T T H H Y M M OOO	Surface Area Dep. Storage Average Slope Length Mannings n	IMPERVIOUS PERVIOUS (i) $(ha) =$ 2.45 0.27 $(mm) =$ 1.00 5.00 $(\$) =$ 1.00 2.00 $(m) =$ 134.66 40.00 $=$ 0.013 0.250			
Developed and Distributed by Smart City Water Inc Copyright 2007 – 2020 Smart City Water Inc All rights reserved.	NOTE: RAINF.	ALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.			
		TRANSFORMED HYETOGRAPH			
	TIME	RAIN TIME RAIN TIME RAIN TIME RAIN			
***** DETAILED OUTPUT *****	hrs	mm/hr hrs mm/hr hrs mm/hr hrs mm/hr			
	0.083	0.00 1.667 6.68 3.250 14.48 4.83 1.11			
	0.167	0.00 1.750 6.68 3.333 7.80 4.92 1.11			
Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat	0.250	0.00 1.833 18.94 3.417 7.80 5.00 1.11			
Output filename: C:\Users\stanous\AppData\Local\Clivica\VH5\4a4b2b43-29c0-4f4e-	0.333	1.11 1.917 18.94 3.500 7.80 5.08 1.11			
ay3U-3446elae5bfa\355bbdeZ-1adZ-4UCU-byb/-1b5ffa8al21d\scen	0.417				
Summary filename: C:Users\sfanous\AppData\Loca\Loca\ClviCa\VH5\4a4b2b43-29c0-4f4e-	0.500	1.11 2.083 18.94 3.667 7.80 5.25 1.11			
aysu-344belaesbla(355bdde2-1ad2-4UcU-byb/-155fla8a121d(scen	0.583				
	0.667				
	0.750	1.11 2.333 31.24 3.917 4.46 3.30 1.11			
DATE: 02-09-2021 TIME: 01:20:05	U.833				
NOTE:	0.917				
USEK:	1.000	1.11 2.583 51.24 4.167 4.46 5.75 1.11			

1.167 1.250 1.333 1.417 1.500 1.583	1.11 1.11 6.68 6.68 6.68 6.68	2.750 2.833 2.917 3.000 3.083 3.167	51.24 14.48 14.48 14.48 14.48 14.48 14.48	4.333 4.417 4.500 4.583 4.667 4.750	2.23 5 2.23 6 2.23 6 2.23 6 2.23 6 2.23 6 2.23 6 2.23	.92 1.11 .00 1.11 .08 1.11 .17 1.11 .25 1.11
Max.Eff.Inten.(m	m/hr)=	51.24		44.37		
over	(min)	5.00		10.00		
Storage Coeff.	(min) =	3.99	(ii)	7.82 (ii)		
Unit Hyd. Tpeak	(min) =	5.00		10.00		
Unit Hyd. peak	(cms) =	0.24		0.13		
					*TOTALS	*
PEAK FLOW	(cms) =	0.35		0.03	0.380	(iii)
TIME TO PEAK	(hrs) =	2.75		2.75	2.75	
RUNOFF VOLUME	(mm) =	54.69		37.75	53.00	
TOTAL RAINFALL	(mm) =	55.69		55.69	55.69	
RUNOFF COEFFICIE	NT =	0.98		0.68	0.95	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
- CN* = 93.6 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
- THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

(%) =

(m) =

=

Average Slope

Max.Eff.Inten.(mm/hr) =

Mannings n

Length

RESERVOIR(0642)	OVERFLOW	IS OFF				
DT= 5.0 min	OUTFLOW	STORAGE	1	OUTFLOW	STORAGE	
	(cms)	(ham)	i	(cms)	(ham)	
	0 0000	0 0000	i i	0 0510	0 1120	
	0.0050	0.0617		0.0310	0 1266	
	0.0000	0.001/		0.0750	0.1200	
	0.0200	0.0820		0.0960	0.1376	
	0.0360	0.1003	I	0.1150	0.1490	
	AR	EA OPE	AK	TPEAK	R.V.	
	(h	a) (cm	s)	(hrs)	(mm)	
INFLOW : ID= 2 (0012) 2.	720 0	.380	2.75	53.00	
OUTFLOW: TD = 1 (0642) 2.	720 0	.050	3.75	51.84	
	,					
PE	AK FLOW R	EDUCTION [0011	(0in1(%) = 1	3 27	
тт Т	ME SHIFT OF P	EAK FLOW	2040	(min)= 6	0.00	
MA	XIMUM STORAG	E USED		(ham)=	0 1116	
1117	ATHON STORAG	6 0560		(114.111.) -	0.1110	
CALIB	Duran (ha	12 0				
STANDHYD (0002)	Area (na) = 13.08	. ·		52.00	
1D= 1 DT=15.0 min	Total imp(%)= 61.00	Di	r. Conn.(%)	= 53.00	
	TMDE	DUTOILS	DEDU	TOUR (i)		
Surface Area	(ha) =	U 21	r 11 K V	1002 (I)		
Surrace Area	(11d) -	0.34	5	. 34		
Dep. Storage	(11111) =	1.00	5	.00		

1.00

301.99

0.013

51.24

2.30

40.00

0.250

42.06

DATE: February 2021

over	(min)	15.00		30.00			
Storage Coeff.	(min) =	16.80	(ii)	97.80	(ii)		
Unit Hyd. Tpeak	(min) =	15.00		105.00			
Unit Hyd. peak	(cms) =	0.07		0.01			
						TOTALS	
PEAK FLOW	(cms) =	0.92		0.16		0.944	(iii)
TIME TO PEAK	(hrs) =	2.75		4.25		2.75	
RUNOFF VOLUME	(mm) =	54.69		29.94		43.05	
TOTAL RAINFALL	(mm) =	55.69		55.69		55.69	
RUNOFF COEFFICIE	ENT =	0.98		0.54		0.77	

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

CN* = 85.0 Ia = Dep. Storage (Above)

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0021)	Area	(ha)=	6.05			
ID= 1 DT= 5.0 min	Total	Imp(%)=	67.00	Dir. Co	nn.(%)=	66.00
		IMPERVI	OUS	PERVIOUS	(i)	
Surface Area	(ha) =	4.0	5	2.00		
Dep. Storage	(mm) =	1.0	0	5.00		
Average Slope	(%) =	1.0	0	2.00		
Length	(m) =	200.8	3	40.00		

= 0.013

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

	-	TRA	ANSFORM	ED HYETOGRA	PH		
TIME	RAIN	TIME	RAIN	' TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	' hrs	mm/hr	hrs	mm/hr
0.083	0.00	1.667	6.68	3.250	14.48	4.83	1.11
0.167	0.00	1.750	6.68	3.333	7.80	4.92	1.11
0.250	0.00	1.833	18.94	3.417	7.80	5.00	1.11
0.333	1.11	1.917	18.94	3.500	7.80	5.08	1.11
0.417	1.11	2.000	18.94	3.583	7.80	5.17	1.11
0.500	1.11	2.083	18.94	3.667	7.80	5.25	1.11
0.583	1.11	2.167	18.94	3.750	7.80	5.33	1.11
0.667	1.11	2.250	18.94	3.833	4.46	5.42	1.11
0.750	1.11	2.333	51.24	3.917	4.46	5.50	1.11
0.833	1.11	2.417	51.24	4.000	4.46	5.58	1.11
0.917	1.11	2.500	51.24	4.083	4.46	5.67	1.11
1.000	1.11	2.583	51.24	4.167	4.46	5.75	1.11
1.083	1.11	2.667	51.24	4.250	4.46	5.83	1.11
1.167	1.11	2.750	51.24	4.333	2.23	5.92	1.11
1.250	1.11	2.833	14.48	4.417	2.23	6.00	1.11
1.333	6.68	2.917	14.48	4.500	2.23	6.08	1.11
1.417	6.68	3.000	14.48	4.583	2.23	6.17	1.11
1.500	6.68	3.083	14.48	4.667	2.23	6.25	1.11
1.583	6.68	3.167	14.48	4.750	2.23		
Max Eff Inton (m	n /h n) =	E1 04		27 05			
max.str.inten.(III	(min)	5 00		20.00			
Storage Cooff	(min) -	5.00	(;;)	15 57 (11)			
Unit Hud Moool	$(m \pm n) =$	5.07	()	10.07 (II)			
оптс пус. Треак	(1111) -	5.00		20.00			

0.250

Mannings n

Unit Hyd. peak	(cms) =	0.21	0.07	
				TOTALS
PEAK FLOW	(cms) =	0.57	0.15	0.702 (iii)
TIME TO PEAK	(hrs) =	2.75	2.92	2.75
RUNOFF VOLUME	(mm) =	54.69	30.60	46.50
TOTAL RAINFALL	(mm) =	55.69	55.69	55.69
RUNOFF COEFFICI	ENT =	0.98	0.55	0.83

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 88.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
- THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
- (111) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

Max.Eff.Inten.(mm/hr) =

	ADD	H.	ĽD	(U	163	8)				
	1	+	2	=	Э	3	1	AREA	QPEAK	TPEAK	R.V.
-								(ha)	(cms)	(hrs)	(mm)
			ID	1=	1	(0002):	13.68	0.944	2.75	43.05
		+	ID	2=	2	(0021):	6.05	0.702	2.75	46.50
			==:								
			ID	=	3	(0658):	19.73	1.646	2.75	44.11

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0645)	OVERFLOW	IS OFF				
IN= 2> OUT= 1						
DT= 5.0 min	OUTFLOW	STORAGE	1	OUTFLOW	STORAGE	
	(cms)	(ha.m.)	1	(cms)	(ha.m.)	
	0.0000	0.0000	1	0.2360	0.6393	
	0.0290	0.3310		0.3410	0.7100	
	0.0950	0.4595	1	0.4450	0.7485	
	0.1680	0.5720	Ι	0.5320	0.7925	
	λP		r	TDEAK	D V	
	AR (h	a) (cms	-11	(bre)	(mm)	
INFLOW · ID= 2 (0658) 19	730 1	646	2 75	44 11	
OUTFLOW: TD = 1 (0645) 19.	730 0.	212	4.92	43.96	
· · · · · · · · · · · · · · · · · · ·	,					
P	EAK FLOW R	EDUCTION [Ç	20ut	/Qin](%)= 1	2.88	
Т	IME SHIFT OF P	EAK FLOW		(min)=13	0.00	
M	AXIMUM STORAG	E USED		(ha.m.) =	0.6156	
STANDHYD (0656)	Area (ha) = 14.51				
ID= 1 DT=15.0 min	Total Imp(%) = 54.00	Di	r. Conn.(%)	= 46.00	
	1.11	,				
	IMPE	RVIOUS H	PERV	IOUS (i)		
Surface Area	(ha) =	7.84	6	.67		
Dep. Storage	(mm) =	1.00	5	.00		
Average Slope	(%) =	1.00	2	.30		
Length	(m) = 31	1.02	40	.00		
Mannings n	= 0	.013	0.	250		

51.24

39.18

DATE: February 2021

over	(min)	15.00	30.00	
Storage Coeff.	(min) =	16.80 (:	ii) 97.80	(ii)
Unit Hyd. Tpeak	(min) =	15.00	105.00	
Unit Hyd. peak	(cms) =	0.07	0.01	
				TOTALS
PEAK FLOW	(cms) =	0.84	0.18	0.876 (iii)
TIME TO PEAK	(hrs)=	2.75	4.25	2.75
RUNOFF VOLUME	(mm) =	54.69	28.55	40.57
TOTAL RAINFALL	(mm) =	55.69	55.69	55.69
RUNOFF COEFFICIE	ENT =	0.98	0.51	0.73

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

CN* = 84.0 Ia = Dep. Storage (Above)

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(0657) OVERE	LOW IS OFF				
IN= 2> OUT= 1	1					
DT= 5.0 min	OUTFI	OW STOR	AGE	OUTFLOW	STORAGE	
	(cms) (ha.m	n.)	(cms)	(ha.m.)	
	0.00	0.0	000	0.3640	0.2594	
	0.01	90 0.2	147	0.5250	0.2723	
	0.14	60 0.2	350	0.6840	0.2789	
	0.25	90 0.2	500	0.8190	0.2863	
		AREA	QPEAK	TPEAK	R.V.	
		(ha)	(cms)	(hrs)	(mm)	
INFLOW : ID= 2	(0656)	14.510	0.876	2.75	40.57	
OUTFLOW: ID= 1	(0657)	14.510	0.362	3.50	40.37	
	PEAK FLOW	REDUCTIO	DN [Qout	/Qin](%)= 4	11.34	
	TIME SHIFT	OF PEAK FLO	WC	(min) = 4	15.00	
	MAXIMUM SI	ORAGE USI	ED	(ha.m.)=	0.2594	

_ .

_ .

|



	ID= 1 DT=15.0 min	Total I	Imp(%)= 5	4.00 Dir. Conn	1.(%)= 46.00	
				· · · · · · · · · · · · · · · · · · ·		
V V I SSSSS U U A L (v 6.1.2003) V V I SS U U AA L V V I SS U U AAAAA L V V I SS U U A A L VV I SSSSS UUUUU A A LLLLL	Surface Area Dep. Storage Average Slope Length Mannings n	(ha) = (mm) = (%) = (m) = =	IMPERVIOU 7.84 1.00 1.00 311.02 0.013	S PERVIOUS (1 6.67 5.00 2.30 40.00 0.250)	
OOO TTTTT TTTTT H H Y Y M M OOO TM O O T T H H Y Y MM MM O O	NOTE: RAINF.	TALL WAS 1	FRANSFORME	D TO 15.0 MIN.	TIME STEP.	
о о т т н н у м м о о						
000 T T H H Y M M 000	TME	PATN	TRA	DATN I' TIME	PATN TTME	PATN
Copyright 2007 - 2020 Smart City Water Inc	hrs	s mm/hr	hrs	mm/hr ' hrs	mm/hr hrs	mm/hr
All rights reserved.	0.250	6.00 6.00	3.250 3.500	13.00 6.250 13.00 6.500 13.00 6.750	23.00 9.25 23.00 9.50	53.00 53.00
**** DETATIED OUTPUT****	1 000	, 0.00) 6.00	4 000	13 00 7 000	23.00 9.75	53.00
	1.250	4.00	4.250	17.00 7.250	13.00 10.25	38.00
	1.500	4.00	4.500	17.00 7.500	13.00 10.50	38.00
Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat	1.750	4.00	4.750	17.00 7.750	13.00 10.75	38.00
Output filename: C:\Users\sfanous\AppData\Local\Civica\VH5\4a4b2b43-29c0-4f4e-	2.000) 4.00	5.000	17.00 8.000	13.00 11.00	38.00
a330-3440elae3bla(bcb60c80-1322-4414-6120-03349462c80/\Scen Summary filename. C.\Users\sfanous\appBata\Local/Civica\W15\4a4b2b43-29c0-4f4e-	2.230	6.00 6.00	1 5 500	13.00 8.250	13.00 11.25	13.00
a930-3446e1ae5bfa\bcb80c80-1592-44f4-8f20-039a9462c807\scen	2.750	6.00	5.750	13.00 8.750	13.00 11.75	13.00
	3.000	6.00	6.000	13.00 9.000	13.00 12.00	13.00
DATE: 02-09-2021 TIME: 01:53:18	Max.Eff.Inten.(m	um/hr)=	53.00	61.44		
USER:	Storage Coeff.	(min) =	16.80	(ii) 97.80 (ii	.)	
	Unit Hyd. Tpeak	(min) =	15.00	105.00	,	
	Unit Hyd. peak	(cms) =	0.07	0.01		
		(0.00	0.70	*TOTALS*	• 、
COMMENTS:	PEAK FLOW	(CmS) =	10.96	11 50	1.378 (11	1)
	RUNOFF VOLUME	(mm) =	211.00	190.49	199.92	
	TOTAL RAINFALL	(mm) =	212.00	212.00	212.00	
	RUNOFF COEFFICIE	INT =	1.00	0.90	0.94	
** STMULATION • Run 62 **						
<pre>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>></pre>	 (i) CN PROCEDU: CN* = 9: (ii) TIME STEP THAN THE S (iii) PEAK FLOW 	JRE SELECT 02.0 Ia (DT) SHOU STORAGE CO DOES NOT	IED FOR PE a = Dep. S JLD BE SMA DEFFICIENT INCLUDE B	RVIOUS LOSSES: torage (Above) LLER OR EQUAL ASEFLOW IF ANY.		
Ptotal=212.00 mm Comments: HAZEL						
	RESERVOIR(0680)	OVERE	FLOW IS OF	F		
TIME RAIN TIME RAIN TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr ' hrs mm/hr hrs hrs	IN= 2> OUT= 1 DT= 5.0 min	OUTFI (cms 0.00 0.01 0.14	LOW STO s) (ha 000 0. 190 0. 460 0.	RAGE OUTFLC .m.) (cms) 0000 0.525 2147 0.684 2350 0.819	W STORAGE (ha.m.) i0 0.2723 i0 0.2789 i0 0.2863	
		0.25	590 0. 640 0	∠500 1.785 2594 0.000	0 0.2864	
		0.30	0.0	2007 0.000	0.0000	
CALIB STANDHYD (0679) Area (ha)= 14.51			AREA (ha)	QPEAK TPEA (cms) (hrs	K R.V.	

DATE: February 2021

2

INFLOW : ID= 2	(0679) 14.510	1.378 10.00	199.92
OUTFLOW: ID= 1	(0680) 14.510	1.470 10.00	199.72
	PEAK FLOW REDUCTION	1 [Qout/Qin](%)=106	.64
	TIME SHIFT OF PEAK FLOW	(min) = 0	.00
	MAXIMUM STORAGE USEI) (ha.m.) = 0	.2850
**** WARNING	: HYDROGRAPH PEAK WAS NO	T REDUCED.	
	CHECK OUTFLOW/STORAGE	TABLE OR REDUCE	DT.

ID= 1 DT= 5.0 min	Total	Imp(%)=	67.00	Dir. Conn.(%)=	66.00
STANDHYD (0677)	Area	(ha) =	6.05		
CALIB					

	IMPERVIOUS	PERVIOUS	(i)
ha)=	4.05	2.00	
mm) =	1.00	5.00	
(%)=	1.00	2.00	
(m) =	200.83	40.00	
=	0.013	0.250	
	ha) = mm) = (%) = (m) = =	IMPERVIOUS ha) = 4.05 mm) = 1.00 (%) = 1.00 (m) = 200.83 = 0.013	$\begin{array}{rrrr} IMPERVIOUS & PERVIOUS \\ ha) = & 4.05 & 2.00 \\ mm) = & 1.00 & 5.000 \\ (\%) = & 1.00 & 2.00 \\ (m) = & 200.83 & 40.00 \\ = & 0.013 & 0.250 \end{array}$

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

		TRA	ANSFORMED HYETO	GRAPH	
TIME	RAIN	TIME	RAIN ' TIM	E RAIN TIME	RAIN
hrs	mm/hr	hrs	mm/hr ' hr	s mm/hr hrs	mm/hr
0.083	6.00	3.083	13.00 6.083	23.00 9.08	53.00
0.167	6.00	3.167	13.00 6.167	23.00 9.17	53.00
0.250	6.00	3.250	13.00 6.250	23.00 9.25	53.00
0.333	6.00	3.333	13.00 6.333	23.00 9.33	53.00
0.417	6.00	3.417	13.00 6.417	23.00 9.42	53.00
0.500	6.00	3.500	13.00 6.500	23.00 9.50	53.00
0.583	6.00	3.583	13.00 6.583	23.00 9.58	53.00
0.667	6.00	3.667	13.00 6.667	23.00 9.67	53.00
0.750	6.00	3.750	13.00 6.750	23.00 9.75	53.00
0.833	6.00	3.833	13.00 6.833	23.00 9.83	53.00
0.917	6.00	3.917	13.00 6.917	23.00 9.92	53.00
1.000	6.00	4.000	13.00 7.000	23.00 10.00	53.00
1.083	4.00	4.083	17.00 7.083	13.00 10.08	38.00
1.167	4.00	4.167	17.00 7.167	13.00 10.17	38.00
1.250	4.00	4.250	17.00 7.250	13.00 10.25	38.00
1.333	4.00	4.333	17.00 7.333	13.00 10.33	38.00
1.417	4.00	4.417	17.00 7.417	13.00 10.42	38.00
1.500	4.00	4.500	17.00 7.500	13.00 10.50	38.00
1.583	4.00	4.583	17.00 7.583	13.00 10.58	38.00
1.667	4.00	4.667	17.00 7.667	13.00 10.67	38.00
1.750	4.00	4.750	17.00 7.750	13.00 10.75	38.00
1.833	4.00	4.833	17.00 7.833	13.00 10.83	38.00
1.917	4.00	4.917	17.00 7.917	13.00 10.92	38.00
2.000	4.00	5.000	17.00 8.000	13.00 11.00	38.00
2.083	6.00	5.083	13.00 8.083	13.00 11.08	13.00
2.167	6.00	5.167	13.00 8.167	13.00 11.17	13.00
2.250	6.00	5.250	13.00 8.250	13.00 11.25	13.00
2.333	6.00	5.333	13.00 8.333	13.00 11.33	13.00
2.417	6.00	5.417	13.00 8.417	13.00 11.42	13.00
2.500	6.00	5.500	13.00 8.500	13.00 11.50	13.00
2.583	6.00	5.583	13.00 8.583	13.00 11.58	13.00
2.667	6.00	5.667	13.00 8.667	13.00 11.67	13.00
2.750	6.00	5.750	13.00 8.750	13.00 11.75	13.00

DATE: February 2021

2.833	6.00	5.833	13.00 8.83	33 13.00 11.	.83 13.00
2.917	6.00	5.917	13.00 8.91	13.00 11.	.92 13.00
3.000	6.00	6.000	13.00 9.00	0 13.00 12.	.00 13.00
Max.Eff.Inten.(m	um/hr)=	53.00	54.12		
over	(min)	5.00	15.00		
Storage Coeff.	(min) =	5.00	(ii) 14.03	(ii)	
Unit Hyd. Tpeak	(min) =	5.00	15.00		
Unit Hyd. peak	(cms) =	0.21	0.08		
				TOTALS	ł
PEAK FLOW	(cms) =	0.59	0.29	0.883	(iii)
TIME TO PEAK	(hrs) =	10.00	10.00	10.00	
RUNOFF VOLUME	(mm) =	211.00	192.52	204.72	
TOTAL RAINFALL	(mm) =	212.00	212.00	212.00	
RUNOFF COEFFICIE	INT =	1.00	0.91	0.97	

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

CN* = 94.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0678) ID= 1 DT=15.0 min	Area Total	(ha) = Imp(%) =	13.68 61.00	Dir. Conn.(%)=	53.00
		IMPERVI	DUS	PERVIOUS (i)	
Surface Area	(ha) =	8.3	1	5.34	
Dep. Storage	(mm) =	1.0	C	5.00	
Average Slope	(%) =	1.0	C	2.30	
Length	(m) =	301.9	9	40.00	
Mannings n	=	0.01	3	0.250	

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 MIN. TIME STEP.

		TRA	NSFORMED HYETOGR	APH	
TIME	RAIN	TIME	RAIN ' TIME	RAIN TIME	RAIN
hrs	mm/hr	hrs	mm/hr ' hrs	mm/hr hrs	mm/hr
0.250	6.00	3.250	13.00 6.250	23.00 9.25	53.00
0.500	6.00	3.500	13.00 6.500	23.00 9.50	53.00
0.750	6.00	3.750	13.00 6.750	23.00 9.75	53.00
1.000	6.00	4.000	13.00 7.000	23.00 10.00	53.00
1.250	4.00	4.250	17.00 7.250	13.00 10.25	38.00
1.500	4.00	4.500	17.00 7.500	13.00 10.50	38.00
1.750	4.00	4.750	17.00 7.750	13.00 10.75	38.00
2.000	4.00	5.000	17.00 8.000	13.00 11.00	38.00
2.250	6.00	5.250	13.00 8.250	13.00 11.25	13.00
2.500	6.00	5.500	13.00 8.500	13.00 11.50	13.00
2.750	6.00	5.750	13.00 8.750	13.00 11.75	13.00
3.000	6.00	6.000	13.00 9.000	13.00 12.00	13.00
Max.Eff.Inten.(mm	1/hr)=	53.00	63.29		
over (min)	15.00	30.00		
Storage Coeff. (min) =	16.80	(ii) 97.80 (ii)	
Unit Hyd. Tpeak (min)=	15.00	105.00		
Unit Hyd. peak (cms)=	0.07	0.01		
				TOTALS	

PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICI	(cms) = (hrs) = (mm) = (mm) = ENT =	1.04 10.00 211.00 212.00 1.00	0.58 11.50 193.11 212.00 0.91	1.390 (iii) 10.00 202.59 212.00 0.96
 (i) CN PROCED CN* = (ii) TIME STEP THAN THE (iii) PEAK FLOW 	URE SELECTED 93.0 Ia = (DT) SHOULD STORAGE COEF DOES NOT IN	FOR PERVIOU Dep. Storag BE SMALLER FICIENT. CLUDE BASEFI	S LOSSES: e (Above) OR EQUAL OW IF ANY.	
ADD HYD (0675) 1 + 2 = 3 ID1= 1 (06 + ID2= 2 (06	ARE (ha 77): 6.0 78): 13.6	A QPEAK) (cms) 5 0.883 8 1.390	TPEAK 1 (hrs) 10.00 204 10.00 202	R.V. (mm) .72 .59
ID = 3 (06	75): 19.7	3 2.272	10.00 203	.24
RESERVOIR(0645) IN= 2> OUT= 1 DT= 5.0 min	OVERFLO OUTFLOW (cms) 0.0000 0.0290 0.0950 0.1680 0.2360	W IS OFF STORAGE (ha.m.) 0.0000 0.3310 0.4595 0.5720 0.6393	OUTFLOW (cms) 0.3410 0.4450 0.5320 1.5380 0.0000	STORAGE (ha.m.) 0.7100 0.7485 0.7925 1.4815 0.0000
INFLOW : ID= 2 (OUTFLOW: ID= 1 (0675) <u>1</u> 0645) 1	AREA QPE (ha) (cm 9.730 2 9.730 1	AK TPEAK (hrs) (hrs) .272 10.(.537 11.3	R.V. (mm) 00 203.24 17 203.04
P T M	EAK FLOW IME SHIFT OF AXIMUM STOR	REDUCTION [PEAK FLOW AGE USED	Qout/Qin](%)= (min)= (ha.m.)=	= 67.65 = 70.00 = 1.4815
CALIB STANDHYD (0665) ID= 1 DT= 5.0 min	Area (Total Imp	ha)= 2.72 (%)= 90.00	Dir. Conn.	(%)= 90.00
Surface Area Dep. Storage Average Slope Length Mannings n	IM (ha) = (mm) = (%) = (m) = =	PERVIOUS 2.45 1.00 1.00 134.66 0.013	PERVIOUS (i) 0.27 5.00 2.00 40.00 0.250	
NOTE: RAIN	FALL WAS TRA	NSFORMED TO	5.0 MIN. T	IME STEP.

DATE: February 2021

	TRA	NSFORMED HYETOGR	APH	
TIME RAIN	TIME	RAIN ' TIME	RAIN TIME	RAIN
hrs mm/hr	hrs	mm/hr ' hrs	mm/hr hrs	mm/hr
0.083 6.00	3.083	13.00 6.083	23.00 9.08	53.00
0.167 6.00	3.167	13.00 6.167	23.00 9.17	53.00
0.250 6.00	3.250	13.00 6.250	23.00 9.25	53.00
0.333 6.00	3.333	13.00 6.333	23.00 9.33	53.00
0.417 6.00	3.417	13.00 6.417	23.00 9.42	53.00
0.500 6.00	3.500	13.00 6.500	23.00 9.50	53.00
0.583 6.00	3.583	13.00 6.583	23.00 9.58	53.00
0.667 6.00	3.667	13.00 6.667	23.00 9.67	53.00
0.750 6.00	3.750	13.00 6.750	23.00 9.75	53.00
0.833 6.00	3.833	13.00 6.833	23.00 9.83	53.00
0.917 6.00	3.917	13.00 6.917	23.00 9.92	53.00
1.000 6.00	4.000	13.00 7.000	23.00 10.00	53.00
1.083 4.00	4.083	17.00 7.083	13.00 10.08	38.00
1.167 4.00	4.167	17.00 7.167	13.00 10.17	38.00
1.250 4.00	4.250	17.00 7.250	13.00 10.25	38.00
1.333 4.00	4.333	17.00 7.333	13.00 10.33	38.00
1.417 4.00	4.417	17.00 7.417	13.00 10.42	38.00
1.500 4.00	4.500	17.00 7.500	13.00 10.50	38.00
1.583 4.00	4.583	17.00 7.583	13.00 10.58	38.00
1.667 4.00	4.667	17.00 7.667	13.00 10.67	38.00
1.750 4.00	4.750	17.00 7.750	13.00 10.75	38.00
1.833 4.00	4.833	17.00 7.833	13.00 10.83	38.00
1.91/ 4.00	4.917	17.00 7.917	13.00 10.92	38.00
2.000 4.00	5.000	12 00 1 8.000	12.00 11.00	12 00
2.003 0.00	5 167	13 00 9 167	13.00 11.00	13.00
2 250 6 00	5 250	13 00 8 250	13 00 11 25	13 00
2 333 6 00	5 3 3 3	13 00 8 333	13 00 11 33	13 00
2 417 6 00	5 417	13 00 8 417	13 00 11 42	13 00
2 500 6 00	5 500	13 00 8 500	13 00 11 50	13 00
2 583 6 00	5 583	13 00 8 583	13 00 11 58	13 00
2 667 6 00	5 667	13 00 8 667	13 00 11 67	13 00
2.750 6.00	5.750	13.00 8.750	13.00 11.75	13.00
2.833 6.00	5.833	13.00 8.833	13.00 11.83	13.00
2.917 6.00	5.917	13.00 8.917	13.00 11.92	13.00
3.000 6.00	6.000	13.00 9.000	13.00 12.00	13.00
<pre>Max.Eff.Inten.(mm/hr) =</pre>	53.00	52.87		
over (min)	5.00	10.00		
Storage Coeff. (min)=	3.94	(ii) 7.72 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00		
Unit Hyd. peak (cms)=	0.24	0.13		
	0.00	0.04	*TOTALS*	、 、
TIME TO DEVE (CMS) =	10 00	0.04	U.4UU (111 10 00)
DINOFE VOLUME (mm) -	211 00	100.00	200.00	
TOTAL PAINEALL (mm) -	212.00	212 00	209.04	
BUNOFF COEFFICIENT =	1 00	0.94	0.99	
NOROTI CODITICIDAT -	1.00	0.91	0.00	
***** WARNING: STORAGE COEFF. 1	IS SMALLE	R THAN TIME STEP	!	
(1)				
(i) CN PROCEDURE SELECTE	ED FOR PR	RVIOUS LOSSES:		

(i) $CN^* = 97.0$ Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR (0642)	OVERFL	OW IS OFF				
DT= 5.0 min	OUTFLO	N STORAGE	E I	OUTFLOW	STORAGE	
	- (cms)	(ha.m.)	i i	(cms)	(ha.m.)	
	0.000	0.000)	0.0730	0.1266	
	0.005	0.061	7 1	0.0960	0.1376	
	0.020	0.0820))	0.1150	0.1490	
	0.036	0.1003	3 I	0.3350	0.1968	
	0.051	0.1120)	0.0000	0.0000	
		AREA OF	PEAK	TPEAK	R.V.	
		(ha) (o	cms)	(hrs)	(mm)	
INFLOW : ID= 2 (0665)	2.720	0.400	10.00	209.84	
OUTFLOW: ID= 1 (0642)	2.720	0.334	10.08	208.69	
	PEAK FLOW	REDUCTION	[Qout	/Qin](%)=	83.53	
	TIME SHIFT OF	F PEAK FLOW		(min) =	5.00	
	MAXIMUM STO	RAGE USED		(ha.m.) =	0.1968	
FINISH						

Appendix A.4: Quality Control

Snell's Hollow SWM Pond 1



Water Quality Control Requirements

Table: Water Quality Storage Requirements Based on Receiving Waters

Protection Level 1	Storage Volume (m ³ /ha) for Impervious Level						
SWMP Type	0%	0% 35% 55% 70% 85% 100%					
Wetlands	36	80	105	120	140	160	
Wet Pond	53	140	190	225	250	275	

* For wet ponds, all of the storage, except for 40 m³/ha represents the permanent pool volume. The 40 m3/ha represents extended detention storage.

Source: 2003 SWM Planning & Design Manual

SWM Pond 1

Input:					
Weighted Imperviousness =	54%				
Area =	14.51	ha			
Level of Protection:	1				
SWMP Type : \	Vet Pon	d			
Calculation:					
Total Storage Volume =	187	m³/ha	\rightarrow	2,718	m ³
Permanent Pool Volume =	147	m ³ /ha	\rightarrow	2,137	m ³
Active Storage Volume =	40	m³/ha	\rightarrow	580	m ³

Snell's Hollow SWM Pond 2



Water Quality Control Requirements

Table: Water Quality Storage Requirements Based on Receiving Waters

Protection Level 1	Storage Volume (m ³ /ha) for Impervious Level							
SWMP Type	0%	0% 35% 55% 70% 85% 100%						
Wetlands	36	80	105	120	140	160		
Wet Pond	53	140	190	225	250	275		

* For wet ponds, all of the storage, except for 40 m³/ha represents the permanent pool volume. The 40 m3/ha represents extended detention storage.

Source: 2003 SWM Planning & Design Manual

SWM Pond 2

Input:					
Weighted Imperviousness =	63%				
Area =	19.73	ha			
Level of Protection:	1				
SWMP Type : \	Vet Pon	d			
Calculation:					
Total Storage Volume =	208	m³/ha	\rightarrow	4,106	m ³
Permanent Pool Volume =	168	m³/ha	\rightarrow	3,317	m ³
Active Storage Volume =	40	m³/ha	\rightarrow	789	m ³

Appendix A.5: Water Balance Calculations
5	Water Holding Capacity mm	Hydrologic Soil Group	Precipitation mm	Evapo- transpiration mm	Runoff mm	Infiltration [®]	
Urban Lawns/Sh	allow Rooted Cro	ops (spinach, b	eans, beets, car	rots)			
Fine Sand	50	A	940	515	149	276	
Fine Sandy Loam	75	В	940	525	187	228	
Silt Loam	125	С	940	536	222	182	
Clay Loam	100	CD	940	531	245	164	
Clay	75	D	940	525	270	145	
Moderately Root	ed Crops (corn a	nd cereal grain	ns)			201	
Fine Sand	75	A	940	525	125	291	
Fine Sandy Loam	150	В	940	539	160	241	
Silt Loam	200	С	940	543	199	199	
Clay Loam	200	CD	940	543	218	179	
Clay	150	D	940	539	241	160	
Pasture and Shru	ibs						
Fine Sand	100	А	940	531	102	307	
Fine Sandy Loam	150	В	940	539	140	261	
Silt Loam	250	С	940	546	177	217	
Clay Loam	250	CD	940	546	197	197	
Clay	200	D	940	543	218	179	
Mature Forests							
Fine Sand	250	A	940	546	79	315	
Fine Sandy Loam	300	В	940	548	118	274	
Silt Loam	400	С	940	550	156	234	
Clay Loam	400	CD	940	550	176	215	
Clay	350	D	940	549	196	196	
Notes: Hydrologic with high runoff p baseflow and runo * This is the total in determined by sun	Soil Group A rep otential. The evap ff. nfiltration of which uming a factor for	presents soils w otranspiration v h some dischar, topography, so	ith low runoff por values are for ma ges back to the s vils and cover.	tential and Soil G ture vegetation. S tream as base flow	roup D repre treamflow is w. The infiltre	esents soils composed of ation factor is	
<u>Topography</u> Flat Land, average slope < 0.6 m Rolling Land, average slope 2.8 r Hilly Land, average slope 28 m ta			< 0.6 m/km pe 2.8 m to 3.8 n 28 m to 47 m/kn	ı/km 1	0.3 0.2 0.1		
Soils	Tight impe Medium co Open Sand	rvious clay mbinations of (y loam	clay and loam		0.1 0.2 0.4		
<u>Cover</u> Cultivated Land					0.1		

TRSPA WATER BALANCE TOOL



	mm/year	%
Input:		
Precip	868	100%
Output:		
Evavp	695	62%
Runoff	110	10%
Recharge	311	28%
Total Output	1116	100%

	mm/year	%
Input:		
Precip	868	100%
Output:		
Evavp	541	62%
Runoff	86	10%
Recharge	242	28%
Total Output	868	100%

TABLE 1: WATER BUDGET - PRE DEVELOPMENTWATER BALANCE/WATER BUDGET ASSESSMENT

		Drainage Area 1		Drainage Area 2	Drainage Area 3	
Catchment Designation	Natural Feature Area	Imperviousness	Agricultural and Meadow	Agricultural and Meadow	Agricultural and Meadow	
Area (m²)	241000	1980	219020	126000	29000	
Pervious Area (m²)	241000	0	219020	126000	29000	
Impervious Area (m ²)	0	1980	0	0	0	
Infiltration Factors		•				Ĺ
Topography Infiltration Factor (Rolling Land)	0.2	N/A	0.2	0.2	0.2	
Soil Infiltration Factor (Soil Type D)	0.1	N/A	0.1	0.1	0.1	
Land Cover Infiltration Factor	0.2	N/A	0.1	0.1	0.1	
MOE Infiltration Factor	0.5	N/A	0.4	0.4	0.4	1
Inputs (per unit area)						
Precipitation (mm/year	868	868	868	868	868	
Total Inputs (mm/year)	868	868	868	868	868	
Outputs (per unit area)						
Precipitation Surplus (mm/year)	418	781	418	418	418	
Net Surplus (mm/year)	418	781	418	418	418	
Downspout Disconnection Retention*	0	0	0	0	0	
Evapotranpiration (mm/year)	450	87	450	450	450	
Roof Evapotranspiration (mm/year)**	0	0	0	0	0	
Rooftop Runoff Lawn Evaporation (mm/year)	0	0	0	0	0	
Total Evapotranspiration (mm/yr)	450	87	450	450	450	
Infiltration (mm/year)	209	0	167	167	167	
Rooftop Infiltration (mm/year)**	0	0	0	0	0	
Total Infiltration (mm/year)	209	0	167	167	167	
Runoff Pervious Area (mm/year)	209	781	251	251	251	
Runoff Impervious Area (mm/year)	0	0	0	0	0	
Total Runoff (mm/year)	209	781	251	251	251	
Total Outputs (mm/year)	868	868	868	868	868	
Difference (Inputs - Outputs)	0	0	0	0	0	
Input Volumes						
Precipitation (m [°] /year)	209188	1719	190109	109368	25172	
Total Inputs (m³/year)	209188	1719	190109	109368	25172	
Outputs (Volumes)						
Precipitation Surplus (m ³ /year)	100738	1547	91550	52668	12122	
Net Surplus (m ³ /year)	100738	1547	91550	52668	12122	
Downspout Disconnection Retention* (m ³ /year)	0	0	0	0	0	
Evapotranpiration (m ³ /year)	108450	172	98559	56700	13050	
Roof Evapotranspiration (m ³ /year)	0	0	0	0	0	
Rooftop Runoff Lawn Evaporation (m ³ /year)	0	0	0	0	0	
Total Evapotranspiration (m ³ /year)	108450	172	98559	56700	13050	
Infiltration (m ³ /year)	50369	0	36620	21067	4849	
Rooftop Infiltration (m ³ /year)	0	0	0	0	0	
Total Infiltration (m ³ /year)	50369	0	36620	21067	4849	
Runoff Pervious Area (m ³ /year)	50369	1547	54930	31601	7273	
Runoff Impervious Area (m ³ /year)	0	0	0	0	0	
Total Runoff (m³/year)	50369	1547	54930	31601	7273	
Total Outputs (m ³ /year)	209188	1719	190109	109368	25172	
Difference (Inputs - Outputs)	0	0	0	0	0	

Total
617000
617000
615020
1980
868
868
419
419
0
449
0
0
449
183
0
183
236
230
868
0
535556
535556
258625
258625
0
276931
0
0
0
276931
112905
0
112905
145720
0
145720
535556
0

TABLE 2: WATER BUDGET - POST DEVELOPMENT WATER BALANCE/WATER BUDGET ASSESSMENT

		Area drainii	ng to Pond 1	Area drainii	ng to pond 2	Southe	rn Area	Eastern Area Dr	aining to Pond 2	
Catchment Designation	Natural Feature Area	Pervious Area	Impervious Area	Pervious Area	Impervious Area	Pervious Area	Impervious Area	Pervious Area	Impervious Area	Total
Area (m²)	247400	66864	78237	53783	83017	2680	24520	19702	40798	617000
Pervious Area (m ²)	247400	66863.5	0	53782.86	0	2680	0	19702	0	390428
Impervious Area (m²)	0	0	78236.5	0	83017.14	0	24520	0	40798	226572
Infiltration Factors			•							
Topography Infiltration Factor (Rolling Land)	0.2	0.2	N/A	0.2	N/A	0.2	N/A	0.2	N/A	
Soil Infiltration Factor (Soil Type D)	0.1	0.1	N/A	0.1	N/A	0.1	N/A	0.1	N/A	
Land Cover Infiltration Factor	0.2	0.1	N/A	0.1	N/A	0.1	N/A	0.1	N/A	
MOE Infiltration Factor	0.5	0.4	N/A	0.4	N/A	0.4	N/A	0.4	N/A	
Inputs (per unit area)										
Precipitation (mm/year	868	868	868	868	868	868	868	868	868	868
Total Inputs (mm/year)	868	868	868	868	868	868	868	868	868	868
Outputs (per unit area)	410	440	704	440	704	440	704	440	704	554
Precipitation Surplus (mm/year)	418	418	781	418	/81	418	/81	418	/81	551
Net Surplus (mm/year)	418	418	781	418	/81	418	/81	418	781	551
Evanotranniration (mm/year)	450	450	87	450	87	450	87	450	87	317
Roof Evapotranspiration (mm/year)**	450	450	0	450	0	450	0	450	0	0
Roof Evaporation (mm/year)	0	0	0	0	0	0	0	0	0	0
Total Evapotranspiration (mm/yr)	450	450	87	450	87	450	87	450	87	317
Infiltration (mm/year)	209	167	0	167	0	167	0	167	0	123
Rooftop Infiltration (mm/vear)**	0	0	0	0	0	0	0	0	0	0
Total Infiltration (mm/year)	209	167	0	167	0	167	0	167	0	123
Runoff Pervious Area (mm/year)	209	251	0	251	0	251	0	251	0	142
Runoff Impervious Area (mm/year)	0	0	781	0	781	0	781	0	781	287
Total Runoff (mm/year)	209	251	781	251	781	251	781	251	781	429
Total Outputs (mm/year)	868	868	868	868	868	868	868	868	868	868
Difference (Inputs - Outputs)	0	0	0	0	0	0	0	0	0	0
Input Volumes										
Precipitation (m³/year)	214743	58038	67909	46684	72059	2326	21283	17101	35413	535556
Total Inputs (m³/year)	214743	58038	67909	46684	72059	2326	21283	17101	35413	535556
Outputs (Volumes)										
Precipitation Surplus (m³/year)	103413	27949	61118	22481	64853	1120	19155	8235	31871	340197
Net Surplus (m³/year)	103413	27949	61118	22481	64853	1120	19155	8235	31871	340197
Downspout Disconnection Retention* (m ³ /year)	0	0	0	0	0	0	0	0	0	0
Evapotranpiration (m ³ /vear)	111330	30089	6791	24202	7206	1206	2128	8866	3541	195359
Roof Evapotranspiration (m ³ /vear)	0	0	0	0	0	0	0	0	0	0
Rooftop Runoff Lawn Evaporation (m ³ /vear)	0	0	0	0	0	0	0	0	0	0
Total Evanotranspiration (m ³ /year)	111330	30089	6791	24202	7206	1206	2128	8866	3541	195359
Infiltration (m ³ /year)	51707	11180	0,51	8002		1200	0	3394		75621
Poofton Infiltration (m ³ /yoar)	31707	11188	0	0992	0	448	0	5294	0	73021
	54707	0	0	0000		440		0	0	75004
Total Inflitration (m /year)	51707	11180	0	8992	0	448	0	3294	0	/5621
	51/0/	16769	0	13489	0	6/2	0	4941	0	8/5/8
Runoff Impervious Area (m ⁻ /year)	0	0	61118	0	64853	0	19155	0	31871	176998
Total Runoff (m [*] /year)	51707	16769	61118	13489	64853	672	19155	4941	31871	264576
Total Outputs (m³/year)	214743	58038	67909	46684	72059	2326	21283	17101	35413	535556
Difference (Inputs - Outputs)	0	0	0	0	0	0	0	0	0	0

Water	r Balance Mitigation Ca Pre Development Infintration = Post Development Infiltration =	Iculations - OP 112,905 m ³ /y 75,621 m ³ /y	TION 1				
	Post to Pre Deficit =	37,284 m ³ /y					
Overall Require 36.96 ha x An Required Annua Based on this ar will produce an a	ed mitigation nnual Precipitation Depth = 37,284 r Il Precpitation Depth to meet deficit = nalysis, it is concluded that precipitation events of annual amount of precipitation equal to	n ³ /year 101 mm/yr depth less than or equal to 101 mm/yr	2.68 mm	990.53 m ³ /event			
OPTION 1	Catchment 203 will provide own site plan of Infiltration trenches proposed on Low dens Infiltration trenches at park area	controls to achieve post to pr aity development west of Hea	e infiltration (5mm) Irt lake Road				
	Mitigation Measures Catchment 203 on-site controls Topsoil Amendment = Infiltration Trenches=	5,200 m³/y 0 m³/y 29,620 m³/y					
	= Mitgation VouIme Provided Deficit	34,820 m³/y 2,464 m³/y	98%				
Site Plan Mitiga 2.72 ha x And Required Annua Based on this ar will produce an a	ation nual Precipitation Depth = 5,200 r al Precpitation Depth to meet deficit = nalysis, it is concluded that precipitation events of annual amount of precipitation equal to	n ³ /year 191 mm/yr depth less than or equal to 191 mm/yr	5.00 mm	136.00 m ³ /event			
Infiltration Tren Considering ha 2.23 ha x An Required Annua Based on this ar will produce an a	nches= alf the roof area nual Precipitation Depth = 17,380 r al Precpitation Depth to meet deficit = nalysis, it is concluded that precipitation events of annual amount of precipitation equal to	n ³ /year 781 mm/yr depth less than or equal to 781 mm/yr	27.35 mm	608.54 m ³ /event	Roof Backyards Front		8.9 4.45 3.56 0.89
Backyards 3.56 ha x And Required Annua Based on this an will produce an a	nual Precipitation Depth = 8,950 r Il Precpitation Depth to meet deficit = nalysis, it is concluded that precipitation events of annual amount of precipitation equal to	n ³ /year 251 mm/yr depth less than or equal to 251 mm/yr	6.60 mm	234.96 m ³ /event		making runoff 0	
In the park area	a						
1.31 ha x And Required Annua Based on this ar will produce an a	nual Precipitation Depth = 3,290 r Il Precpitation Depth to meet deficit = nalysis, it is concluded that precipitation events of annual amount of precipitation equal to	n³/year 251 mm/yr depth less than or equal to 251 mm/yr	6.60 mm	86.46 m ³ /event		making runoff 0	

				Job: 4851
	Infiltrat	tion Sizing Cal	culations for backyards - Option 1	Feb-21
Required Infiltration Syste	m Footprint A	rea		
Infiltration Volume	843.50	m³		
drawdown time	48	hours	(Based on Hydro-Geologic report- hydraulic conductivity = 10 ⁻⁶)	
infiltration rate	15	mm/h		
Safety Factor	2.5			
Design Infiltration Rate	6	mm/h	MOE Eqn 4.3	
Required Footprint Area	7322	m ²		
Р	roposed Infilt	ration Details - Ti	renches	
Length=	2000	m		
Width=	1.5	m	(2000m x 1.5m x 0.72 m)	
Trench Volume Provided=	864.00	m³		
Required Storage Depth =	0.72	m		
Drawdown time=	48.00	hours		
Volume retained per site =	864.00	m ³		
Therefore the proposed systen retention volume that exceeds	n has the requ the required v	ired footprint area olume for mitigatio	to drain within 48 hours and will provide a n	
* Soils with Satutrated Hydraul	ic Conductivity	$-1(10^{-6})$ cm/s co	relates to an infiltration rate of 15mm/h	
Low Impact Development Desi	ign Manual (TF	RCA and CVC, 20	0)	
				Job: 4851
	Infil	tration Sizing	Calculations for Park - Option 1	Feb-21
Required Infiltration Syste	m Footprint A	rea		
Infiltration Volume	86.46	m³		
drawdown time	48	hours	(Based on Hydro-Geologic report- hydraulic conductivity = 10 ⁻⁶)	
infiltration rate	15	mm/h		
Safety Factor	2.5			
Design Infiltration Rate	6	mm/h	MOE Eqn 4.3	
Required Footprint Area	751	m ²		
Р	roposed Infilt	ration Details - T	renches	
•	201	m		
Lenath=	201			
Length= Width=	1.5	m	(201m x 1.5m x 0.72 m)	
Length= Width= Trench Volume Provided=	1.5 86.83	m m³	(201m x 1.5m x 0.72 m)	
Length= Width= Trench Volume Provided= Required Storage Depth =	1.5 86.83 0.72	m m ³ m	(201m x 1.5m x 0.72 m)	
Length= Width= Trench Volume Provided= Required Storage Depth = Drawdown time=	1.5 86.83 0.72 48.00	m m ³ m hours	(201m x 1.5m x 0.72 m)	
Length= Width= Trench Volume Provided= Required Storage Depth = Drawdown time= Volume retained per site =	1.5 86.83 0.72 48.00 86.83	m m ³ m hours m ³	(201m x 1.5m x 0.72 m)	
Length= Width= Trench Volume Provided= Required Storage Depth = Drawdown time= Volume retained per site =	1.5 86.83 0.72 48.00 86.83	m m ³ m hours m ³	(201m x 1.5m x 0.72 m)	
Length= Width= Trench Volume Provided= Required Storage Depth = Drawdown time= Volume retained per site = Therefore the proposed system	1.5 86.83 0.72 48.00 86.83	m m ³ m hours m ³ ired footprint area	(201m x 1.5m x 0.72 m) to drain within 48 hours and will provide a	
Length= Width= Trench Volume Provided= Required Storage Depth = Drawdown time= Volume retained per site = Therefore the proposed system retention volume that exceeds	1.5 86.83 0.72 48.00 86.83 n has the required ve	m m ³ hours m ³ ired footprint area plume for mitigatio	(201m x 1.5m x 0.72 m) to drain within 48 hours and will provide a n	
Length= Width= Trench Volume Provided= Required Storage Depth = Drawdown time= Volume retained per site = Therefore the proposed system retention volume that exceeds	1.5 86.83 0.72 48.00 86.83 n has the required vertice the required vertice to the required vertice the required vertice to the	m m ³ m hours m ³ ired footprint area olume for mitigatio	(201m x 1.5m x 0.72 m) to drain within 48 hours and will provide a n	
Length= Width= Trench Volume Provided= Required Storage Depth = Drawdown time= Volume retained per site = Therefore the proposed system retention volume that exceeds * Soils with Satutrated Hydraul Low Impact Development Desi	1.5 86.83 0.72 48.00 86.83 n has the required vertice the required vertice to	m m ³ m hours m ³ ired footprint area olume for mitigatio = 1(10 ⁻⁶) cm/s con RCA and CVC, 20 ⁻	(201m x 1.5m x 0.72 m) to drain within 48 hours and will provide a n rrelates to an infiltration rate of 15mm/h	



Water	Balance Mitigation Cal Pre Development Infintration = Post Development Infiltration =	culations - O	PTION 2		
	Post to Pre Deficit =	37,284 m ³ /y			
Overall Require 36.96 ha x An Required Annua Based on this ar will produce an a	ed mitigation nual Precipitation Depth = 37,284 m ³ I Precpitation Depth to meet deficit = nalysis, it is concluded that precipitation events of c annual amount of precipitation equal to	³ /year 101 mm/yr depth less than or equal to 101 mm/yr	2.68 mm	990.53 m ³ /event	
OPTION 2	Catchment 203 will provide own site plan co Infiltration trenches proposed on Low density Infiltration facilility proposed at the park facil	ntrols to achieve post to y development west of He ity	pre infiltration eart lake Road (only for areas o	Iraining to SWM Pond 2)	
	Mitigation Measures Catchment 203 on-site controls Infiltration Facility Infiltration Trenches=	5,200 m ³ /y 22,150 m ³ /y 12,590 m ³ /y			
	Mitgation Voulme Provided = Deficit =	39,940 m ³ /y -2,656 m ³ /y	102%		
Site Plan Mitiga 2.72 ha x And Required Annua Based on this ar will produce an a	ation nual Precipitation Depth = 5,200 m ³ I Precpitation Depth to meet deficit = nalysis, it is concluded that precipitation events of c annual amount of precipitation equal to	³ /year 191 mm/yr depth less than or equal to 191 mm/yr	5.00 mm	136.00 m ³ /event	
Infiltration facil	ity at the proposed park on the west				5 /
2.84 ha x Ani Required Annua Based on this ar will produce an a	nual Precipitation Depth = 22,150 m ³ I Precpitation Depth to meet deficit = nalysis, it is concluded that precipitation events of c annual amount of precipitation equal to	³ /year 781 mm/yr depth less than or equal to 781 mm/yr	27.35 mm	775.37 m ³ /event	Roof Backyards Front
Infiltration Tren For areas drain Considering ha 1.06 ha x An Required Annua Based on this ar will produce an a	inches= ing to SWM Pond 2 If the roof area nual Precipitation Depth = 8,320 m ³ I Precpitation Depth to meet deficit = nalysis, it is concluded that precipitation events of c annual amount of precipitation equal to	³ /year 781 mm/yr depth less than or equal to 781 mm/yr	27.35 mm	291.25 m ³ /event	Roof Backyards Front
Backayds 1.70 ha x Ani Required Annua Based on this ar will produce an a	nual Precipitation Depth = 4,270 m ³ I Precpitation Depth to meet deficit = nalysis, it is concluded that precipitation events of c annual amount of precipitation equal to	³ /year 251 mm/yr depth less than or equal to 251 mm/yr	6.60 mm	112.45 m ³ /event	

5.67 2.835 2.268 0.567

4.2596 2.1298 1.70384 0.42596

making runoff 0

				Job: 4851
	Infiltrat	ion Sizing Ca	alculations for backyards - Option 2	Feb-21
Required Infiltration Syste	m Footprint A	rea		
Infiltration Volume	403.70	m³		
Number of Lots	1			
Inillftration Volume Per lot	403.70	m³		
drawdown time	48	hours	(Based on Hydro-Geologic report- hydraulic conductivity = 10 ⁻⁶)	
infiltration rate	15	mm/h		
Safety Factor	2.5			
Design Infiltration Rate	6	mm/h	MOE Eqn 4.3	
Required Footprint Area	3504	m²		
Р	roposed Infilt	ration Details - [.]	Trenches	
Lenath=	935	m		
Width=	1.5	m	(935m x 1.5m x 0.72 m)	
Trench Volume Provided=	403 92	m ³	(
Required Storage Depth =	0.72	m		
Drawdown time=	48.00	hours		
Volume retained per site =	403 92	m ³		
· · · · · · · · · · · · · · · · · · ·				
* Soils with Satutrated Hydraul Low Impact Development Desi	ic Conductivity ign Manual (TF	= 1(10 ⁻⁶) cm/s c CA and CVC, 20	orrelates to an infiltration rate of 15mm/h 010)	
				loh: 4851
		Infiltra	ition Gallery - Option 2	Feb-21
Required Infiltration Syste	m Footprint A	rea		
Infiltration Volume	775.37	m ³		
drawdown time	48	hours	(Based on Hydro-Geologic report- hydraulic conductivity = 10 ⁻⁶)	
infiltration rate	15	mm/h		
Safety Factor	2.5			
Design Infiltration Rate	6	mm/h	MOE Eqn 4.3	
Required Footprint Area	6731	m²		
Р	roposed Infilt	ration Details - ⁻	Trenches	
Area	3000	m2		
Trench Volume Provided=	864.00	m ³		
Required Storage Depth =	0.72	m		
Drawdown time=	48.00	hours		
Volume retained per site =	864.00	m ³		
Therefore the proposed system	n has the requi	red footprint are	a to drain within 48 hours and will provide a	
retention volume that exceeds	the required vo	plume for mitigat	ion	
* Soils with Satutrated Hydraul	ic Conductivity	= 1(10 ⁻⁶) cm/s c	orrelates to an infiltration rate of 15mm/h	
Low Impact Development Des	ign Manual (TF	CA and CVC, 2	010)	

Water	Balance Mitigation Ca Pre Development Infintration = Post Development Infiltration =	Culations - 112,905 m ³ /y 75,621 m ³ /y	OPTION 3	8		
	Post to Pre Deficit =	37,284 m ³ /y				
Overall Require 36.96 ha x An Required Annual Based on this an will produce an a	d mitigation nual Precipitation Depth = 37,284 m Precpitation Depth to meet deficit = alysis, it is concluded that precipitation events of c innual amount of precipitation equal to	1 ³ /year 101 mm/yr lepth less than or equal 101 mm/yr	to	2.68 mm	990.53 m ³ /event	
OPTION 2	Catchment 203 will provide own site plan co Perforated CWC'S (ONLY ROOF AREAS)	ontrols to achieve pos	st to pre infiltration			
	Mitigation Measures Catchment 203 on-site controls Perforated CWC	5,200 m ³ /y 32,084 m ³ /y				
	Mitgation Voulme Provided = Deficit =	37,284 m ³ /y 0 m ³ /y	100%			
Site Plan Mitiga 2.72 ha x Anr Required Annual Based on this an will produce an a	tion nual Precipitation Depth = 5,200 m l Precpitation Depth to meet deficit = alysis, it is concluded that precipitation events of c innual amount of precipitation equal to	1 ³ /year 191 mm/yr depth less than or equal 191 mm/yr	to	5.00 mm	136.00 m ³ /event	
Perforated CWC	C's (Only roofs) west of Heartlake road					Roof
6.32 ha x Anr Required Annual Based on this an will produce an a	nual Precipitation Depth = 32,084 m I Precpitation Depth to meet deficit = alysis, it is concluded that precipitation events of c innual amount of precipitation equal to	1 ³ /year 508 mm/yr depth less than or equal 508 mm/yr	to	14.62 mm	923.98 m ³ /event	Backyards Front

0.01 100

12.64 6.32 5.056 1.264

					Job: 4851
Infiltra	tion Sizing C	alculations for (CWC - Option 3		Feb-21
Required Infiltration Sys	stem Footprint /	Area			
Infiltration Volume	923.98	m³			
drawdown time	48	hours			
infiltration rate	15	mm/h			
Safety Factor	2.5				
Design Infiltration Rate	6	mm/h	MOE Eqn 4.3		
Required Footprint Area	8021	m²			
	Proposed I	nfiltration Details -	Trenches		
Dia=	300	mm			
Length=	1950	m			
Width=	1.5	m	(1950m x 1.5m x 0.72m)		
Porosity=	40	%			
Total Trench Volume Provided =	925	m ³			
Minimum Required Storage Depth =	0.72	m	Approx Depth of Infiltration Sy	0.72	
Drawdown time=	48.00	hours			
Total Volume retained =	925	m ³			
Therefore the proposed system has the required footprir	nt area to drain w	ithin 48 hours and w	vill provide a		
retention volume that exceeds the required volume for m	nitigation				
* Soile with Setutrated Hydroulic Conductivity = $1(10^{-6})$	m/a corrolatos ta	on infiltration rate o	f15mm/b		
Solis with Saturated Hydraulic Conductivity = $I(10^{\circ})$ C		an inilitration rate o	гэлшил		
Low impact Development Design Manual (TRCA and CV	vC, ZUTU)				

TABLE 6: WATER BUDGET -SUMMARY TABLE

		Site						
Characteristics	Total Pre- development	Total Pre- evelopment Post-development (Pre		Post-development with mitigation (OPTION 1)	Change (pre to post with mitigation) (OPTION1)			
Inputs (Volumes)								
Precipitation (m ³ /year)	535,556	535,556	0%	535556	0%			
Total Inputs (m³/year)	535,556	535,556	0%	535556	0%			
Outputs (Volumes	s)							
Precipitation surplus (m ³ /year)	258,625	340,197	24%	340197	24%			
Net Surplus (m³/year	258,625	340,197	24%	340197	24%			
Total Evapotranspiration (m ³ /year)	276,931	195,359	- 42%	195359	-42%			
Total Infiltration (m ³ /year)	112,905	75,621	-49%	110441	-2%			
Total Runoff (m ³ /year)	145,720	264,576	45%	229756	37%			
Total Outputs (m³/year)	535,556	535,556	0%	535556	0%			

Infiltration Deficit (Without		
mitigation)	37284 m ³ /year	
Infiltration Deficit		
(Withmitigation)	2464 m ³ /year	

TABLE 7: WATER BUDGET -PRE SUMMARY TABLE

				Site
Characteristics	Pre-Development Drainage Area 1	Pre-Development Drainage Area 2	Pre-Development Drainage Area 3	Total Pre- development
	Inputs	s (Volumes)		
Precipitation (m ³ /year)	401,016	109,368	25,172	535,556
Total Inputs (m³/year)	401,016	109,368	25,172	535,556
	Output	ts (Volumes)		
Precipitation surplus (m ³ /year)	193,835	52,668	12,122	258,625
Net Surplus (m³/year	193,835	52,668	12,122	258,625
Total Evapotranspiration (m ³ /year)	207,181	56,700	13,050	276,931
Total Infiltration (m ³ /year)	86,989	21,067	4,849	112,905
Total Runoff (m ³ /year)	106,846	31,601	7,273	145,720
Total Outputs (m³/year)	401,016	109,368	25,172	535,556

Appendix B Sanitary Servicing Calculations

Appendix B.1: Background Information





_

Sarah Fanous

From:	Yashaswy Gollamudi
Sent:	February 9, 2021 5:19 PM
То:	Gorzynski, Derek; Lipka, Bob
Cc:	Koryun Shahbikian; Sarah Fanous
Subject:	RE: 4851-Sanitary Sewer Works on Kennedy Road and Heartlake Road

Thank you very much for the information Derek.

Regards, Yash



From: Gorzynski, Derek <derek.gorzynski@peelregion.ca>
Sent: February 9, 2021 2:23 PM
To: Yashaswy Gollamudi <ygollamudi@schaeffers.com>; Lipka, Bob <boguslaw.lipka@peelregion.ca>
Cc: Koryun Shahbikian <kshahbikian@schaeffers.com>; Sarah Fanous <sfanous@schaeffers.com>
Subject: RE: 4851-Sanitary Sewer Works on Kennedy Road and Heartlake Road

Hi Yash

We are currently finishing the Kennedy Road design with the intention to issue a construction tender in the late spring of 2021. It is my understanding however that the Region of Peel is working on the capital projects deferral list. Since the list has not been finalised yet I cannot definitively confirm if the construction will start this year.

Regards

Derek Gorzynski, P. Eng. Project Manager, Capital Works Wastewater Collection & Conveyance Public Works Region of Peel 10 Peel Centre Drive, Suite B, 4th Floor Brampton, ON L6T 4B9 Tel. 905.791.7800 x5013 Cell. 905.867.0560



This email, including any attachments, is intended for the recipient specified in the message and may contain information

which is confidential or privileged. Any unauthorized use or disclosure of this email is prohibited. If you are not the intended recipient or have received this e-mail in error, please notify the sender via return email and permanently delete all copies of the email. Thank you.

From: Yashaswy Gollamudi <<u>ygollamudi@schaeffers.com</u>>
Sent: February 9, 2021 1:50 PM
To: Lipka, Bob <<u>boguslaw.lipka@peelregion.ca</u>>; Gorzynski, Derek <<u>derek.gorzynski@peelregion.ca</u>>
Cc: Koryun Shahbikian <<u>kshahbikian@schaeffers.com</u>>; Sarah Fanous <<u>sfanous@schaeffers.com</u>>
Subject: RE: 4851-Sanitary Sewer Works on Kennedy Road and Heartlake Road

CAUTION: EXTERNAL MAIL. DO NOT CLICK ON LINKS OR OPEN ATTACHMENTS YOU DO NOT TRUST.

Hello Bob,

Thank you very much for the information.

Derek,

We appreciate it if you could please provide the status of the Kennedy Road Sanitary Sewer Project (Project No. 15-2153) (See below).

Thank you and Regards, Yash



SCHAEFFERS CONSULTING ENGINEERS

YASHASWY GOLLAMUDI, B.Sc. WATER RESOURCES ANALYST 6 Ronrose Drive, Concord, Ontario, L4K 4R3 1el, 905.738.6100 (ext. 299) fax, 905.738.6875

From: Lipka, Bob <<u>boguslaw.lipka@peelregion.ca</u>>
Sent: February 9, 2021 12:07 PM
To: Yashaswy Gollamudi <<u>ygollamudi@schaeffers.com</u>>; Gorzynski, Derek <<u>derek.gorzynski@peelregion.ca</u>>
Cc: Koryun Shahbikian <<u>kshahbikian@schaeffers.com</u>>; Sarah Fanous <<u>sfanous@schaeffers.com</u>>
Subject: RE: 4851-Sanitary Sewer Works on Kennedy Road and Heartlake Road

Hi Yash,

The 450/375mm diameter sanitary sewer has been installed across Hwy 410 and through the Heart Lake Employment Subdivision, all the way to Heart Lake Road. There are some minor deficiencies that needs to be rectified and the subdivision needs to be registered before the Region takes over this sanitary sewer. It is anticipated that this will be completed sometime this Spring. In order to service the lands around Mayfield Road and Heart Lake Road the sanitary sewer would need to be extended from the existing stub along Heart Lake Road to Mayfield Road.

With regards to your second inquiry about the proposed sanitary sewer on Kennedy Road I need to redirect you to Derek Gorzynski (copied on this email) who is the project manager for this project.

Regards,

Bob Lipka, C.E.T. Project Manager Engineering, Development Services Public Works Tel. 905-791-7800 ext. 5071 Fax. 905-791-1442

In response to the emergence of the novel coronavirus, the Region of Peel is implementing various measures to protect our customers, employees and workplaces. Development Services will endeavour to maintain the continuity of our business operations, however delays in service may still be experienced. We appreciate your patience during this time.

From: Yashaswy Gollamudi <<u>ygollamudi@schaeffers.com</u>>
Sent: February 9, 2021 11:18 AM
To: Lipka, Bob <<u>boguslaw.lipka@peelregion.ca</u>>
Cc: Koryun Shahbikian <<u>kshahbikian@schaeffers.com</u>>; Sarah Fanous <<u>sfanous@schaeffers.com</u>>
Subject: 4851-Sanitary Sewer Works on Kennedy Road and Heartlake Road

CAUTION: EXTERNAL MAIL. DO NOT CLICK ON LINKS OR OPEN ATTACHMENTS YOU DO NOT TRUST.

Good Morning Bob,

Hope you are doing well.

Could you please provide a status update of the following sanitary sewer works being undertaken in the Region of Peel:

- Sanitary sewer that will be servicing lands around Mayfield and Heart Lake Roads area. Works are being undertaken as part of the Heart Lake Employment Lands project (Project No. T-09012Ba)
 - Could you please confirm if the sewers are in service? The below email mentioned that the installation would be completed in 2020.
- Kennedy Road Sanitary Sewer (a 1200mm diameter CPP sanitary sewer, on Kennedy Raod North and Conservation Drive, City of Brampton) – Project No. 15-2153
 - Could you please confirm if the sewers are installed?

We appreciate your help on the above.

Thank you and Regards, Yash



From: Lipka, Bob [mailto:boguslaw.lipka@peelregion.ca]
Sent: February 25, 2020 9:27 AM
To: Janaani Pathmanapan
Cc: Koryun Shahbikian
Subject: RE: Request for Information - Countryside Drive & Heart Lake Road

Good morning Jenny,

The sanitary sewer that will be servicing lands around Mayfield and Heart Lake Roads area is currently being constructed as part of Heart Lake Employment Lands project (Project No. T-09012Ba). We are extending 375mm diameter sanitary sewer along an internal road from the east side of Hwy 410 to Heart Lake Road, approximately 300 meters north of Countryside Drive. Underground works should be completed sometime late Spring / early Summer 2020. For the design drawings please contact TMIG as they are the consultant for the project. Regards,

Bob

From: Janaani Pathmanapan <<u>ipathmanapan@schaeffers.com</u>
Sent: February 24, 2020 12:13 PM
To: Lipka, Bob <<u>boguslaw.lipka@peelregion.ca</u>
Cc: Koryun Shahbikian <<u>kshahbikian@schaeffers.com</u>
Subject: Request for Information - Countryside Drive & Heart Lake Road

CAUTION: EXTERNAL MAIL. DO NOT CLICK ON LINKS OR OPEN ATTACHMENTS YOU DO NOT TRUST.

Hello Bob,

Schaeffers & Associates has been retained to work on a development located on Mayfield and Heart Lake Road. I am seeking some information regarding the sanitary sewer along Countryside Drive to Heart Lake Road.

I would like to know if this sewer has been installed? I would also like to request for a plan and profile of this sewer.

I greatly appreciate any information you would be able to provide me with.

Thank you,

Janaani Jenny Pathmanapan, C.E.T. Water Resources Analyst

Schaeffer & Associates Limited

6 Ronrose Drive Concord, Ontario L4K 4R3 Tel: 905 738 6100 Fax: 905 738 6875 Appendix B.2: Sanitary Demand Calculations

Sanitary Flow Calculation



Project No:

4851

SCHAEFFERS CONSULTING ENGINEERS

Infiltration Rate:		0.2	L/s/ha
	Residential and		
Generation Rate:	Employment Areas	302.8	L/capita/day

Estimated Site Discharge

Site Discharge TO East (Heart Lake Road)	Units	Population	Average Demand (L/S)	Harmon's Peaking Factor	Flow (L/s) **	Infiltration (L/s)*	Total PeakFlow (L/s)
A1	325	1042	3.65	3.79	13.84	2.93	16.77
В	338	863	3.02	3.84	11.61	1.21	12.82
С	188	512	1.79	3.97	7.12	0.54	7.66
Total	851	2417	8	-	32.57	4.68	37.26
Site Discharge TO West (KENNEDY ROAD)	Units	Population	Average Demand (L/S)	Harmon's Peaking Factor	Flow (L/s) **	Infiltration (L/s)*	Total PeakFlow (L/s)
A2	236	775	2.72	3.87	10.51	2.71	13.21

*As per Peel Region Design Guidelines

**Sanitary flow as per Peel Region Guidelines

Appendix C Water Servicing Calculations

Appendix C.1: Water Supply Calculations

Water Supply Calculation (Residential Low Density)

Project:Snell's Hollow Secondary Plan AreaProject No:2019-4851

Fire Protection:	117 L/s
Average Daily Demand:	280 L/capita/day
Residential Area:	10.39 ha

Average Daily Demand

Land Use	Population	Average Day Demand (I/s)‡	
Residential	1249	4.05	

Max Daily Demand

	Dopulation	Dooking Easter	Max Daily
Land Use	Population	Feaking Facior	Demand (L/s)
Residential	1249	2.0	8.10

Peak Hour Demand

Land Lica	Population	Poaking Easter	Peak Hour	
Land Use	Population	Feaking Factor	Demand (L/s)	
Residential	1249	3.0	12.14	

Max Day + Fire Flow

Land Use	Average Day Demand (L/s)‡	Max. Hour Demand Peaking Factor‡	Peak Hour Demand (L/s)	Max Day Demand Peaking Factor‡	Max Day Demand (L/s)	Fire Flow (L/s)	Total Flow (L/s)
Total	4.05	3.0	12.14	2.00	8.10	116.67	124.762



Water Supply Calculation (Residential - Townhouses)

Project:Snell's Hollow Secondary Plan AreaProject No:2019-4851

Fire Protection:	150 L/s
Average Daily Demand:	280 L/capita/day
Residential Area:	4.43 ha

Average Daily Demand

Land Use	Population	Average Day Demand (l/s)‡
Residential	1007	3.26

Max Daily Demand

	Population	Poaking Easter	Max Daily
Land Use	Fopulation	Feaking Factor	Demand (L/s)
Residential	1007	2.0	6.53

Peak Hour Demand

Land Lica	Population	Poaking Easter	Peak Hour
Land Use	Population	Peaking Factor	Demand (L/s)
Residential	1007	3.0	9.79

Max Day + Fire Flow

Land Use	Average Day Demand (L/s)‡	Max. Hour Demand Peaking Factor‡	Peak Hour Demand (L/s)	Max Day Demand Peaking Factor‡	Max Day Demand (L/s)	Fire Flow (L/s)	Total Flow (L/s)
Total	3.26	3.0	9.79	2.00	6.53	150.00	156.529



Water Supply Calculation (Residential - Medium-high density)

Project:Snell's Hollow Secondary Plan AreaProject No:2019-4851

Fire Protection:	317 L/s
Average Daily Demand:	280 L/capita/day
Residential Area:	2.52 ha

Average Daily Demand

Land Use	Population	Average Day Demand (l/s)‡
Residential	843	2.73

Max Daily Demand

Land Use	Population	Peaking Factor	Max Daily Demand (L/s)
Residential	843	2.0	5.46

Peak Hour Demand

Land Lise	Population	Peaking Eactor	Peak Hour
Land Use	Fopulation	Feaking Factor	Demand (L/s)
Residential	843	3.0	8.20

Max Day + Fire Flow

Land Use	Average Day Demand (L/s)‡	Max. Hour Demand Peaking Factor‡	Peak Hour Demand (L/s)	Max Day Demand Peaking Factor‡	Max Day Demand (L/s)	Fire Flow (L/s)	Total Flow (L/s)
Total	2.73	3.0	8.20	2.00	5.46	316.67	322.130



Water Supply Calculation (Commercial)

Project: Snell's Hollow Secondary Plan Area

Project No: 2019-4851

Fire Protection:	417 L/s
Average Daily Demand:	300 L/capita/day
Residential Area:	1.47 ha

Average Daily Demand

Land Use	Population	Average Day Demand (I/s)‡
Residential	93	0.32

Max Daily Demand

Land Use	Population	Peaking Factor	Max Daily Demand (L/s)
Residential	93	1.4	0.45

Peak Hour Demand

Land Use	Population	Peaking Factor	Peak Hour Demand (L/s)
Residential	93	3.0	0.96

Max Day + Fire Flow

Land Use	Average Day Demand (L/s)‡	Max. Hour Demand Peaking Factor‡	Peak Hour Demand (L/s)	Max Day Demand Peaking Factor‡	Max Day Demand (L/s)	Fire Flow (L/s)	Total Flow (L/s)
Total	0.32	3.0	0.96	1.40	0.45	416.67	417.117



Appendix C.2: Water Supply Analysis Report

WATER SUPPLY ANALYSIS REPORT

SNELL'S HOLLOW SECONDARY PLAN AREA

TOWN OF CALEDON

PROJECT 2019-4851

FEBRUARY 2021



SCHAEFFERS CONSULTING ENGINEERS

Concord, Ontario L4K 4R3

Table of Contents

PAGE

1.0	MUNICIPAL SERVICING	1
	1.1 Introduction	1
	1.2 Existing Conditions	1
	1.3 Pressure Zone 7	4
	1.4 Proposed Connections and Boundary Conditions	4
	1.5 Design Criteria	4
	1.6 Proposed Water Supply System	5
	1.7 WaterCAD Modelling and Results	6
	1.7.1 Domestic Demand Results	6
	1.7.2 Fire Flow Results	7
	1.8 Turnover Rate	7
2.0	SUMMARY AND CLOSING REMARKS	9

List of Tables

PAGE

Table 1-1: Hazen-Williams Coefficients	5
Table 1-2: Snell's Hollow Water Supply Demand Scenarios	6
Table 1-3: Expected Pressure Range in Snell's Hollow Secondary Plan Area	6

List of Figures

PAGE

Figure 1.1: Location Plan	2
Figure 1.2: Subject Site	3
Figure 1.3: Water Supply Servicing	8

List of Appendices

- Appendix A: Water Supply Background Information
- Appendix B: Water Demand Calculations
- Appendix C: WaterCAD Model

1.0 MUNICIPAL SERVICING

1.1 Introduction

The following sections demonstrate that the proposed water distribution plan can adequately supply potable drinking water to the proposed developments within the Snell's Hollow Secondary Plan Area. The subject site is bound by Highway 410 to the north, Kennedy Road to the southeast, Mayfield Road to the south as illustrated in **Figure 1.1**.

The Snell's Hollow Secondary Plan Area is approximately 62.4 ha that includes lands on both sides of Heart Lake Road, with the majority of the site area on the west side of Heart Lake Road. Out of the 62.4 ha, development is proposed in approximately 36.97 ha.

1.2 Existing Conditions

The existing water supply network adjacent to the subject site consists of watermains and feedermains along Mayfield Road, Heart Lake Road and Kennedy Road. There are 400mm diameter, 750mm diameter and 600mm diameter watermains along Mayfield Road, and 400mm diameter watermain, as well as 900mm diameter and 1200mm diameter feedermains running along Heart Lake Road. There is a 300mm watermain and a 600mm feedermain on Kennedy Road.




1.3 **Pressure Zone 7**

The subject site is located within Region of Peel Pressure Zone 7 Central (7C) within the Central Transmission System. Pressure Zone 7C is supplied from the elevated Mayfield West tank (CS7) with the top water level (TWL) of 327.7m. The elevated tank is supplied from the North Brampton pumping station HLP7C. Pressure Zone 7 services the areas with the elevation of 243.4m – 289.6m. The entirety of the subject area is within the Pressure Zone 7 serviceable area.

1.4 **Proposed Connections and Boundary Conditions**

It is proposed to connect the southwest portion of the site to the 300mm watermain Kennedy Road and the 400mm watermain on Heart Lake Road. It is proposed to connect the northeast portion of the site to the 400mm watermain on Heart Lake Road and to connect to the 400mm watermain on Mayfield Road east of Heart Lake road for looping purposes. The commercial medium-high residential blocks on Mayfield Road will have connections directly to the Mayfield Road 400mm watermain. Two hydrant tests were performed in October 2020, one on Kennedy Road north of Mayfield Road and one on Heart Lake Road north of Mayfield Road. Hydrant tests reported static pressure of 78 psi and 80 psi respectively, resulting in the hydraulic grade of 317.85 m and 317.26m. These values were used as the boundary conditions in the water supply model. The TWL of 327.7m was used in the Minimum Hour Demand scenario. Hydrant tests are presented in the **Appendix A**.

1.5 **Design Criteria**

As per the Region of Peel's Design Criteria for watermains, the following guidelines were used in the design calculations for the water supply:

- an average residential daily demand of 280 l/person/day and 300/employee/day for industrial, commercial or institutional areas (ICI);
- a maximum day demand factor of 2.0 for residential and 1.4 for ICI;
- a peak hour demand factor of 3.0;
- minimum hour demand factor of 0.5 per the MOE *Design Guidelines for Drinking Water* Systems – 2008, Table 3-1: Peaking factors, population range of 3000 – 10000;
- a minimum pressure of 275 kPa (40 psi) during the peak hour demand;

- a minimum pressure of 140 kPa (20 psi) tested for fire flow under maximum day flow;
- a maximum pressure of 690 kPa (100 psi) under static load or during the minimum hourly demand;
- a minimum watermain diameter of 150mmØ for residential areas;
- Fire Underwriters Survey fire flow calculation cannot be performed since residential unit details are not available, therefore, fire flow requirements from the neighbouring municipalities will be used until the detailed water supply analysis:
 - a minimum fire flow demand of 7,000 l/min for single family & semi-detached units;
 - o a minimum fire flow demand of 9,000 l/min for townhouses;
 - a minimum fire flow demand of 19,000 l/min for multi-unit apartment buildings;
 - \circ a minimum fire flow demand of 25,000 l/min for commercial areas.

Water Demands were calculated for the proposed development based on the land use, units per area and persons per unit rate provided by Region of Peel. Land use per the *Preliminary Development Concept Plan*, by GSAI, dated December 16, 2020. Water demand calculations for the proposed development can be found in **Appendix B** for reference.

The Hazen Williams coefficients used in the model are listed in Table 1-1.

Pipe Diameter (mm)	Coefficient
150	100
200-250	110
300-600	120
600+	130

 Table 1-1: Hazen-Williams Coefficients

1.6 **Proposed Water Supply System**

Approximately 364 low-density units, 345 medium-density units, and 378 medium-high-density units are proposed with the total population of 3099 residents. The commercial area and work from



home will account for approximately 217 jobs. The residential areas east of Heart Lake Road and between Heart Lake Road and Kennedy Road will be serviced internally by a network of 200mm diameter watermains. Commercial area and medium-high density residential area will connect to the Mayfield Road. The water supply demands for the subject site are summarized in **Table 1-2** below including each design demand scenario. For further detail of the water demands please refer to the calculations provided in **Appendix B** and the WaterCAD modeling provided in **Appendix C**.

Fire **Critical Scenario** Demand Flow Average Min Peak Max Max Day + Fire Land Use Day Hour Hour Day l/s l/s l/s l/s l/s l/s Residential 10.04 5.02 30.13 20.09 317 438.14 ICI, WFH 0.75 0.38 2.26 1.05 417

 Table 1-2: Snell's Hollow Water Supply Demand Scenarios

1.7 WaterCAD Modelling and Results

WaterCAD (CONNECT Edition) water supply modelling was prepared in order to analyze the proposed system under various demand scenarios (Average Day, Max Day, Peak Hour, Fire Flow, Minimum Hour). WaterCAD modelling outputs for the demand scenarios are included in Appendix C for reference. **Table 1-3** below presents the pressure range expected as per the WaterCAD modeling.

1.7.1 Domestic Demand Results

Servicing Scenario	Maximum Pressure (kPa)	Minimum Pressure (kPa)
Average Day	520	454
Peak Hour	517	451
Max Day	519	453
Min Hour	622	557

Table 1-3: Expected	l Pressure Range in	Snell's Hollow	Secondary Plan Area
---------------------	---------------------	-----------------------	---------------------

All of the expected pressures in the Snell's Hollow Secondary Plan Area are in the required ranges per the Region of Peel criteria. The full modelling results are presented in **Appendix C**.

1.7.2 Fire Flow Results

Fire flow simulations showed that the required single-family house, townhouse, medium-highdensity areas, and commercial area requirements are achieved at each node. Full modelling results are presented in **Appendix C**.

At this moment, there are no detailed designs for the medium density and medium-high density areas, therefore a Fire Underwriters Survey (FUS) fire protection calculation cannot be completed to get the fire flows specifically for the townhouse Blocks. In the detailed design stage, the FUS calculation will be performed and specific flows will be calculated.

1.8 **Turnover Rate**

Turnover rate for the residential areas has been calculated to ensure sufficient renewal of the potable water. Assuming the watermain size of 200mm in the residential areas, 25% occupancy and minimum consumption the ultimate buildout will turnover every 1.71 days. Typically, the requirement for turnover is every 3 to 5 days, therefore, the development at full build out satisfies water age requirements.



2.0 SUMMARY AND CLOSING REMARKS

This report provides Town of Caledon with the necessary water supply analysis to support the design of water supply network for the Snell's Hollow Secondary Plan Area. Water supply to the development will be provided by the Pressure Zone 7 Central with the Mayfield West Elevated Tank and North Brampton Pumping Station. Subject site will connect to the existing watermains on Heart Lake Road, Mayfield Road and Kennedy Road. All of the water supply demands and fire flow requirements are satisfied.

Two hydrant tests were completed in October 2020 and are supporting the water supply analysis findings.

We trust that you will find the contents of this report satisfactory. Please contact the undersigned if you have any questions or concerns. Respectfully Submitted,

SCHAEFFER & ASSOCIATES LTD.

Bogdan Pavlovic, **MESc**, **E.I.T**, Water Resources Analyst

Koryun Shahbikian, LLM, M.Eng., P.Eng. Partner

2.0 SUMMARY AND CLOSING REMARKS

This report provides Town of Caledon with the necessary water supply analysis to support the design of water supply network for the Snell's Hollow Secondary Plan Area. Water supply to the development will be provided by the Pressure Zone 7 Central with the Mayfield West Elevated Tank and North Brampton Pumping Station. Subject site will connect to the existing watermains on Heart Lake Road, Mayfield Road and Kennedy Road. All of the water supply demands and fire flow requirements are satisfied.

Two hydrant tests were completed in October 2020 and are supporting the water supply analysis findings.

We trust that you will find the contents of this report satisfactory. Please contact the undersigned if you have any questions or concerns.

Respectfully Submitted,

SCHAEFFER & ASSOCIATES LTD.

Jalisbutt

Bogdan Pavlovic, **MESc**, **E.I.T**, Water Resources Analyst

Koryun Shahbikian, LLM, M.Eng., P.Eng. Partner

APPENDIX A

Water Supply Background Information



SNELL'S HOLLOW PRELIMINARY DEVELOPMENT CONCEPT PLAN TOWN OF CALEDON



DRAFT FOR DISCUSSION PURPOSES ONLY

LEGEND



UNIT ESTIMATES





2.18ha x 55 UPHA =120 UNITS BACK-TO-BACK TOWNHOUSES:

2.25ha x 100 UPHA = 225 UNITS

MEDIUM-HIGH DENSITY RESIDENTIAL 2.52ha x 150 UPHA = 378 UNITS

APPROXIMATE TOTAL UNITS: 1,087 UNITS

POPULATION ESTIMATES

LAND USE	TOTAL NUMBER OF UNITS	PERSONS PER UNIT*	POPULATION
LOW DENSITY (DETACHED, SEMI-DETACHED & ST. TOWNHOUSES)	364	3.43	1249
MEDIUM DENSITY (TOWNHOUSES)	345	2.92	1007
MEDIUM-HIGH DENSITY (TOWNHOUSES, APARTMENTS)	378	2.23	843
TOTALS	1,087		3,099

* PERSONS PER UNIT RATE PROVIDED BY REGION OF PEEL

JOB ESTIMATES

LAND USE	NUMBER OF JOBS
COMMERCIAL 63 JOBS / ha)	93
WORK FROM HOME & NO FIXED EMPLOYMENT 4% OF TOTAL POPULATION)	124
TOTALS	217

PARKLAND DEDICATION

LAND USE	REQUIRED PARKLAND (ha)
RESIDENTIAL AREAS (5% NDA) - 33.46 X 5%	1.67
COMMERCIAL AREAS (2% NDA) - 1.47 X 2%	0.03
TOTALS	1.70

PEOPLE & JOBS DENSITY

TOTAL PEOPLE & JOBS TOTAL AREA (ha)		TOTAL PEOPLE & JOBS PER HECTARE
3316	39.09	84.83









5-200 Connie Cres. Concord ON L4K 1M1 Phone 416-883-9777 Fax 905-303-6977

FLOW TEST REPORT

LOCATION OF RESIDUAL HYDRANT N of Kennedy Rol. & Snellview Blvd. LOCATION OF FLOW HYDRANT S of Kennedy Rol. & Snellview Blvd. TIME OF TEST 1:53 PM WATERMAIN SIZE 300 mm STATIC PRESSURE 78 psi

NUMBER OF OUTLETS	PITOT PRESSURE	FLOW (US G.P.M.)	RESIDUAL PRESSURE
One 2 ¹ / ₂ " hydrant port	37 psi	1020	72 psi
Two 2 ¹ / ₂ " hydrant port	30 psi	1830	68 psi





5-200 Connie Cres. Concord ON L4K 1M1 Phone 416-883-9777 Fax 905-303-6977

FLOW TEST REPORT

LOCATION OF RESIDUAL HYDRANT NW corner of Heart Lake Rd. & Mayfield Rd. LOCATION OF FLOW HYDRANT NW on Heart Lake Rd.

TIME OF TEST 1:20 PM WATERMAIN SIZE 400 MM STATIC PRESSURE 80 psi

NUMBER OF OUTLETS	PITOT PRESSURE	FLOW (US G.P.M.)	RESIDUAL PRESSURE
One 2 ¹ / ₂ " hydrant port	55 psi	1240	75 psi
Two 2 ¹ / ₂ " hydrant port	40 psi	2120	70 psi



Snell's Hollow

Project No. 4851 Test 1 - AQUAZITION Flow Test Results of October 14 2020 Location: Residual: Flow:

NW Corner of Heart Lake Road & Mayfield Road NW on Heart Lake Road

Flow US. GPM	Test Results Residual Pressure psi	Flow L/s	Residual Presure kPa
0	80	0	552
1240	75	78	518
2120	70	134	483

For a total required flow demand of **233 L/s** the equivalent residual pressure is

	375	kPa
	54	psi
For a residual pressure of 20 psi or 140 kPa the equivalent flow is		
	351	L/s
	5564	USGPM

4633 IGPM

1 USG = 3.785 litres

1 IG = 4.546 litres

1 psi = 6.9 kpa



Snell's Hollow

Project No. 4851 Test 2 - AQUAZITION Flow Test Results of October 14 2020 Location: Residual: Flow:

North of Kennedy Road & Snellview Blvd South of Kennedy Road & Snellview Blvd

	Test Results		
	Residual		Residual
Flow	Pressure	Flow	Presure
US. GPM	psi	L/s	kPa
0	78	0	538
1020	72	64	497
1830	68	115	469

For a total required flow demand of **233 L/s** the equivalent residual pressure is

	375	kPa
	54	psi
For a residual pre or 140 kPa the ec	essure of 20 psi quivalent flow is	
	298	L/s
	4724	USGPM

3933 IGPM

1 USG = 3.785 litres

1 IG = 4.546 litres

1 psi = 6.9 kpa



APPENDIX B

Water Demands and

Turnover Calculation

Project: 2019-4851 Snell's Hollow Town of Caledon Region of Peel



Population Calculation

Proposed Residential Development

Unit Calculation Per Land-Use

Density	Units/ha	Area (ha)	Units
Detached/Semi-Detached/Street Townhouses	35	10.39	364
Dual-frontage Townhouses	55	2.18	120
Back-to-Back Townhouses	100	2.25	225
Medium-High Density Residential	150	2.52	378
Total			1087

Population Estimates Per Land Use

Density	Pop/unit*	# of Units	Population
Low Density	3.43	364	1249
Medium Density	2.92	345	1007
Medium-High Density	2.23	378	843
Total			3099

Job Estimates

Job Estimate Calculation Per Land-Use

Density	Criteria	Number of Jobs
Commercial	63 Jobs/ha (1.47 ha)	93
Work From Home & No Fixed Employment	4% of Total Population	124
Total		217

Note: Based on the Snell's Hollow Preliminary Development Concept Plan

* Per GSAI, persons per unit rate provided by Region of Peel

Project: 2019-4851

Snell's Hollow Town of Caledon Region of Peel



Water Supply Calculation

Average Residential Daily Demand: Industrial, Commercial or Industrial 280 L/capita/day 300 L/employee/day

Number of WaterCAD Junctions 40

Average Daily Demand per Junction 0.27 l/s

Average Daily Demand

Land Use	Population	Average Daily Demand (l/s)
Residential	3099	10.04
Commercial, WFH	217	0.75
Total		10.80

Max Daily Demand

Land Use	Population	Peaking Factor	Maximum Daily Demand (L/s)
Residential	3099	2.0	20.09
Commercial, WFH	217	1.4	1.05
Total			21.14

Peak Hour Demand

Land Use	Population	Peaking Factor	Peak Hour Demand (L/s)
Residential	3099	3.0	30.13
Commercial, WFH	217	3.0	2.26
Total			32.39

Max Daily Demand per Junction 0.53 l/s

Peak Hourly Demand per Junction 0.81 l/s

Minimum Hour Factor per MOE0.5Minimum Hour Demand per Junction0.14 l/s

Project: 2019-4851 Snell's Hollow Town of Caledon Region of Peel



Turnover Rate Calculation

Minimum Consumption

0.14 m³/day

Turnover Rate Calculation

Stage	Length	Diameter	Area	Volume	25% Population	Current Consumption	Day/Turnover
	(m)	(mm)	(m ²)	(m ³)	(-)	(m³/day)	(Day)
Ultimate Buildout	5895	200.00	0.03	185.197	775	108.5	1.71

APPENDIX C

WaterCAD Digital Output



ID	Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)	Pressure Head (m)
34	1.4	264 13	0.27	317.22	520	53 00
78	1-26	204.13	0.27	317.22	510	53.03
104	1-34	264.46	0.27	317.20	516	52.76
107	1-33	264.48	0.27	317.22	516	52.70
102	1-35	204.40	0.27	317.22	510	52.74
60	J-33	204.09	0.27	317.22	513	52.55
36	1-5	204.73	0.27	317.22	513	52.47
50 74	J-3/	265.22	0.27	317.21	509	52.23
72	1-23	265.22	0.27	317.20	509	52.04
72	1_22	205.25	0.27	317.20	503	51.81
38	1-6	205.45	0.27	317.20	507	51.01
05 05	J-0	205.40	0.27	317.21	506	51.75
35 40	17	205.49	0.27	317.21	506	51.72
-+0 66	1_20	205.50	0.27	317.21	505	51.60
134	J-20	205.00	0.27	317.20	503	51.00
134	J-43	203.73	0.27	317.22	504	51.47
131	J-44	203.03	0.27	317.22	503	51.37
120	J-0	203.00	0.27	317.21	503	51.35
139	J-47	200.00	0.27	317.20	502	51.20
76	1-25	200.02	0.27	317.22	501	51.20
107	143	200.03	0.27	317.20	501	51.25
121	J-45	266.24	0.27	317.20	100	50.07
113	1-38	200.24	0.27	317.21	499	50.97
110	J-37	266.64	0.27	317.22	499	50.57
58	J_16	266 73	0.27	317.22	490	50.00
136	1-46	267.00	0.27	317.22	/02	50.45
56	J-40	267.00	0.27	317.20	492	50.20
62	J_18	267.10	0.27	317.22	490	50.07
88	1-29	267.17	0.27	317.22	430	49.93
68	1-21	267.20	0.27	317.22	400	49.96
108	1-36	267.38	0.27	317.20	403	49.80
46	J-10	267.58	0.27	317 21	486	49.63
.0	J-30	267.88	0.27	317.22	483	49.34
86	J-28	267.89	0.27	317 22	483	49.33
98	J-32	268.44	0.27	317.21	477	48.77
54	J-14	268 45	0.27	317.22	477	48 77
84	.1-27	268.68	0.27	317.22	475	48.54
52	J-13	268.00	0.27	317 22	473	48.30
48	J-11	269.85	0.27	317 21	464	47.36
50	J-12	270.78	0.27	317.21	454	46.43

Scenario: Max Day + Fire Flow Current Time Step: 0.000 h FlexTable: Junction Table

ID	Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)	Pressure Head (m)
34	J-4	264.13	0.53	317.11	519	52,98
78	J-26	264 19	0.53	317 25	519	53.06
104	J-34	264.46	0.53	317.11	515	52.65
102	J-33	264.48	0.53	317.11	515	52.63
106	J-35	264.69	0.53	317.10	513	52.41
60	J-17	264.75	0.53	317.11	512	52.36
36	J-5	264.98	0.53	317.10	510	52.12
74	J-24	265.22	0.53	317.25	509	52.03
72	J-23	265.23	0.53	317.25	509	52.02
70	J-22	265.45	0.53	317.25	507	51.80
38	J-6	265.46	0.53	317.10	505	51.64
95	J-31	265.49	0.53	317.10	505	51.61
40	J-7	265.50	0.53	317.10	505	51.60
66	J-20	265.66	0.53	317.25	505	51.59
134	J-45	265.75	0.53	317.10	503	51.35
131	J-44	265.85	0.53	317.11	502	51.26
42	J-8	265.86	0.53	317.10	501	51.24
139	J-47	266.00	0.53	317.24	502	51.24
116	J-39	266.02	0.53	317.11	500	51.09
76	J-25	266.03	0.53	317.25	501	51.22
127	J-43	266.17	0.53	317.25	500	51.08
44	J-9	266.24	0.53	317.10	498	50.86
113	J-38	266.25	0.53	317.10	498	50.85
110	J-37	266.64	0.53	317.10	494	50.46
58	J-16	266.73	0.53	317.11	493	50.38
136	J-46	267.00	0.53	317.25	492	50.25
56	J-15	267.15	0.53	317.11	489	49.96
62	J-18	267.17	0.53	317.12	489	49.95
88	J-29	267.29	0.53	317.11	488	49.82
68	J-21	267.30	0.53	317.25	489	49.95
108	J-36	267.38	0.53	317.10	487	49.72
46	J-10	267.58	0.53	317.10	485	49.52
91	J-30	267.88	0.53	317.11	482	49.23
86	J-28	267.89	0.53	317.11	482	49.22
98	J-32	268.44	0.53	317.10	476	48.66
54	J-14	268.45	0.53	317.11	476	48.66
84	J-27	268.68	0.53	317.11	474	48.43
52	J-13	268.92	0.53	317.11	472	48.19
48	J-11	269.85	0.53	317.10	462	47.25
50	J-12	270.78	0.53	317.10	453	46.32

Scenario: Max Day + Fire Flow Current Time Step: 0.000 h Fire Flow Node FlexTable: Fire Flow Report

Label	ls Fire Flow Run Balanced?	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (L/s)	Fire Flow (Available) (L/s)	Flow (Total Needed) (L/s)	Flow (Total Available) (L/s)	Pressure (Calculated Residual @ Total Flow Needed) (kPa)	Pressure (Calculated Residual) (kPa)	Pipe w/ Maximum Velocity	Velocity of Maximum Pipe (m/s)
J-5	True	True	117.00	118.00	117.53	118.53	366	363	P-2	2.22
J-6	True	True	117.00	118.00	117.53	118.53	336	333	P-2	2.19
J-7	True	True	117.00	118.00	117.53	118.53	359	356	P-2	2.15
J-8	True	True	117.00	118.00	117.53	118.53	355	353	P-17(1)	2.24
J-9	True	True	117.00	118.00	117.53	118.53	329	327	P-17(1)	2.27
J-10	True	True	117.00	118.00	117.53	118.53	339	337	P-17(1)	2.30
J-11	True	True	117.00	118.00	117.53	118.53	322	320	P-17(1)	2.42
J-12	True	True	117.00	118.00	117.53	118.53	324	322	P-17(1)	2.58
J-17	True	True	117.00	118.00	117.53	118.53	313	310	P-14	3.82
J-21	True	True	117.00	118.00	117.53	118.53	322	320	P-19	3.77
J-31	True	True	117.00	118.00	117.53	118.53	351	349	P-17(1)	2.71
J-32	True	True	117.00	118.00	117.53	118.53	301	298	P-38	3.77
J-36	True	True	117.00	118.00	117.53	118.53	265	262	P-41	3.87
J-45	True	True	117.00	118.00	117.53	118.53	215	210	P-14	3.82
J-4	True	True	150.00	151.00	150.53	151.53	327	324	P-2	3.19
J-13	True	True	150.00	151.00	150.53	151.53	299	297	P-17(1)	3.53
J-14	Irue	Irue	150.00	151.00	150.53	151.53	305	303	P-17(1)	3.54
J-15	True	True	150.00	151.00	150.53	151.53	320	318	P-17(1)	3.60
J-16	True	True	150.00	151.00	150.53	151.53	263	261	P-14	4.87
J-18	Irue	Irue	150.00	151.00	150.53	151.53	341	340	P-17(1)	3.64
J-20	True	True	150.00	151.00	150.53	151.53	442	442	P-18	2.50
J-22	True	True	150.00	151.00	150.53	151.53	446	446	P-56	2.77
J-23	True	True	150.00	151.00	150.53	151.53	444	444	P-56	2.87
J-24	True	True	150.00	151.00	150.53	151.53	439	438	P-56	2.92
J-25	True	True	150.00	151.00	150.53	151.53	436	435	P-56	2.94
J-20	True	True	150.00	151.00	150.53	151.53	437	430	P-00	2.85
J-27	True	True	150.00	151.00	150.53	151.53	297	295	P-17(1)	3.58
J-20	True	True	150.00	151.00	150.53	151.55	304	302	P-17(1)	3.59
130		True	150.00	151.00	150.55	151.55	200	287	P-17(1)	3.01
1.33	True	True	150.00	151.00	150.53	151.53	250	207	D_11	1 02
1-34	True	True	150.00	151.00	150.53	151.53	243	203	P_41	4.92
1-35	True	True	150.00	151.00	150.53	151.53	243	240	P-41	4.52
J-37	True	True	150.00	151.00	150.53	151.53	108	105	P-41	4.52
1-38	True	True	150.00	151.00	150.55	151.53	217	21/	P_41	4.52
1_30	True	True	150.00	151.00	150.55	151.53	220	∠14 217	P_41	4.92
.1-43	True	True	150.00	151.00	150.53	151 53	446	445	P-56	3.07
.1-44	True	True	150.00	151.00	150.53	151 53	222	210	P-14	4.87
.1-46	True	True	317.00	318.00	317 53	318 53	407	407	P-60	2 70
.1-48	True	True	317.00	318.00	317.00	318.00	530	530	P-60	2.70
.1-47	True	True	417.00	418.00	417 53	418.53	321	320	P-60	3.50

ID	Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)	Pressure Head (m)
34	.1-4	264 13	0.81	316 94	517	52 81
78	J-26	264.19	0.81	317.23	519	53.04
104	J-34	264.46	0.81	316.92	513	52.46
102	J-33	264.48	0.81	316.92	513	52.44
106	J-35	264 69	0.81	316.92	511	52.23
60	.1-17	264 75	0.81	316.92	511	52 17
36	J-5	264.98	0.81	316.91	508	51.93
74	J-24	265.22	0.81	317.23	509	52.01
72	J-23	265.23	0.81	317.23	509	52.00
70	J-22	265.45	0.81	317.23	507	51.78
38	J-6	265.46	0.81	316.90	503	51.44
95	J-31	265.49	0.81	316.91	503	51.42
40	J-7	265.50	0.81	316.90	503	51.40
66	J-20	265.66	0.81	317.23	505	51.57
134	J-45	265.75	0.81	316.92	501	51.17
131	J-44	265.85	0.81	316.92	500	51.07
42	J-8	265.86	0.81	316.90	500	51.04
139	J-47	266.00	0.81	317.22	501	51.22
116	J-39	266.02	0.81	316.92	498	50.90
76	J-25	266.03	0.81	317.23	501	51.20
127	J-43	266.17	0.81	317.23	500	51.06
44	J-9	266.24	0.81	316.90	496	50.66
113	J-38	266.25	0.81	316.92	496	50.67
110	J-37	266.64	0.81	316.92	492	50.28
58	J-16	266.73	0.81	316.92	491	50.19
136	J-46	267.00	0.81	317.23	492	50.23
56	J-15	267.15	0.81	316.93	487	49.78
62	J-18	267.17	0.81	316.95	487	49.78
88	J-29	267.29	0.81	316.93	486	49.64
68	J-21	267.30	0.81	317.23	489	49.93
108	J-36	267.38	0.81	316.92	485	49.54
46	J-10	267.58	0.81	316.90	483	49.32
91	J-30	267.88	0.81	316.93	480	49.05
86	J-28	267.89	0.81	316.93	480	49.04
98	J-32	268.44	0.81	316.90	474	48.46
54	J-14	268.45	0.81	316.92	474	48.47
84	J-27	268.68	0.81	316.93	472	48.25
52	J-13	268.92	0.81	316.92	470	48.00
48	J-11	269.85	0.81	316.90	460	47.05
50	J-12	270.78	0.81	316.91	451	46.13

ID	Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)	Pressure Head (m)
34	.1-4	264 13	0.13	327 69	622	63 56
78	1-26	264.10	0.10	327.00	622	63 51
104	.1-34	264.10	0.10	327.69	619	63 23
101	1-33	264.48	0.10	327.60	619	63.20
102	1-35	264.69	0.10	327.69	617	63.00
60	J-17	264.75	0.10	327.60	616	62.94
36	1-5	264.98	0.10	327.69	614	62.54
74	.1-24	265.22	0.10	327 70	611	62.48
72	.1-23	265.22	0.10	327 70	611	62.10
70	.1-22	265.20	0.10	327 70	609	62.25
38	.1-6	265.46	0.10	327.69	609	62.20
95	.1-31	265.49	0.10	327.69	609	62.20
40	.1-7	265.50	0.10	327.69	609	62.19
66	J-20	265.66	0.13	327.70	607	62.04
134	J-45	266.10	0.13	327 69	603	61 59
131	.1-44	265.85	0.13	327 69	605	61.84
42	J-8	265.86	0.13	327 69	605	61.83
139	.1-47	266.00	0.13	327 70	604	61 70
116	J-39	266.02	0.13	327.69	604	61.67
76	J-25	266.03	0.13	327.70	604	61.67
127	J-43	266.17	0.13	327.70	602	61.53
44	J-9	266.24	0.13	327.69	601	61.45
113	J-38	266.25	0.13	327.69	601	61.44
110	J-37	266.64	0.13	327.69	597	61.05
58	J-16	266.73	0.13	327.69	597	60.96
136	J-46	267.00	0.13	327.70	594	60.70
56	J-15	267.15	0.13	327.69	592	60.54
62	J-18	267.17	0.13	327.69	592	60.52
88	J-29	267.29	0.13	327.69	591	60.40
68	J-21	267.30	0.13	327.70	591	60.40
108	J-36	267.38	0.13	327.69	590	60.31
46	J-10	267.58	0.13	327.69	588	60.11
91	J-30	267.88	0.13	327.69	585	59.81
86	J-28	267.89	0.13	327.69	585	59.80
98	J-32	268.44	0.13	327.69	580	59.25
54	J-14	268.45	0.13	327.69	580	59.24
84	J-27	268.68	0.13	327.69	578	59.01
52	J-13	268.92	0.13	327.69	575	58.77
48	J-11	269.85	0.13	327.69	566	57.84
<u>5</u> 0	J-12	270.78	0.13	327.69	557	56.91

Appendix D Floodplain Analysis

Area Breakdown for Future Drainage Conditions



	Area	TIMP	XIMP	A x TIMP
Mayfield Pond	9.76	0.45	0.45	4.39
Subdivision	17.23	0.60	0.53	10.28
Open Area	24.76	0.07	0.07	1.73
	51.75	0.32	0.32	16.41

	Area	TIMP	XIMP	A x TIMP	A x XIMP
Subdivision Residential	14.51	0.54	0.46	7.84	6.67
Subdivision Commercial	2.72	0.90	0.90	2.45	2.45
Total Subdivision	17.23	0.60	0.53	10.28	9.12

DATE: February 2021

VISUAL OTTHYMO OUTPUT: Snell's Hollow Secondary Plan Area Town of Caledon

AREA [ha] - 17.230 7601 PKFW [m ³ /s] - 2.465 AREA [ha] - 51.750 PKFW [m ³ /s] - 7.028	AREA [h 7602 PKFW [r 624 PKF	a] - 24.760 n ³ /s] - 3.180 A [ha] - 9.760 W [m ³ /s] - 1.384	<pre></pre>

	Visual O' FUTI H	ГТНҮМО ^{тм} Schematic JRE CONDITIONS MAZEL STORM	Image: READ STORM Filename: C:\Users\sfanous\AppD Image: Apple state ata\Local\Temp\ Image: Apple state 1e295dad-7e03-4676-aa3a-084fecfb41c1\ef422a33 Image: Apple state 1e395dad-7e03-4676-aa3a-084fecfb41c1\ef422a33 Image: A
	Job #: 2019-4851	Date: February 2021	hrs mm/hr hrs 10.00 13.00 17

VISUAL OTTHYMO OUTPUT: Snell's Hollow Secondary Plan Area Town of Caledon

CALIB NASHYD (7602) A: ID= 1 DT=15.0 min I: U	rea (ha)= 24.76 a (mm)= 8.90 .H. Tp(hrs)= 0.43	Curve Number (CN) = 88.0 # of Linear Res.(N) = 3.00	
NOTE: RAINFALL	WAS TRANSFORMED TO	L5.0 MIN. TIME STEP.	
TIME hrs 1 0.250 0.500 0.750 1.000 1.250 1.500 1.750 2.000 2.250 2.500 2.750 3.000	TRANSFORM RAIN TIME RAIN mm/hr hrs mm/hr 6.00 3.250 13.00 6.00 3.500 13.00 6.00 4.000 13.00 4.00 4.250 17.00 4.00 4.500 17.00 4.00 5.000 17.00 6.00 5.250 13.00 6.00 5.500 13.00 6.00 5.750 13.00 6.00 6.000 13.00	ED HYETOGRAPH ' TIME RAIN TIME ' hrs mm/hr hrs 6.250 23.00 9.25 6.500 23.00 9.50 6.750 23.00 9.75 7.000 23.00 10.00 7.250 13.00 10.25 7.500 13.00 10.50 7.750 13.00 10.75 8.000 13.00 11.25 8.500 13.00 11.50 8.750 13.00 11.75 9.000 13.00 12.00	RAIN mm/hr 53.00 53.00 53.00 38.00 38.00 38.00 38.00 13.00 13.00 13.00 13.00
Unit Hyd Qpeak (cm. PEAK FLOW (cm. TIME TO PEAK (hr: RUNOFF VOLUME (m TOTAL RAINFALL (m RUNOFF COEFFICIENT (i) PEAK FLOW DOES 1 	<pre>s) = 2.199 s) = 3.180 (i) s) = 10.000 m) = 172.321 m) = 212.000 = 0.813 NOT INCLUDE BASEFLOW T rea (ha) = 17.23 otal Imp(%) = 60.00</pre>	LF ANY. Dir. Conn.(%)= 53.00	
Surface Area (h. Dep. Storage (m Average Slope (Length (n Mannings n	IMPERVIOUS PH a) = 10.34 m) = 1.00 %) = 1.00 m) = 338.92 = 0.013 WAS TRANSFORMED TO	ERVIOUS (i) 6.89 5.00 2.00 40.00 0.250 5.0 MIN TIME STEP	
TIME hrs n 0.083 0.167 0.250 0.333 0.417 0.500 0.583 0.667	TRANSFORME RAIN TIME RAIN mm/hr hrs mm/hr 6.00 3.083 13.00 6.00 3.167 13.00 6.00 3.250 13.00 6.00 3.250 13.00 6.00 3.500 13.00 6.00 3.503 13.00 6.00 3.583 13.00 6.00 3.667 13.00	ED HYETOGRAPH ' TIME RAIN TIME ' hrs mm/hr hrs 6.083 23.00 9.08 6.167 23.00 9.17 6.250 23.00 9.25 6.333 23.00 9.33 6.417 23.00 9.42 6.500 23.00 9.50 6.583 23.00 9.58 6.667 23.00 9.67	RAIN mm/hr 53.00 53.00 53.00 53.00 53.00 53.00 53.00 53.00

0.750 0.832 0.917 1.000 1.083 1.167 1.250 1.333 1.417 1.500 1.583 1.667 1.750 1.833 1.917 2.000 2.083 2.167 2.255 2.333 2.417 2.500 2.583 2.667 2.750 2.833 2.917	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3.750 3.833 3.917 4.000 4.083 4.167 4.250 4.333 4.417 4.500 4.583 4.417 4.500 4.583 4.677 4.750 4.833 4.917 5.000 5.083 5.167 5.250 5.333 5.417 5.500 5.583 5.667 5.750 5.833 5.917	13.00 13.00 13.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 13.00 13.00 13.00 13.00 13.00 13.00 13.00 13.00 13.00 13.00	6.750 6.833 6.917 7.000 7.083 7.167 7.250 7.333 7.417 7.500 7.583 7.667 7.750 7.833 7.667 7.750 7.833 7.917 8.000 8.250 8.333 8.417 8.583 8.667 8.750 8.833 8.917	23.00 23.00 23.00 23.00 13.00 13.00	$\begin{array}{c} 9.75\\ 9.83\\ 9.92\\ 10.00\\ 10.08\\ 10.17\\ 10.25\\ 10.33\\ 10.42\\ 10.50\\ 10.58\\ 10.67\\ 10.75\\ 10.83\\ 10.92\\ 11.00\\ 11.08\\ 11.17\\ 11.25\\ 11.33\\ 11.42\\ 11.50\\ 11.58\\ 11.67\\ 11.75\\ 11.83\\ 11.92 \end{array}$	53.00 53.00 53.00 53.00 38.00 38.00 38.00 38.00 38.00 38.00 38.00 38.00 38.00 38.00 38.00 38.00 38.00 38.00 13.00 13.00 13.00 13.00 13.00 13.00 13.00 13.00
3.000 Max.Eff.Inten.(n over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL	<pre>) 6.00 mm/hr) = (min) (min) = (min) = (cms) = (cms) = (hrs) = (mm) = (mm) = </pre>	6.000 53.00 5.00 6.85 5.00 0.18 1.34 10.00 211.00 212.00	13.00 (ii) 1 2	9.000 60.64 20.00 15.47 (ii 20.00 0.07 1.12 10.00 81.93 12.00	13.00 *TOT 2. 10 197 212	12.00 PALS* 465 (ii: 0.00 7.34 2.00	13.00
RUNOFF COEFFICIE (i) CN PROCEDU CN* = 8 (ii) TIME STEP THAN THE S (iii) PEAK FLOW	ENT = JRE SELECTE 38.0 Ia (DT) SHOUI STORAGE COE DOES NOT I	1.00 ED FOR PE = Dep. S LD BE SMA EFFICIENT ENCLUDE B	RVIOUS torage LLER OR ASEFLOW	0.86 LOSSES: (Above) EQUAL IF ANY.	C		
CALIB STANDHYD (0624) ID= 1 DT= 5.0 min Surface Area Dep. Storage Average Slope Length	Area Total In (ha) = (mm) = (%) = (m) =	(ha) = mp(%) = 4 IMPERVIOU 4.39 1.00 1.00 255.08	9.76 5.00 IS PE	Dir. Conn RVIOUS (i 5.37 5.00 2.00 40.00	.(%)= 4	15.00	

0.013

=

0.250

Mannings n

VISUAL OTTHYMO OUTPUT: Snell's Hollow Secondary Plan Area Town of Caledon

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

		TRA	NSFORMED H	HYETOGR	APH		
TIME	RAIN	TIME	RAIN '	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr '	hrs	mm/hr	hrs	mm/hr
0.083	6.00	3.083	13.00 0	5.083	23.00	9.08	53.00
0.167	6.00	3.167	13.00 0	5.167	23.00	9.17	53.00
0.250	6.00	3.250	13.00 0	5.250	23.00	9.25	53.00
0.333	6.00	3.333	13.00 0	5.333	23.00	9.33	53.00
0.417	6.00	3.417	13.00 0	5.417	23.00	9.42	53.00
0.500	6.00	3.500	13.00 0	5.500	23.00	9.50	53.00
0.583	6.00	3.583	13.00 6	5.583	23.00	9.58	53.00
0.667	6.00	3.667	13.00 6	5.667	23.00	9.67	53.00
0.750	6.00	3.750	13.00 6	5.750	23.00	9.75	53.00
0.833	6.00	3.833	13.00 6	0.833	23.00	9.83	53.00
0.91/	6.00	3.917	13.00 6	5.91/ 7.000	23.00	9.92	53.00
1.000	6.00	4.000	13.00 .	/.000	23.00	10.00	53.00
1.083	4.00	4.083	17.00	/.083	13.00	10.08	38.00
1.16/	4.00	4.167	17.00 1	/.16/	13.00	10.17	38.00
1.250	4.00	4.250	17.00 1	7.250	13.00	10.25	38.00
1.333	4.00	4.333	17.00 1	1.333	13.00	10.33	38.00
1.41/	4.00	4.41/	17.00 1	7.500	12.00	10.42	38.00
1.500	4.00	4.500	17.00 1	7.500	13.00	10.50	38.00
1.583	4.00	4.585	17.00 1	1.383	12 00 1	10.58	20.00
1 750	4.00	4.007	17.00 1	7.750	12.00	10.07	20.00
1.730	4.00	4.730	17.00 1	1.130	13.00	10.75	30.00
1 917	4.00	1 4 917	17 00 1	7 917	13.00	10.03	38 00
2 000	4 00	1 5 000	17 00 1 8	3 000	13.00	11 00	38 00
2 083	6.00	1 5 083	13 00 1 8	2 083	13 00 1	11 08	13 00
2.003	6.00	1 5 167	13 00 1 8	3 167	13 00 1	11 17	13 00
2 250	6.00	1 5 250	13 00 1 8	3 250	13 00 1	11 25	13 00
2 333	6.00	1 5 333	13 00 1 8	3 333	13 00 1	11 33	13 00
2 417	6.00	1 5 417	13 00 1 8	3 417	13 00 1	11 42	13 00
2 500	6.00	1 5 500	13 00 1 8	3 500	13 00 1	11 50	13 00
2 583	6.00	1 5 583	13 00 1 8	3 583	13 00 1	11 58	13 00
2 667	6.00	5 667	13 00 1 8	3 667	13 00 1	11 67	13 00
2 750	6.00	1 5 750	13 00 1 8	3 750	13 00 1	11 75	13 00
2.833	6.00	1 5.833	13.00 8	3.833	13.00	11.83	13.00
2.917	6.00	5.917	13.00 8	3.917	13.00	11.92	13.00
3.000	6.00	6.000	13.00 9	9.000	13.00	12.00	13.00
Max.Eff.Inten.(mm	ı/hr)=	53.00	51.	.17			
over	(min)	5.00	20.	.00			
Storage Coeff.	(min) =	5.78	(ii) 15.	.00 (ii)		
Unit Hyd. Tpeak	(min) =	5.00	20.	.00			
Unit Hyd. peak	(cms) =	0.20	0.	.07			
DEAK BLOW	()	0.65	^	74	* TOT	ALS*	
PLAK FLOW	(CIIIS) =	0.65	0.	. /4	1.	384 (111)
DUNCEE VOLUME	(mm) =	211 00	10.	.00	100		
KUNUFF VOLUME	(mm) =	211.00	1//. 010	. 33	192	.48	
DUNCES COFFETCES	(1100) = TTT -	212.00	212.	.UU 9/	212		
NUMBER CORFEICIES	· -	1.00	υ.	.04	0	• J L	

(i)	CN 1	PROCE	EDURE	SELECTED	FOR	PERVIOUS	LOSSES:
	CN	* =	88.0) Ia =	Dep.	Storage	(Above)

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ID1= 1 (0624): + ID2= 2 (7601):	AREA (ha) 9.76 17.23	QPEAK (cms) 1.384 2.465	TPEAK (hrs) 10.00 10.00	R.V. (mm) 192.48 197.34
ID = 3 (40016):	26.99	3.849	10.00	195.58
NOTE: PEAK FLOWS DO	NOT INCLU	JDE BASEFI	LOWS IF A	NY.
ADD HYD (40016)				
ADD HYD (40016) 3 + 2 = 1	AREA	QPEAK	TPEAK	R.V.
ADD HYD (40016) 3 + 2 = 1	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ADD HYD (40016) 3 + 2 = 1 ID1= 3 (40016) :	AREA (ha) 26.99	QPEAK (cms) 3.849	TPEAK (hrs) 10.00	R.V. (mm) 195.58

ID = 1 (40016): 51.75 7.028 10.00 184.45

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH

_____ | ADD HYD (40016)|

TILO-TIAS TIE	an. Existing 110	ouplain nivel. Sells n	ID-LIUD Meaci	I. SHEIS THD								
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
0 11 7 11	1000.0	100.1/ 01 450	(113/5)	(11)	(11)	(11)	(11)	(11/11)	(11/5)	(112)	(11)	
Snells Trib	1082.8	100 Year 6hr AES	5.30	257.03	263.31	256.29	263.31	0.000000	0.01	1062.43	201.73	0.00
Snells Trib	1082.8	Regional	12.87	257.03	263.43	256.41	263.43	3 0.000000	0.02	1086.88	203.66	0.00
Snells Trib	1061.1	100 Year 6hr AES	5.30	256.09	263.31	256.39	263.31	0.000000	0.01	1089.12	. 195.27	0.00
Snells Trib	1061.1	Regional	12.87	256.09	263.43	256.51	263.43	0.000000	0.02	1112.73	196.73	0.00
Snells Trib	1012	100 Year 6hr AES	5.30	256.13	263.31	256.76	263.31	0.000000	0.01	761.28	146.60	0.00
Snells Trib	1012	Regional	12.87	256.13	263.43	256.95	263.43	0.000000	0.02	779.82	157.44	0.00
Snells Trib	1011	100 Year 6hr AES	5.30	256.03	263.31	256.26	263.31	0.000000	0.01	1103.19	255.01	0.00
Snells Trib	1011	Regional	12.87	256.03	263.43	256.39	263.43	3 0.000000	0.02	1134.00	255.71	0.00
Snells Trib	1010	100 Year 6hr AES	5.30	256.24	263.31	256.35	263.31	0.000000	0.01	1434.40	282.89	0.00
Snells Trib	1010	Regional	12.87	256.24	263.43	256.43	263.43	3 0.000000	0.01	1468.64	284.63	0.00
Snells Trib	1009	100 Year 6br AES	5 30	256.06	263.31		263.31	0 00000	0.01	770 23	197 44	0.00
Snells Trib	1009	Begional	12.87	256.06	263.43		263.43	3 0.000000	0.02	794.19	199.71	0.00
Snells Trib	1008	100 Year 6hr AES	5.30	256.06	263.31		263.31	0.00000	0.01	783.29	164.06	0.00
Snells Trib	1008	Begional	12.87	256.06	263.43		263.43	3 0.000000	0.02	803.16	165.46	0.00
Snells Trib	1007	100 Year 6hr AES	5.30	256.06	263.31		263.31	0.000000	0.01	571.06	107.26	0.00
Snells Trib	1007	Regional	12.87	256.06	263.43		263.43	3 0,000000	0.03	584.09	108.95	0.00
			. 2.07	_00.00	200.40		200.40		0.00	004.00	1	0.00
Snells Trib	1006	100 Year 6br AES	5.30	255 93	263 31		263 31	0 000000	0.01	646 85	118.85	0.00
Snells Trib	1006	Begional	12.87	255.93	263.43		263.4	0.000000	0.07	661 26	120.16	0.00
			. 2.07	200.00	200.40			0.000000	0.02	001.20	1	0.00
Snells Trib	1005	100 Year 6br AES	5.30	255.93	263.31		263 31	0.00000	0.02	511.46	117.63	0.00
Snells Trib	1005	Begional	12.87	255.93	263.43		263.43	0 000000	0.02	525 74	119.41	0.00
	1000	riogional	12.07	200.00	200.10		200.10			020171		0.00
Snells Trib	1004	100 Year 6hr AES	5.30	255.90	263.31		263.31	0 000000	0.02	355.48	78.98	0.00
Snells Trib	1004	Begional	12.87	255.90	263.43		263.43	0.000001	0.05	365.20	82.15	0.00
	1004	riogional	12.07	200.00	200.40		2000.44	0.000001	0.00	000.20	02.10	0.01
Snells Trib	1003	100 Year 6br AES	5 30	255 58	263.34		263 31	0.00000	0.02	424 92	80.04	0.00
Snells Trib	1003	Begional	12.87	255 58	263.43		263.43	0.000000	0.02	434.62	80.94	0.00
	1000	riogional	12.07	200.00	200.40		200.10	0.000000	0.04	404.02	00.04	0.00
Snells Trib	1002	100 Year 6br AES	5 30	255 58	263.31	255.70	263 31	0.000000	0.01	1077 19	196.23	0.00
Snells Trib	1002	Begional	12.87	255.58	263.43	255.80	263.4	0.000000	0.07	1100.89	197.19	0.00
	1002	ricgional	12.07	200.00	200.40	200.00	2001-0	0.000000	0.02	1100.00	107.10	0.00
Snells Trib	1001.5	100 Vear 6br AES	5 30	255 15	263 31		263.31	0.00000	0.01	801 53	131.78	0.00
Snells Trib	1001.5	Begional	12.87	255.15	263.43		263.01	0.000000	0.01	817.46	132.60	0.00
	1001.5	riegional	12.0/	200.10	200.40		200.40	0.000000	0.02	017.40	102.00	0.00
Spelle Trib	1001.2	100 Vear 6br AES	5 30	255.45	263.31		263 31	0.00000	0.01	744.48	133.02	0.00
Shells Trib	1001.2	Regional	12.87	255.45	263.43		263.01	0.000000	0.01	760.88	137.47	0.00
	1001.2	riegionai	12.07	200.40	200.40		200.40	0.000000	0.02	700.00	137.47	0.00
Spolle Trib	1001	100 Voor 6br AES	5 20	255 48	262.21	256.21	262.21	0.000000	0.03	220.65	146.11	0.00
Snells Trib	1001	Begional	12.87	255.48	263.43	256.59	263.43	0.000001	0.00	338.24	147.52	0.00
	1001	ricgionar	12.01	200.40	200.40	200.00	200.40	0.000001	0.00	000.24	147.52	0.01
Spells Trib	1000.6		Culvert		—						-	
	1000.0		Guiven								-	
Spelle Trib	1000	100 Vear 6br AES	5 30	254 35	255 10	255.19	255 37	0 140352	1 90	2 70	52.54	1.01
Snells Trib	1000	Begional	12.00	254 25	255.19	255.79	200.07	0 112122	0 EA	5.75	63 50	1.01
	1000	riegionai	12.07	2.04.00	200.40	200.40	200.01	0.113133	2.04	5.00	03.50	1.00
Snells Trib	999.46	100 Year 6br AES	5 20	253.40	254.05	252.76	254.07	0.007201	0.40	11.00	26.10	0.04
Sholls Trib	999.40	Begional	12.97	200.49	204.00	200.70	204.07	0.007301	0.48	20.10	20.10	0.24
510/10 1110	000.40	. logional	1001	200.43	204.03	200.01	204.00	. 0.000000	0.40	23.10	+3.01	0.17
Snells Trib	999.05	100 Year 6br AES	13.94	253.05	254.05	253.00	25/ 05	0 000093	0.00	175 01	220 50	0.02
Snells Trib	999.05	Begional	32.36	253.05	254.00	253.32	254.50	0.000083	0.00	299.41	223.33	0.03
	000.00	riegional	52.50	200.00	204.00	200.02	204.00	0.000000	0.11	200.41	200.21	0.03
Snells Trib	998	100 Year 6br AES	12.2/	253.05	254.05	252.10	25/ 05	5 0.000000	0.00	997 71	2/18 01	0.02
Snells Trib	998	Begional	32.36	253.05	254 59	253.18	254.50	0.000045	0.00	372.86	256.97	0.02
	000	. logional	52.50	200.00	£0 4 .03	200.10	204.08	0.000045	0.09	572.00	200.97	0.02
Snells Trib	997	100 Year 6br AES	13.34	253.05	254.05		254.05	5 0.000020	0.04	310.40	334.69	0.01
Snells Trib	997	Begional	32.36	253.05	254.58		254.58	0.000026	0.07	492.03	345.01	0.01
	007	. isgional	02.30	200.00	204.00		204.00	0.000020	0.07	432.03	- 040.01	0.02
Snells Trib	995 76	100 Year 6br AES	12.2/	253.05	254 04		25/ 0/	0.000122	0.11	103 60	130 74	0.04
Snells Trib	995 76	Begional	20.04	200.00	254.04		204.04	0.000123	0.11	106 //	1/10 2.74	0.04
	000.70	ogional	52.00	200.00	LU7.J/		204.07	0.000100	0.17	130.44	140.00	0.04
Snells Trib	995.05	100 Year 6br AES	13.34	253.05	254.03		254.03	0 000233	0.15	92 80	105.49	0.05
Snells Trib	995.05	Regional	32.36	253.05	254.55		254.56	0.000299	0.23	150.92	113.78	an 0
			02.00	_00.00	201.00		20.00	2.000200	0.20	100.02	1	0.00
Snells Trib	994	100 Year 6hr AES	13.34	252.72	254.02		254.02	0.00024	0.05	267.07	258.34	0.02
Snells Trib	994	Regional	32.36	252.72	254.54		254.54	0.000024	0.08	403.50	262.53	0.02
			02.00	202.72	204.04		204.04	0.000000	0.00	-100.00	1	0.02
Snells Trib	993.45	100 Year 6br AES	13.34	253.02	253.99	253.37	254.00	0 003906	0.57	23.66	28 52	0.19
Snells Trib	993,45	Regional	32.36	253.02	254.47	253.63	254.51	0.005055	0.87	38.41	32.09	0.24
			02.00	100.02	201111	_00.00	20.01		0.07	00.41	1	1
Snells Trib	993	100 Year 6hr AES	13.34	252.90	253.68	253.27	253.70	0.006257	0.56	24.01	40.71	0.23
Snells Trib	993	Regional	32.36	252.90	254.14	253.48	254.17	0.005447	0.73	44.29	46.49	0.23
			-								-	

HEC-RAS Plan: Existing Floodplain River: Sells Trib-Etob Reach: Snells Trib

HEC-RAS Plan: Existing Floodplain River: Sells Trib-Etob Reach: Snells Trib (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Snells Trib	992	100 Year 6hr AES	13.34	251.66	252.93	252.33	252.94	0.004976	0.60	22.60	31.99	0.22
Snells Trib	992	Regional	32.36	251.66	253.55	252.63	253.58	0.003641	0.76	46.76	50.50	0.20
Snells Trib	991	100 Year 6hr AES	13.34	250.79	252.62		252.63	0.002648	0.51	26.57	29.09	0.16
Snells Trib	991	Regional	32.36	250.79	253.28		253.30	0.002595	0.69	49.23	38.20	0.17
Snells Trib	990.7	100 Year 6hr AES	13.34	250.71	252.42		252.43	0.001964	0.55	29.38	34.16	0.15
Snells Trib	990.7	Regional	32.36	250.71	253.07		253.09	0.002147	0.74	55.98	46.49	0.17
Snells Trib	990.2	100 Year 6hr AES	13.34	250.38	251.43	251.42	251.70	0.094368	2.34	6.05	11.28	0.91
Snells Trib	990.2	Regional	32.36	250.38	251.90	251.90	252.31	0.077224	3.00	12.35	15.86	0.90
Snells Trib	990	100 Year 6hr AES	13.34	249.72	250.25	250.02	250.26	0.008794	0.41	32.90	116.99	0.24
Snells Trib	990	Regional	32.36	249.72	250.59	250.14	250.60	0.003333	0.34	95.17	211.48	0.16



Appendix E Engineering Drawings



F:\4851\4851-DRAWINGS\4851-GP-1-2.dwg, 2/17/2021 9:40:01 AM, mzemlyanoy



F:\4851-DRAWINGS\4851-GP-1-2.dwg, 2/17/2021 9:40:06 AM, mzemlyanoy





F:\4851\4851-DRAWINGS\4851-GR-1-5.dwg, 2/17/2021 9:39:24 AM, mzemlyanoy
















		-	
TOTAL POND BLOCK AREA	1.60ha		
DESCRIPTION	PROVIDED STORAGE	REQUIRED STORAGE	
PERMANENT POOL EL.258.00-259.50	2,250m ³	2,137m ³	
100YR. W.L. EL.259.50-260.50	4,200m ³	2,863m ³	
REGIONAL W.L. EL.259.50-261.00	7,180m ³	5,968m ³	



NOTES: FOR SWM POND SECTIONS 1-5 REFER TO DWG. No. SWM-3



F:\4851\4851-DRAWINGS\4851-SWM-1.dwg, 2/17/2021 9:38:47 AM, mzemlyanoy



TOTAL POND BLOCK AREA	1.73ha	
DESCRIPTION	PROVIDED STORAGE	REQUIRED STORAGE
PERMANENT POOL EL.258.80-260.20	4,400m ³	3,317m ³
100YR. W.L. EL.260.20-261.50	7,980m ³	7,925m ³
REGIONAL W.L. EL.260.20-262.70	19,510m ³	19,037m ³



NOTES: FOR SWM POND SECTIONS 6-9 REFER TO DWG. No. SWM-4

